Natural Eating Behaviour and its Effect on Labour Outcomes

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Dedication

Thankyou to my wonderful family, Les, Karen, David, Stephen and Lachlan. Your love, support and faith throughout this long journey gave me strength and confidence to achieve my goal.
I wish to express my gratitude to the people who provided help, support, and guidance throughout this thesis. My deepest gratitude goes to my first supervisor, Professor Sue Nagy. During our four years involvement she provided me with inspiration and empowered me with the belief that I was capable of attaining this goal.

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My thanks also goes to the mothers for participating in this study and to the midwives and anaesthetists who either gave their time to complete questionnaires or assisted with the recruiting phase of the main study.

Finally, I wish to acknowledge the Australian College of Midwives NSW Branch for assisting with the funding of this study.
Statement of Authentication

The work presented in this thesis is, to the best of my knowledge and belief, original except as acknowledged in the text. I hereby declare that I have not submitted this material, either in full or in part, for a degree at this or any other institution.

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(Signature)
Table of Contents

Table of Contents ................................................................................................................................. i
List of Tables ........................................................................................................................................ v
List of Figures ......................................................................................................................................... viii
List of Appendices ............................................................................................................................... ix
Glossary................................................................................................................................................ x
Abstract............................................................................................................................................... xiii

CHAPTER 1
INTRODUCTION................................................................................................................................. 1
  1.1 Conceptual framework.................................................................................................................... 3
  1.2 Purpose of the study...................................................................................................................... 5
  1.3 Overall aims of this series of studies ......................................................................................... 5
  1.4 Questions to be addressed by this series of studies................................................................. 6
  1.5 Organisation of the thesis......................................................................................................... 7

CHAPTER 2
ASPIRATION AND GENERAL ANAESTHESIA............................................................................ 10
  2.1 Introduction............................................................................................................................... 10
  2.2 Pathophysiology of aspiration ................................................................................................. 13
  2.3 Aetiology of general anaesthesia-related aspiration incidents.............................................. 16
  2.4 General anaesthesia and aspiration in obstetrics .................................................................... 23
  2.5 Incidence of maternal aspiration deaths in Australia post 1950 ............................................ 36
  2.6 Current anaesthesia-related aspiration prevention strategies .............................................. 38
  2.7 Summary of general anaesthesia and aspiration in obstetrics ............................................. 51

CHAPTER 3
ORAL INTAKE DURING LABOUR.................................................................................. 54
  3.1 Introduction............................................................................................................................... 54
  3.2 Overview of oral intake during labour.................................................................................... 56
  3.3 Physiological effect of restricted oral intake during labour.................................................. 60
  3.4 Psychological effect of restricted oral intake during labour..................................................... 66
  3.5 Other factors affecting labour ............................................................................................... 68
  3.6 Reintroducing food in labour: an increasing trend................................................................. 70
  3.7 Effect of oral intake on birth outcomes................................................................................... 73
  3.8 Assumptions regarding vomiting and intravenous fluids..................................................... 83
CHAPTER 4
STUDY 1 – ORAL INTAKE POLICIES IN NEW SOUTH WALES HOSPITALS

4.1 AIM
4.2 METHOD
4.2.1 Study design and setting
4.2.2 Instruments
4.2.3 Data collection
4.2.4 Participants
4.2.5 Ethical considerations
4.2.6 Data analysis

4.3 RESULTS
4.3.1 The existence of a written policy
4.3.2 Content of the hospital policies

4.4 DISCUSSION
4.4.1 The effect of policy variation on midwifery practice
4.4.2 The effect of research on practice

4.5 CONCLUSION
4.5.1 Study limitations and further research
4.5.2 Recommendation for clinical practice and research

CHAPTER 5
STUDY 2 – MIDWIVES’ BELIEFS AND PRACTICES REGARDING ORAL INTAKE

5.1 AIM
5.2 METHOD
5.2.1 Study design and setting
5.2.2 Ethics approval
5.2.3 Instrument
5.2.4 Participants
5.2.5 Data collection
5.2.6 Data analysis

5.3 RESULTS
5.3.1 Midwifery experience
5.3.2 Midwives’ knowledge of the hospital protocol regarding oral intake
5.3.3 Midwives’ management of oral intake during labour
5.3.4 The relationship between midwives’ experience and practice
5.3.5 Midwives’ reasoning for feeding or fasting labouring women

5.4 DISCUSSION
5.4.1 Hospital protocol, midwives’ practice and low-risk pregnancies
5.4.2 Hospital protocol, midwives’ practice and high-risk labours ........................................... 143
5.4.3 Midwives’ decision to practise contrary to hospital protocol ........................................... 145
5.4.4 Midwives’ reasoning for their practice decision ............................................................... 149
5.4.5 Evidence-based guidelines .............................................................................................. 155

5.5 CONCLUSION .................................................................................................................. 159
5.5.1 Study limitation and further research ............................................................................. 160

CHAPTER 6

STUDY 3 – PREVENTING ASPIRATION DURING ANAESTHESIA .......... 162

6.1 AIM .................................................................................................................................. 164

6.2 METHOD .... .................................................................................................................... 164
6.2.1 Study design and setting .............................................................................................. 164
6.2.2 Instrument .................................................................................................................... 165
6.2.3 Participants and procedure ........................................................................................... 166
6.2.4 Data analysis ................................................................................................................ 166

6.3 RESULTS AND DISCUSSION ......................................................................................... 167
6.3.1 Dietary restrictions before general anaesthesia ............................................................. 167
6.3.2 Epidural anaesthesia and dietary restrictions for labour .............................................. 174
6.3.3 Strategies to minimise aspiration and its effect ............................................................. 175

6.4 CONCLUSION .................................................................................................................. 177
6.4.1 Limitations of the study and future research ................................................................. 178

CHAPTER 7

STUDY 4 – EFFECT OF EATING ON LABOUR DURATION AND INCIDENCE OF MEDICAL INTERVENTION .................. 179

7.1 OPERATIONAL DEFINITIONS FOR LABOUR .................................................................. 182
7.1.1 First stage of labour ........................................................................................................ 182
7.1.2 Second stage of labour ................................................................................................. 183

7.2 AIM .................................................................................................................................. 184
7.2.1 Independent variable ..................................................................................................... 184
7.2.2 Outcomes of interest ..................................................................................................... 184

7.3 HYPOTHESES ................................................................................................................. 185

7.4 METHOD .......................................................................................................................... 186
7.4.1 Study design and setting .............................................................................................. 186
7.4.2 Ethics approval ............................................................................................................. 186
7.4.3 Sample .......................................................................................................................... 186
7.4.4 Instruments ................................................................................................................... 189
7.4.5 Procedure ...................................................................................................................... 191
7.4.6 Overview of data analysis ............................................................................................. 193
7.4.7 Type I error rate .......................................................................................................... 198
List of Tables

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table 1</td>
<td>Anaesthetic practices, prevention strategies and discoveries related to aspiration since 1920</td>
<td>33</td>
</tr>
<tr>
<td>Table 2</td>
<td>Maternal deaths in Australia, 1967-1996</td>
<td>37</td>
</tr>
<tr>
<td>Table 3</td>
<td>Comparison of anti-acid therapies used by anaesthetists for labour and pre-operatively during the 1980s</td>
<td>43</td>
</tr>
<tr>
<td>Table 4</td>
<td>Oral intake allowances for women in established labour from 1984 to 1994 in the United Kingdom</td>
<td>72</td>
</tr>
<tr>
<td>Table 5</td>
<td>Eating &amp; non-eating group sample sizes for oral intake studies</td>
<td>80</td>
</tr>
<tr>
<td>Table 6</td>
<td>Association between oral intake in labour and aspiration</td>
<td>92</td>
</tr>
<tr>
<td>Table 7</td>
<td>Summary of the rationales used for each side of the labouring woman’s oral intake debate</td>
<td>93</td>
</tr>
<tr>
<td>Table 8</td>
<td>NSW hospital ‘level’ allocation, number of hospitals and facilities available in each level</td>
<td>98</td>
</tr>
<tr>
<td>Table 9</td>
<td>NSW hospital levels and position regarding written policy or usual practice</td>
<td>102</td>
</tr>
<tr>
<td>Table 10</td>
<td>Oral intake for labouring women with low risk pregnancies</td>
<td>103</td>
</tr>
<tr>
<td>Table 11</td>
<td>Oral intake for low-risk pregnancies by hospital level</td>
<td>104</td>
</tr>
<tr>
<td>Table 12</td>
<td>Oral intake for labouring women with high risk pregnancies by hospital level (N = 93)</td>
<td>105</td>
</tr>
<tr>
<td>Table 13</td>
<td>Demographics of the four hospitals</td>
<td>120</td>
</tr>
<tr>
<td>Table 14</td>
<td>Midwives’ years of experience</td>
<td>121</td>
</tr>
<tr>
<td>Table 15</td>
<td>Midwives’ exposure to models of midwifery care</td>
<td>122</td>
</tr>
<tr>
<td>Table 16</td>
<td>The ‘usual practice’ according to respondents</td>
<td>124</td>
</tr>
<tr>
<td>Table 17</td>
<td>Practice of midwives within RPHs for oral intake of labouring women with low-risk pregnancies during first stage of labour</td>
<td>126</td>
</tr>
<tr>
<td>Table 18</td>
<td>Practice of midwives within URPHs for oral intake of labouring women with low-risk pregnancies during first stage of labour</td>
<td>127</td>
</tr>
<tr>
<td>Table 19</td>
<td>Midwives’ knowledge and compliance with their hospital’s ‘usual practice’ for oral intake during labour by hospital policy type (restricted and unrestricted)</td>
<td>128</td>
</tr>
<tr>
<td>Table 20</td>
<td>Practice of midwives in the RPHs for oral intake of labouring women with high-risk pregnancies during first stage of labour</td>
<td>130</td>
</tr>
<tr>
<td>Table 21</td>
<td>Practice of midwives in the URPHs for oral intake of labouring women with high-risk pregnancies during first stage of labour</td>
<td>130</td>
</tr>
<tr>
<td>Table 22</td>
<td>Comparison of experience (in years), midwifery model exposure and oral intake practice for labouring women among the midwives in the restricted practice hospitals (RPH) and unrestricted practice hospitals (URPH)</td>
<td>133</td>
</tr>
<tr>
<td>Table 23</td>
<td>NHMRC designation of levels of evidence*</td>
<td>149</td>
</tr>
<tr>
<td>Table 24</td>
<td>Anaesthetist’s preferences for oral intake restrictions for labouring women with an effective epidural in situ (N = 30)</td>
<td>175</td>
</tr>
<tr>
<td>Table 25</td>
<td>Pre-operative pharmacological strategies employed by anaesthetists for emergency caesarean section patients (N = 30)</td>
<td>176</td>
</tr>
<tr>
<td>Table 26</td>
<td>Eating and non-eating group sample description (N = 217)</td>
<td>200</td>
</tr>
<tr>
<td>Table 27</td>
<td>Comparison of eating behaviour and the timing of the start of early labour</td>
<td>202</td>
</tr>
<tr>
<td>Table 28</td>
<td>Comparison between eating behaviour and hospital practice regarding oral intake during labour</td>
<td>203</td>
</tr>
<tr>
<td>Table 29</td>
<td>Comparing eating groups for incidence of vomiting during labour</td>
<td>204</td>
</tr>
<tr>
<td>Table 30</td>
<td>Descriptive statistics for the progress of labour between groups (N = 164 - 217)</td>
<td>208</td>
</tr>
<tr>
<td>Table 31</td>
<td>Comparison of cervical dilatation on admission to hospital between groups</td>
<td>209</td>
</tr>
<tr>
<td>Table 32</td>
<td>Descriptive statistics for maternal age and gestation</td>
<td>213</td>
</tr>
<tr>
<td>Table 33</td>
<td>Descriptive statistics for predictors ethnicity, eating and fetal position in relation to hospital estimated length of labour</td>
<td>214</td>
</tr>
<tr>
<td>Table 34</td>
<td>Regression summary for dependent variable: hospital-estimated length of labour in hours</td>
<td>216</td>
</tr>
<tr>
<td>Table 35</td>
<td>Partial and semipartial correlations between hospital-estimated length of labour and predictors</td>
<td>217</td>
</tr>
<tr>
<td>Table 36</td>
<td>Comparison of medical interventions between eating groups (N = 217)</td>
<td>219</td>
</tr>
<tr>
<td>Table 37</td>
<td>Comparison of women who experienced hunger between the restrictive and unrestricted practice hospitals (N = 94)</td>
<td>222</td>
</tr>
<tr>
<td>Table 38</td>
<td>Descriptive statistics for time of day, stage of labour and women’s experience of hunger</td>
<td>223</td>
</tr>
</tbody>
</table>
List of Figures

FIGURE 1  THE LINKS BETWEEN THE FOUR AIMS OF THE RESEARCH  8

FIGURE 2  MATERNAL MORTALITY FROM PULMONARY ASPIRATION IN THE UNITED KINGDOM  35

FIGURE 3  TERMINOLOGY DESCRIBING THE COURSE OF LABOUR IN RELATION TO CERVICAL DILATATION  183
# List of Appendices

<table>
<thead>
<tr>
<th>Appendix</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>APPENDIX B</td>
<td>NSW Hospitals’ Questionnaire</td>
<td>279</td>
</tr>
<tr>
<td>APPENDIX C</td>
<td>Midwives’ Questionnaire</td>
<td>281</td>
</tr>
<tr>
<td>APPENDIX D</td>
<td>Anaesthetists’ Questionnaire</td>
<td>283</td>
</tr>
<tr>
<td>APPENDIX E</td>
<td>Human Ethics Research Committees Approval Letters</td>
<td>286</td>
</tr>
<tr>
<td>APPENDIX F</td>
<td>Food and Fluid Record Form</td>
<td>290</td>
</tr>
<tr>
<td>APPENDIX G</td>
<td>Information Sheet for Oral Intake Study</td>
<td>292</td>
</tr>
<tr>
<td>APPENDIX H</td>
<td>Consent Form for Oral Intake Study</td>
<td>293</td>
</tr>
<tr>
<td>APPENDIX I</td>
<td>Food Consumed by Women During the Established Phase of the First Stage of Labour</td>
<td>294</td>
</tr>
<tr>
<td>APPENDIX J</td>
<td>Correlations Between Predictors and Hospital-Estimated Length of Labour</td>
<td>295</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
<td></td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Active phase of labour</td>
<td>Also referred to as the active phase of the first stage of labour. Cervix dilates from 3 to 7 cm (inclusive) (Cassidy, 1999). Hospital staff estimate the timing of the commencement and completion of the active phase of labour.</td>
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<tr>
<td>Usual practice</td>
<td>Refers to the common or usual practice employed by most midwives when a written policy does not exist.</td>
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<tr>
<td>Artificial rupture of membranes</td>
<td>To rupture the forewaters using an Amnihook; commonly used to stimulate contractions during labour (Williams, 1999).</td>
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<tr>
<td>Clear fluid</td>
<td>A liquid that is easy to see through and free of particulate matter, for example water, cordial, juice, jelly, milk-free tea or coffee.</td>
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<tr>
<td>Early phase of labour</td>
<td>Also referred to as the early phase of the first stage of labour. The period which begins with the onset of regular labour contractions and ends when the cervix is 3 cm dilated (Cassidy, 1999a). In this study the length of the early phase of the first stage of labour was attained by calculating the number of hours between the women’s estimate of the commencement of their labour and the midwives estimate of the commencement of their established labour.</td>
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</tr>
<tr>
<td>Eating group</td>
<td>Women who have eaten food at any time during the first stage of labour (early, active, or transition).</td>
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</tr>
<tr>
<td>Established labour</td>
<td>Active and transition phases of the first stage of labour combined (3 – 10 cm cervical dilatation inclusive) – as estimated by hospital staff.</td>
<td></td>
</tr>
<tr>
<td>Fast / fasted / fasting</td>
<td>To refrain from all food and liquids.</td>
<td></td>
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<tr>
<td>Free fluid</td>
<td>Any form of liquid or food that becomes liquified in the mouth, for example, jelly, icecream, custard, milk.</td>
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</tr>
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<td>Term</td>
<td>Definition</td>
<td></td>
</tr>
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<td>-------------------------------------------</td>
<td>---------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Hospital-estimated length of labour</td>
<td>The number of hours between the commencement of established labour (3 cm cervical dilatation) and the birth of the baby; does not include the early phase of the first stage of labour</td>
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</tr>
<tr>
<td>Length of labour</td>
<td>The number of hours between the commencement of established labour (3 cm cervical dilatation) and the birth of the baby; does not include the early phase of the first stage of labour (Cassidy, 1999).</td>
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</tr>
<tr>
<td>Light diet</td>
<td>A liquid or food that is easily digested by the stomach, for example, toast, bread, biscuits, eggs, stewed fruit.</td>
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</tr>
<tr>
<td>Medical augmentation</td>
<td>The use of an intravenous syntocinon infusion to improve uterine contractions and hasten labour progress (Williams, 1999).</td>
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</tr>
<tr>
<td>Medical intervention</td>
<td>Any medical procedure undertaken to improve or alter the labour or birth process (e.g., medical augmentation, artificial rupture of membranes, epidural anaesthesia, forceps or ventouse-assisted delivery or caesarean section).</td>
<td></td>
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<tr>
<td>Multiparous</td>
<td>A woman who has borne one or more children (Cassidy, 1999).</td>
<td></td>
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<tr>
<td>Nil by mouth</td>
<td>To refrain from all oral consumption of food and liquids.</td>
<td></td>
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<tr>
<td>Non-eating group</td>
<td>Women who have only consumed clear fluids throughout the first stage of labour (early, active, and transition).</td>
<td></td>
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<tr>
<td>Nulliparous</td>
<td>A woman who has never borne a child (Cassidy, 1999).</td>
<td></td>
</tr>
<tr>
<td>Occipito-anterior position</td>
<td>The occiput (back of baby’s head) points to the left or right iliopectineal eminence of the pelvis (front of pelvis) (Thomson, 1996).</td>
<td></td>
</tr>
<tr>
<td>Occipito-lateral position</td>
<td>The occiput (back of baby’s head) points to the left or right midway between the iliopectineal eminence and the sacro-iliac joint of the pelvis (side of pelvis) (Thomson, 1996).</td>
<td></td>
</tr>
<tr>
<td>Occipito-posterior position</td>
<td>The occiput (back of baby’s head) points to the left or right sacro-iliac joint of the pelvis (back of pelvis) (Thomson, 1996).</td>
<td></td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
<td></td>
</tr>
<tr>
<td>---------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Prolonged labour</td>
<td>A labour that exceeds 24 hours, or 12 hours when actively managed (Williams, 1999).</td>
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</tr>
<tr>
<td>Restricted Practice Hospital</td>
<td>Hospital that has an unwritten ‘usual practice’ that only allows labouring women with low-risk pregnancies to consume clear fluids during labour.</td>
<td></td>
</tr>
<tr>
<td>RPH</td>
<td>Restricted Practice Hospital.</td>
<td></td>
</tr>
<tr>
<td>Transition</td>
<td>Also referred to as the transition phase of the first stage of labour. Cervix dilates from 7 to 10 cm (Cassidy, 1999).</td>
<td></td>
</tr>
<tr>
<td>Unrestricted Practice Hospital</td>
<td>Hospital that has an ‘usual practice’, followed by most midwives, which allows labouring women with low-risk pregnancies to eat and drink during labour as desired.</td>
<td></td>
</tr>
<tr>
<td>URPH</td>
<td>Unrestricted Practice Hospital.</td>
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<tr>
<td>Usual practice</td>
<td>A practice which is based on the convention established by informal agreement between staff when a written policy does not exist.</td>
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</tr>
<tr>
<td>Uterine inertia</td>
<td>Uterine contractions which are weak and cause slow dilatation of the cervix and subsequently a long, slow labour (Williams, 1999).</td>
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</tr>
<tr>
<td>Written policy</td>
<td>Refers to a practice which is documented in the hospital’s policy or procedure manual.</td>
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</tr>
</tbody>
</table>
Abstract

The appropriate oral intake for labouring women has long been a controversial issue among midwives and anaesthetists. Anaesthetists argue that any type of food and, to some extent, fluid consumption during labour, will increase a woman’s risk of gastric content aspiration if general anaesthesia is required. Many midwives believe that aspiration, being such a rare event with contemporary medical practice, is unlikely in the hands of a skilled obstetric anaesthetist. These midwives believe that labouring without any form of sustenance other than water or clear fluids may be detrimental for the woman, her baby and the progress of labour. To date, research has been unable to provide reliable information to support either side of this debate. This thesis presents a series of studies (three surveys and a comparative trial) designed to enhance the body of knowledge available for decisions about labouring women’s oral requirements.

The surveys were conducted to describe the policies of hospitals in New South Wales, Australia, and the views and practices of anaesthetists and midwives regarding the oral intake of labouring women. Hospitals were found to have varying policies for this issue. Midwives were found to vary in their practice for the labouring woman’s oral intake and up to one-third of these midwives practised contrary to their hospital’s ‘usual practice’ when no written policy existed. The rationales provided by these midwives for their practice decisions were unsupported by research evidence.
The majority of anaesthetists agreed that pregnant women should ‘fast’ before surgery and throughout the labour process, although a few allowed ‘clear fluids’. However, their views varied for the dietary allowances for labouring women with an effective epidural anaesthetic in situ.

The main findings of this thesis come from a comparative study conducted to explore the effect of eating or not eating food on labour and birth outcomes of 217 nulliparous women with low risk pregnancies, (Eating group = 123; Non-eating group = 94). The study employed a naturalistic approach to its design in order to capture the actual eating behaviour of labouring women rather than the manipulated approach used in a randomised control trial. Eating food during the early phase of the first stage of labour was associated with nearly a two-hour longer hospital-estimated labour. When women ate food during both their early and established phases of labour, an average of 3.5 hours was added to their hospital-estimated labour. The incidence of vomiting or medical interventions during labour and adverse birth outcomes were found to be unaffected by the voluntary consumption of food. The findings from this series of studies suggest women should be informed of the lack of evidence to support any dietary regime for labour, along with the possible risks and benefits, and allowed to make their own decisions about their oral intake needs for labour.

Although this thesis has augmented knowledge, it has been unable to demonstrate that eating food during labour improves labour and birth outcomes. However, it did not find this practice to be harmful for mothers or babies. The lack of reliable research evidence on which to base practice decreases the ability of midwives to be
assured of the ‘best practice’ for labouring women’s oral intake. Depending on experience and labouring women’s preference alone has created interhospital and interprofessional inconsistency. Further research is essential to ascertain ‘best practice’ for this aspect of care.
Introduction

Policies and practices directing care for women during childbirth are determined by a combination of cultural and organizational directives that reflect historical, religious, legislative, professional and resource authority and controls. Outside of the legislative requirements, the preferences of the medical practitioners substantially influence clinical policy in established health facilities. As would be expected, clinical practice varies between countries, regions and facilities, with controversial practice policies generating considerable discussion and debate among medical and non-medical clinicians. Midwifery practice is reflective of those influences.

This research focuses on one component of the management of women during childbirth. There is no consensus among clinicians about whether a woman should be allowed to eat, and to a lesser extent drink, during her labour. There are two
opposing, but not mutually exclusive, opinions. Fasting women during labour became common practice with the increased use of general anaesthesia during labour. Anaesthetists are concerned that to perform a general anaesthetic, especially in an emergency situation when a woman has recently eaten, puts the woman at an increased risk of regurgitation and aspiration (Mendelson, 1946; Slater [anaesthetist], personal communication June 2000; Warner, Warner, & Weber, 1993). For the anaesthetist, this concern far outweighs any perceived benefit of women eating during their labour. However, despite extensive research to identify methods to prevent gastric aspiration, the safety or efficacy of ‘fasting’ as an aspiration prevention method has not been investigated. There is also limited research investigating the physiological and psychological implications oral intake restrictions may have on labouring women (Berry, 1997; Laifer, 1992; Sleutel & Golden, 1999).

Those opposed to a blanket policy to fast all women during labour believe that withholding food and sometimes fluids during labour may be detrimental to the mother, her fetus and the progress of labour. This view is held by many midwives (e.g., Horner, 1989; Lewis, 1992; Pengelley & Gyte, 1998). The midwifery literature has been heavily weighted with opinions supporting oral intake for labouring women as a strategy for improving labour outcomes (e.g., Berry, 1997; Chern-Hughes, 1999; Ludka & Roberts, 1993). These opinions, however, are not supported by sufficient, reliable research. Although randomised clinical studies have been conducted over the last decade, their methodologies differ and their findings conflict (e.g., Scrutton, Metcalfe, Lowy, Seed, & O’Sullivan, 1999;
1.1 Conceptual framework

In Western countries childbirth usually takes place in hospital and although hospital birth centres are becoming more common, the majority of births are in labour wards. Some hospitals have attempted to replace the sterile, ‘operating room’ appearance and environment of labour wards by refurbishing to conceal equipment as much as possible; however, the policies and practices continue to reflect the beliefs and priorities of health professionals, primarily controlled by doctors. The focus is on the medical management of childbirth (Stephens, 1998). Within that context, the ‘accepted practices’ during labour have adopted some of the preparation and precautions associated with surgery. For example, until the 1980s, the perineum was shaved and enemas were given to labouring women to prevent infection of the newborn. Neither of these interventions was based on evidence, and neither endured. However, other practices do continue, albeit without outcome based evidence. Restricting oral intake during labour is a common practice that has been accepted as routine care in labour wards. The practice was initiated following research by Mendelson (1946) based on retrospective observations of obstetric patients and experiments on rabbits; it was implemented as a precaution against aspiration should a general anaesthetic be required during labour or birth.

Aspiration of gastric contents during anaesthesia was common during the first half of the 20th century (Mendelson, 1946; Morley, 1955) when anaesthetic procedures, equipment and drugs were being developed. Since that time procedures and
technology have changed, and, as a result, aspiration during anaesthesia is extremely rare today (American Society of Anesthesiologists, 1998; Department of Health, 2001; Hawthorne, Wilson, Lyons, & Dresner, 1996). The management of childbirth has also changed in that general anaesthesia is no longer used during labour, it is extremely rare during vaginal delivery and most caesarean sections are now performed under epidural anaesthesia which is not associated with aspiration (Brownridge, 1994; Ong, Cohen, Cumming, & Palahniuk, 1987).

The midwife’s role is to provide care to women during pregnancy, labour and the puerperium. Midwifery practice has evolved to have a particular focus on promoting normal processes of childbirth and minimising intervention (Thorstensen, 2000). Sharing information, including women’s legal right to make choices, empowers women to make decisions about the type of birth experience they desire (Fahy, 2002; Too, 1996). This empowerment also encourages women to accept responsibility for their decisions (Too, 1996). Lack of involvement in decision-making and control over the birth process has been demonstrated to affect a woman’s satisfaction with her childbirth experience (Goodman, Mackey, & Tavakoli, 2004). It has been suggested that dissatisfaction may have an immediate and long-term effect on women’s emotional, physical and sexual health (Laurence, 1997) and enjoyment of breastfeeding and parenting (Laurence, 1997; Simkin, 1992). Women have many decisions to make regarding their desired childbirth experience: whether they wish to eat and drink during their labour is a choice they should be trusted to make based on the available evidence. However, the evidence is weak and research findings conflict.
Childbirth in western countries takes place in hospitals where policy and practice focuses on the medical management of women and their babies, and in some cases is based on tradition rather than evidence from outcomes. This research is located within the above context, and was conducted to determine the practice among hospitals, midwives and anaesthetists, and the natural behaviour of women regarding food intake during labour. This information will add to the current knowledge of the effect of food consumption by labouring women on their birth outcomes.

1.2 Purpose of the study

This research has been designed to address gaps in evidence to inform clinical decisions and policy for the management of oral intake for women during labour. The thesis presents results from a series of related projects that address the following aims.

1.3 Overall aims of this series of studies

1. To determine the range and content of written policies and verbal (unwritten) practices in hospitals in NSW, Australia, regarding oral intake during labour for low and high-risk labouring women (Study 1, Chapter 4)

2. To explore the practices and views of midwives, within four hospitals in Sydney, NSW, regarding oral intake for labouring women, both low and high-risk (Study 2, Chapter 5)
3. To explore the practices and views of obstetric anaesthetists, within the same four Sydney hospitals, regarding the aspiration prevention strategies used for the induction of general anaesthesia for a caesarean section (Study 3, Chapter 6)

4. To compare the maternal and newborn outcomes of low-risk, English-speaking, nulliparous (‘first baby’) labouring women who ate food during their labour (Eating Groups) with those who did not eat during their labour (Non-eating Group) (Study 4, Chapter 7). Comparisons between the groups were examined for:
   - the length of labour
   - the occurrence of medical interventions
   - the incidence of vomiting
   - participant’s retrospective views about their reason for eating or not eating food during their labour.

1.4 Questions to be addressed by this series of studies

1. What is the content of written policies and/or unwritten usual practices used by hospitals throughout NSW, Australia for the management of labouring women’s oral intake?

2. What are the views, practices and decision-making processes used by midwives regarding the oral intake of labouring women with low and high-risk pregnancies?
3. Are obstetric anaesthetists consistent in their aspiration prevention strategies for women requiring an emergency caesarean section under general anaesthesia, and for labouring women with an epidural anaesthetic in situ?

4. Is there a difference in length of labour for nulliparous women who ingest food at will during their labour and those who do not ingest any food during their labour?

5. Is there a difference between the frequency of medical interventions for nulliparous women who ingest food at will during their labour and nulliparous women who do not ingest any food during their labour?

1.5 Organisation of the thesis

The study described in this thesis has five components, distributed among six chapters. First, there is a review of the evidence that is guiding policy and clinical practice regarding oral intake by women during labour. Chapter 2 provides information regarding the historical background of general anaesthesia in obstetrics and its association with gastric content aspiration. It also explores the pathophysiology, aetiology, preventative strategies and maternal mortality statistics of aspiration which occurs during general anaesthesia. Chapter 3 examines the type and content of evidence used for allowing labouring women food. It reports the history of labouring women’s diets, the possible physiological and psychological needs of these women and the relationship with food intake, along with research conducted in this area.
Chapters 4, 5, 6 and 7 present results of a series of studies that collectively address the aims of the research (Figure 1). The survey reported in Chapter 4 was designed to determine the content of hospital policies for the oral intake of women during labour and whether these policies were written in the hospital’s policy and procedure manual or were simply the usual practice within the maternity unit. Each public facility and a number of private facilities in NSW with a dedicated midwifery unit were invited to participate. In Chapter 5 the findings of a survey of midwives working in four Sydney hospitals is reported. This survey was conducted to identify the personal beliefs and practices of midwives regarding the management of oral intake for labouring women and to ascertain whether these midwives followed their hospital’s policy for this aspect of care.

Figure 1 The links between the four aims of the research
Next, anaesthetists completed a survey of their views and practices pertaining to strategies used to prevent gastric content aspiration for women requiring emergency caesarean section under general anaesthesia. Information was also sought regarding their recommendations for the oral intake of women under the effect of epidural anaesthesia for labour. The findings are reported in Chapter 6. Chapter 7 reports the findings of a naturalistic, comparative study with concurrent controls. This study was undertaken to identify the natural eating behaviour of labouring women and to compare the length of labour and the incidence of medical interventions and birth outcomes for women who chose to eat food during their labour (Eating groups) with those who chose not to eat any food (Non-eating group).

The following two chapters examine the evidence refuting and supporting the safety of oral intake during labour.
Aspiration and General Anaesthesia

2.1 Introduction

Debates regarding pregnant women’s oral intake requirements for labour and childbirth are argued from two perspectives. The opponents to allowing women to eat and drink argue that there is a risk of gastric content aspiration by women if a general anaesthetic is required during the course of their labour. The alternative clinical position is to allow women to eat and drink if they wish, citing improvement to labour and birth outcomes when oral intake is permitted.

The literature reviewed to investigate these two perspectives has focused on the scientific and theoretical knowledge of the physiological and psychological effect of food and fluid in labour, haematological alterations, digestion, gastric emptying, and aspiration along with anaesthetic research into drugs and techniques employed during obstetric general anaesthesia and their effect on maternal aspiration.
Historical and contemporary opinion, however, tend to provide a less than adequate basis for current practice.

Search strategies to identify literature regarding aspiration and its association with general anaesthesia and for the oral intake of labouring women comprised obstetric, anaesthetic, and midwifery text books as well as a number of systematic searches of the computerised databases of published papers, CINAHL (1982 – 2004), PreMEDLINE and MEDLINE (1966 – 2004), and the complete Cochrane Library. Two main searches were conducted using the keywords (1) ‘obstetric anaesthesia or anesthesia’ and ‘aspiration’ and (2) ‘oral intake’, or ‘food’, or ‘diet’, and ‘labour or labor.’ The information gathered regarding obstetric anaesthesia and aspiration provided an understanding of the history and the significance of anaesthesia on the incidence of aspiration morbidity and mortality among pregnant women.

Of the 47 articles retrieved regarding oral intake and labour there were 15 research articles: four were randomised control trials and nine were surveys. Two randomised, controlled trials investigated the effect of food consumption by labouring women on labour and birth outcomes (Scrutton et al., 1999; Tourangeau, Carter, Tansil, McLean, & Downer, 1999). Tourangeau et al. (1999) investigated the effect of intravenous fluid compared with food consumption on the production of ketones during labour, whereas Scrutton, Metcalfe, Lowy, Seed, and O’Sullivan (1999) examined the effect on labour and birth outcomes of labouring women who ate food compared with those who drank water only. Two randomised, controlled trials explored various types of fluid intake (Kubli, Scrutton, Seed, & O’Sullivan, 2002; Scheepers et al., 2002). Three unpublished randomised control trials
investigating the effect of food consumption on labour outcomes were also located (Rodwell, 1992; Tranmer, 1999; Yiannouzis & Parnell, 1994). This chapter presents the pathophysiology and aetiology of gastric content aspiration and reviews the literature pertaining specifically to the risk of aspiration during labour if general anaesthesia is required.

Aspiration is ‘the introduction of a foreign substance into the lungs’ (Goodwin, 1996, p. 58). This thesis is concerned with the aspiration of gastric contents associated with childbirth which may occur during general anaesthesia. Death attributed to anaesthesia-related aspiration has been a concern since its occurrence was first documented in 1853 (Gardiner, 1958). The argument supporting the continuation of oral intake restrictions for all labouring women is underpinned by this concern. The seminal study which first estimated its incidence rate and described the effect that aspiration of gastric contents had on the lungs of obstetric patients was reported in 1946 by Curtis Mendelson, an American obstetrician. Based on his findings, Mendelson recommended that all labouring women be ‘fasted’ as one strategy for preventing aspiration of gastric contents during general anaesthesia. While Mendelson (1946) did not establish the association between aspiration and general anaesthesia, its rare incidence occurs mostly during this type of anaesthesia (Newton & Champion, 1997).

Aspiration during general anaesthesia is no more prevalent in obstetrics than any other population group (Olsson, Hallen, & Hambraeus-Jonzon, 1986). Pregnant women are usually young, fit and healthy and undergoing what should be a normal process (Seeley, 1987) and it is for this reason that every maternal death or accident
is brought to public attention. Because aspiration of stomach contents during general anaesthesia in pregnant women is a concern for anaesthetists, it has strongly influenced the clinical practice of midwives and obstetricians. A review of the pathophysiology, history, aetiology and current preventative strategies for anaesthesia-related aspiration is, therefore, pertinent to this review.

2.2 Pathophysiology of aspiration

Gastric contents can be inhaled into the trachea and enter the lungs following either active vomiting or passive regurgitation (Cheek & Gutsche, 1987; Morgan, 1977). Vomiting is an active reflex that may be activated during induction of general anaesthesia, probably as the endotracheal tube stimulates the pharynx (Crawford, 1956). Regurgitation is silent and usually goes unnoticed by attending clinicians (Kallar, 1988; Morgan, 1977), with light anaesthesia posing the same risk as deep anaesthesia (Kaller, 1988; Kluger & Short, 1999). The epiglottis, vocal cords and cough reflex all participate in the protective mechanism to prevent aspiration of gastric contents when regurgitation occurs but these protective reflexes are obliterated during general anaesthesia (Morgan, 1977).

Regurgitation is sometimes caused when the airways become partially obstructed (Kallar, 1988). Premedication with narcotics (Todd & Nimmo, 1983), some antacids (Kallar & Everett, 1993) and drugs commonly used for general anaesthesia, such as thiopentone (Dawson & Cockroft, 1996; Vanner, Pryle, O’Dwyer, & Reynolds, 1992a) and succinylcholine (Blitt, Gutman, Cohen, Weisman, & Dillon, 1970; Miller & Way, 1971; Muravchick, Burkett, & Gold, 1981), have also been implicated in the incidence of regurgitation of stomach contents. Regurgitation and
vomiting are often ‘associated with difficult, prolonged and repeated attempts at intubation’ (Hardy, 1988, p.162). Lastly, prolonged fasting and dehydration are known to cause retching (Sutherland, Stock, & Davies, 1986).

A patient may aspirate solids (food), fluid, or gastric acids. Mendelson (1946) was the first to describe the damage caused to the lungs after he injected various types of fluid (such as hydrochloric acid, water, semi-digested food) directly into the trachea of rabbits who had been anaesthetised with an injection of sodium pentothal (Mendelson, 1946). When liquid gastric contents with pH less than 2.5 are aspirated a chemical burn results on contact (Awe, Fletcher, & Jacob, 1966; Goodwin, 1996). The extent of the burn depends on the strength of the acid and the surface area involved (Gibbs, 1986; Kallar, 1988). In the extreme incident, the lung parenchyma is completely destroyed and surfactant is diluted, inactivated or destroyed (Seeley 1987). The alveoli fill with hyaline exudate and extravasated red blood cells within ten minutes (Awe, Fletcher, & Jacob, 1966; Seeley, 1987) in order to neutralise the contaminated material (Sabawala, 1969). Pulmonary oedema, haemorrhage and inflammation occur (Teabeaut, 1952) resulting in extreme hypoxaemia and acute onset of respiratory distress (Goodwin, 1996; Kallar, 1988). The bronchial epithelium may be partially or completely sloughed and the remaining functional alveoli are enlarged (Bannister & Sattilaro, 1962). This causes hypoxia, hypovolaemia (Awe, Fletcher, & Jacob, 1966) and metabolic disturbances (Hackl et al., 1997) within 24 to 36 hours after aspiration (Goodwin, 1996). Hyaline membrane disease and adult respiratory distress syndrome may appear 48 hours after the insult. Ten to 15% of patients who aspirate will develop circulatory shock and deteriorate rapidly but most patients will improve within one to four days after
their aspiration episode (Burchman, 1996). Seventy-two hours after the aspiration insult, abatement and regeneration of the lung damage has begun (Hackl et al., 1997; Downs, Chapman, Modell, & Hood, 1974).

Aspiration of partially digested food causes a different pathologic response which Burchman (1996) and Gibbs (1986) considered to be more damaging. According to Teabeaut (1952), food particles produce a foreign body reaction in the lungs. This reaction causes cellular exudate which evolves into a foreign body lesion comprising epithelioid cells surrounded by macrophages and lymphocytes. Smaller particles can produce an obstructive bronchiolitis approximately 48 hours after aspiration occurs (Rubin & Wood, 1993).

The overall prognosis of an anaesthesia-related gastric aspiration incident has not changed over the past fifty years. Most patients make a full recovery (Burchman, 1996; Mendelson, 1946), and those who do not are usually elderly and debilitated (Bynum & Pierce, 1976). Seeley (1987) believes that many small volume aspiration incidences are unnoticed and usually tolerated by patients.

Animal studies demonstrate that a gastric volume greater than 25 ml or consisting of a pH less than 2.5 (Roberts & Shirley, 1974) puts the patient most at risk of pneumonitis; the most significant factor is the acidity of the stomach contents (Bannister & Sattilaro, 1962; Teabeaut, 1952). Aspiration of stomach contents with a pH less than 1.75 has been associated with a 100% mortality rate in humans (James, Modell, Gibbs, Kuck, & Ruiz, 1983; Lewis, Burgess & Hampson, 1971). The precise gastric volume and pH which expose a patient to the risk of aspiration, however, is unknown (Alahuhta, 1996), although it has been estimated as a pH less
than 3.5 and gastric volume greater than 50 ml (Rocke, Brock-Utne, & Rout, 1993). The 50 ml gastric volume is the amount of aspiration not the amount regurgitated nor the total volume in the stomach (Gorback, 1989).

Research on sedated cats, which have an oesophageal sphincter that functions similarly to that of humans, found that 21 ml per kilogram of gastric fluid, on average, was required for spontaneous regurgitation to occur, and this amount was not necessarily accompanied by aspiration (Ploude & Hardy, 1986). This information provided by Ploude and Hardy (1986) suggests that a 60 kilogram human would require a gastric fluid volume of 1260 ml before spontaneous regurgitation occurs.

The pathophysiology following an aspiration incident is the reason for anaesthetists’ caution regarding the labouring woman’s oral intake. However, clinically important aspiration of stomach contents into the lungs has always been a rare event (Ingebo et al., 1997; Olsson et al., 1986), even in Mendelson’s (1946) era. Over the past decade, maternal death from aspiration has become almost non-existent (Department of Health, 2001; NHMRC, 2001).

2.3 Aetiology of general anaesthesia-related aspiration incidents

Having explored the pathophysiology of anaesthesia-related aspiration, attention now focuses on factors that are known to influence its incidence. Some patients are more at risk of aspiration of stomach contents than others and numerous attempts have been made to characterise patients at increased risk. The majority of patients fall into identifiable high-risk groups. Patients who are heavily sedated,
semiconscious or who have a neuromuscular disease are more likely to aspirate gastric contents (Gibbs & Modell, 1994). People with an anatomical abnormality or neurologic disease which interfere with the normal airway protection mechanism are also at increased risk. Pregnancy, oesophageal reflux, recent trauma or seizure disorders increase the risk (Gibbs & Modell, 1994), and obesity, diabetes, peptic ulcer disease, stress or pain and narcotic medications have also been implicated (Olsson et al., 1986).

A review of the literature indicates that pulmonary aspiration occurs rarely in modern anaesthesia practice (Department of Health, 1996, 2001; Olsson et al., 1986; Warner et al., 1993) but when it does the cause is multifactorial. It is affected by:

_Age:_ children and the elderly are at greatest risk (Borland et al., 1998; Clifton & Hotten, 1963; Lunn & Devlin, 1987; Olsson et al., 1986; Tiret & Hatton, 1986; Wang & Hagerdal, 1992)

_Gender:_ males experience a higher incidence of aspiration than females (Beecher & Todd, 1954; Cliften & Hotten, 1963; Edwards, Morton, Pask, & Wylie, 1956; Olsson et al., 1986; Warden, Borton, & Horan, 1994)

_Health status:_ aspiration patients often are in poor health (Borland et al., 1998; Clifton & Hotten, 1963; Hovi-Viander, 1980; Kluger & Short, 1999; Tiret & Hatton, 1986).

_Time of day:_ aspiration rate increases three to sixfold during the night between 1800 and 0700 hours (Clifton & Hotten, 1963; Olsson et al., 1986)
Emergency versus non-emergent surgery: in the past, aspiration occurred twice as often among emergency cases when compared with elective cases (Hovi-Viander, 1980; Rubin & Wood, 1993; Tiret & Hatton, 1986). During the early 1970s emergency obstetric surgery performed under general anaesthesia was the second highest category leading to aspiration of gastric contents (Bynum & Pierce, 1976). It should be remembered that this was during the period of particulate antacids and the early years of rapid sequence induction of anaesthesia, which will be discussed further in this review. More recently, however, aspiration has been found to be far more likely to occur in elective than emergency surgical cases (Borland et al., 1998; Kluger & Short, 1999) which may be attributed to the effectiveness of precautions taken for the emergency patient (Borland et al., 1998).

Anaesthesia method: patients induced intravenously are almost three times as likely to aspirate compared with patients receiving inhalation induction (Borland et al., 1998). Thiopentone, for example, causes a rapid fall in upper oesophageal sphincter pressure, increasing the risk of regurgitation and aspiration (Vanner et al., 1992a). Regional anaesthesia and aspiration, however, are not associated (O’Sullivan, 1994) making this the anaesthesia of choice for patients at risk of aspiration (Alahahta, 1996; Cunningham, MacDonald, Leveno, Gant, & Gilstrap, 1993; Oberoi & Phillips, 2000).

Stomach contents: a greater incidence was noted among patients who had fasted less than two hours or greater than 24 hours (Borland et al., 1998). Kluger and Short (1999), however, found that the majority of aspiration incidents in
their study occurred where patients had been fasted; the fluid aspirated being bile.

*Anaesthetist error or mismanagement:* human error contributes up to 90% of all system failures (Allnutt, 1987) and is cited frequently as being a cause of aspiration (e.g., Beecher & Todd, 1954; Harrison, 1978; Hawthorne et al., 1996; Holland, 1962, 1970, 1987; Kluger & Short, 1999; Morgan, 1987; Olsson et al., 1986; Sinclair, Simmons, & Cyna, 1999; Taylor, Larson, & Prestwich, 1976; Warden et al., 1994) particularly among emergency cases performed at night (Olsson et al., 1986; Rosen, 1981). A common criticism made of hospital administrations and anaesthetists was the tendency to assign obstetric anaesthesia to junior anaesthetists, especially overnight in specialized maternity hospitals (Crawford, 1978; O’Sullivan, 1962; Rosen, 1981). Anaesthetic error is believed to occur because established principles of pre-anaesthetic preparation were neglected, choice of anaesthetic or dosage was inappropriate, or observation and post-operative care was poor (Holland, 1970). Over the period 1960 to 1968 in NSW an average 4.3 errors per fatality were made by anaesthetic personnel (Holland, 1970). A vast improvement was found 25 years later by Warden et al. (1994) when, among 161 anaesthetic-related deaths, the anaesthetic error rate had been reduced to 1.8 errors per death. Inadequate management of either pre- or post-operative care contributed to over a third of deaths (Warden et al., 1994) with the three cases of gastric content aspiration all being attributed to anaesthetic error. In the 1989 report from the Confidential Enquiries into Maternal Deaths in the United Kingdom, the primary cause assigned to all
cases of anaesthesia-related aspiration deaths was substandard care and failure to intubate satisfactorily.

The physical state of the anaesthetist at the time of anaesthesia: lack of sleep and fatigue have been shown to adversely affect the professional performance of anaesthetists (Chopra, Bovill, Spierdijk, & Koornneef, 1992).

Provision of anaesthesia: inadequate anaesthesia can lead to coughing/straining and subsequent regurgitation, vomiting or both (Kluger & Short, 1999).

Inadequate preparation of the patient: failure of the anaesthetist to complete a careful clinical and physical assessment of the patient (Dupont, Hamza, Jullien, & Narchi, 1990; Elsberry, Shulman, & Moore, 1990; Kluger & Short, 1999; Ostheimer, 1992) and failure to detect a difficult airway preoperatively are associated with aspiration. The assessment should include a clinical history (Davies, Weeks, Crone, & Pavlin, 1989), checking for symptoms of gastro-oesophageal reflux and airway oedema (Davies et al., 1989) and an assessment of the airways in the sitting and recumbent positions (Davies et al., 1989).

Anaesthetist's experience: aspiration incidents were more likely to occur in the hands of junior anaesthetists (Borland et al., 1998; Clifton & Hotten, 1963; Holland, 1962; Kluger & Short, 1999; Morton & Wylie, 1951; Olsson et al., 1986; Rubin & Wood, 1993).

Type of operation being performed: oesophageal surgery, for example, increases the risk of aspiration (Borland et al., 1998; Clifton & Hotten, 1963).
Assistance for anaesthetist: inadequate assistance for the anaesthetists during induction of anaesthesia is implicated (Kluger & Short, 1999).

Difficult intubation: the cause of most anaesthesia-related morbidity and mortality (Cormack & Lehane, 1984) is difficult intubation and is associated with many pulmonary aspiration episodes (Gibbs, Rolbin, & Norman, 1984).

Almost all aspiration-related anaesthetic mortality cases brought before the Closed Claims Committee in the United States since 1985 have been associated with either mask general anaesthesia, difficult (or oesophageal) intubation, or lack of cricoid pressure during induction (Chadwick, 1996).

The cause of aspiration incidents is multifactorial, with anaesthetist error or mismanagement being the main contributing factors (Department of Health, 1979, 1982, 1991). ‘This suggests that the risk of pulmonary aspiration is more a function of how the anaesthetic is conducted than the presence of traditionally accepted risk factors like increased gastric volume’ (Soreide, 1997, p. 23). No maternal mortality report can be found which implicates the patient’s stomach contents or their preoperative food and/or fluid consumption as a causative factor. The literature implicates anaesthetic error and mismanagement rather than oral intake and gastric content as significantly contributing to episodes of aspiration.

Care should be taken when reading the literature on the subject of aspiration morbidity and mortality. Professional-guarding and medico-legal implications have generated controversy regarding the reporting of statistics (e.g., Brunner & Suddarth, 1987; Gibbs & Modell, 1994; Rowe, 1997) and possible misrepresentation.
of content cited in studies (e.g., Alahuhta, 1996). For example, Alahuhta (1996), relating the findings from a study by Olsson et al. (1986), reported a fourfold increase in aspiration incidents among caesarean section cases when compared with non-obstetric cases. This statement could be interpreted as a warning for anaesthetists when dealing with obstetric anaesthesia. However, the author did not report, of the 83 aspiration incidents in this study, that only five were caesarean sections and that all deaths from aspiration (n = 4) occurred among males aged between 46 and 63 years.

‘There is a complex interplay between patient risk factors, anaesthetic technique and surgical procedure [during general anaesthesia]. Recognition of risk factors, securing the airway and ensuring a meticulous anaesthetic technique may prevent [aspiration]’ (Kluger & Short, 1999, p.20). Current guidelines for the prevention of aspiration are for:

- an experienced anaesthesia assistant to be available at all times
- the application of appropriate cricoid pressure with all inductions of general anaesthesia using muscle relaxants
- all emergency patients to be intubated
- all patients with delayed gastric emptying or increased intra-abdominal pressure to be intubated
- high-risk cases to be extubated when awake and lying on their side (Kluger & Short, 1999).
Interestingly, these anti-aspiration guidelines do not include oral intake restrictions for the patient. The following section will discuss the history of general anaesthesia and aspiration in obstetrics and the improvement and refinement of prevention strategies which have all but eradicated maternal aspiration mortality when all required procedures are followed.

2.4 General anaesthesia and aspiration in obstetrics

General anaesthesia became a common occurrence of labour by the mid-1850s following Queen Victoria’s anaesthetised labour. The increasing use of epidural anaesthesia and newer induction drugs since the 1970s have largely replaced gaseous anaesthesia except for emergency situations (Bevis, 1984; Brownridge, 1994). Major advances occurring in anaesthesia, both pharmacologically and technically, particularly since 1950, have significantly reduced morbidity to the extent that general anaesthesia is now considered a low-risk intervention.

Policy and practices regarding oral intake during labour have also changed over the past 50 years. Before 1950 women were encouraged to eat during their labour; however, after 1950 medical opinion was revised and the majority of women were kept ‘nil by mouth’. For this reason, the literature describing the development of general anaesthesia and interventions to reduce aspiration will be discussed in two parts. Literature reporting the United Kingdom maternal mortality statistics pre and post 1950 will be followed by a review of Australian aspiration-related maternal mortality incidences post-1950.
2.4.1 General anaesthesia and aspiration in obstetrics pre-1950

The association between aspiration of gastric contents and respiratory distress following general anaesthesia was first published by Mendelson (1946). ‘Mendelson syndrome’ described the damage caused to the lungs when highly acidic fluid was aspirated (Bevis, 1999). Ether anaesthesia was achieved by inhalation of fumes through a mask applied over the patient’s nose and mouth and was first used in the United States of America during childbirth in 1847 with chloroform inhalational anaesthesia being used in the United Kingdom (Bevis, 1984; Brownridge, 1994). Following the use of chloroform for childbirth by Queen Victoria during the 1850s, chloroform anaesthesia became an expectation by women, not only for caesarean sections, but for the relief of pain during labour and for the birth (Bevis, 1984; Brownridge, 1994).

The use of inhalation anaesthesia was not without risk. Before 1950, when inhalational anaesthesia such as ether or chloroform was almost exclusively used in obstetrics (Phillips, 1968), 60% of all anaesthetic deaths were attributed to aspiration of gastric contents (Edwards, Morton, Pask, & Wylie, 1956; Merrill & Hingson, 1951). Most maternal deaths occurred while the women were receiving inhalational anaesthesia for an instrumental delivery or for pain relief in labour (Crawford & Oppit, 1976; Mendelson, 1946). The anaesthetic was often administered by inexperienced personnel using an opaque face-mask which prevented the woman’s airway being viewed (O’Sullivan, 1962). In some labour wards, face-masks were strapped to the woman’s face during the anaesthetic process.
(O’Sullivan, 1962). Skilled anaesthetists were rare and intubation and cricoid pressure were seldom used during anaesthesia (Ludka & Roberts, 1993).

Anaesthetists in the United Kingdom and the United States were aware of the risks associated with inhalational anaesthetics. Chloroform required careful administration to prevent overdose while the anaesthetic process using ether was slow and problematic (Phillips & Frazier, 1962) and associated with a 40% vomiting rate during or immediately following the anaesthetic (La Salvia & Steffen, 1950). Ether was later found to irritate the respiratory tract, stimulating respiratory secretions (Swonger & Matejski, 1991). Despite these reports, ether and chloroform continued to be used in maternity units until the 1960s and 1970s according to reports from Australia and the United States (B. Slater [anaesthetist], personal communication, June 2000; Clifton & Hotten, 1963; Krantz & Edwards, 1973).

Some obstetric procedures combined with inhalational anaesthesia increased the risk of maternal death. The lithotomy position was introduced before 1940 to replace the lateral position for forceps deliveries (Hall, 1940). Both these factors are independent risk factors for aspiration and, when combined, there was an alarming increase in the incidence of fatalities from aspiration of gastric contents during forceps deliveries performed under general anaesthetic (Morley, 1955). Forceps deliveries continued to be performed with the women in the lithotomy position until the 1980s and were associated with the majority of maternal anaesthetic-related aspiration deaths in the United Kingdom and Australia (Clifton & Hotten, 1963; Crawford, 1956; Krantz & Edwards, 1973; Parker, 1956) regardless of the general anaesthetic used (Clifton & Hotten, 1963).
Mendelson’s (1946) research, conducted in one hospital in New York between 1932 and 1945, confirmed the damage caused to the lungs when gastric contents were inhaled. His often-cited research retrospectively investigated 44,016 obstetric anaesthesia patients for incidences of suspected aspiration while under an ether-mix inhalational anaesthetic. Of the obstetric cases investigated, there were only 66 cases of anaesthesia-related aspiration identified, 45 of which were definite cases according to Mendelson (1946). No woman died of aspiration pneumonia and all women who aspirated made a full recovery. The two maternal deaths reported in this study occurred from suffocation caused by a large piece of solid food obstructing their trachea. Maternal mortality and morbidity attributed to aspiration during the 1930s to mid 1940s, according to Mendelson’s study, was 0.004% and 0.045% respectively. A limitation of Mendelson’s study was that he used sodium pentothal to anaesthetise the rabbits in his experimental study instead of the ether mix administered to women at the time. The literature does not report a comparison between aspiration caused while under the effect of an inhaled ether mix and that caused while under intravenous sodium pentathol (thiopentone). It is unknown, therefore, what effect ether itself may have on the incidence of aspiration.

In an effort to prevent morbidity and mortality attributed to aspiration of gastric contents during the course of a general anaesthesia, Mendelson (1946) proposed that:

- all labouring women be kept ‘nil by mouth’ in order to keep the stomach empty
- local anaesthetic instead of general anaesthesia be employed where feasible
alkalization of stomach contents before general anaesthesia was necessary to increase gastric pH levels

competent administration of general anaesthesia by specially trained doctors was to replace untrained personnel, such as nurses, midwives, general practitioners and obstetricians, who customarily administered general anaesthesia

it was essential to have adequate equipment including suction, laryngoscope, and bronchoscope on hand during general anaesthesia to enable prompt treatment of aspiration episodes.

Anaesthetists were slow to implement several of Mendelson’s recommendations, such as the implementation of specially trained anaesthetists, the use of epidural as the anaesthetic of choice for labouring women, and the availability of suctioning equipment wherever general anaesthesia was administered. It also appears that Mendelson’s recommendations were accepted and implemented without research to substantiate their effectiveness or safety. When data were reported, maternal mortality rate was the only benchmark used for evaluating the perceived success or failure of each strategy.

2.4.2 General anaesthesia and aspiration in obstetrics post-1950

Mendelson’s (1946) study triggered anaesthetists and hospitals to review practices which resulted in the rapid adoption of new drugs and new techniques (Beecher & Todd, 1954). Despite the introduction of ‘nil by mouth’ policies for labour and modifications to practice, the maternal death rate attributed to anaesthesia-related aspiration increased during the first two decades following Mendelson’s 1946 report
Chapter 2 – Aspiration and General Anaesthesia

(Beecher & Todd, 1954; Crawford, 1986; Holland, 1970) escalating to a peak in the 1970s (Crawford, 1986). Various factors contributed to the increase including anaesthetic drug regimes used at the time, techniques for the induction of anaesthesia, and obstetric practices.

During the 1950s inhalation anaesthesia was used almost exclusively for obstetric patients in Britain and aspiration was the most frequent single cause of maternal death (Edwards et al., 1956; Merrill & Hingson, 1951) accounting for up to half of the 65 obstetric anaesthetic deaths (Edwards et al., 1956; Phillips, 1968). Even in this early decade these fatalities were considered preventable and rarely excusable (Culver, Makel, & Beecher, 1951). Concern was being expressed during this decade regarding the increase in deaths during anaesthesia associated with the use of drugs such as intravenous barbiturates, muscle relaxants, sodium pentothal, neostigmine, scopolamine, cocaine and morphine among others. All these drugs had side effects which reduced the women’s ability to control or prevent aspiration of gastric contents on an involuntary autonomic basis (Snow & Nunn, 1959; Swonger & Matejski, 1991). Many deaths were attributed to injudicious use of these drugs (Macintosh, 1948).

Another drug associated with aspiration was ergometrine. Crawford (1986) reminded us that mortality did not occur because of acid-aspiration in Mendelson’s study. Aspiration became a mortality statistic, believed Crawford (1986), following the introduction of intravenous ergometrine for birth. The effect of ergometrine was to cause broncho-constriction, pulmonary oedema and pulmonary vasoconstriction along with vomiting (Hunter & Moir, 1983) which added to the stress of an
aspiration insult (Crawford, 1986). Ergometrine also markedly increased the lower oesophageal sphincter pressure allowing any regurgitated stomach contents to reach the trachea (Dimopoulos, Brock-Utne, Downing, Edwards, & Moshal, 1979).

The first antacids introduced in the 1960s to alkalize stomach contents had the effect of increasing the incidence of aspiration (Department of Health, 1969, 1972; Eyler, Cullen, Welch, & Murphy, 1982; Taylor, 1975) (Figure 2). These antacids contained aluminium and magnesium hydroxides and were found to be more damaging than gastric contents alone when aspirated (Bond, Stoelting, & Gupta et al., 1979; Gibbs Schwartz, Wynne, Hood, & Ruck, 1979; Heaney & Jones, 1979; Taylor, 1975). Some hospitals continued to use these antacids up to the 1980s (Burgess & Crowhurst, 1989; Sweeney & Wright, 1986) (Table 3).

Other major changes in obstetric and anaesthetic practices at the time were the introduction of intravenous infusions, oxytocic and tocolytic drugs which may also have contributed to the increased severity of Mendelson’s syndrome in pregnancy (MacLennan, 1986). Oxytocin and opiates have an antidiuretic effect and, combined with intravenous fluids and the pregnant woman’s own elevated antidiuretic hormone, may result in water overload (Johnstone, 1972; MacLennan, 1986; Schwartz & Jones, 1978). This excess fluid may contribute to the development of pulmonary oedema causing and aggravating the effect of pulmonary aspiration if it occurred (McKay & Mahan, 1988).

A variety of techniques were developed to reduce the risk of aspiration; however, these interventions had the reverse effect and contributed to the hazard they were meant to prevent. One such practice was the introduction of the ‘foot-down (head-
up) position’ (Morton & Wylie, 1951; Snow & Nunn, 1959) also known as the reverse Trendelenburg or ‘sitting-up’ position. This position caused fatal aspiration in all patients in which it was used, according to Dinnick’s (1964) report from the United Kingdom. In a sedated patient with little or no ability to control regurgitation or vomiting, stomach contents once in the pharynx drain down the trachea.

Cricoid pressure and endotracheal intubation, when first introduced as routine procedures during induction of anaesthesia in the 1950s and 1960s, were attributed to many aspiration cases while the techniques were being perfected. Endotracheal tubes of the past have themselves been problematic with kinking or the formation of an aneurysm in the balloon blocking the airway provided by the tube (Dinnick, 1964).

The pursuance of an empty stomach before the induction of general anaesthesia was of prime importance following Mendelson’s report (1946). Despite prolonged fasting before general anaesthesia, the majority of patients had large gastric volumes (Roberts & Shirley, 1974). To overcome this problem, anaesthetists used either a gastric tube or a drug known as apomorphine which induced vomiting to empty the stomach (Abramson, 1945; Davies & Howells, 1973). Both methods were extremely unpleasant for the patient, and neither guaranteed an empty stomach (O’Sullivan, 1962). A side effect of both methods was an increased production of gastric acids (Guyton, 1986) which, if aspirated, caused far more damage to the lungs than food and fluid (Kallar & Everett, 1993). A device known as an oesophageal blockade was developed in the early 1950s for the purpose of creating a
blockage in the oesophagus. It was unsuccessful because the oesophagus expanded around the blockade allowing the passage of regurgitated stomach contents (Macintosh, 1951).

Before the 1950s the administration of oral glucose drinks pre-operatively to diabetic patients was a common practice; it was abandoned because aspiration of this fluid was a hazard (Dinnick, 1964). Until 1964, however, a major teaching hospital in Sydney routinely gave labouring women 250 ml of flavoured hypertonic glucose cordial (known as ‘Imperial fluid’) every hour in the belief that it provided labouring women with energy (Slater, June 2000, personal communication). This drink, however, usually caused the women to vomit. When one considers the obstetric practices of the day at this one hospital: (1) the common use of chloroform for pain relief and birth, combined with (2) the use of the lithotomy position for forceps deliveries (a position which increases intragastric pressure) and (3) the emetic effect of the ‘Imperial fluid’ drink, women were at high risk of an aspiration episode. Interestingly, since the use of chloroform and hypertonic glucose cordial were discontinued in this hospital, there have been no aspiration-related deaths in this labour ward (Slater, June 2000, personal communication).

In an endeavour to reduce the number of maternal deaths attributed to anaesthesia-related aspiration of gastric contents, anaesthetists have vigorously researched the contributory causes of, and prevention strategies for, aspiration episodes. Many obstetric and anaesthetic practices have played a part in the aspiration problem (Table 1) and their effects can be followed in Figure 2. National records of maternal mortality were not kept until 1952 in the United Kingdom (Ministry of Health,
1957) and 1960 in Australia (Holland, 1962). The United Kingdom has always had a far greater population, birth rate and proportionally larger number of maternal deaths than Australia. For example, there were 2 003 611 births in the United Kingdom during the triennial report into maternal deaths 1967-1969 with 27 deaths (0.134 : 10 000) occurring because of anaesthesia-related aspiration (Department of Health, 1972). During the same period, Australia had a birth rate of 713 064 and a maternal mortality rate attributed to aspiration of three (0.042 : 10 000); all were forceps deliveries (NHMRC, 1972). For this reason maternal mortality statistics for the United Kingdom have been used for Figure 2.

A sharp rise in maternal mortality attributed to anaesthesia-related aspiration incidents during the 1960s (Figure 2) coincides with the introduction of the first antacids and the recommendation that cricoid pressure and endotracheal intubation be used for all obstetric general anaesthesia (Table 1). Further, not all anaesthetists followed recommendations to use cricoid pressure and endotracheal intubation for all general anaesthesia cases (Sellick, 1961; Parker, 1956), and those who did, may have been developing their skills in this area. It seems that the very strategies implemented to reduce aspiration incidents may, at first, have aggravated the problem.
Table 1  Anaesthetic practices, prevention strategies and discoveries related to aspiration since 1920

<table>
<thead>
<tr>
<th>Year</th>
<th>Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>1920s</td>
<td>Ether or chloroform were employed for all births (Leavitt, 1986).</td>
</tr>
<tr>
<td>1936</td>
<td>Thiopentone (Pentothal) first introduced for induction of anaesthesia (Moore, Bill, Flynn, McKean, &amp; Howard, 1989).</td>
</tr>
<tr>
<td>1940</td>
<td>Forceps deliveries in the lithotomy position under general anaesthetic (GA) became fashionable (Hall, 1940).</td>
</tr>
<tr>
<td>1942</td>
<td>Lumbar epidural block became popular (Brownridge, 1994).</td>
</tr>
<tr>
<td>1946</td>
<td>Introduction of ‘nil by mouth’ recommended for all labouring women (Mendelson, 1946).</td>
</tr>
<tr>
<td>1950s</td>
<td>Gastic tube used to empty stomach before GA in common use (O’Sullivan, 1962).</td>
</tr>
<tr>
<td>1951</td>
<td>Foot-down &amp; head-up position recommended for induction of GA to prevent aspiration (Morton &amp; Wylie, 1951).</td>
</tr>
<tr>
<td>1951</td>
<td>Suxamethonium, a muscle relaxant, first introduced for anaesthesia (Thwaites, Rice, &amp; Smith, 1999).</td>
</tr>
<tr>
<td>1956</td>
<td>Recommendation for all forceps deliveries to be performed under pudendal block instead of GA (Parker, 1956).</td>
</tr>
<tr>
<td>1956</td>
<td>Recommendation for endotrachial intubation to accompany all obstetric general anaesthesia (Parker, 1956).</td>
</tr>
<tr>
<td>1959</td>
<td>Endotrachial intubation became common place (Morgan, 1987).</td>
</tr>
<tr>
<td>1961</td>
<td>Cricoid pressure recommended for all GA patients (Sellick, 1961).</td>
</tr>
<tr>
<td>1962</td>
<td>Gastric tube and the drug, apomorphine, not recommended for use before GA (O’Sullivan, 1962).</td>
</tr>
<tr>
<td>1966</td>
<td>Magnesium trisilicate introduced as an antacid to be given pre-operatively (Taylor &amp; Pryce-Davies, 1966).</td>
</tr>
<tr>
<td>1968</td>
<td>Recommendation that suction equipment be readily available at each anaesthesia (Phillips, 1968).</td>
</tr>
<tr>
<td>1970</td>
<td>Magnesium trisilicate considered ineffective as a single dose and recommendation made for 2nd hourly administration to all labouring women (Crawford, 1970).</td>
</tr>
<tr>
<td>1975</td>
<td>Danger of particulate antacids reported (Taylor, 1975).</td>
</tr>
<tr>
<td>1980s</td>
<td>Forceps under general anaesthesia phased out (Crawford, 1986).</td>
</tr>
<tr>
<td>1982</td>
<td>Failure to intubate the trachea was the principal avoidable factor in maternal mortality attributed to aspiration (Department of Health, 1982).</td>
</tr>
<tr>
<td>1982</td>
<td>Difficulty with intubation the major factor in maternal mortality (Department of Health, 1982).</td>
</tr>
<tr>
<td>1982</td>
<td>Sodium citrate 30ml recommended for all obstetric patients pre-operatively (Duffy &amp; Woodhouse, 1982).</td>
</tr>
<tr>
<td>Year</td>
<td>Event</td>
</tr>
<tr>
<td>------</td>
<td>-----------------------------------------------------------------------</td>
</tr>
<tr>
<td>1983</td>
<td>H2 receptor antagonists, cimetidine and ranitidine, introduced as an improved antacid (Hodgenson et al., 1983; Moir, 1983).</td>
</tr>
<tr>
<td>1984</td>
<td>Magnesium trisilicate remains the most popular antacid in United Kingdom despite research (Sweeney &amp; Wright, 1986).</td>
</tr>
<tr>
<td>1984</td>
<td>7% of labouring women in United Kingdom are permitted food during labour (Garcia &amp; Garforth, 1989).</td>
</tr>
<tr>
<td>1984</td>
<td>Propofol introduced for induction of anaesthesia (Fox &amp; Rowbotham, 1999).</td>
</tr>
<tr>
<td>1986</td>
<td>Report of Confidential Enquiries into Maternal Deaths now included Scotland and Northern Ireland in their statistics and included all maternal deaths up to one year following birth (Department of Health, 1986).</td>
</tr>
<tr>
<td>1987</td>
<td>Increasing trend towards the use of epidural anaesthesia for caesarean section (Ong, Cohen, Cumming, &amp; Palahniuk, 1987).</td>
</tr>
<tr>
<td>1989</td>
<td>32.8% of labouring women in United Kingdom permitted food during labour (Michael, Reilly, &amp; Caunt, 1991).</td>
</tr>
<tr>
<td>1992</td>
<td>Ranitidine and sodium citrate before GA recommended as best prophylaxis (Yau, Kan, Gin, &amp; Oh, 1992).</td>
</tr>
<tr>
<td>1996</td>
<td>H2 receptor antagonists + sodium citrate +/- dopamine antagonist (maxalon) recommended as aspiration prophylaxis (Stuart, Kan, Rowbottom, Yau, &amp; Gin, 1996).</td>
</tr>
</tbody>
</table>

From 1970 there has been a continuing reduction in mortality attributed to aspiration. A number of obstetric and anaesthetic drugs and practices have been trialled over the years, many in conjunction with the ‘fasting’ of all labouring women. Some have required refinement while others have been discontinued depending on their effect on the aspiration rate (Edwards et al., 1956; Lock & Greiss, 1955; Phillips, 1968).

The incidence of aspiration had reduced significantly by the mid-to-late 1980s (Bassell & Marx, 1987), with maternal mortality rate in the United Kingdom and the United States being very similar despite the United Kingdom being more liberal with food and fluids while most United States facilities employed ‘nil by mouth’ policies for labour (Michael et al., 1991). Data from the Confidential Enquiries into
Maternal Deaths in the United Kingdom in the late 1980s and 1990s demonstrates a reduction in maternal aspiration-related mortality despite the increase in the number of maternity units encouraging labouring women to eat and drink.

Figure 2 Maternal mortality from pulmonary aspiration in the United Kingdom

Data collected from Reports on Confidential Enquiry into Maternal Deaths in United Kingdom (Ministry of Health 1957–1966; Department of Health 1969–2001)

The greater use of epidural anaesthesia for caesarean section (Breen, Dierenfield, & McNeil, 1998; Glosten, 2000; Soreide, 1997) is probably the biggest factor in the reduction of aspiration-related maternal mortality. Epidural anaesthesia, administered during labour for pain relief or for medical indications (Brownridge,
Chapter 2 – Aspiration and General Anaesthesia

1994), eliminates the requirement for general anaesthesia (Lucas, Ciccone, & Yentis, 1999) should surgery be required. Epidural anaesthesia does not affect the ‘gag’ reflex and is not associated with aspiration, making it a safer option for surgery (Conklin, 1990).

There has been one incidence of maternal mortality reported over the last decade from the United Kingdom and Australia (Department of Health, 1996, 1998, 2001; NHMRC, 1993, 1998, 2001). The last aspiration-related maternal death occurred in the United Kingdom with a woman being anaesthetised for the fifth time in four days: the first for a caesarean section, the following three to control postpartum haemorrhage and the last to remove an abdominal pack inserted during the fourth general anaesthetic. The woman was transferred to theatre from the Intensive Care Unit with invasive cardiovascular monitoring in place, was not given any gastric secretion prophylaxis and did not receive cricoid pressure or intubation for the general anaesthetic. The condition of the woman and the lack of standard preventative techniques at the time of the fifth general anaesthetic caused the demise of this woman (Department of Health, 2001).

2.5 Incidence of maternal aspiration deaths in Australia post 1950

In Australia, one of the first triennial reports into maternal mortality reported a total of three deaths associated with aspiration – all were forceps deliveries (NHMRC, 1972). There have been no maternal deaths attributed to aspiration in Australia since 1987 (NHMRC, 1993, 1994, 1996, 1998, 2001) – (Table 2). Although the focus of this review reports maternal deaths attributed to anaesthesia-related aspiration, cardiac arrest was the major cause of anaesthesia-related maternal deaths.
and continues to cause at least one maternal death per triennium (NHMRC, 1998).

A breakdown of the causes and contributing factors of all maternal deaths directly attributed to anaesthesia in Australia during these years can be found in Appendix A.

Table 2 Maternal deaths in Australia, 1967-1996

<table>
<thead>
<tr>
<th>Years</th>
<th>Total confinement</th>
<th>Direct maternal deaths</th>
<th>Anaesthetic related deaths</th>
<th>Aspiration deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>1967-1969</td>
<td>713 064</td>
<td>166</td>
<td>13</td>
<td>3</td>
</tr>
<tr>
<td>1970-1972</td>
<td>790 818</td>
<td>150</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>1973-1975</td>
<td>726 690</td>
<td>60</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>1976-1978</td>
<td>678 098</td>
<td>52</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>1979-1981</td>
<td>682 880</td>
<td>54</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>1982-1984</td>
<td>713 985</td>
<td>42</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>1985-1987</td>
<td>726 642</td>
<td>32</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>1988-1990</td>
<td>754 468</td>
<td>37</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>1991-1993</td>
<td>769 253</td>
<td>27</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>1994-1996</td>
<td>778 471</td>
<td>46</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>


While national reports from the United Kingdom and Australia provide statistics and information regarding maternal mortality, the extent of morbidity is relatively unknown worldwide because of the lack of documentation (Olsson et al., 1986). A Swedish, four-year, multicentre audit of aspiration pneumonitis in obstetric and gynaecologic patients found an aspiration incidence of 0.11% in caesarean section patients (Soreide, Bjornestad, & Steen, 1996). Clinically important gastric content aspiration has always been a rare event (Ingebo et al., 1997; Johnson, Keirse, Enkin,
& Chalmers, 1989; Olsson et al., 1986) with few patients who have aspirated developing pneumonitis (Bannister & Sattilero, 1962).

The reduction in aspiration-related maternal mortality in Australia and the United Kingdom is probably most strongly linked to the increased use of regional anaesthesia for caesarean section instead of general anaesthesia (O’Sullivan, 1994). A secondary explanation is attributed to the improvements in anaesthetic drugs (Fox & Rowbotham, 1999; Siafaka, Vadalouca, Gatziou, Petropoulus, & Salamalekis, 1992) and improved anaesthetic techniques (Department of Health, 1996; Kallar & Everett, 1993; NHMRC, 1998; Oberoi & Phillips, 2000) which include management of a difficult airway during endotracheal intubation (Asai & Shingu, 1998; Parr, Gregory, & Baskett, 1998).

2.6 Current anaesthesia-related aspiration prevention strategies

Over the past five decades there have been significant advances in pharmacology, technology and techniques used in anaesthetics and by the 1970s a corresponding reduction in anaesthesia-related mortality and morbidity, including aspiration, was evident. The prevention of aspiration during general anaesthesia continues to be of prime importance for anaesthetists.

Cheek and Gutsche wrote… ‘the first and most important step in the prevention of pulmonary aspiration is the recognition that every labouring woman is at risk for this catastrophe’ (1987, p. 308). This statement, however, holds for every patient undergoing general anaesthesia, particularly if they are very young, old or in poor health (Olsson et al., 1986). It has been recommended that every pregnant woman
requiring obstetric surgery be treated as though she has a full stomach of highly acidic fluid and considered at risk for aspiration (Alahuhta, 1996; Elsberry et al., 1990; Oberoi & Phillips, 2000; Schaut, Khona, & Gross, 1997; Taylor & Pryse-Davies, 1966). Again, this is a standard, precautionary strategy that pertains to all patients receiving general anaesthesia.

As with any type of anaesthesia, general anaesthesia should be given by a skilled anaesthetist (Haire, 1987). Most cases of pulmonary aspiration during general anaesthesia can be prevented by prior identification of risk factors such as morbid obesity (Endler, Mariona, Sokol, & Stevenson, 1988; Moir, 1983), careful observation and expert anaesthesia care (Cheek & Gutsche, 1987).

The most effective way to minimise this risk is to use regional anaesthesia (Alahuhta, 1996; Cunningham et al., 1993; Oberoi & Phillips, 2000). When regional anaesthesia is not possible and general anaesthesia is used, the following regime of preventative practices are employed by the anaesthetist to avert aspiration of stomach contents:

- a period of fasting (Gibbs, 1986; Mendelson, 1946)

- neutralisation of stomach contents with an antacid or Histamine-2 (H₂) receptor antagonists or both (Hawkins, Gibbs, Martin-Salvaj, Orleans, & Beaty, 1998; O’Sullivan, 1993)

- pre-oxygenation of every pregnant woman before induction of anaesthetic (Dawson & Cockroft, 1996)
• rapid sequence induction of anaesthesia accompanied by airway protection by way of cricoid pressure during intubation and inflation of the cuff (Bevis, 1999; Cheek & Gutsche, 1987; Dawson & Cockroft, 1996; Gibbs & Modell, 1994)

• awake extubation of the trachea (Dawson & Cockroft, 1996; Gibbs & Modell, 1994).

These five steps will be discussed further.

2.6.1 A period of fasting

Fasting (no food or fluid consumption), or restricting labouring women to clear fluids, has been common practice in maternity units as one of a number of aspiration prevention strategies. Despite a myriad of aspiration prevention research endeavours over the last half century, no research had investigated the safety or efficacy of dietary restrictions such as ‘fasting’ for labour until 1992 (e.g., Rodwell, 1992; Scrutton et al., 1999), and none have examined the effect a ‘fasting’ regime has on the incidence of anaesthesia-related aspiration. The safety and efficacy of fasting regimes for the prevention of aspiration, therefore, are unknown.

An empty stomach before induction of general anaesthesia is one rationale for the fasting, yet that does not guarantee an empty stomach (Champion & McCormick, 2002; Miller, Wishart, & Nimmo, 1983; O’Sullivan, 1994; Sandhar, Goresky, Maltby, & Shaffer, 1989). Gastric volume has not been demonstrated to cause, or to be a contributing factor to, the occurrence of aspiration among non-obstetric surgical patients (e.g., Miller et al., 1983; Phillips, Hutchinson, & Davidson, 1993; Schreiner & Nicolson, 1995; Splinter & Schaefer, 1991) or labouring women regardless of
their oral intake (Kubli et al., 2002; Scrutton et al., 1999; Yiannouzis & Parnell, 1994). Nonetheless, a preoperative ‘fast’ of at least four to six hours (Tweedle & Nightingale, 1988) before elective surgery is considered safe practice to minimise the risk of gastric content aspiration during general anaesthesia (Chapman, 1996; Hamilton-Smith, 1972; Kallar & Everett, 1993). Many labouring women, however, are expected to endure a fast which not only exceeds six hours but may last longer than 24 hours (Lewis, 1992). Despite prolonged fasting before induction of anaesthesia, large volumes of acidic contents have been found in non-obstetric, elective patients (Hester & Heath, 1977; Simpson & Stakes, 1987) and 70 per cent of elective caesarean sections (Roberts & Shirley, 1976). Gastric secretion associated with hunger can be as high as 500 ml per hour (Guyton, 1986). Studies have demonstrated that the majority of patients have a gastric volume which exceeds the recommended maximum safe volume of 50 ml by 12% to 80% before induction of general anaesthesia (Cote, Goudsouzian, Liu, Dedrick, & Szyfelbein, 1982; Plourde & Hardy, 1986). Aspiration of undiluted, acidic gastric secretions have been shown to be more damaging to the lungs than gastric contents neutralised by food and fluids (McKay & Mahan, 1988; Mendelson, 1946; Miller et al., 1983).

The physiological and hormonal changes associated with pregnancy are other reasons given for restricting oral intake as a method to reduce the risk of aspiration. Restricting oral intake for all labouring women on the basis of these changes (such as relaxation of the lower or upper oesophageal sphincter and increased intra-abdominal pressure), however, is not supported by research (e.g., Bannister, 1962; Cotton & Smith, 1981; Davison, Davison, & Hay, 1970; Hester & Heath, 1977; Miller et al., 1983; Van Thiel et al., 1977).
2.6.2 Neutralisation of stomach contents

Over the past 40 years anaesthetists have been experimenting with drugs which neutralise gastric contents, increase gastric emptying time, or inhibit gastric secretion. During the 1960s and into the 1970s particulate antacids were administered to patients before general anaesthesia to increase the pH of the stomach contents (Bond, 1979 et al.; Gibbs et al., 1979). These drugs (containing aluminium and magnesium hydroxides), however, were found to be more damaging when aspirated than gastric contents (Bond et al., 1979; Gibbs et al., 1979; Heaney & Jones, 1979). As a consequence the maternal aspiration mortality rate rose during this period (Department of Health, 1969, 1972; Eyler et al., 1982; Taylor, 1975). Particulate antacids continued to be administered pre-operatively and during labour well into the 1980s in the United Kingdom and Australia, long after research had demonstrated their danger (Burgess & Crowhurst, 1989; Sweeney & Wright, 1986) – Table 3.
Table 3 Comparison of anti-acid therapies used by anaesthetists for labour and pre-operatively during the 1980s

<table>
<thead>
<tr>
<th></th>
<th>United Kingdom 1984</th>
<th>Australia 1987</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Sweeney &amp; Wright, 1986)</td>
<td>(Burgess &amp; Crowhurst, 1989)</td>
</tr>
<tr>
<td></td>
<td>During labour %</td>
<td>Emerg. C/S* %</td>
</tr>
<tr>
<td>No Prophylaxis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Antacids</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Magnesium Trisilicate</td>
<td>53.5</td>
<td>57.0</td>
</tr>
<tr>
<td>(15 ml 2/24 in labour &amp;/or one only dose before C/S)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Mylanta</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>- Sodium Citrate</td>
<td>23.0</td>
<td>42.3</td>
</tr>
<tr>
<td>(30ml x 1 dose before C/S)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H₂ Receptor Antagonist</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Cimetidine (oral)</td>
<td>3.4</td>
<td>4.1</td>
</tr>
<tr>
<td>- Ranitidine (IMI/IVI)</td>
<td>11.3</td>
<td>10.7</td>
</tr>
<tr>
<td>Antacid + H₂ Antagonist</td>
<td>6.8</td>
<td>12.4</td>
</tr>
<tr>
<td>Anticholinergic + Antacid</td>
<td>0</td>
<td>25.4</td>
</tr>
<tr>
<td>Metoclopramide + Antacid</td>
<td>0</td>
<td>9.3</td>
</tr>
<tr>
<td>Other</td>
<td>0</td>
<td>6.0</td>
</tr>
</tbody>
</table>

* Emerg.C/S = Emergency Caesarean Section

A variety of drugs are in current use with non-particulate antacids such as sodium citrate being most commonly administered pre-operatively to obstetric patients (Alahuhta, 1996). Although sodium citrate is more effective than the antacids of the past, neutralisation of stomach contents is not always assured (Cheek & Gutsche, 1987; Duffy & Woodhouse, 1982; Manchikanti, Grow, Colliver, Hadley, & Hohlbein, 1985). Histamine-2 receptor antagonists (H₂ blockers) have been demonstrated to be the most effective agent currently available for neutralising stomach contents (Thomas, 1994), but are of little value in an emergency situation as they take 60 to 90 minutes to become effective (O’Sullivan, 1990). Although
there is strong evidence to demonstrate that neither of these pharmaceuticals prevent aspiration (Rowe, 1997), the United Kingdom and Australia have experienced a 50-75% reduction in aspiration episodes since their introduction (Department of Health, 1982, 1986, 1991; NHMRC, 1981, 1987, 2001).

Anticholinergic drugs such as omeprazole and metoclopramide have also been administered to combat acid aspiration. Although omeprazole (Losec) is a gastric acid secretion inhibitor (Swonger & Matejski, 1991), its use is limited in an emergency situation as it takes at least 30 minutes to have effect (Rocke, Rout, & Gouws, 1994) and it is not considered cost-effective (Stuart et al., 1996). Metoclopramide is a gastrointestinal stimulant which accelerates gastric emptying without affecting gastric acid production (Swonger & Matejski, 1991). Despite being more effective in preventing aspiration of particulate matter and bile than antacids it has yet to be proved effective and safe for pregnant women (Kluger & Short, 1999).

2.6.3 Pre-oxygenation

Pre-oxygenation is the initial step in the rapid sequence induction process (see below). Although not an aspiration prevention measure per se, it is recommended in order to produce an oxygen reserve in the lung alveoli before intubation. This oxygen reserve compensates for the pregnant woman’s increased oxygen needs (James, 1992) and also the possibility of delay in ventilation for difficult intubation cases (Crawford, 1986; Hunter, 1987).
Aspiration during general anaesthesia most frequently occurs during the time from loss of consciousness to completion of the tracheal intubation process.

Recommendations prefer the patient is given 100% oxygen to breathe via a mask for at least two to five minutes (also referred to as denitrogenation) before administration of an induction agent (Crawford, 1986; Gibbs & Modell, 1994). This procedure, however, varies among anaesthetists from four deep breaths to the recommended five minutes (Thwaites et al., 1999).

2.6.4 Rapid sequence induction of anaesthesia

No pharmacologic prophylactic regime employed to reduce gastric acidity and volume is completely efficient. Rapid sequence induction with cricoid pressure is considered the mainstay in aspiration prevention. It is now regarded as mandatory for all patients with an increased risk of aspiration (Kallar & Everett, 1993; Oberoi & Phillips, 2000; Rosen, 1981) such as obstetric patients (Soreide, 1997).

The technique for rapid sequence induction has evolved over the past 50 years with the introduction of suxamethonium (succinylcholine) in 1951; however, the technique is not founded on rigorous evidence (Thwaites et al., 1999). The procedure depends on meticulous attention to safe anaesthetic technique, as failure to observe precautions is the major reason for aspiration-related maternal deaths (Enkin et al., 2000; Stuart et al., 1996).

The basic rapid sequence induction technique consists of (1) the administration of an induction agent, (2) application of cricoid pressure, (3) paralysis of the patient with a neuromuscular blocking drug and avoidance of positive pressure ventilation before
securing the airway, and (4) endotracheal intubation with immediate cuff inflation (Gibbs & Modell, 1994). The theory which underpins this sequence of events is that the technique will prevent regurgitated gastric contents being aspirated into the patient’s lungs (Gibbs & Modell, 1994). While each sequence is followed consistently, each anaesthetist develops a unique technique based on their training, experiences, and practices (Thwaites et al., 1999). Each of the four steps will be discussed in further detail.

1. Administration of an induction agent

Changes in the type of induction agent used for obstetric general anaesthesia over the last century have positively affected outcomes. The induction agent produces unconsciousness, decreased sensitivity to pain, relaxation of skeletal muscles and depression of reflexes (Swonger & Matejski, 1991). The induction agent thiopental (pentothal, thiopentone) started replacing inhalational agents, such as ether and chloroform, for obstetric general anaesthesia in the early 1950s (Thwaites et al., 1999).

During the 1990s propofol replaced thiopental for obstetric anaesthesia (Fox & Rowbotham, 1999). A nonbarbiturate hypnotic (Swonger & Matejski, 1991), it is considered better suited for obstetric anaesthesia than thiopental (Siafaka et al., 1992; Tillmann Hein & Putman, 1997). The most desirable features of propofol are rapid and clear emergence from anaesthesia (Valtonen, Kanto, & Rosenberg, 1989), and its apparent antiemetic action (Sebel & Lowdon, 1989) when compared with thiopental. Propofol is thought to provide a greater depressive action on the
pharyngeal and laryngeal reflexes when compared with other anaesthetic agents, providing better conditions for intubation (McKeating, Bali, & Dundee, 1988; Skinner, Biswas, & Mahajan, 1998). It is also associated with less hypertensive response during laryngoscopy and intubation (Abboud, Zhu, Richardson, Peres Da Silva, & Donovan, 1995).

2. Cricoid pressure

Cricoid pressure is a technique first recommended by Sellick in 1961 to accompany endotracheal intubation as an aspiration preventative. The manoeuvre requires an assistant to apply pressure on the cricoid cartilage, depressing it against the cervical vertebrae to temporarily occlude the upper end of the oesophagus, preventing regurgitation of gastric contents during intubation (Rubin & Wood, 1993; Sellick, 1961; Vanner & Pryle, 1992). The literature relating to the use of cricoid pressure during rapid sequence induction suggests that this procedure is sometimes incorrectly applied causing greater problems than if it were not applied at all (e.g., Allman, 1995; Brimacombe & Berry, 1998; Department of Health, 1979; 1982; Sellick, 1982).

When applied correctly, cricoid pressure improves the view at laryngoscopy and therefore intubation conditions (Vanner, Clarke, Moore, & Raftery, 1997). Insufficient pressure does not occlude the oesophagus while excessive force can make intubation difficult and even impossible (Allman, 1995; Cook, 1996; Meek, Gittins, & Duggan, 1999; Olsson et al., 1986). Failure to apply cricoid pressure, relaxation of pressure before intubation and inefficient application have been
implicated as direct causes of many aspiration incidences (e.g., Allman, 1995; Brimacombe & Berry, 1998; Department of Health, 1979; 1982). Perfecting the technique, however, is problematic as there is conflict in the information regarding the correct timing (Mittal, Stewart, & Schirmer, 1992; Tournadre, Chassard, Berrada, & Bouletreau, 1997; Vanner, O’Dwyer, Pryle, & Reynolds, 1992), application technique (Crowley & Giesecke, 1990; Haridas, 1998; Williamson, 1991; Yentis, 1997), and length of time cricoid pressure must be sustained (Meek et al., 1999).

Cricoid pressure does not have universal support from clinicians. In France it is rarely used yet the incidence of fatal aspiration is much lower than in other countries such as the United Kingdom (1.4 per 10 000 anaesthetics versus 4.7 per 10 000) – (Benhamou, 1995; Olsson et al., 1986). Benhamou (1995) believes that cricoid pressure is unnecessary in obstetric general anaesthesia because pregnant women are not at risk of aspiration.

3. Muscle relaxants

The type of muscle relaxant used during obstetric general anaesthesia has changed over the last 50 years. A muscle relaxant is given intravenously following the induction agent and cricoid pressure (Swonger & Matejski, 1991). These drugs are required during the rapid sequence procedure to facilitate endotracheal intubation (van Vlymen & White, 2000). The most commonly used of this class of drugs between the 1950s and 1990s has been succinylcholine (suxamethonium). Unfortunately, succinylcholine has numerous undesirable side effects (Durant &
Katz, 1982) and has been found to increase the incidence of aspiration during general anaesthesia (Blitt et al., 1970).

A number of newer neuromuscular blockers, such as atracurium, rocuronium and vecuronium, entered the market in the 1990s with drug choice, dosage and timing of injection varying among anaesthetists (Thwaites et al., 1999). Currently rocuronium is the drug of choice for caesarean sections (Baraka, Sayyid, & Assaf, 1997; Dobson, McCluskey, Meakin, & Baker, 1999) and is believed to improve intubating conditions (Magorian, Flannery, & Miller, 1993; McCourt, Salmela, Carroll, & Kerr, 1997).

The anaesthetic agent and the neuromuscular relaxant combination employed for obstetric general anaesthesia play an important part in the intubating conditions (Baraka, Sayyid, & Assaf, 1997; Skinner et al., 1998). Propofol and rocuronium in combination have been shown to provide ‘near perfect’ intubation conditions (Dobson et al., 1999; Skinner et al., 1998).

4. Endotracheal intubation

Endotracheal intubation has contributed to many aspiration incidents over the years (Department of Health, 1982; Cormack & Lehane, 1984; Gibbs, Rolbin, & Norman, 1984). The insertion of a cuffed endotracheal tube, while a trained assistant applies cricoid pressure to occlude the oesophagus, was first recommended by Parker in 1956 but did not become common practice until the 1960s despite the prior introduction of thiopentone and suxamethonium inductions (Morgan, 1986, 1987). During the 1960s the incidence of anaesthesia-related maternal deaths doubled
(Department of Health, 1969; Morgan, 1987) with many aspiration cases being a
direct result of technical difficulties during tracheal intubation (Cohen, 1979) often
in the hands of inexperienced staff (Goodrich, 1979).

Improvement and perfection of the technique has played a part in the reduction in
maternal mortality rates over the last four decades; however, it is the assignment of
specialist obstetric anaesthetists for all obstetric anaesthetic cases which has made
the greatest improvement to outcomes (Olsson et al., 1986). Contemporary practice
advocates that every obstetric patient undergoing general anaesthesia receive
endotracheal intubation (Bevis, 1999; Miller et al., 2000).

The process of rapid sequence induction for caesarean section has continually been
refined. With the introduction of new induction and muscle relaxant drugs in the
mid 1980s, improvements in cricoid pressure and intubation techniques, along with
sophisticated monitoring equipment, general anaesthesia has become far safer for

2.6.5 Extubation when awake

The risk of aspiration extends throughout the operative period, with caution being
just as necessary during endotracheal extubation (Arandia & Grogono, 1980; Brock-
Utne & Downing, 1986). Vomiting and coughing are difficult to avoid and
gastrooesophageal reflux may be more frequent in the postoperative period (Warner
et al., 1993). The endotracheal tube should not be removed unless the woman is in
the lateral position, fully awake, completely responsive to commands and has no
sign of muscle weakness (Burchman, 1996; Gibbs, 1986). If the tube is removed before this time, the patient may still be at risk of aspiration (Cheek & Gutsche, 1987; Gibbs & Modell, 1994).

The occurrence of maternal mortality related to aspiration during obstetric anaesthesia is rare and it is difficult to prove conclusively that any or all of the above aspiration prophylaxis techniques are critical to the success of the procedure. However, as they are relatively inexpensive and believed to have no side effects, it is considered preferable to ‘…take the risk of applying useless measures instead of missing a potential benefit’ (Schneck, Scheller, & Kocks, 1999, p.533). Even when all the preventative measures are employed the ‘…rapid sequence induction is not a panacea’ (Gross, 1998, p.278). There may be failed intubations, inadvertent gastric inflation with positive pressure ventilation, and uncooperative intravenous lines which occlude or infiltrate before the muscle relaxant has reached the circulation. Even after endotracheal intubation the anaesthetist may have equipment failures, such as an air leak in the tube (Lewer, Karim, & Henderson, 1997) or faulty testing apparatus (Baraka, Siddik, Sfeir, Salem, & Joseph, 1997), all of which may increase the risk of aspiration.

2.7 Summary of general anaesthesia and aspiration in obstetrics

The prevention of aspiration of gastric contents during general anaesthesia has been a focus of anaesthetic research over the last 50 years. Although ‘fasting’ policies have been included as part of the aspiration prevention process, they cannot compensate for any of the other aspiration prevention measures (Elkington, 1991) or
for anaesthetic error (DeAmici, Ceriana, Gabutti, Ramaiolli, & Geraci, 1997; Gaba, 1989; Runciman, Webb, Barker, & Currie, 1993).

Despite the lack of research to demonstrate an association between aspiration and oral intake, fasting is believed to better ensure an empty stomach if general anaesthesia is required (Chapman, 1996; Kallar & Everett, 1993; Mendelson, 1946), thereby preventing aspiration. Because the need for an emergency caesarean section cannot always be predicted in advance, fasting all labouring women is recommended as a precaution (Gibbs & Modell, 1994). Fasting, however, does not ensure an empty stomach nor does it prevent aspiration (Rocke et al., 1993). Moreover, the safety and efficacy of fasting labouring women as an aspiration preventative has not been investigated (Boyle, 1997).

The current strategies employed during general anaesthesia, including preinduction (fasting, antacids, pre-oxygenation), rapid sequence induction and postinduction strategies, are believed to have contributed to the reduction in mortality and morbidity statistics attributed to aspiration of gastric contents. The introduction of monitoring systems for use during anaesthesia, such as the pulse oximeter, capnography, oxygen analyser, and low pressure (circuit) alarms, have played a significant part in the detection of anaesthetic incidents (Runciman et al., 1993; Webb et al., 1993). In the past decade, maternal deaths from aspiration have become extremely rare, achieved by a combination of new anaesthetic drugs and techniques, improvements to anaesthetists’ training and the introduction of H₂ receptor antagonists (Department of Health, 1994; Hawkins et al., 1998; Thwaites et al., 1989). The greatest contributor, however, is probably the increased use of
regional anaesthesia for caesarean section and for all forceps deliveries, replacing general anaesthesia (Oberoi & Phillips, 2000; O’Sullivan, 1994; Rowe, 1997).

Believing intravenous fluids are a suitable replacement for oral intake providing calories, electrolytes and fluid requirements for labour (Sommer, Norr, & Roberts, 2000; Wasserstrum, 1992), anaesthetists find no compelling reason to ease the current oral intake restrictions. This belief, along with evidence supporting the rationale for allowing food and fluid intake during labour, will be discussed in Chapter 3.
Oral Intake During Labour

3.1 Introduction

Chapter 2 explored the occurrence of aspiration and included a review of the particular literature associated with obstetric general anaesthesia and various interventions that have been introduced into practice. This chapter examines the literature pertaining to the history of dietary regimes for labour, the physiological and psychological effect of restricting food and fluids for labouring women and the increasing trend among health professionals to allow oral intake for these women. Research conducted to investigate the effect of oral intake and other factors associated with labour and birth outcomes are also discussed. The effect of restricting oral intake as a method of preventing the incidence of vomiting will be examined along with the substitution of intravenous fluids for oral intake during labour.
For many labouring women the restriction of oral intake poses no problem as they do not want to eat, but for those who are denied food when hungry it can be a very upsetting experience (Enkin et al., 2000). There have been anecdotal reports of women secreting food during labour, despite knowing it was not permitted. These women may have a physiological or psychological need to eat food during their labour. This need to eat may be stimulated by hormonal influences or simply the body’s routine biological rhythm of regular mealtimes. In a study of over 300 women, Tranmer (1999) found that 50% of women ate some form of food during the early phase of the first stage of labour, while the desire for food declined during the active phase of labour (Armstrong & Johnston, 2000; Scrutton et al., 1999; Tranmer, 1999).

Odent, a well-known French obstetrician who encourages women to feel empowered, intuitive and confident in their body’s ability to birth naturally, believes labour rarely starts when a pregnant woman is hungry. Once labour establishes women seldom want to eat, according to Odent (1994). When food and fluid is available, labouring women are more likely to eat during early labour, but only drink fluids in declining quantities throughout established labour (Chern-Hughes, 1999; Ludka & Roberts, 1993; Odent, 1994; O’Reilly, Hoyer, & Walsh, 1993; Rooks et al., 1989).

Research suggests that labouring women may be stimulated to eat in early labour by hormonal influences (Rigg & Yen, 1977). The hormones prolactin and oxytocin play a crucial part in the progress of labour. Women’s serum prolactin concentrations are at their highest by the end of pregnancy and during the first few
hours of labour (Rigg & Yen, 1977) stimulating the women’s desire to eat during the early phase of labour (McNabb, 2002). As labour progresses, the prolactin level decreases and the oxytocin level increases which, along with the corresponding sensation of pain, suppresses the desire for food (McNabb, 2002).

Another suggestion is that there may be a relationship between women’s innate biological 24-hour clock, commonly referred to as the circadian rhythm (Cugini et al., 2000), and their desire to eat during labour. Regardless of the theories put forward, researchers have yet to identify the factors that influence appetite during labour.

3.2 Overview of oral intake during labour

Throughout history cultures have placed special significance on the food and fluid consumed by women during the perinatal period. Customs and beliefs about the diet of a labouring woman vary from country to country. In many cultures the labouring woman is given refreshments throughout her labour, particularly fluids, with herbal teas, soups, broths, coconut juice and fluids rich in glucose commonly reported (Inch, 1989). Herbal concoctions and oils have been used widely, and still are administered in some cultures (Broach & Newton, 1988). There have been reports of women being encouraged to eat or drink raw eggs, dried placenta, or urine to prevent or accelerate prolonged labour (Broach & Newton, 1988). In England, during the first half of the 20th century, women were strongly encouraged to eat and drink throughout labour to avoid general weakness, long labour, and postpartum haemorrhage (Ludka & Roberts, 1993). In contemporary western society labour has been medicalised, with the precautionary consequence of this being to restrict oral
intake to reduce aspiration of gastric contents if general anaesthesia is required
during the course of labour. For that reason an investigation of the literature relating
to trends in oral intake during labour is included in this thesis.

The preferred practice for labouring women’s oral intake in the western world has
varied over the last 50 to 60 years. During the mid 1940s, the common use of drugs
and general anaesthesia for vaginal births, forceps deliveries and caesarean sections
resulted in oral intake during labour being withheld (Keppler, 1988; Ludka &
Roberts, 1993) to reduce the risk of sedated women regurgitating and aspirating
their gastric contents (Haire, 1987).

A repertoire of recommendations appeared in obstetric text books and journal
articles during the 1950s and 1960s regarding the oral intake for labouring women
from ‘nil by mouth’ to ‘fluids’ to ‘easily digested foods’ (Hingson & Hellman,
1956; Mayes, 1953; Masani, 1964; Phillips, 1968). The introduction of ‘active
management of labour’ in the 1970s meant that the length of labour should not
exceed 12 hours and so it was believed that fasting for this length of time was
inconsequential (O’Sullivan, 1994).

During the 1980s obstetric text books recommended the avoidance of all but the
ingestion of small amounts of clear liquids when labour was imminent (Bassell &
Marx, 1987), with labouring women being fasted once labour began (that is, no food
or fluids orally) (Hunter, 1987). Most institutions in the United Kingdom, however,
usually restricted labouring women to water throughout labour, with a few hospitals
permitting food in early or unestablished labour (Garcia, Garford, & Ayers, 1985).
Obstetric text books written in the 1990s recommended that only small sips of water or chips of ice be permitted and that food was unnecessary and dangerous at any time during labour (Hawkins, Chestnut, & Gibbs, 2001). The management of oral intake during labour within hospitals during the 1990s varied widely with some restricting women to ice chips once labour was established, while others allowed a light diet and free fluids throughout labour (Cassidy, 1999). Until the last decade no study had been reported, other than Mendelson’s (1946), to evaluate these dietary recommendations.

‘Clear fluid’ policies have been based on studies of non-obstetric patients. Results have demonstrated that when compared with fasting, gastric volume and pH level were unchanged or improved by the ingestion of clear fluids up to two hours before induction of general anaesthesia (Schreiner & Nicolson, 1995; Splinter & Schaefer, 1991). These results suggest that if aspiration occurs during general anaesthesia, the damage to the lungs will not be any worse than if the patient had fasted. However, these investigators stated that their sample size was too small to investigate or determine the association between the ingestion of these fluids and the incidence of aspiration during general anaesthesia.

The only study to have investigated the impact of clear fluids ingested by labouring women compared women who drank water with those who drank an isotonic drink (Kubli et al., 2002). The isotonic drink contained a composite of carbohydrates, sodium, potassium, calcium and water. The study found that gastric volume, incidence of vomiting, and maternal and neonatal outcomes were similar between groups. The only difference found was an improvement in plasma glucose among
the isotonic drink group. It was considered that the consumption of an isotonic
drink, which prevented ketosis without increasing gastric volume, was preferable to
food during labour in an effort to prevent the possibility of aspiration if general
anaesthesia was required.

The effect of fluid-type foods (such as, jelly, custard, yoghurt, ice-cream, soups)
other than clear fluids during labour has not been investigated. Research that has
investigated the safety and efficacy of food and fluid intake by labouring women has
concentrated on measuring:

- stomach contents and plasma metabolic levels of fatty acids, glucose, lactate and
  insulin (Scrutton et al., 1999)

- the incidence of vomiting (Scrutton et al., 1999; Yiannouzis & Parnell, 1994)

- differences between groups for a number of maternal and neonatal outcomes
  (Rodwell, 1992; Scrutton et al., 1999; Tranmer, 1999; Yiannouzis & Parnell, 1994).

Aspiration during general anaesthesia is a very rare event; therefore, a large sample
of participants would be required for the study to have sufficient power to determine
whether there was an association between food consumption and the incidence of
aspiration (Kraemer & Thiemann, 1987). No study has been able to recruit such a
large sample, so the association is hypothetical rather than demonstrated.

Contemporary policy in some hospitals is to routinely withhold food and sometimes
fluids during labour. Broach and Newton (1988a) believe that womens’ natural,
physiological and psychological desire or needs are ignored, overruled by inflexible hospital policies and some out-of-date caregivers. This form of labour management is now being questioned in many parts of the western world (e.g., Broach & Newton, 1988; Elkington, 1991; Ludka & Roberts, 1993).

3.3 Physiological effect of restricted oral intake during labour

Findings from one small study (Rodwell, 1992) suggest that the length of labour and birth outcomes will be improved by the unrestricted intake of food and fluids by labouring women. Other researchers, however, have found no difference in outcomes (Scrutton et al., 1999; Tranmer, 1999). The physical exertion of labour and birth is associated with a large caloric expenditure (Chern-Hughes, 1999). In fact, the Food and Nutrition Board in New York have recommended a caloric requirement during labour of 700 to 1100 calories per day (cited by Ludka, 1987). However, no research on the caloric needs of labouring women was identified in an extensive search of the literature.

Most labouring women successfully complete their labour without eating and sometimes without drinking, despite the expenditure of energy. The concern, however, is not for the average labour but for those labours which are prolonged. A labour is considered prolonged when it exceeds 24 hours for nulliparous women or 12 hours when managed medically (Williams, 1999). Friedman (1978) noted that 5% of nulliparous women are in labour for more than 35 hours whilst 5% of multiparous women can have a labour of more than 20 hours with the mean length of labour being 12 and 7.6 hours respectively. For those women enduring a long labour it has been suggested that the prolonged period without food may be harmful
to the mother, her fetus and the progress of labour (e.g., Horner, 1989; Lewis, 1992; Pengelley & Gyte, 1998). Clinicians who support oral intake during labour base their practice on this opinion. However, not all clinicians agree with the practice and base their practice on opinions regarding aspiration risk during general anaesthesia if required (Mendelson, 1946; Slater, personal communication June 2000; Warner, Warner, & Weber, 1993). Slow progress in labour is closely related to weak uterine contractility, and anything that interferes with the blood supply to the uterus will reduce the efficiency of uterine contractions (Enkin et al., 2000). It has been suggested that the blood supply to the uterus may be diverted to the stomach for the digestion of food causing less efficient contractions, consequently making labour longer (Enkin et al 2000); but this is not substantiated by research.

There have been numerous studies conducted over the last 40 years investigating the effect of fasting pregnant and, more recently, labouring women. These studies specifically examined the maternal and fetal blood glucose and ketone levels and their subsequent effect, including their association with prolonged labour (e.g., Foulkes & Dumoulin, 1985; Kim & Felig, 1972; Metzger, Ravnikar, Vileisis, & Freinkel, 1982; Rudolf & Sherwin, 1983; Sabata, Wolf, & Lansmann, 1968; Scrutton, Lowy, & O'Sullivan, 1996). An understanding of the findings from these studies forms the basis of the argument for allowing women to eat during their labour. As the prevention of prolonged labour is the main impetus for feeding labouring women (Inch, 1989), the relationship between prolonged labour and maternal and fetal blood glucose and ketone levels is important.
In pregnancy, fasting of long duration is associated with increased plasma and urinary ketones and hypoglycaemia (Felig & Lynch, 1970; Scow, Chernick, & Brinley, 1964). This, along with the increased urinary nitrogen excretion and raised plasma levels of free fatty acids has been termed ‘accelerated starvation’ (Metzger et al., 1982). Ketosis is evident after brief periods of fasting and represents an acceleration of the normal response to withholding calories (Rudolf & Sherwin, 1983). Hypoglycaemia, hypoalaninaemia and hyperketonaemia normally occur after 24 to 36 hours of fasting but in pregnancy they occur within 16 hours (Metzger, Phelps, Freinkel, & Navickas, 1980).

A study of women in their third trimester of pregnancy found they had an extreme decrease in glucose plasma levels, alanine and free fatty acids following a 12 hour fast (6 pm to 6 am) when compared with non-pregnant women (Metzger et al., 1982). The level of ketonaemia was found to increase and moderate obesity gave no protection against the tendency for ‘accelerated starvation’ in pregnancy (Metzger et al., 1982). This alteration in women’s metabolism has been attributed to the fetus’s nutritional requirements (Rudolf & Sherwin, 1983). The muscular exertion of labour and birth plus enforced fasting during this period have been found to accentuate the ‘accelerated starvation’ syndrome (Sabata et al., 1968).

The body’s utilization of glucose and production of ketones are orchestrated by the hormones of pregnancy in order to meet the demands of the developing fetus. An understanding of the role of glucose and ketones during pregnancy and labour and their association with prolonged labour is, therefore, important to this discussion.
3.3.1 The role of glucose in normal pregnancy

Glucose is the principal source of energy for the fetus and is diffused rapidly across the placenta (Miller, Skiba, & Klapholz, 1978; Sabata et al., 1968). The feto-placental unit in pregnancy drains glucose and glycogenic amino acids away from the mother (Rudolf & Sherwin, 1983). The reduction in maternal glucose levels suppresses insulin secretion and enhances lipolysis and the conversion of fatty acids into ketones which in turn stores glucose for use by the fetus (Felig, 1977; Rudolf & Sherwin, 1983; Ryan, Brower, O’Sullivan, & Skylar, 1982). Hypoglycaemia and hypoinsulinaemia, therefore, occur more rapidly in pregnancy if the woman undergoes a period of fasting (Rudolf & Sherwin, 1983).

It has been estimated that glucose intake by pregnant women at term is increased by about 16 per cent and, in order to maintain the required glucose needs, the liver’s production of glucose is enhanced (Kalhan, D’Angelo, Savin, & Adam, 1979). The woman’s body also uses the fat stores which were laid down during the earlier months of pregnancy to compensate for the body’s increased need for glucose (Cassidy, 1999). Despite the body’s compensatory measures, glucose levels fall and free fatty acids rise during late pregnancy and this trend continues as labour progresses, as does the incidence of ketosis (Anderson, 1998).

Recent studies have investigated and compared the metabolic profile (fatty acids, glucose, insulin, and ketone bodies) of labouring women who drank isotonic fluid (Kubli et al., 2002) or ate food (Scrutton et al., 1999) with those who did not. These studies found that although oral intake prevented maternal ketosis during labour, such practices made no difference to labour and birth outcomes. This information
implies that maintaining glucose levels throughout labour by the ingestion of food and fluids does not improve labour and birth outcomes contrary to opinions found within the literature (Broach & Newton, 1988; Dumoulin & Foulkes, 1984; Ludka & Roberts, 1993; Rooks et al., 1989).

3.3.2 The role of ketones in normal pregnancy and labour

Ketone bodies are formed in the liver as a result of fat metabolism when fatty acids are used by the body as fuel (Odent, 1994). Fat metabolism occurs whenever glycogen stores are depleted (Keppler, 1988). Ketosis is the accumulation of large quantities of ketone bodies in the blood (Miller & Keane, 1975). Ketosis is a normal response to exertion and fasting and pregnant women are more prone to ketosis because of increased fetal demands, increased fat utilization and pregnancy-induced hormone changes (Dumoulin & Foulkes, 1984; Hazle, 1996; McKay & Mahan, 1988).

An increase in ketone bodies may result in an overload in the blood and subsequent ketonuria (Anderson, 1998). During pregnancy the glomerular filtration rate increases resulting in increased secretion of ketones in the urine (Keppler, 1988). The level of ketosis is estimated by measuring urine output of ketones. Forty percent of women in normal labour exhibit ketonuria on urinalysis (Dumoulin & Foulkes, 1984) and small to moderate ketonuria is not considered harmful (Keppler, 1988; Morton, 1993; Rudolf & Sherwin, 1983). Mild dehydration and moderate ketosis are considered normal in labour and are believed to be beneficial in protecting the fetal brain from hypoxic damage (Newton, Newton, & Broach, 1988).
However, severe ketosis may progress to ketoacidosis which may be life-threatening to the mother (Ludka & Roberts, 1993), and it is considered to be indicative of an unfavourable environment for the fetus (Rudolf & Sherwin, 1983). High levels of ketonuria have been found to be directly related to extended labour (Bencini & Symonds, 1972; Foulkes & Dumoulin, 1985), increased need for induction and augmentation in nulliparous women, forceps deliveries and increased blood loss (Broach & Newton, 1988a; Foulkes & Dumoulin, 1985). The augmentation rate has been found to double amongst those labouring women with ketosis and to be higher amongst those with prolonged labour, demonstrating a perceived association between ketosis and uterine inertia (Foulkes & Dumoulin, 1985). When ketone bodies are excreted in the urine large quantities of sodium and potassium are also removed decreasing the blood pH. It has been suggested that this may be the relationship between ketonuria and prolonged labour (Ludka & Roberts, 1993).

A comparison of labouring women allowed to eat with those only permitted water found that the plasma level of non-esterified fatty acids and ketones were lower and the glucose level higher by the end of the first stage of labour in the fed group; however, the length of labour was similar regardless of oral intake (Scrutton et al., 1996; Scrutton et al., 1999). It has been suggested that there is a physiological benefit to the progress of labour when ketones are low and glucose is kept at a level sufficient to meet the caloric needs of labour (Dumoulin & Foulkes, 1984; Ludka, 1987), but there is no supporting research evidence. The supposition that withholding food in labour may predispose the woman to severe ketosis is also without evidence.
A contrasting theory suggests that during labour ketone bodies are not waste products of metabolism but readily available energy sources for the muscle and brain of the mother (Rudolf & Sherwin, 1983). Ketones easily cross the placenta where fetal tissues, especially the brain, liver and lungs, are believed to use them as an alternate source of fuel (Kim & Felig, 1972; Leturque et al., 1989;Sabata et al., 1968; Shambaugh, Koehler, & Freinkel, 1977). Ketone bodies are an important substrate in the synthesis of lipids in the developing fetal brain and for myelin synthesis (Patel, Johnson, Rajan, & Owens, 1975). They are also used by the fetus to lay down adipose tissue (white and brown fat) which is so important for thermostasis in the first days of newborn life (Anderson, 1998).

In summary, the literature suggests that mild to moderate ketosis is a normal consequence of labour although the association between high ketonuria and the progress of labour is inconclusive. There is also no evidence to inform the debate about the beneficial or detrimental effect of ketone bodies to the mother or fetus. It appears that ketosis only becomes a problem when it exceeds, what is assumed to be, normal levels. Normal ketone levels tend to be exceeded when labour becomes prolonged. There is no conclusive evidence demonstrating that prolonged labour causes an over-production of ketone bodies or an over-production of ketone bodies causes prolonged labour.

### 3.4 Psychological effect of restricted oral intake during labour

Restricting or denying food and fluids also has a psychological effect in addition to the obvious physical effects (Elkington, 1991). Eating and drinking are associated with friendship, security, and comfort and are believed to have a pacifying effect on
a person (Hamilton-Smith, 1972). Being able to eat and drink as desired during labour is not only associated with nutrition, hydration and physical comfort, but has also been associated with giving the labouring woman a feeling of control in her labour (Baker, 1996).

Odent (1994) observed that the rate of intervention during labour is lowered when there are no restrictions on a woman’s oral intake in labour and that the benefits outweigh the risks of general anaesthesia-related aspiration. Restriction of oral intake during labour may increase the labouring woman’s perception of pain and reduce morale which in turn may adversely affect the progress of labour, resulting in the ‘snow-balling’ effect of medical intervention (Chern-Hughes, 1999; Lewis, 1992; Simkin, 1986).

Having food and, to a certain extent, fluids withheld is stressful and stress can lead to an increase in circulating catecholamines. The increase in catecholamines may increase arterial pressure and increase blood flow to active muscles while decreasing blood flow to organs not needed for rapid activity, such as the uterus and the placenta (Broach & Newton, 1988a; Guyton, 1986). When circulating catecholamines rise, they in turn cause an increase in metabolism and the body’s demand for glucose, which ultimately has an effect on muscle strength and blood coagulation (Guyton, 1986).

The body’s use, need and production of glucose, ketones, and certain hormones appear to be the basis for the development of assumptions to support the labouring woman’s physiological and psychological need for food and fluids throughout labour. Although research has identified the role of these substances, it is not
known how these changes affect the labour and birth process. There is no substantial research to support the assumption that the ingestion of food and fluids throughout labour has a beneficial effect.

3.5 Other factors affecting labour

Research has demonstrated that a number of other factors can affect labour and birth outcomes other than oral intake, such as the position of the fetus during labour, maternal age and ethnicity. Therefore, a large sample and a research design that will control for this interplay of factors is necessary when considering the effect eating has on labour and birth outcomes.

3.5.1 Position of the fetus in labour

The length of labour may be affected by weak uterine contractions, an abnormal pelvic shape, or the position of the fetus (such as, occipito-lateral, occipito-posterior and breech positions) during the labour and birth process (Williams, 1999; Hofmeyr & Kulier, 2000). Prolonged labour is commonly associated with the occipito-lateral and occipito-posterior positions of the fetus (Fitzpatrick, McQuillan, & O’Herlihy, 2001; Hofmeyr & Kulier, 2000). The occipito-anterior (OA) position of the fetus is preferable to the occipito-posterior (OP) and occipito-lateral (OL) positions because descent of the fetus through the pelvis is improved when the occiput of the fetus lies in the anterior part of the pelvis (Williams, 1999a). When the fetus assumes the OP position, in particular, labour is slow and contractions may be irregular and less effective because the larger diameter of the fetal head, which is associated with this position, prevents sufficient cervical stimulation (Williams, 1999). Established
practice considers labour prolonged if it exceeds 24 hours or 12 hours when the labour is managed actively (Williams, 1999). Nulliparous labours are more likely to be considered prolonged and, therefore, more likely to be actively managed (Williams, 1999).

### 3.5.2 Maternal age and ethnicity

Maternal age and ethnicity have also been associated with longer labours. There have been conflicting reports from research investigating the effect of maternal age on labour duration (Adashek, Peaceman, Lopez-Zeno, Minogue, & Socol, 1993; Cohen, Newman, Friedman, 1980; Friedman & Sachtleben, 1965). Ethnicity has been demonstrated in a number of studies to be associated with the length of labour (e.g., Albers, Schiff, & Gorwoda, 1996; Fitzpatrick, et al., 2001; Jones & Larson, 2003).

When labour is considered prolonged, strategies such as artificial rupture of membranes (surgical augmentation) and intravenous syntocinon infusion (medical augmentation) are most commonly employed to hasten labour (Kruse, 1993). Artificial rupture of membranes is often the first medical intervention instituted if the membranes have not already ruptured spontaneously, and this is usually supplemented by medical augmentation (Seneviratne, deSilva, deSilva, & Rudra, 1998). This strategy is known as active management of labour (Sadler, Davison, & McCowan, 2001).

Other forms of medical intervention associated with prolonged labours are an increased need for drugs to reduce the pain of labour, such as an intramuscular
injection of pethidine and epidural anaesthesia, instrumental vaginal delivery (forceps or ventouse), emergency caesarean section, and perinatal asphyxia (Kruse, 1993). Artificial rupture of membranes and medical augmentation in labour have been associated with higher instrumental vaginal and emergency caesarean section delivery rates (Seneviratne et al., 1998). Controversy, however, exists about whether epidural anaesthesia is associated with prolonging labour and also increasing the need for instrumental and emergency caesarean section deliveries (McGrady, 1997; Sharma et al, 1997; Thorp & Breelove, 1996; Yancey, Pierce, Schweitzer, & Daniels, 1999). Prolonged labours, particularly those caused by malpositions such as occipito-lateral and occipito-posterior positions in labour, are associated with high rates of instrumental delivery especially among nulliparous women (Fitzpatrick et al., 2001).

3.6 Reintroducing food in labour: an increasing trend

Hunger or thirst during labour, particularly prolonged labours, have been reported when women are restricted to water as their only oral intake (Broach & Newton, 1988a; Crawford, 1956; Elsberry et al., 1990; Newton & Champion, 1997). It has been suggested that complaints of hunger and thirst by these women may have been the impetus for the ever-increasing trend toward the reintroduction of food and various fluids for labouring women in developed countries (Baker, 1996; Michael, Reilly, & Caunt, 1991; Soreide, Holst-Larson, & Steen, 1994). Tranmer (1999) found that, when labouring women were allowed to eat and drink as desired, there were subsequently no complaints of hunger or thirst.
Anaesthetists are concerned that oral intake other than clear fluids may increase the risk of aspiration if a general anaesthetic is required during the course of labour. In the Netherlands, however, where there is a 39% home birth rate and women have free access to food and fluids in their own home, the caesarean section rate is less than 10% with a maternal mortality rate less than 1% per 10 000 births (Odent, 1994). Despite the non-restrictive policy for oral intake in this country, the mortality rate for Mendelson syndrome was 0.018 per 1000 caesarean sections, using data on nearly 2 000 000 deliveries from 1983-1992. This statistic is no higher than in other countries where a restrictive oral intake policy is followed (Scheepers, Essed, & Brouns, 1998).

Consumer choice in childbirth was emphasised in the ‘Changing Childbirth’ report in the United Kingdom (Department of Health, 1993). The report was widely distributed and the recommendations promoted as a basis for care. One of the recommendations supported a less rigorous attitude towards fasting during labour and, as a consequence, the number of women choosing to eat and drink increased, despite the recommendations of obstetric anaesthesiologists (Scrutton, 1997). Consequently, birth attendants are increasingly encouraging labouring women to determine their own oral intake needs (Berry, 1997; Chern-Hughes, 1999; Scheepers et al., 1998). A number of surveys conducted in the United Kingdom between 1984 and 1997 demonstrated the increasing trend towards women consuming food throughout labour. In 1984, seven per cent of hospitals allowed women to eat during labour, by 1989 there were 33%, and by 1994 the number had increased to 53% (Berry, 1997) – Table 4. A survey conducted of Norwegian hospitals in 1993
noted only half their hospitals restricted food intake during labour (Soreide et al., 1994).

While the literature does not conclusively identify the factors that have changed practice regarding oral intake during labour, there are recurring themes. The decrease in aspiration-related maternal mortality statistics, as evidenced by reports from the Confidential Enquiry into Maternal Deaths in the United Kingdom (Ministry of Health, 1966; Department of Health, 1969 – 2001), has in some clinical areas provided evidence to relax policies and allow oral intake. A number of midwifery articles were published during the 1980s and 1990s which questioned the need to fast labouring women along with the possible benefits of feeding these women (e.g., Broach & Newton, 1988; Charbonneau, 1993; Dumoulin & Foulkes, 1984; Department of Health, 1993). Publication of research reports which found positive outcomes for women and their babies when food was eaten during labour (e.g., Rodwell, 1992) may also have encouraged changes in practice.

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<tr>
<td>Ice Chips only</td>
<td>25%</td>
<td>3.6%</td>
<td>1.42%</td>
</tr>
<tr>
<td>Water</td>
<td>86%</td>
<td>96.4%</td>
<td>98.6%</td>
</tr>
<tr>
<td>Free fluids</td>
<td>34%</td>
<td>64.7%</td>
<td>52.0%</td>
</tr>
<tr>
<td>Food</td>
<td>7%</td>
<td>32.8%</td>
<td>52.9%</td>
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* Where percentage exceeds 100% women were permitted food and free fluids and water.
The absence of written policies or clinical guidelines regarding oral intake for labour in many maternity units in the United Kingdom could also influence the practice of midwives. Michael et al. (1991) surveyed 351 maternity units during 1989 and found that 20.5% of units had no written policy regarding oral intake for women during labour (Michael et al., 1991). The absence of policies has been implicated as a reason for conservative management of labour (Baker, 1996; Michael et al., 1991). In a survey of 11 maternity units in England, it was noted that many midwives in these units were unsure of the existence of a written policy in their hospital regarding oral intake in labour, with traditional practice being the ‘agreed or usual practice’ (Al-Najjar, 1998).

Anecdotal evidence has had a strong influence on the reintroduction of oral intake for labouring women. The research performed over the last decade to examine the effect of food intake during labour will be examined next.

### 3.7 Effect of oral intake on birth outcomes

Seven studies were located which investigated the effect of oral intake on labour and birth outcomes. These studies were conducted in the United States, Ireland, the United Kingdom and Canada and published between 1990 and 2002. No Australian research was identified pertaining to this topic.

Elsberry et al. (1990) undertook a retrospective comparative study at the North Bronx Hospital in New York to determine the oral intake behaviour of labouring women and the effect of the food on ketonuria and incidence of vomiting. This hospital was renowned for its low intervention rate in labour despite treating a large
percentage of women with high-risk pregnancies (70%). At the time of the study this hospital had a caesarean section rate of approximately 11%, which was half the national average for the United States, and an instrumental birth rate of 0.3% (Haire & Elsberry, 1991). An uncontrolled, convenience sample of 86 labouring women were surveyed in this study. It was found that all 86 women chose to eat and drink before admission to hospital. On admission, the majority of women were in active labour and oral intake was found to decrease with only 24% continuing to eat and 47% continuing to drink. One finding of interest was that women who consumed foods containing fat were more likely to vomit and have ketonuria. However, more rigorous research containing a larger sample size is necessary to investigate the relationship between oral intake and physiological outcomes.

In nearly ten years of practice before 1983 and over 20 000 births, not one woman at this hospital in New York had aspirated. During a six-month period in 1983 a policy was introduced for fasting women during labour. This policy, the only change in practice at the time, was associated with a caesarean section rate of 38% and an instrumental birth rate of 35% (Ludka, 1987). The use of medical augmentation for labour increased fivefold and the need for newborn admissions to the neonatal intensive care unit rose to 69%. One aspiration-related maternal death occurred during this period in a woman who had fasted for 36 hours. As a consequence of these poor outcomes the policy of fasting labouring women was discontinued for normal labours, which resulted in a return to the previous statistics (Ludka, 1987).
A second study conducted in 1990, within four maternity facilities in northeastern United States of America, investigated the occurrence of oral intake of labouring women permitted to eat and drink as desired during their labours (Roberts & Ludka, 1993). This descriptive study used an uncontrolled, convenience sample (N = 76) and demonstrated that 100% of women chose to drink and 85% to eat during labour. The amount of food and fluids consumed during labour depended on the time of day and tended to decrease as cervical dilatation increased. Only two women ate food during the late phase (transition) of the first stage of labour and drinking among the other women was reduced to sips of water in second stage. There were no incidences of aspiration among these women. Again this was a small, uncontrolled sample which provided no information about the safety or efficacy of food and fluid intake during labour.

An unpublished, randomised control trial, was conducted in the United Kingdom with a sample size of 297 labouring women who ate food during labour. Yiannouzis and Parnell (1994) compared the effect on labour and birth outcomes of a light, low-fat diet during labour with water only intake. These researchers found that the group who ate food was more likely to vomit and the mean length of labour was one hour and 34 minutes longer than the control group (Yiannouzis & Parnell, 1994). Limitations of this study were that only the food consumed after admission to hospital was documented; whatever the women had eaten at home was not included. It was suggested by the authors that what the women had eaten at home may have had an impact on labour outcomes. The recommendations from this research were that the types and quantities of food women choose to eat during the 24 hour period before birth be included in further research.
A narrowly focused approach was taken for a study conducted in Canada in 1998 which examined the ketonuria levels of labouring women. Following the introduction of dietary restrictions for labouring women in this hospital, it was noted that there was an increase in the incidence of dehydration and ketosis, leading to intravenous therapy being used to meet their fluid and nutrient requirements (Tourangeau, Carter, Tansil, McLean, & Downer, 1999). Tourangeau et al. (1999) conducted an uncontrolled, convenience study (N = 219) to investigate the incidence of ketonuria if intravenous therapy was not instigated in labour unless there was an indication. Healthy, low-risk labouring women were encouraged to consume a light diet and fluids throughout labour if they did not require an intravenous infusion. The results demonstrated that the incidence of ketonuria was similar between the intravenous therapy group and the group allowed to eat and drink.

Scrutton et al. (1999) conducted a stratified, randomised, controlled trial of 88 women comparing labour and birth outcomes of a group of women allowed to eat a light, low-residual diet throughout labour with a group of women only allowed water. Scrutton et al. (1999) found no differences between the groups. In this same study Scrutton et al. (1999) also measured, by way of ultrasonography, the gastric contents of both groups of women. Not surprisingly, the women permitted to eat food were found to have a larger gastric volume at the end of labour than the women who did not eat and, if vomiting occurred, the group who ate vomited larger volumes. These investigators also found that eating during labour prevented the development of ketosis.
An unpublished doctoral thesis conducted by Tranmer (1999) was obtained. This study was a randomised control trial consisting of 328 nulliparous, labouring women. Although Tranmer (1999) randomised women to an ‘Eating group’ and a ‘Water-only group’ before the commencement of labour, there was a 50% non-compliance rate among the subjects. Tranmer (1999) found no difference between groups for any labour or birth outcome; however, this study was flawed by the lack of compliance.

A study by Kubli et al. (2002) compared the consumption of an isotonic ‘sport drink’ (a clear fluid) with water in their randomised control trial of 60 labouring women. Kubli et al. (2002) found that the labouring women assigned to the sports drink group had a reduced incidence of ketosis during labour, while no difference was found for gastric volume by ultrasonography, the incidence of vomiting or any maternal and neonatal outcomes measured. Although this information is of importance to the birthing community, it provides no information about the intake of food. It is the safety and efficacy of food intake during labour which is the issue of most concern in the debate about oral intake for labouring women.

The report from a randomised control trial conducted in Belfast was limited to a newspaper publication containing details of the sample size (N = 46) and findings only (Rodwell, 1992). Although this study reported an improvement to all measured labour and birth outcomes, attempts to establish communications with the study investigators to follow-up their methodology received no response.

The studies of interest to the research reported in this thesis were the three randomised control trials which investigated food intake during labour (Scrutton et
al., 1999; Tranmer, 1999; Yiannouzis & Parnell, 1994), only one of which was published in a peer-reviewed journal (Scrutton et al., 1999). Despite using the same design, their methodological differences found conflicting results. Conflicting results among the studies were associated with differences in (1) aims, (2) sample sizes, (3) recruitment and data collection strategies and, (4) the method used by each study to control for the variable parity (number of babies a woman has birthed). Findings may also have been influenced by the differing rates of medical induction and augmentation and epidural anaesthesia used during labour within each of the study settings.

Although each of the previous studies examined the effect of labouring women’s food intake on the length of labour, the major aim of each study differed. While the main aim of the study by Yiannouzis and Parnell (1994) was to detect a difference between groups (Eating and Non-eating) for the length of labour, Tranmer’s (1999) study was interested in detecting a difference between eating groups for the incidence of dystocia during labour (that is, labour progress < 0.5 cm/hour over 4 hours). A different approach was taken by Scrutton et al. (1999) whose aim was to determine whether a difference existed between the Eating groups for gastric volume and plasma $\beta$-hydroxybutyrate, nonesterified fatty acids and glucose levels, thereby determining whether food intake during labour influenced the incidence of ketosis during labour. The different aims and outcome variables measured for these studies influenced the sample sizes selected for each study.

The differing aims of each study meant the measures used for the power calculations to determine sample size also varied (Scrutton et al., 1999; Tranmer, 1999;
Yiannouzis & Parnell, 1994). Yiannouzis and Parnell’s (1994) sample size of 297 subjects, 157 being nulliparous women (Eating group = 101; Non-eating group = 56), was not determined by way of a power analysis, rather their aim was to recruit as large a sample as possible. This oversight was a consequence of a lack of research knowledge and appropriate support (personal correspondence Katie Yiannouzis, 10 January 2004). Scrutton et al. (1999) and Tramner (1999) based their power calculations on the detection of plasma metabolic differences and the reported incidence of dystocia in North American hospitals respectively.

The three studies consequently differed in the sample size used (Table 5). A total sample size of 88 was required for Scrutton’s et al. (1999) study. The two Eating groups were stratified into nulliparous (n = 64) and multiparous (n = 24) women resulting in four smaller groups for analysis. Although the sample size in this study was large enough to detect a difference between the Eating groups for plasma metabolic differences, it may have been too small to determine if there was a difference for the length of labour.

Tranmer’s (1999) study required 330 subjects and recruitment was restricted to nulliparous women with low-risk pregnancies because it has been demonstrated that these women are more likely to have longer labours. Although Tranmer (1999) reported an Eating group of 163 and a Non-eating group of 165, up to 50% of women in both groups were noncompliant. Women were considered to have ‘eaten’ if they consumed a source of glucose, whether as a food or a fluid, therefore a percentage of these women may not have eaten food. By Tranmer’s (1999) criterion (any woman who had consumed a source of glucose) there were only 85 women in
the Eating group and 79 women in the Non-eating group during the *early phase* of the first stage of labour. During the *established phase* there were only 63 women in the Eating group and 151 in the Non-eating group. However, despite the non-compliance within both groups, Tranmer’s (1999) analysis was based on the comparison of the total sample (Eating group = 163; Non-eating group = 165) regardless of oral intake during labour. As such, the contaminated sample severely limited the reliability of this study’s findings.

### Table 5  Eating & Non-eating group sample sizes for oral intake studies

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<tr>
<td></td>
<td>Eat</td>
<td>Non-eat</td>
<td>Eat</td>
</tr>
<tr>
<td>Early Labour</td>
<td>85</td>
<td>86</td>
<td>-</td>
</tr>
<tr>
<td>Established Labour</td>
<td>63</td>
<td>151</td>
<td>45</td>
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The timing of recruitment (before labour or at hospital admission in labour), and consequently the data collected also varied between the studies. Tranmer (1999) recruited women before labour commenced and collected data for both the *early* and *established* phases of the first stage of labour. During analysis, however, Tranmer (1999) did not differentiate between food eaten during these two phases of labour, instead analysing oral intake as one variable. Scrutton et al. (1999) and Yiannouzis and Parnell (1994) did not take into consideration food that may have been consumed by their subjects during the *early phase* of labour. Recruitment and data collection were confined to the *established phase* of labour only, allowing researchers more control, and therefore compliance, over oral intake. The
differences in recruitment and data collection strategies may have impacted on the results found among the studies.

The length of labour is also known to be influenced by parity (Cohen et al., 1980; Kruse, 1993) and as such was considered a major confounding variable in each of these three studies, evidenced by the methods used in their efforts to tighten control over this variable. Tranmer (1999) overcame the effect of parity by recruiting nulliparous women only. This strategy better ensured homogeneity but limited generalisability of the findings to nulliparous women (Polit & Hungler, 1999).

Scrutton et al. (1999) and Yiannouzis and Parnell (1994) used a stratified random sampling method to provide homogeneous subsets of nulliparous and multiparous women. This strategy, however, further decreased the already small group sizes, particularly in Scrutton’s et al. (1999) study, and consequently the ability to detect a difference for the length of labour if such a difference existed (Polit & Hungler, 1999).

Along with differing methodological approaches among the three studies, there were also variations in the management of labour: in particular, the use of syntocinon infusion and the rate of epidural analgesia. There was a large difference among the studies in the percentage of women who received a syntocinon infusion to induce and ‘actively manage’ labour. A labour that is ‘actively managed’ in this way is shorter than a labour that is not (Macer, Macer, & Chan, 1992). Labour was ‘actively managed’ for 78% of Scrutton’s et al. (1999), 84% of Tranmer’s (1999) and 36% of Yiannouzis and Parnell’s (1994) subjects. This difference in ratios
between ‘actively managed’ and naturally managed labours may have influenced the findings.

Epidural anaesthesia has been demonstrated to affect the eating habits of labouring women (Scrutton et al., 1996). It was reported by Scrutton et al. (1996) that women with an effective epidural were ‘keen’ to eat solid food throughout their labour. As many as 90% of the women in Scrutton’s et al. (1999) study were ‘under the effect’ of epidural analgesia during their labour, as were 38% of the nulliparous women in Yiannouzis and Parnell’s study (1994), with neither study reporting a non-compliance problem for oral intake. The epidural rate of subjects in Tranmer’s (1999) study was 76%, yet only half the women in this Eating group consumed food (or a source of glucose) during the established phase of labour. The difference occurred because Tranmer (1999), although having randomised women to eating and non-eating groups, allowed women to follow their desire for food and fluids during labour, while Yiannouzis and Parnell (1994) regularly offered food to their Eating group throughout labour (Yiannouzis, personal communication, January 22, 2004). Although not reported, regular enticements to eat food were probably also given to Scrutton’s et al. (1999) subjects. Under the effect of epidural analgesia women may eat simply because the food is provided, not because they are hungry or need the food. These women may eat in excess of their body’s natural desire, leading to larger than normal gastric volumes and a greater tendency to vomit; both of which were found to occur in Scrutton’s et al. (1999) and Yiannouzis and Parnell’s (1994) studies. Randomisation of labouring women to eating and non-eating groups therefore, (the design employed in the studies by Scrutton et al. [1999], Tranmer [1999], and Yiannouzis & Parnell [1994]), may not be an
appropriate design for this type of study. Randomising women to groups for oral intake purposes creates an unnatural setting with women eating food when they may not have been hungry or were nauseated and women being denied food when hungry. Although randomisation is recognised as the preferred design to control for confounding variables and to better ensure homogeneity (Polit & Hungler, 1999), it does not reflect the real life situation.

To summarise, differences in methodological approaches and management of labour among these three studies (Scrutton et al., 1999; Tranmer, 1999; Yiannouzis & Parnell, 1994) led to conflicting results. The variation in the major aim of each study and the subsequent sample sizes selected are considered to be the main reasons the studies did not agree on the effect eating during labour may have on the length of labour. Nevertheless, these studies do provide some evidence for use in policy or guideline development within hospital maternity units. In the absence of reliable evidence the World Health Organisation (1996) has recommended that labouring women be encouraged to drink fluids only; however, opinions of clinicians differ with the opposing view being that restricting food during labour is unlikely to be beneficial (Enkin et al., 2000).

3.8 Assumptions regarding vomiting and intravenous fluids

The paucity of substantial research to empirically test the effect of oral intake for labouring woman has contributed to practice based on the following untested dicta: (1) the need for an empty stomach for general anaesthesia, (2) the need to fast all labouring women, (3) nil by mouth regimes to reduce vomiting during labour and
general anaesthesia and (4) intravenous infusions as an appropriate substitute for nutrition during labour.

The practice of fasting women during labour and the effect of that on gastric secretion and vomiting were discussed in Chapter 2. Just as there is little evidence to support that practice, research has also yet to demonstrate a relationship between oral intake and aspiration of gastric contents (Jacob, 1998; Michael et al., 1991) and the safety and efficacy of fasting regimes for labouring women. Although the cause and effect of vomiting during general anaesthesia was discussed earlier, this section will elaborate on the association between vomiting and labour. Intravenous infusions in lieu of oral intake for labouring women have been well documented and advocated by anaesthetists (e.g., Benhamou & Auroy, 1993; Tourangeau et al., 1999). The risks and benefits of this intervention for labouring women require deliberation.

3.8.1 Vomiting during labour

The assumption that eating during labour predisposes a labouring woman to vomiting and, if general anaesthesia is required, a greater likelihood of aspiration, requires further discussion. Vomiting is an extremely common feature of labour regardless of whether women have eaten or not (Roberts & Ludka, 1993; Yiannouzis & Parnell, 1994). It is most commonly associated with rapid progression of labour when ‘the cervix triggers the pain receptors and stimulates nausea, vomiting and diaphoresis regardless of intake’ (Roberts & Ludka, 1993, p.1570, cited as personal communication with Boulaep, 1991). When the stomach is empty, vomiting is a very unpleasant experience (Yiannouzis & Parnell, 1994).
Some women have complained that they might not have been sick or nauseated during labour if they had been able to have something to eat (Mitchell, 2000).

Vomiting has also been associated with prolonged fasting during labour (Sutherland et al., 1986), consuming foods with high fat content (Haire & Elsberry, 1991) and maternal hyponatraemia (Keppler, 1988; Schwartz & Jones, 1978). During prolonged fasting the symptoms of nausea and vomiting are accentuated (Sutherland et al., 1986) because of the acidic gastric secretions and swallowed air which have collected in the stomach. This collection of gastric contents predisposes the women to regurgitation of highly acid fluid (pH <2.5) if general anesthesia is required (Bannister & Sattilaro, 1962).

While the association between obstetric and anaesthetic drugs and techniques and vomiting during labour (e.g., Crawford, 1956; Davies & Howeels, 1973; Hunter & Moir, 1983; La Salvia & Steffen, 1950) is established, studies of the effect oral intake has on labour outcomes have found that women who ate food were more likely to vomit than those women who drank water only (Scrutton et al., 1999; Yiannouzis & Parnell, 1994). Both these studies, however, encouraged food intake for women assigned to the eating group of their randomised control trials, and outcomes may have been different had these women self-selected their oral intake requirements.

### 3.8.2 Intravenous infusions for labour

Intravenous therapy as treatment for labour was first recommended by Mendelson (1946) for women experiencing long labours to compensate for their ‘fast.’
Originally, intravenous fluids were prescribed to replace presumed nutritional and fluid deficits for women who were considered high-risk; however, the practice became widespread over time and in some facilities was routine (Davis & Riedmann, 1991).

Although intravenous therapies were being used for labour from the end of the 1940s (Pengelley & Gyte, 1998a), research evaluating the effect on labour was not conducted until the mid 1970s. The data unexpectedly demonstrated that intravenous therapy had physiological consequences for the mother and fetus and psychological implications for the mother (e.g., Ames, Cobbold, & Maddock, 1975; Lawrence, Brown, Parsons, & Cooke, 1982; Schwartz & Jones, 1978).

Water intoxication can occur if labour is prolonged and the woman receives intravenous fluids throughout. Drugs commonly used during labour such as oxytocin have an antidiuretic effect, and combined with intravenous fluids and the pregnant woman’s own elevated antidiuretic hormone, may result in water intoxication (Johnstone, 1972; MacLennan, 1986; Schwartz & Jones, 1978). When this drug is combined with epidural anaesthesia, which is a common form of labour pain management (NSW Health Department, 2001), the labouring woman may be severely compromised (Keppler, 1988). This fluid overload may contribute to the development of pulmonary oedema causing and aggravating the effect of pulmonary aspiration if it occurs (Feeney, 1982; McKay & Mahan, 1988). It can also lead to postpartum cerebral oedema, convulsions, severe brain damage, severe visual deficit, dysphasia and maternal death (Burt, Oliver, & Whitener, 1969; Gupta & Cohen, 1972; Lilien, 1968; Paech, 1998; Storch, 1971). Tarnow-Mordi, Shaw, Lin,
Gardner, and Flynn (1981) recommended a maximum intravenous intake of 1200 ml per day because of the woman’s impaired water excretion ability during labour.

The properties of the intravenous therapies can also contribute to adverse events. There have been three types of intravenous solutions used for labour over the last 50 years: glucose, saline and Hartmann’s. Glucose (dextrose) infusions were found to cause hyperglycaemia and hyperinsulinaemia in the woman (Ames, Cobbold, & Maddock, 1975; Lawrence et al., 1982; Morton, Jackson, & Gillmer, 1985) and hyperinsulinaemia (Lucas, Adrian, Aynsely-Green, & Bloom, 1980; Mendiola, Grylack, & Scanlon, 1982; Rutter, Spencer, Mann, & Smith, 1980) and lactic acidosis in the fetus (Ames, Cobbold, & Maddock, 1975; Lawrence et al., 1982; Singhi, Kang, & Hall, 1982). According to Gabbe (1988), large volumes (amount unspecified) of glucose solutions may also increase maternal blood volume resulting in an increased cardiac output.

Other findings associated with high-dose glucose infusion during labour were a lowering of the labouring woman’s pain threshold (Odent, 1994), a slowing of labour progress (Anderson, Cordero, & Hon, 1982), an increased incidence of neonatal jaundice (Gabbe, 1988; Kenepp et al., 1982; Singhi, Kang, & Hall, 1982) and an increased weight loss of the newborn in the first two days of life (Keppler, 1988). Because of the harmful effects of glucose administration and the suggestion that ketones may in fact be useful in labour, there has been a dramatic shift away from routine intravenous therapy especially for low-risk labouring women (Morton, 1993).
Glucose infusions, being salt-free, also lead to both maternal and fetal hyponatraemia (Schwartz & Jones, 1978; Stratton, Stronge, & Boylan, 1995; Tarnow-Mordi et al., 1981). Maternal hyponatraemia has been known to result in vomiting, cerebral oedema, pulmonary oedema, oliguria, coma and convulsions (Gupta & Cohen, 1972; Keppler, 1988; Schwartz & Jones, 1978). Fetal hyponatraemia can produce convulsions, apnoea, cyanosis, respiratory distress, feeding difficulties (Dahlenbury, Burnell, & Braybrook, 1980) and transient tachypnea (Sleutel & Golden, 1999).

The sole or excessive use of saline solutions led to fluid overload contributing to pulmonary oedema and hypernatraemia (Enkin et al., 2000; Gabbe, 1988). The investigation of Hartmann’s solution for administration during labour (Morton et al., 1985; Ramanathan, Masih, Ashok, Arismendy, & Turndorf, 1984) require a more detailed examination particularly where it is used for epidural preloading and maintenance (Morton et al., 1985).

The psychological effects of intravenous therapies have also been investigated (Newton, Newton, & Broach, 1988). The intravenous apparatus causes pain and restriction of movement. The release of catecholamines in response to pain, in combination with immobilisation of the woman, has been associated with reduced uterine efficiency and slow progress of labour (Broach & Newton, 1988; Davis & Riedmann, 1991).

Nevertheless, the maintenance of an intravenous line for all labouring women is strongly supported by some clinicians (Benhamou & Auroy, 1993) to prevent dehydration and ketosis, to provide intravenous access for oxytocin or other drug
administration, and to prevent hypotension should epidural anaesthesia be required. In some obstetric units in NSW epidural anaesthesia continues to be used for pain relief for up to 74% of labouring women (NSW Health Department, 2001). In Scrutton’s et al. (1999) study, conducted in the United Kingdom, 90% of women received epidural anaesthesia during labour.

While the use of intravenous therapy is strongly supported by a number of midwives and anaesthetists, there is an opposing view. By the end of pregnancy, a woman’s plasma volume has increased by some 40% (Millns, 1991; Sleutel & Golden, 1999) with two or more litres of water, depending on the degree of oedema, being stored in the extravascular spaces (Grant, 1992; Lind, 1983; Macleod, 1987; Newton, Newton, & Broach, 1988). This is considered an adequate store of fluids for the first 24 hours of labour if women have access to unlimited oral fluids (Chern-Hughes, 1999; Enkin et al., 2000; Macleod, 1987; O’Sullivan, 1994). Renal plasma flow and glomerular filtration rate increase and are matched by an increase in tubular reabsorption (Millns, 1991). Water excretion is delayed during labour because of the increased level of plasma antidiuretic hormone (Schwartz & Jones, 1978; Tarnow-Mordi et al., 1981). As a result of these processes, pregnant women retain extra fluids which reduce the requirement for additional fluids (Lind, 1983; Odent, 1994).

The articles reviewed regarding the use of intravenous fluids during labour present epidemiologic and clinical arguments against the routine and often unnecessary use of intravenous fluids as a compensation for the restriction of oral intake. There may
be labouring women who require intravenous therapy; however, it is suggested that
the needs of a few should not be interpreted as the treatment of benefit for all.

3.9 Summary of the evidence relating to oral intake for labouring women

Those who support the practice of providing food and fluid to women during labour
suggest it results in an increased state of physical and emotional wellbeing of
women and that there is improvement to labour and birth outcomes when oral intake
is self-regulated (Baker, 1996; Chern-Hughes, 1999; Lewis, 1992; Pengelley &
Gyte, 1998). Anecdotal information and opinion are the basis of supportive
evidence because rigorous research evidence is lacking.

There is a view that restricting oral intake for labouring women is a tradition which
continues without evidence of improved outcomes for the women or their newborn
(Sleutel & Golden, 1999). Despite extensive research into gastric emptying during
pregnancy and labour and its suspected association with aspiration, ‘a relationship
between oral intake and aspiration of gastric contents has yet to be shown’ (Michael

The National Health and Medical Research Council (NHMRC, 1998a) has published
a ‘Level of Evidence’ rating scale which enables practitioners to determine the
reliability of the professional health literature – level 1 being the most reliable.
Table 6 was developed by the researcher to provide premises and their associated
source of evidence which can assist in deciding whether eating during labour has an
effect on the incidence of aspiration during general anaesthesia.
The associations presented in Table 6 do not support the restriction of oral intake for labouring women as a strategy to prevent the incidence of aspiration during general anaesthesia. As Elkington eloquently stated:

There are no data demonstrating the medical relevance of any particular policy [regarding oral intake in labour] from a risk-reduction perspective … these policies are the result of tradition rather than thoughtful decision. These policies may persist on the basis of anecdotal experience, institutional inertia to change policies begun in the 1940s, compromise with anesthesia department policy to ensure adequate coverage, exaggerated notions of risk, or fear of litigation (Elkington, 1991, p.305).

In the latest national reports from the United Kingdom (Department of Health, 2001) and Australia (NHMRC, 2001), there was one maternal death attributed to aspiration of gastric contents caused by anaesthetic error in a severely compromised woman. No aspiration death has ever been attributed to the oral intake of an obstetric patient in either the United Kingdom or Australian Maternal Mortality reports despite the reintroduction of food for labouring women almost twenty years ago (Baker, 1996; Michael et al., 1991). Anaesthetic error is the principal cause of aspiration incidents.
Chapter 3 – Oral Intake During Labour

Table 6: Association between oral intake in labour and aspiration

<table>
<thead>
<tr>
<th>Premises</th>
<th>Level of evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. During pregnancy the body undergoes anatomical and physiological changes which may cause some women to be more susceptible to regurgitation.</td>
<td>Level III scientific evidence (Attie et al., 1982; O'Reilly et al., 1993).</td>
</tr>
<tr>
<td>2. When systemic narcotics have not been used during labour, women have a normal gastric emptying rate.</td>
<td>Level II scientific evidence (Nimmo, Prescott &amp; Wilson, 1975)</td>
</tr>
<tr>
<td>3. The stomach is NEVER empty regardless of the length of time a person fasts. Gastric emptying and pH are unchanged or improved in non-obstetric patients by clear fluid intake before surgery.</td>
<td>Level III scientific evidence (Guyton, 1986)</td>
</tr>
<tr>
<td>4. Gastric emptying is unchanged and pH improved in gynaecologic patients by a light diet 2 – 4 hours before surgery.</td>
<td>Level II scientific evidence (Splinter &amp; Schaefer, 1991)</td>
</tr>
<tr>
<td>6. The majority of aspiration episodes are either directly or indirectly associated with anaesthetic error.</td>
<td>Level IV evidence (Hawthorne et al., 1996; Sinclair et al., 1999).</td>
</tr>
<tr>
<td>7. Aspiration is unlikely to occur when a woman receives:</td>
<td>Level IV evidence</td>
</tr>
<tr>
<td>- a pre-operative risk assessment by an anaesthetist to identify whether a general anaesthetic is a safe option</td>
<td>(Kluger &amp; Short, 1999),</td>
</tr>
<tr>
<td>- the most currently available drugs for obstetric anaesthesia (such as propofol and rocuronium combination)</td>
<td>(Tillmann Hein &amp; Putman, 1997),</td>
</tr>
<tr>
<td>- correct application of all the steps in the ‘rapid sequence induction’ process (pre-oxygenation, cricoid pressure, endotracheal intubation) and extubation after she wakes from the anaesthetic</td>
<td>(Dawson &amp; Cockroft, 1996),</td>
</tr>
<tr>
<td>9. The maternal mortality rate associated with aspiration is now extremely rare with no cases occurring in Australia since 1987.</td>
<td>Level IV evidence (Dept of Health, 1998; NHMRC, 2001; Schneck et al., 1999)</td>
</tr>
</tbody>
</table>

Conclusion: A pregnant woman is unlikely to aspirate during a general anaesthetic whether or not she has eaten. Level IV evidence (Dept of Health, 1998; NHMRC, 2001).

Whether oral intake should be restricted or allowed during labour continues to be debated. Table 7 provides a summary of the perceived advantages and disadvantages of eating during labour based on the evidence within Chapters 2 and 3.
**Table 7** Summary of the rationales used for each side of the labouring woman’s oral intake debate

<table>
<thead>
<tr>
<th>Allowing oral intake</th>
<th>Restricting oral intake</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gastric acid secretion continues during fasting; therefore, oral intake decreases the gastric acidity,</td>
<td>Greater risk of morbidity and mortality from aspiration pneumonia if general anaesthetic is required during the course of labour (Report by the American Society of Anesthesiologists, 1999; Scrutton et al., 1994).</td>
</tr>
<tr>
<td>and consequently, the severity of aspiration pneumonia if it occurs (Pengelley &amp; Gyte, 1998).</td>
<td></td>
</tr>
<tr>
<td>Fasting is stressful; stress can increase the length of labour (Lewis, 1998; Newton &amp; Champion, 1997;</td>
<td>Greater incidence of vomiting if women eat during labour (Yiannouzis &amp; Parnell, 1994).</td>
</tr>
<tr>
<td>Pengelley &amp; Gyte, 1998).</td>
<td></td>
</tr>
<tr>
<td>Eating food may provide women with a more efficient labour and less risk of medical and surgical</td>
<td></td>
</tr>
<tr>
<td>intervention (Ludka, 1987; Pengelley &amp; Gyte, 1998; Rodwell, 1992).</td>
<td></td>
</tr>
<tr>
<td>Fasting can lead to ketosis and ketonuria, which may increase the length of labour and the need for</td>
<td></td>
</tr>
<tr>
<td>interventions (Dumoulin &amp; Foulkes, 1984; Pengelley &amp; Gyte, 1998).</td>
<td></td>
</tr>
</tbody>
</table>

The following chapters provide details of the four studies conducted to examine the overall aims of the study being reported in this thesis and to provide information to lessen the gap in knowledge regarding the labouring woman’s oral intake.

Chapter 4: Survey of New South Wales hospitals

Chapter 5: Survey of midwives within four Sydney hospitals

Chapter 6: Survey of obstetric anaesthetists in the same four Sydney hospitals and
Chapter 7: Comparative trial with concurrent controls to explore eating behaviour during labour and the effect eating food has on labour and birth outcomes.
Study 1 – Oral Intake Policies in New South Wales Hospitals

Basing practice on the best available evidence is considered to be paramount in contemporary midwifery management (Berggren, 1996; Carr & Schott, 2002). A systematic review of a research topic is viewed as the pinnacle of the evidence hierarchy with randomised control trials regarded as the most reliable study design (NHMRC, 1998a). Clinical practices related to birth vary widely among institutions and individual practitioners, with many being traditional routines based on the preferences of authoritative figures such as senior medical officers, and the experiences and anecdotal knowledge of senior midwives within the unit (Burgum, 1997; Carr & Schott, 2002; Gerrish & Clayton, 2004). Some practices are documented within policy and procedure manuals while others are unwritten but largely the convention of the unit (Carr & Schott, 2002).
The management of the labouring woman’s oral intake is one aspect of midwifery practice which is often found to be an unwritten convention within midwifery units (Michael et al., 1991). The paucity of reliable research upon which to base this aspect of care limits the development of a research-based written policy or guideline. This chapter presents results of the first of four studies designed collectively to provide evidence regarding labouring women’s oral intake to inform midwifery practice.

4.1 AIM

This study had two aims. The first was to identify the content of written policies for the management of labouring women’s oral intake in midwifery units throughout New South Wales, Australia. Second, in the absence of a written policy, the Nursing Unit Manager of each midwifery facility was requested to provide information about the usual practice employed for this aspect of labour management.

The objectives of this study were:

- to document the number of hospitals with a written policy and number without
- to determine the content of these policies
- to determine the usual practice in hospitals without a written policy
- to document the rationale for restricting or allowing oral intake for labouring women.
4.2 METHOD

4.2.1 Study design and setting

A self-complete survey design was used to fulfil the aims of the study. Data were collected between December 1999 and January 2000. All public hospitals in New South Wales (NSW) and all private hospitals in the Sydney metropolitan area were eligible for inclusion in this prospective survey. Two data sources were used to identify eligible health facilities: the Australian College of Midwives’ NSW branch (ACMI-NSW) database and the NSW Health Department’s Midwives Data Collection database.

The NSW Health Department has categorised hospitals into six levels according to their staffing and facilities to cater for obstetric and neonatal patients (NSW Health Department, 2000; 2001; 2002). Private hospitals have not been allocated a Level but simply grouped together as ‘private hospitals’ (M. Pym, personal communication, March 22, 2002). Table 8 provides an overview of the facilities available at each of these hospital levels.
Table 8 NSW hospital ‘Level’ allocation, number of hospitals and facilities available in each level

<table>
<thead>
<tr>
<th>Level</th>
<th>Facilities available</th>
<th>No. of hospitals in each level (N = 113)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Provides post-natal care only. No obstetric or midwifery staff available. Level 1 neonatal service. However, unplanned births do occur on occasion.</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>Small isolated hospitals which cater for low-risk pregnancies only. Medical officer and midwives available. Level 2 neonatal service.</td>
<td>35</td>
</tr>
<tr>
<td>3</td>
<td>Country and smaller metropolitan hospitals which cater for pregnancies of low to moderate risk (&gt;36 week gestation). Accredited medical practitioner available and access to specialist obstetrician.</td>
<td>20</td>
</tr>
<tr>
<td>4</td>
<td>Country base or metropolitan hospitals which cater for pregnancies of moderate risk (&gt;34 week gestation), have an accredited medical practitioner on-site and 24 hour obstetric, anaesthetic and paediatric on-call cover. Level 3 neonatal service.</td>
<td>21</td>
</tr>
<tr>
<td>5</td>
<td>Hospitals with the same cover as Level 4 hospitals but able to care for selected high-risk pregnancies. Have a Level 4 neonatal care unit. Specialist midwifery staff on-site (such as clinical midwifery consultant).</td>
<td>9</td>
</tr>
<tr>
<td>6</td>
<td>Specialist obstetric hospitals provide care for low, moderate, and high-risk pregnancies. Level 5 neonatal service. 24 hour on-site obstetric and neonatal registrars. Access to feto-maternal specialist. Experienced midwives and full-time clinical midwifery consultant and clinical midwifery educator.</td>
<td>7</td>
</tr>
<tr>
<td>Private Hospitals</td>
<td>No criteria provided.</td>
<td>11</td>
</tr>
</tbody>
</table>

4.2.2 Instruments

The five-item questionnaire was developed specifically to fulfil the requirements of the current study (Appendix B) with items being generated from the literature (Baker, 1996; Michael et al., 1991). The questionnaire provided data regarding the hospital’s annual birth rate and the presence of a written policy for oral intake in labour. In the absence of a written policy, a description of the usual practice within the midwifery unit regarding oral intake for labouring women with low and high-risk pregnancies was requested. The definition of what was considered a low or
high-risk pregnancy was left to the discretion of the person completing the survey. The survey only requested information on oral intake during labour and did not specify the stage or phase of labour.

The management for labouring women’s oral intake was considered as a ‘written policy’ when the management for this aspect of care was documented in the hospital’s policy or procedure manual. The management was considered as the ‘usual practice’ when it was not documented in either of these manuals but was the common practice followed by most midwives.

The questionnaire contained a mixture of closed-ended, dichotomous (yes-no) questions and open-ended questions. The combination of both types of questions enabled a variation in responses. Open-ended questions provided a richer and fuller perspective on the topic than closed-ended questions alone by allowing the respondents to elaborate, in their own words, on their fixed-response (Polit & Hungler, 1999). Closed-ended questions provided more precise, quantifiable data (Polit & Hungler, 1999). Two independent researchers critiqued and further refined the questionnaire before dissemination to ensure instrument validity.

4.2.3 Data collection

All public and private maternity units located in hospitals within the Sydney metropolitan area were surveyed by phone while all other hospitals surveyed outside this area were sent the questionnaire by mail. No contact was made to these hospitals before the dissemination of the survey. Postal surveys were addressed to the nursing unit manager of the labour ward at each hospital in NSW. Where the
survey was conducted by phone interview the researcher spoke with the nursing unit manager of the labour ward or the senior midwife in charge at the time of the interview. On average, the survey took five minutes to complete.

4.2.4 Participants

Of the 156 hospitals contacted, 27 no longer provided maternity services, therefore 129 hospitals were surveyed. A total of 113 hospitals (public hospitals = 102, private hospitals = 11) responded giving a return rate of 88%. Information for low-risk pregnancies was obtained from all 113 hospitals. Only 84% (n = 94) of the hospitals were able to provide information for high-risk pregnancies because 16% (n = 19) stated they transferred all women with high-risk pregnancies to their nearest referral hospital. The annual birth rate for 1999 for the surveyed hospitals was between 2 and 4,305 (NSW Health Department, 2001).

4.2.5 Ethical considerations

Approval was obtained from the Human Ethics Committee of the University of Western Sydney. Consent for participation in this study was assumed by the completion and return of the questionnaire to the investigator when the survey was conducted by post. When the questionnaire was completed by phone interview, consent was assumed when the respondent agreed to participate in the interview.

4.2.6 Data analysis

Frequencies and percentages were calculated for the closed-ended, dichotomous responses. Open-ended responses were analysed using content analysis (Beanland,
Schneider, LoBiondo-Wood, & Haber, 1999). The responses to the open-ended questions were read several times in order for the investigator to become familiar with the content. Codes were developed and summarised into categories according to the type of food and/or fluids women were permitted during labour. Frequencies and percentages for each category were calculated (Polit & Hungler, 1999; Weber, 1990). The text was coded by a second person to provide inter-rater reliability (Weber, 1990) yielding a 95% agreement. Discussion on coding differences resulted in a 100% agreement.

### 4.3 RESULTS

#### 4.3.1 The existence of a written policy

Of the 113 responding hospitals 20 (18%) had a written policy for the management of oral intake during labour. Ninety-three hospitals (82%) did not have a formal policy; rather, practice followed a convention established among staff or staff-determined management on a case by case basis. Table 9 shows the raw scores for hospitals with a ‘written policy’ or an unwritten ‘usual practice’ for the oral intake of labouring women according to their NSW Health Department allocated service level. The public hospitals are grouped according to their level of obstetric care, and private hospitals are shown separately.
4.3.2 Content of the hospital policies

The content of the written policies or ‘usual practices’ for the management of the labouring woman’s oral intake varied. Each hospital gave two responses regarding the content of their protocol: one pertained to labouring women with low-risk pregnancies, the other was for high-risk pregnancies. The majority of hospitals (62%, n = 70) allowed labouring women with low-risk pregnancies to eat food throughout their labour. However, when the pregnancy was considered high-risk, only 6% (n = 7) of hospitals allowed food during the labour process. The oral intake allowances for labouring women with low and high-risk pregnancies are reported separately.

4.3.2.1 Hospital position for labouring women with low-risk pregnancies

The type of oral intake permitted during labour varied among hospitals for women with low-risk pregnancies. Table 10 provides data on two variables: type of oral intake permitted for these women, and the percentage of hospitals with a written policy and those with an unwritten ‘usual practice’ for each oral intake type. Four
hospitals (4%) permitted women ice only, while 39 (34%) restricted women to a form of fluid (water; clear fluid; any type of fluid) and 70 hospitals (62%) allowed women to eat and drink as they desired.

<table>
<thead>
<tr>
<th>Protocol</th>
<th>Hospitals with a written policy (n = 20)</th>
<th>Hospitals with a 'usual practice' (n = 93)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eat food as desired</td>
<td>8</td>
<td>52</td>
</tr>
<tr>
<td>Given food only if requested</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Fluids only</td>
<td>3</td>
<td>13</td>
</tr>
<tr>
<td>Clear fluids</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Ice and water</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>Ice only</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Doctor's discretion</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Nil by mouth</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Eighty per cent of hospitals with Level 3 maternity facilities allowed labouring women with low-risk pregnancies to eat food. Almost 60% of hospitals designated as Level 1, 2, 4, and 5 (Table 8) permitted food for these women during labour. All but one Level 6 hospital restricted oral intake to water and ice. The number and percentage of hospitals in each of the NSW Health Department’s designated maternity service Levels and their position regarding the consumption of food by labouring women can be found in Table 11.
4.3.2.2 Hospital protocol for labouring women with high-risk pregnancies

Nineteen smaller hospitals (Levels 1 and 2) stated they did not cater for high-risk pregnancies, rather these women were transferred to the closest referral hospital. Of the remaining 94 hospitals, 18 (19%) stated they had a written policy while 76 (81%) did not, relying instead on midwives knowledge of the ‘usual practice’. The content of these policies for the management of oral intake for labouring women with high-risk pregnancies varied among the hospitals. Only 6 hospitals (6%) allowed labouring women food to eat when the pregnancy was considered high-risk. Table 12 shows the number of hospitals by designated maternity Level and the type of oral intake protocol they have adopted for labouring women with high-risk pregnancies.
Table 12 Oral intake for labouring women with HIGH RISK pregnancies by hospital level (N = 93)

<table>
<thead>
<tr>
<th>Practice</th>
<th>Number of hospitals per level</th>
<th>Total hospitals per oral intake category (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Food &amp; fluids</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Any fluid type</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Clear fluid</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>Water</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Ice</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Nil by mouth</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Medical officer’s decision</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Assess through out labour</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

4.4 DISCUSSION

This survey was the first of its kind in Australia to investigate the standard policy guiding practice for the management of oral intake for labouring women. Most surveyed hospitals did not have a written policy for this aspect of labour management, and among those who did, there was variation. The ‘usual practice’ in hospitals without a written policy also varied.

The reason for the absence of a written policy to guide the management of oral intake for labouring women and the inconsistency in practice among NSW hospitals is not known. It may be that hospitals are unfamiliar with the evidence, unable to locate evidence relating to specific practice (i.e., nil by mouth), or confused by the conflicting research evidence relating to specific forms of oral intake (i.e., food).

The effect of the various hospital policies and practices on midwives’ practice along with the type of evidence used for oral intake within hospitals are discussed further.
4.4.1 The effect of policy variation on midwifery practice

The absence of written policies for the oral intake of labouring women in the majority of facilities, and the variation in practice where policies do exist, raises issues of patient safety. For example, the relocation of midwives from a hospital which allows women to eat and drink as they desire to one that restricts women to fluid or ice throughout labour may pose problems. These midwives may continue with past practices which may compromise both midwives and women. The requirement to change work practices is known to be a source of stress (Barber, 1998); however, if these midwives do not comply with the practices of their current hospital they may be subjected to pressure to conform, compounding the stress (Farrell, 2001; Shallows, 2001; Stewart, 2001). Midwives in this situation may in turn develop a lack of confidence in their own knowledge and abilities and experience fear and anxiety in their new workplace (Shallows, 2001). There is, therefore, a need for a nationally-developed, written, evidence-based policy or guideline to regulate practice for this aspect of labour management.

4.4.2 The effect of research on practice

The impetus of oral intake restrictions began with Mendelson in 1946 as one of a number of strategies recommended to reduce the incidence of aspiration of gastric contents during general anaesthesia. Since Mendelson published his results a variety of oral intake regimes for labour have been recommended within the literature. The nil by mouth policy was widely adopted in the late 1940s following Mendelson’s (1946) publication and reinforced in the 1970s with the introduction of ‘active management for labour’. Mendelson’s (1946) ‘nil by mouth’
recommendation was introduced for labouring women during a time when
inhalational anaesthesia was extensively used throughout the labour and birth
process and aspiration prevention strategies were unknown (Mendelson, 1946).
During the 1970s, with the introduction of the ‘active management of labour’, it was
considered that labour should not exceed 12 hours and therefore fasting for this
length of time was inconsequential (O’Sullivan, 1994). However, not all labours
today are ‘actively managed’ and, even when they are, they may still exceed 12
hours.

Policies which restrict women to ice chips, water, or both reflect the
recommendations from various anaesthetic and obstetric textbooks (e.g., Bassell &
Marx, 1987; Hawkins et al., 2001). However, the source of the reference was not
cited by the authors. The move toward allowing the consumption of food and
broadening the type of fluid allowed during labour appears to have accompanied the
myriad of midwifery articles published since the late 1980s which reported the
benefits to labour progress when oral intake is not restricted (e.g., Berry, 1997;
Chern-Hughes, 1999; Rooks et al., 1989). However, this literature is based on
untested assumptions of biological knowledge (Pengelley & Gyte, 1998) and
anecdotal evidence (e.g., Elsberry et al., 1990). The ability to compare research
which examines the effect of food consumption on labour and birth outcomes has
been limited by methodological differences and conflicting results (Rodwell, 1992;
Scrutton et al., 1999; Tranmer, 1999; Yiannouzis & Parnell, 1994).

Policies that allowed clear fluid oral intake are based on studies of general surgical
patients (e.g., Scarr, Maltby, Jani, & Sutherland, 1989; Splinter & Schaefer, 1991).
The only research to explore the effect of clear fluid consumed by labouring women compared the effect of water consumption with an isotonic fluid (Kubli et al., 2002). These studies, however, do not provide any information on the safety of these fluids in preventing aspiration during general anaesthesia, which was the reason dietary restrictions were first enforced.

The majority of hospitals in NSW designated as Level 3, along with more than half of all other hospitals except Level 6, allowed labouring women free access to food and fluids. Level 6 hospitals, which have equipment and staffing levels required to safely offer care to high-risk women, generally restrict all labouring women to water and ice throughout labour. The 24-hour anaesthetic coverage at the Level 6 hospitals provides anaesthetists with greater exposure to the management of labour and an input into policy development for labouring women’s oral intake. Level 3 hospitals, however, do not have medical personnel residing within the hospital after-hours. The lower the hospital Level the less availability of specialist anaesthetic staff. The higher the hospital Level the greater the amount of medical input, including anaesthetists, and the chance of childbirth becoming medicalised (Cahill, 2001). It may be that the presence or absence of anaesthetic staff in the management of a maternity unit influences the type of policy a hospital has for this aspect of labour management.

A policy for the labouring woman’s oral intake should be evidence-based. It is important that the policy is kept up to date and that clinical midwives are involved in the formulation. The needs and wishes of the informed labouring woman should
also be considered, and care individualised according to the most current research evidence (Department of Health, 1993).

Although there is an abundance of opinion literature and a small number of studies regarding labouring women’s oral intake, lack of rigour makes it difficult for clinicians to use them as a basis for practice. Because so many hospitals in this survey allowed women food throughout their labour, further research is needed to investigate the effect this may have on labour and birth outcomes. Overall, the findings of this study present a case for further research to clarify and substantiate best practice.

4.5 CONCLUSION

The current study found that there are differences in policies and practices among hospitals in NSW for the labouring woman’s oral intake, a situation which also exists in the United Kingdom and the United States of America. The general trend among NSW hospitals was to allow women with low-risk pregnancies to consume food and fluids throughout their labour. When the pregnancy was considered high-risk the majority of these hospitals kept these women ‘nil by mouth’ or at most allowed ‘clear fluids.’ Hospital policies and practices for this aspect of labour management are not evidence-based, as there is insufficient research to inform policy development. As a result, practice is based on local opinion rather than best practice principles. The differences in practice for this aspect of care among NSW hospitals may be problematic for midwives who transfer employment to a hospital with an opposing practice.
4.5.1 Study limitations and further research

One limitation identified in this survey was that only one person, the nursing unit manager or most senior midwife, from each hospital was required to respond to this survey and a copy of the written policies were not obtained. It is not known, therefore, whether the information provided was correct.

4.5.2 Recommendation for clinical practice and research

Assuming each Australian state is experiencing similar inconsistencies in the management of labouring women’s oral intake as those demonstrated in this study, it is recommended that a nationally-developed, written, evidence-based guideline be established for all Australian midwives. This policy or guideline needs to be regularly updated to reflect changes to oral intake during labour which are based on current and reliable research.

An investigation into the effect variation in policy or practice for the oral intake of labouring women may have on the individual midwife is required. To this end, Chapter 5 reports details of a study which explored the beliefs and practices of midwives employed within four Sydney-based hospitals regarding this aspect of labour management.

Further research is essential to investigate the safety and efficacy of feeding labouring women with low-risk pregnancies so that policies and practices may be evidence-based. A prospective, comparative trial was conducted at four hospitals in Sydney, Australia to examine this issue (see Chapter 7).
Study 2 – Midwives’ Beliefs and Practices Regarding Oral Intake

The first study of hospital policies (Chapter 4) demonstrated that there is a diversity of protocols and practices among the hospitals in New South Wales for the management of oral intake for labouring women. The difference in practice is believed to have resulted from a lack of reliable research to direct this form of labour management. In light of the inconsistency in practice among these hospitals, which has also been found among hospitals in the United Kingdom and United States (Baker 1996; Michael et al., 1991), it was of interest to determine whether midwives within NSW hospitals agreed on the management of oral intake for these women.

One previous study exploring midwives’ knowledge of their hospital’s policy for the management of oral intake for labouring women was located; however, the small sample size (N = 11) limits the reliability of this study (Al Najjar, 1998). Midwives
in Al Najjar’s (1998) survey were often found to be unsure whether a policy existed in their unit and what the ‘usual practice’ was. Research investigating midwives’ beliefs regarding the oral intake of labouring women appears to be lacking.

The Australian health system supports four approaches to midwifery practice: (a) standard hospital model, (b) team midwifery program, (c) birth centre and (d) homebirth. In practice, some midwifery units in Sydney accommodate a combination of standard, team midwifery and birth centre care for women with low-risk pregnancies. The majority of hospitals, however, have the standard model only. Homebirths remain independent of the hospital system.

Each midwifery model allows a different level of autonomy for midwives with the majority of midwives practising under the standard hospital model where they have little autonomy. The following description of the four midwifery models was adapted from Halliday, Ellis and Stone (1999).

*The standard hospital model* is operated through a hospital with an obstetrician supervising care. All women are seen by the rostered doctor throughout their pregnancy care or, if attending the midwives’ clinic, they are seen by a midwife for the majority of their pregnancy care while a doctor sees them for a minimum of two visits. Midwives provide care during labour and the early postnatal period. This approach is the most common in hospitals with care being prescriptive, according to formal hospital policies, and lacking continuity of carer. Therefore, midwives’ ability to practice autonomously is limited in this type of midwifery model.
The team midwifery programs are operated through a hospital. A team of midwives, usually between four to eight per team, provide total care for women throughout their pregnancy, labour and postnatal period. The team may care for women with low-risk pregnancies or may have a shared-care arrangement with an obstetrician for women with high-risk pregnancies. An obstetrician is available for consultation and has input into the care provided through this model. This approach provides continuity of care for women, although not continuity of carer, and while there are protocols in place to guide midwives’ practice, team midwifery does provide a greater degree of autonomy within the protocols than the standard hospital model.

Birth centres are set within a hospital in Australia and have a similar arrangement to the team midwifery programs with obstetricians having input into the policies and procedures of the centre and being available for medical management where required. However, these midwives only provide care for women with low-risk pregnancies during the antepartum and intrapartum period. Some may also provide postpartum care for the first 24 hours after birth. The environment created in these centres, and their separateness from the routine labour/delivery units, allows these midwives to acquire a level of autonomy.

Midwives who participate in homebirths do so independently and outside the confines of the hospital system. These midwives provide total care for women with low-risk pregnancies throughout their pregnancy, labour and an extended postnatal period. This group of midwives attains the highest level of autonomy of all four midwifery models.
To examine the beliefs and knowledge of midwives regarding their practice for oral intake during labour, a survey was undertaken within four NSW hospitals based in Sydney. This chapter reports the method, results and a discussion of that survey.

5.1 AIM

The aim of this second study was to explore the practices and views of midwives, within four Sydney hospitals, regarding oral intake for low and high-risk labouring women, and to determine the extent to which midwives followed their hospitals’ protocol regarding this aspect of labour management.

Objectives for this study were:

- to ascertain the practice of individual midwives regarding oral intake for low-risk labouring women
- to ascertain the practice of individual midwives regarding oral intake for high-risk labouring women
- to determine midwives’ rationale for their practice decision
- to examine midwives knowledge of their hospital’s ‘usual practice’ regarding oral intake for labouring women
- to determine the compliance of midwives to hospital protocol for this aspect of labour management
• to determine whether the experience level of the respondents as a practising midwife influences their management of oral intake during labour

• to determine whether management of oral intake during labour is influenced by experience in different models of midwifery care.

5.2 METHOD

5.2.1 Study design and setting
An exploratory survey design was used to collect data from midwives employed in four public Sydney hospitals in NSW. These four hospitals were located in two Area Health Services and had been recruited to participate in the comparative trial (Chapter 7). The majority (80%) of NSW hospitals did not have a written policy for the management of the labouring woman’s oral intake (Chapter 4). The absence of this formal policy within the participating hospitals enabled an exploration of the evidence-base of midwifery practice and consistency of practice between units and midwives.

The four participating hospitals were purposively sampled because (a) the four hospitals had contrasting practices for this aspect of labour, (b) each had an annual birth rate of between 1900 and 2800, (c) they were located in Sydney, making recruitment and data collection more accessible, and (d) each hospital was a local, suburban hospital which serviced a multicultural population of Asian, Middle Eastern, Polynesian and Caucasian women (Table 13, p.120).
The nursing unit manager within the labour and birth unit of each of the four selected hospitals verified that their unit did not have a written policy for the oral intake of labouring women and outlined the ‘usual practice’ employed by the midwives within their unit. Two of these hospitals restricted oral intake to clear fluids once labour was established for women with low-risk pregnancies and ‘nil by mouth’ or ‘sips of water’ for women with high-risk pregnancies. The other two hospitals allowed food and fluids for labouring women with low-risk pregnancies and had a tendency to only restrict oral intake when the pregnancy or labour was identified as high-risk. The hospitals permitting labouring women to eat and drink are described as ‘Unrestricted Practice Hospitals’ (URPH) and those limiting oral intake to clear fluids and ‘nil by mouth’ are described as ‘Restricted Practice Hospitals’ (RPH).

5.2.2 Ethics approval

Ethics approval was obtained from the two participating Area Health Service Human Ethics Committees and the Human Ethics Committee within the University of Western Sydney. There was no coercion to complete the questionnaire and consent from participants was assumed when the questionnaire was completed and returned.

5.2.3 Instrument

The questionnaire contained closed-ended, forced response (yes-no) and open-ended questions (Appendix C). The combination of both types of questions was used to offset the strengths and weaknesses of each type of question. Closed-ended
questions allowed statistical analysis while open-ended questions enabled the gathering of richer information, provided in the respondent’s own words, to the corresponding closed-ended question (Gribch, 1999). To ensure instrument validity the questionnaire was reviewed by two independent researchers before distribution.

Items within this survey were comparable with those used in the hospital survey for the first study in this thesis (see Chapter 4) but were revised to obtain information regarding midwives’ individual beliefs and practices. Items within the questionnaire were designed to investigate midwives’ knowledge and adherence to hospital protocol for the oral intake requirements of labouring women. As written policies did not exist in these hospitals, compliance to the ‘usual practice’ of the unit was explored. The questionnaire also sought information from these midwives regarding (a) their midwifery experience, (b) their usual practice for labouring women’s oral intake, in both low and high-risk pregnancies, (c) and the rationale for their practice decision.

5.2.4 Participants

Midwives employed by the participating hospitals were surveyed between March and June 2000. There were 367 midwives employed within the midwifery units of the four hospitals. Responses were sought from midwives who specifically worked with labouring women (N = 194) as some midwives have not worked in a labour ward for many years and may not be aware of current practices.
5.2.5 Data collection
Following approval by the relevant nursing unit managers, questionnaires were left at the midwives’ desk of each maternity unit depending on the type of unit (e.g., antenatal clinic, labour ward, postnatal unit) and number of midwives rostered to the unit over a four-week period. An information session was conducted for the midwives within each of the four hospitals regarding the questionnaire and its purpose. The midwives were reminded weekly of the questionnaire over the recruitment period. A box for return of the questionnaires was provided for each data collection site. Midwives put the completed questionnaires in this box which was emptied once each week by the researcher.

5.2.6 Data analysis
Data from the completed questionnaires were collated. Dichotomous data were tabulated and frequencies and percentages obtained. Subgroup analysis was undertaken to determine whether practice differed between sites. Means, standard deviations and a student’s t-test were used to compare differences between midwives’ years of professional experience. Chi-square tests identified differences between midwives’ experience in various models of midwifery care and their knowledge of the ‘usual practice’ employed for the labouring woman’s oral intake in their unit.

Open-ended responses were analysed using content analysis (Beanland et al., 1999; Weber, 1990). The views and beliefs of the midwives regarding oral intake for labouring women were coded into themes and then categorised according to the views expressed by the midwives (Cavanagh, 1997; Weber, 1990). The frequencies
and percentages for each category were calculated (Gribch, 1999; Polit & Hungler, 1999). The codes and categories were confirmed by a second researcher and there was a 90% agreement between coders (Weber, 1990). Discussion of coding difference resulted in a 100% agreement.

5.3 RESULTS

The completed surveys were returned (RPH n = 38 and URPH n = 51) yielding a response rate of 46%. Reported in this section is (1) demographic data of midwives’ professional experience, (2) their knowledge of the hospital’s position regarding a written policy or ‘usual practice’ for the management of oral intake for labouring women and its content, (3) the variety of practices adopted by the midwives when managing oral intake for women with either low or high-risk pregnancies, (4) the relationship between hospital protocol, midwives experience and practice, and (5) the rationale for individual practice decisions. An overview of the four participating hospitals, their practice for oral intake during labour, the type of midwifery models available and relevant statistics for each hospital are presented in Table 13.
Table 13 Demographics of the four hospitals

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Hospital B</th>
<th>Hospital C</th>
<th>Hospital D</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Restricted practice hospitals</td>
<td>Unrestricted practice hospitals</td>
<td></td>
</tr>
<tr>
<td>Current annual birth rate</td>
<td>2800</td>
<td>2100</td>
<td>2400</td>
</tr>
<tr>
<td>Birthing services available</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard hospital model</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Birth Centre</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Team Midwifery program</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>*Clientele race/ethnic group (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>87.4</td>
<td>66.2</td>
<td>82.2</td>
</tr>
<tr>
<td>Asian</td>
<td>5.8</td>
<td>19.5</td>
<td>12.2</td>
</tr>
<tr>
<td>Polynesian</td>
<td>3.5</td>
<td>9.1</td>
<td>2.2</td>
</tr>
<tr>
<td>Middle Eastern</td>
<td>3.5</td>
<td>5.2</td>
<td>3.3</td>
</tr>
<tr>
<td>*Clientele age (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 20 years</td>
<td>23</td>
<td>20.8</td>
<td>3.3</td>
</tr>
<tr>
<td>20-29 yrs</td>
<td>65.5</td>
<td>63.7</td>
<td>68.9</td>
</tr>
<tr>
<td>30-35 yrs</td>
<td>9.2</td>
<td>11.7</td>
<td>25.6</td>
</tr>
<tr>
<td>&gt; 35 years</td>
<td>2.3</td>
<td>3.9</td>
<td>2.2</td>
</tr>
<tr>
<td>*Birth outcomes 1999 (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spontaneous</td>
<td>77.5</td>
<td>79.0</td>
<td>63.6</td>
</tr>
<tr>
<td>Forceps/ventouse</td>
<td>6.9</td>
<td>7.4</td>
<td>12.5</td>
</tr>
<tr>
<td>Caesarean section</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elective</td>
<td>8.2</td>
<td>6.9</td>
<td>10.7</td>
</tr>
<tr>
<td>Emergency</td>
<td>6.4</td>
<td>5.1</td>
<td>12.6</td>
</tr>
<tr>
<td>*Epidural rate (%)</td>
<td>10.5</td>
<td>3.1</td>
<td>32.2</td>
</tr>
<tr>
<td>*General anaesthetic rate (%)</td>
<td>6.9</td>
<td>11.0</td>
<td>4.9</td>
</tr>
</tbody>
</table>

(*Statistics provided by the NSW Department of Health, 2001)

5.3.1 Midwifery experience

Participants’ experience was based on two criteria: the years of midwifery experience (not full-time equivalent) and their experience working according to various models of midwifery care. The second criterion was important in that it exposes the midwife to different experiences and practice environments including autonomy levels. It is suggested that midwives’ perceived levels of autonomy may
influence their decision-making abilities (Hutchinson, 1990). For this section information was provided by 97% (n = 86) of the participants.

5.3.1.1 Years of midwifery experience

Midwives from the RPHs and URPHs had a similar midwifery experience when measured in years. Midwifery experience ranged from being less than one year (student midwife) to 37 years (Table 14).

<table>
<thead>
<tr>
<th>Years of midwifery experience</th>
<th>Restricted practice hospitals (n = 38)</th>
<th>Unrestricted practice hospitals (n = 51)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>0 – 2</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>3 – 9</td>
<td>10</td>
<td>14</td>
</tr>
<tr>
<td>10 +</td>
<td>15</td>
<td>29</td>
</tr>
<tr>
<td>Unknown</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Mean (years) (± SD)</td>
<td>8.6 ± (8.01)</td>
<td>10.4 ± (6.42)</td>
</tr>
</tbody>
</table>

5.3.1.2 Experience in various models of midwifery

A larger percentage of midwives working at URPHs had experience in more than one midwifery model of care than midwives employed in the RPHs. Seventy-two per cent of midwives (RPH = 35; URPH = 29) had no experience in any other model of midwifery care other than the standard hospital model. One of the URPHs provided three models of midwifery care for women (standard, birth centre and team midwifery), therefore 77% (n = 20) of the responding midwives from this hospital had experience in more than one midwifery model. Overall, significantly more
midwives from the URPHs had experience in team midwifery and birth centre models of care (Table 15).

Table 15  Midwives’ exposure to models of midwifery care

<table>
<thead>
<tr>
<th>Models of midwifery care</th>
<th>Restricted Practice hospitals (n = 38) (%)</th>
<th>Unrestricted practice hospitals (n = 51) (%)</th>
<th>$\chi^2$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard hospital model</td>
<td>100</td>
<td>100</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>Birth Centre</td>
<td>5</td>
<td>26</td>
<td>6.36</td>
<td>.0117*</td>
</tr>
<tr>
<td>Team Midwifery</td>
<td>0</td>
<td>28</td>
<td>12.38</td>
<td>.0004*</td>
</tr>
<tr>
<td>Homebirth</td>
<td>5</td>
<td>8</td>
<td>0.23</td>
<td>.6311</td>
</tr>
</tbody>
</table>

* $df = 1$; ** Significant at $p = .05$

Some midwives had experience in more than one midwifery model.

Although the years of professional experience was similar between groups, midwives from the URPHs had a more varied experience in midwifery models than the midwives employed in the RPHs.

5.3.2  Midwives’ knowledge of the hospital protocol regarding oral intake

In the absence of a written policy in the study hospitals, and despite the focus on evidence-based practice and patient safety in hospitals, more than half the surveyed midwives working in the RPHs (n = 20) and eight midwives employed in the URPHs were unfamiliar, or did not comply, with their hospital’s ‘usual practice’ for the labouring woman’s oral intake. In this survey, midwives working in the hospitals with a ‘usual practice’ which restricted oral intake (RPH) generally had less knowledge about their facility’s position than midwives working in hospitals whose ‘usual practice’ allowed oral intake (URPH). Of particular concern from the
perspective of patient safety is the fact that many of the midwives working in these hospitals were unaware that their unit did not have a written policy for the labouring woman’s oral intake.

Of the 89 respondents, 16 (18%) incorrectly stated that a written policy existed (RHP = 15; URPH = 1) in their hospital for the oral intake of labouring women. Another 58 (65%) midwives correctly stated that no written policy existed (RHP = 14; URPH = 44), while 15 (24%) were either unsure or did not respond (RHP = 9; URPH = 6).

Midwives’ practice for oral intake in their unit varied with midwives from the RPHs being significantly more likely to ‘fast’ or restrict labouring women to ice or sips of water than midwives employed in the URPHs. The RPH midwives were also more likely to rely on doctor’s orders for this aspect of care and to base their decision for the labouring woman’s oral intake on their risk factors. As was expected, midwives from the URPHs were significantly more likely to allow food and fluids for women with low-risk pregnancies (Table 16). A number of midwives provided more than one response, contributing information about women with low and high-risk pregnancies.
Table 16 The ‘usual practice’ according to respondents

<table>
<thead>
<tr>
<th></th>
<th>Restricted practice hospitals (n = 38) (%)</th>
<th>Unrestricted practice hospitals (n = 51) (%)</th>
<th>$\chi^2$ *</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nil by mouth for labouring women with high-risk pregnancies</td>
<td>10</td>
<td>6</td>
<td>0.65</td>
<td>.4208</td>
</tr>
<tr>
<td>Nil by mouth for all labouring women</td>
<td>10</td>
<td>0</td>
<td>5.62</td>
<td>.0177*</td>
</tr>
<tr>
<td>Ice only for women with high-risk pregnancies</td>
<td>0</td>
<td>3</td>
<td>0.75</td>
<td>.3853</td>
</tr>
<tr>
<td>Ice water or sips of water only</td>
<td>28</td>
<td>6</td>
<td>8.74</td>
<td>.0031*</td>
</tr>
<tr>
<td>Fluids only</td>
<td>5</td>
<td>0</td>
<td>2.75</td>
<td>.3853</td>
</tr>
<tr>
<td>Depends on risk factors</td>
<td>8</td>
<td>0</td>
<td>4.17</td>
<td>.0412*</td>
</tr>
<tr>
<td>If caesarean section suspected try not to feed too much</td>
<td>0</td>
<td>3</td>
<td>0.75</td>
<td>.3853</td>
</tr>
<tr>
<td>Staff discretion</td>
<td>5</td>
<td>12</td>
<td>1.13</td>
<td>.2888</td>
</tr>
<tr>
<td>Depends on the midwife in charge and the doctor on duty</td>
<td>0</td>
<td>3</td>
<td>0.75</td>
<td>.3853</td>
</tr>
<tr>
<td>According to doctor’s verbal order</td>
<td>10</td>
<td>0</td>
<td>5.62</td>
<td>.0177*</td>
</tr>
<tr>
<td>Allowed to eat and drink unless given orders by doctor to fast</td>
<td>0</td>
<td>6</td>
<td>2.31</td>
<td>.1283</td>
</tr>
<tr>
<td>As desired in early labour, fluids in established labour</td>
<td>19</td>
<td>17</td>
<td>0.01</td>
<td>.9251</td>
</tr>
<tr>
<td>Food only if patient requests</td>
<td>5</td>
<td>0</td>
<td>2.75</td>
<td>.0975</td>
</tr>
<tr>
<td>Labouring women with low-risk pregnancies can eat and drink as desired and tolerated</td>
<td>0</td>
<td>44</td>
<td>23.11</td>
<td>&lt;.0001*</td>
</tr>
</tbody>
</table>

* $df = 1$, ** Significant at $p = .05$

5.3.3 Midwives’ management of oral intake during labour

Decisions regarding the type, quantity and frequency of oral intake for women is influenced by clinicians’ preference, hospital protocol, and risk for the pregnancy and labour. Midwives were surveyed to determine their usual practice for allowing food and fluids during labour. The findings are presented below for low-risk and high-risk pregnancies.
5.3.3.1 Midwifery practice for low-risk pregnancies

Each respondent provided information regarding their own practice for the intake of food and fluid for labouring women in their care. Practices varied from ‘nil by mouth’ to ‘whatever the woman desired’. The majority of midwives (n = 78, 88%) from both hospital groups allowed food intake during the early phase of the first stage of labour for women with low-risk pregnancies (RPH = 29 [76%), URPH = 49 [96%]). Once women reached the active phase of the first stage of labour, approximately one-third of the midwives (n = 14) from the RPHs allowed food intake compared with three-quarters of the midwives (n = 39) from the URPHs. By the transition phase of the first stage of labour this number decreased substantially with six midwives only (15%) from the RPHs continuing to allow food compared with 31 midwives (61%) employed in the URPHs (Table 17 and Table 18).

Although it was expected that the majority of midwives employed in the URPHs would allow food during labour, it was surprising to find that many midwives from the RPHs also allowed food, particularly during the established phase of labour. The amount of food allowed by these RPHs midwives, however, may be questionable with some being quite specific about the food they permitted: for example, ‘a bite of chocolate or hot chips if requested’ (R.13, RPH); ‘A small amount of bread if the woman insisted’ (R.22, RPH); ‘may suck barley sugar lollies’ (R.25, RPH).

In the RPHs, where the ‘usual practice’ is for clear fluids once a woman was established in labour, only 8 (21%) midwives practised accordingly. No midwife employed in the URPHs limited women to clear fluids. Approximately 30% of
midwives limited women to fluids (i.e., any type of liquid) once the active phase of labour commenced (RPH = 17; URPH = 8) with another 14% limiting women to fluids once they reached the transition phase of labour (RPH = 24; URPH = 15) (Table 17 and Table 18).

<table>
<thead>
<tr>
<th>Type of oral intake</th>
<th>Number of midwives allowing a particular type of oral intake during each of the three phases of labour</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Early phase</td>
</tr>
<tr>
<td>Food</td>
<td>(n)</td>
</tr>
<tr>
<td>(e.g., eat and drink as desired; light snacks; sandwiches)</td>
<td>29</td>
</tr>
<tr>
<td>Any type of fluid (no food)</td>
<td>1</td>
</tr>
<tr>
<td>(e.g., milk drinks, clear fluids, tea &amp; coffee with milk)</td>
<td></td>
</tr>
<tr>
<td>Clear fluid only</td>
<td>3</td>
</tr>
<tr>
<td>(e.g., water, cordial, black tea or coffee, ice)</td>
<td></td>
</tr>
<tr>
<td>Nil by mouth</td>
<td>0</td>
</tr>
<tr>
<td>Unanswered</td>
<td>5</td>
</tr>
</tbody>
</table>

Four midwives restricted labouring women with low-risk pregnancies to ‘nil by mouth’ at some time during the established phase of labour. While only one midwife from a RPH imposed this restriction on women during the active phase, four did so during the transition phase (RPH = 3; URPH = 1) (see Table 17 and Table 18).
Table 18 Practice of midwives within URPHs for oral intake of labouring women with LOW-RISK pregnancies during first stage of labour (N = 51)

<table>
<thead>
<tr>
<th>Type of oral intake</th>
<th>Number of midwives allowing a particular type of oral intake during each of the three phases of labour</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Early phase</td>
</tr>
<tr>
<td></td>
<td>(n)</td>
</tr>
<tr>
<td>Food (e.g., eat and drink as desired; light snacks; sandwiches)</td>
<td></td>
</tr>
<tr>
<td>49</td>
<td>39</td>
</tr>
<tr>
<td>Any type of fluids (no food) (e.g., milk drinks, clear fluids, tea &amp; coffee with milk)</td>
<td>0</td>
</tr>
<tr>
<td>Clear fluids only (e.g., water, cordial, black tea or coffee, ice)</td>
<td>0</td>
</tr>
<tr>
<td>Nil By Mouth</td>
<td>0</td>
</tr>
<tr>
<td>Unanswered</td>
<td>2</td>
</tr>
</tbody>
</table>

The lack of a written policy to guide the management of oral intake during labour has created inconsistent practice by these midwives. Although many midwives were unaware of the protocol in their hospital and did not know what constituted the ‘usual practice’ for oral intake during labour, the majority (52%) followed the ‘usual practice’ (Table 19). Another 19% deviated from the ‘usual practice’ slightly. For example, instead of providing labouring women with ‘clear fluids’, 10% of midwives in the RPHs allowed ‘water’ only while 6% permitted any type of ‘fluid’. Seven midwives from the RPHs and one from the URPHs acknowledged that they practised contrary to the protocol. One midwife commented that she had to change her practice from ‘ice and water’ for labouring women to allowing ‘food and fluids’ after moving from a hospital with a restricted policy for oral intake to a hospital that was unrestricted. Table 19 demonstrates the number of midwives who followed
their hospital’s protocol for oral intake in labour, knowingly or not, and the number who intentionally practised contrary to the ‘usual practice’.

<table>
<thead>
<tr>
<th>Midwives’ knowledge of ‘usual practice’ (Correctly or incorrectly stated on questionnaire)</th>
<th>Midwives’ compliance to hospital’s ‘usual practice’ (Did or did not follow usual practice)</th>
<th>Restricted practice hospital midwives (n = 38)</th>
<th>Unrestricted practice hospital midwives (n = 51)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incorrectly stated</td>
<td>Followed</td>
<td>0</td>
<td>20</td>
</tr>
<tr>
<td>Incorrectly stated</td>
<td>Did not follow</td>
<td>25</td>
<td>6</td>
</tr>
<tr>
<td>Correctly stated</td>
<td>Followed</td>
<td>3</td>
<td>23</td>
</tr>
<tr>
<td>Correctly stated</td>
<td>Did not follow</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>Unanswered</td>
<td>3</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

5.3.3.2 *Midwifery practice for high-risk pregnancies*

Respondents (n = 89) provided information regarding their personal beliefs and practice for oral intake by labouring women with high-risk pregnancies. The ‘usual practice’ within the RPHs required women with high-risk pregnancies to be kept ‘nil by mouth’ or allowed ‘sips of water’ only during labour while the URPHs were less specific requiring oral intake to be restricted as necessary (Table 20 and Table 21).

Practice varied from ‘nil by mouth’ to ‘whatever the woman desired’ in both the RPHs and URPHs. As would be expected, the RPHs were less likely to allow any food and more likely to keep women ‘nil by mouth’ when their pregnancy was considered high-risk. Thirty per cent of midwives restricted women to ‘nil by mouth’ during the early phase of the first stage of labour (RPH = 19: URPH = 8) and an additional 13% imposed this restriction by the transition phase of labour (RPH =
22: URPH = 16). It was unclear from some of the responses whether fluids such as water or ice were permitted, therefore these responses have been included in the ‘nil by mouth’ category. Five midwives from the URPHs felt they were unable to identify a single category as their decision was made on a case-by-case basis and depended on the progress of labour and the presence of risk factors.

Allowing food during the early phase of labour was common in both the RPH (n = 19, 50%) and URPH (n = 37, 73%); however, once women had reached the active phase of the first stage of labour only 23% of midwives allowed any food (RPH = 2; URPH = 18) and only one midwife from a RPH allowed food during the transition phase of labour. Oral intake was most commonly restricted to women with high-risk pregnancies during labour with approximately 44% of midwives preferring this alternative to other forms of oral intake during the established phase of labour (RPH = 17; URPH = 22) (Table 20 and Table 21).

Overall, the majority of midwives working in hospitals with a restricted protocol for oral intake preferred to limit labouring women with low-risk and high-risk pregnancies to fluids. As expected, midwives from the URPHs were more likely to allow food throughout labour for women with low-risk pregnancies; however, only one-third allowed food once labour was established when the pregnancy was high-risk.
Table 20  Practice of midwives in the RPHs for oral intake of labouring women with HIGH-RISK pregnancies during first stage of labour (N = 38)

<table>
<thead>
<tr>
<th>Type of oral intake</th>
<th>Number of midwives allowing a particular type of oral intake during each of the three phases of labour</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Early phase</td>
</tr>
<tr>
<td></td>
<td>(n)</td>
</tr>
<tr>
<td>Food</td>
<td>19</td>
</tr>
<tr>
<td>(e.g., eat and drink as desired; light snacks; sandwiches)</td>
<td></td>
</tr>
<tr>
<td>Any type of fluids (no food)</td>
<td>0</td>
</tr>
<tr>
<td>(e.g., milk drinks, clear fluids, tea &amp; coffee with milk)</td>
<td></td>
</tr>
<tr>
<td>Clear fluids only</td>
<td>0</td>
</tr>
<tr>
<td>(e.g., clear fluids; water; ice)</td>
<td></td>
</tr>
<tr>
<td>Nil by mouth</td>
<td>19</td>
</tr>
</tbody>
</table>

Table 21  Practice of midwives in the URPHs for oral intake of labouring women with HIGH-RISK pregnancies during first stage of labour (N = 51)

<table>
<thead>
<tr>
<th>Type of oral intake</th>
<th>Number of midwives allowing a particular type of oral intake during each of the three phases of labour</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Early phase</td>
</tr>
<tr>
<td></td>
<td>(n)</td>
</tr>
<tr>
<td>Food</td>
<td>37</td>
</tr>
<tr>
<td>(e.g., eat and drink as desired; light snacks; sandwiches)</td>
<td></td>
</tr>
<tr>
<td>Any type of fluids (no food)</td>
<td>0</td>
</tr>
<tr>
<td>(e.g., milk drinks, clear fluids, tea &amp; coffee with milk)</td>
<td></td>
</tr>
<tr>
<td>Clear fluids only</td>
<td>0</td>
</tr>
<tr>
<td>(e.g., clear fluids; water; ice)</td>
<td></td>
</tr>
<tr>
<td>Nil by mouth</td>
<td>8</td>
</tr>
<tr>
<td>'Depends on risk factors'</td>
<td>0</td>
</tr>
<tr>
<td>Unanswered</td>
<td>6</td>
</tr>
</tbody>
</table>
5.3.4  The relationship between midwives’ experience and practice

The World Health Organisation’s definition of a midwife describes a practitioner working with a high degree of autonomy for clinical decisions (WHO, 1966); however, midwives’ occupational socialization tends to constrain this (Bosanquet, 2002; Chamberlain, 1993). The professional experience of a midwife, including location of practice, could be expected to influence their desire and ability to exercise professional autonomy. However, this premise has not been discussed in the literature.

As there was no written policy to control practice within any of the four participating hospitals, this study sought to investigate whether experience influenced practice where the labouring woman’s oral intake was concerned. Half the midwives (n = 15) who had experienced more than one midwifery model and, to a lesser degree, more than five years’ midwifery experience (RPH = 3; URPH = 12) allowed women with low-risk pregnancies to eat food during labour. Midwives from the URPHs tended to have broader experience in midwifery settings and, not surprisingly, were less restrictive in their management of oral intake for labouring women than midwives from the RPHs – (see Table 15 and Table 16 [pp.122 and 124]).

Comments made by four midwives from RPHs indicated that inexperienced midwives did not have the confidence or were given no choice other than to follow hospital protocol and limit oral intake for labouring women. For example, a midwife with only one year of post-graduate experience stated, ‘[I fast labouring women] only once in established labour, [then] oral fluids only as it is hospital
Another comment made by a midwife from an URPH demonstrated a fear of medical reprisal because of the different beliefs anaesthetic and midwifery staff have regarding oral intake during labour. The midwife wrote, ‘[If I fed these women] I would be chastised for doing it by the anaesthetic staff’ (R.62, URPH).

Differences were observed between midwives’ experience (1) in years and (2) midwifery models, along with (3) their practice regarding oral intake during labour. Thirty-four of the 38 midwives from the RPHs and all 51 midwives from the URPHs provided information regarding their professional experience along with their practice for oral intake in labour. There was inconsistency among midwives regarding labouring women’s oral intake despite the hospital of employment (Table 22). As was anticipated, more midwives with experience in a variety of midwifery models (n = 28, 90%) allowed labouring women food than midwives with experience in the standard hospital model only (n = 21, 39%). Only three (8%) midwives from the RPHs had experience in more than one midwifery model and more than five years midwifery experience compared with 16 (31%) from the URPHs. In this study the ‘usual practice’ within each hospital influenced midwives’ practice more than professional experience (Table 22).
5.3.5 Midwives’ reasoning for feeding or fasting labouring women

Open-ended questions provided further information about the reason respondents varied their management of oral intake for labouring women. Sixty-six per cent (n = 59) of the midwives provided their rationale for either limiting or allowing oral intake during labour for women with low-risk pregnancies (RPH = 24; URPH = 31) while 76% (n = 68) (RPH = 30; URPH = 38) provided their rationale for women with high-risk pregnancies.

Midwives provided a variety of reasons for their practice decision regarding the labouring woman’s oral intake. Two-thirds of the responding RPH midwives (n = 19) believed that oral fluid intake, not food, is important for labouring women, while more than two-thirds of URPH midwives (n = 33) believed food and fluids are both important. Some RPH midwives (n = 6) referred to the hospital policy as the only reason for their practice decision while only three midwives, all of whom were working in a URPH, referred to research evidence.
Most midwives limited oral intake for women with high-risk pregnancies because they believed this group of women has an increased potential for caesarean surgery and its associated aspiration risk if general anaesthesia is required. Thirteen respondents believed food was just as important and safe for women with high-risk pregnancies as it was for women with low-risk pregnancies and provided similar reasons for feeding these women.

Five themes emerged from the open-ended responses provided by these midwives. These themes were labeled as (1) ‘Fast, just in case’, (2) ‘Eating causes vomiting during labour’, (3) ‘It is hospital policy’, (4) ‘Labouring women need food, fluids or both to labour effectively’, and (5) ‘Give food because no research indicating otherwise’. Not all midwives responded to the open-ended questions, while some of the responding midwives provided more than one answer.

(1) ‘Fast, just in case’

Four (7%) respondents stated they fasted labouring women with low-risk pregnancies at some phase of the first stage of labour (RPH = 3; URPH = 1). These midwives fasted women as a precaution for caesarean section, general anaesthesia and to minimise vomiting. A typical reason for fasting labouring women was, ‘...in case of an emergency caesarean section’.

When the pregnancy or labour was considered high-risk, 50% (n = 34) of respondents stated they fasted these women ‘just in case’ (RPH = 20; URPH = 14). These midwives believed there was an increased risk for caesarean section among
this group of women, and were concerned about the risk of gastric content aspiration should a general anaesthetic be required.

(2) ‘Eating causes vomiting during labour’

Three midwives, all from the RPHs, restricted oral intake as a method of preventing vomiting during labour. As one midwife explained, ‘women tend to vomit if they eat during labour’ (Respondent [R].12, RPH).

(3) ‘It is hospital policy’

Although none of the hospitals had a written policy for oral intake during labour, the requirement to comply with hospital policy for oral intake was the basis for the practice decision of six midwives, all working in RPHs. Three midwives stated incorrectly that the hospital policy was for ‘fluids only’ during labour. One midwife (midwifery experience of one year) commented that although the ‘hospital policy is ‘fluids only’... I allow leniency and often let them snack up until established [in labour] and contractions increase in severity’ (R.15, RPH). Three midwives from the RPHs gave no reason for limiting the oral intake of women with high-risk pregnancies other than it being a hospital policy. Responses such as, ‘because it is hospital policy’ (R.23, RPH) and ‘Policy states can have ... ’ (R.16, RPH) were typical examples.

(4) ‘Labouring women need fluids or both food and fluids’

There were two strongly held beliefs among this group of midwives. Twenty midwives felt fluids were very important for labouring women while 33 midwives argued that these women needed both food and fluids to labour effectively.
Particularly among the midwives from the RPHs, fluids was believed to be the only form of oral intake needed by labouring women (RPH = 15; URPH = 4). The main reason given for restricting women to fluids was the perception that they usually do not want to eat during labour, for example, ‘[labouring women] lean towards fluids anyway. They don’t want to eat’ (R.26, RPH); and ‘Most women in established labour do not eat during their labour by choice’ (R.25, RPH).

The belief that labouring women needed both food and fluids was more commonly found among midwives from the URPHs (RPH = 7; URPH = 26). These midwives believed that food and fluids were needed to meet the energy requirements of the labour process, which in turn enabled women to labour more effectively. The most commonly cited reason for feeding these women was their physiological need for nourishment and hydration: for example, ‘they need fluid for hydration and glucose for uterine activity and effective contractions’ (R.52, URPH).

Avoidance of ketosis, which has been suggested to be the result of fasting women, was another reason given by these midwives to support eating during labour. For example, ‘sometimes it is early labour and they are already showing ketones [on urinalysis testing] because they don’t realise they can eat’ (R.81, URPH). Another midwife commented, ‘Women get too tired and labour progress is slower when they are starved, then they are more likely to have the intervention cascade’ (R.61, URPH).

Another belief held by midwives was that there were psychological benefits from eating and drinking as desired throughout labour. Eating and drinking was believed to provide labouring women with a sense of control over their labour and,
subsequently, the labour progress. For example, one midwife stated, ‘They need to feel they have some control and may feel nauseated or dehydrated if not allowed to do what their body is telling them to do’ (R.66, URPH); and another reported, ‘They need to eat to feel normal... ’ (R.48, URPH).

Of the nineteen midwives who allowed women with high-risk pregnancies to eat during the established phase of the first stage of labour, thirteen (RPH = 2; URPH = 11) provided reasons for their practice. Most reasons were similar to the responses provided for feeding women with low-risk pregnancies. However, five midwives believed that these women, although considered high-risk, were unlikely to require a caesarean section. Other responses suggested that feeding these women was not a problem because strategies can be implemented to overcome the risk of aspiration if surgery is required; for example, ‘in emergency situations [sodium] citrate and cricoid pressure applied on induction of anaesthesia’ (R.79. URPH) and ‘the woman can be given epidural... ’ (R.68. URPH).

(5) ‘Give food because no research indicating otherwise’

The lack of research to support the restriction of oral intake for labouring women was expressed by three (6%) midwives, all from one URPH. This hospital had three models of midwifery care in which midwives were able to practise. The comments made by these midwives suggest they were familiar with the literature about this issue and used the available evidence as a basis for practice. An example given by one midwife was that… ‘there is no research claiming women should not eat in labour, high or low risk’ (R.42, URPH). Another midwife was under the impression that ‘there’s been plenty of evidence-based research to support eating and drinking
[during labour] and how it improves labour outcomes' (R.51, URPH). It is unclear what research the midwife was referring to as only one study has been published formally and the findings from that study alone are insufficient to base practice for this aspect of labour management.

5.4 DISCUSSION

The aim of this study was to explore individual midwives’ beliefs and practices regarding the labouring woman’s oral intake. None of the participating hospitals had a written policy for this aspect of labour management although each unit had a ‘usual practice.’ The study also investigated whether midwives complied with the usual practice of their unit. Two of the hospitals permitted women with low-risk pregnancies to eat and drink throughout labour and two permitted clear fluids only. The results of this study identified differences in beliefs and practices among responding midwives employed in the four Sydney hospitals, regardless of their hospital’s ‘usual practice’ for labouring women’s oral intake (restrictive or unrestrictive). The decision to limit or allow food and fluid during labour varied among midwives in all units and was related to women’s risk factors, their stage of labour and the hospital in which they laboured. Only a few midwives referred to research as a basis for their clinical decision.

Two principal factors appeared to direct midwives’ clinical decisions about whether or not food and fluids should be allowed during labour: (1) the ‘usual practice’ (restrictive or unrestrictive) within the hospital and (2) the midwives’ ability to make decisions based on factors other than hospital protocol. The factors that
influenced midwives’ practice decisions will be discussed in light of the research evidence. This will be followed by a discussion of the potential for evidence-based guidelines to assist with practice decisions for the management of oral intake during labour.

5.4.1 Hospital protocol, midwives’ practice and low-risk pregnancies

In this study midwives’ practice for oral intake by labouring women with low-risk pregnancies was primarily related to the ‘usual practice’ within the unit, as no hospital had a written policy. The practice in the RPHs was to limit oral intake to clear fluids once labour was established while the URPHs allowed food and fluids throughout labour.

The majority of midwives working in RPHs incorrectly believed that their hospital had a written policy which stipulated that labouring women with low-risk pregnancies were to have a ‘fluid’ diet. The midwives may have assumed that, because the restriction of oral intake has been a long-held, traditional practice (Brownridge, 1994; Bevis, 1984), there would be a formal policy somewhere in the organisation.

In a study of nurses, it was found that many had never read one or more of their hospital’s policies, relying instead on word-of-mouth information (Ball, 1993). For midwives in this current study to incorrectly believe a written policy existed for oral intake demonstrates that they do not consult policy manuals in their units. Communication of practice procedures via word-of-mouth information has a tendency to change over time or be misinterpreted (Humphris, 1997). When there is
no formal policy for staff to consult, practices change, new staff have no guidance, and dangerous practices could develop. Policies are necessary to ensure patient safety (Cheek & Gibson, 1996) and to protect midwives against litigation if the particular policy has been followed (Burgum, 1997).

Midwives from the URPHs were aware also that their hospital had no written policy for the management of oral intake for women with low-risk pregnancies, and supported the practice of women eating and drinking during labour. The reason the protocol was not in writing may be related to the paucity of reliable supporting research evidence and an awareness of anaesthetists’ opposition to the practice (American Society of Anesthesiologists Task Force on Obstetrical Anesthesia, 1999). Nevertheless, these midwives, as an accountable, professional group (Etuk, 2001), should have initiated and contributed to the development of a policy for this practice management based on the available evidence. The fact that health professionals willingly complied with a practice that they were aware had not been formally ratified by the hospital raises significant concerns for patient safety and has potential legal implications. It is possible for a midwife to be held legally responsible for an adverse outcome attributed to a practice unsupported by a formal policy (Mair, 2000).

Despite the absence of written policies to direct care, there was relative consistency between the practice of midwives in each facility. In effect, a practice convention had evolved. Although this situation might not be unique to these facilities, it is a concern that, despite the contemporary focus on evidence-based practice and procedures, such as accreditation of hospitals, professionals continue to follow
traditions and rituals without questioning the basis for care or referring to hospital policy manuals. The reason for the relatively consistent practice in the absence of a written policy may be related to the process of ‘professional socialisation’ (e.g., Bosanquet, 2002; Chamberlain, 1993; Gray & Smith, 1999; Mackay, 1989).

Before 2005, the NSW 1991 Nurses Act required a person to complete an approved education program in nursing before undertaking a midwifery program (Nurses Registration Board of NSW, 1997). Therefore it can be assumed that the majority of practising midwives have been socialised into the nursing profession before commencing midwifery (Davies & Atkinson, 1991). It has been proposed by Carpenter that the prior influence of nursing socialisation, with ‘its traditional Victorian virtues of obedience, efficiency and submission… and its emphasis on caring for the sick’, has had an effect on the attitudes, beliefs and views of midwives (1993, p.27). Researchers believe that standards of ‘obedience’ and ‘conformity’ set in place during the nursing socialisation process have filtered through, and are maintained in, the socialisation of nurses into the midwifery profession (Chamberlain, 1993, 1996; Currie, 1999). Consequently midwives have been expected to obey those in authority without challenge in order to be accepted by their peers (Bosanquet, 2002; Gray & Smith, 1999; Mackay, 1989). It is suggested that the socialisation process has led to a lack of autonomy, self-reflection and authority to question practice (Bosanquet, 2002; Chamberlain, 1993; Currie, 1999; Mackenzie & Stoljar, 2000).

This socialisation phenomenon was evident in some of the responses regarding oral intake for labouring women provided by midwives in this study. For a midwife to
question or choose not to follow the ‘usual practice’ not only alienates the midwife from those in authority but also from peers (Bosanquet, 2002; Chamberlain, 1993; Friedman, 2000; Kirkham, 1999). Those who oppose the ‘usual practice’ may be subject to verbal abuse, intimidation, humiliation and exclusion by their peers in an attempt to preserve the status quo (Farrell, 2001; Hastie, 1999; McKenna, Smith, Poole, & Coverdale, 2003; Stewart, 2001). The responses of midwives in this study demonstrated that phenomenon. They preferred to conform to the hospital’s ‘usual practice’ in the unit to avoid the often painful consequences of not doing so. They conformed regardless of their own beliefs (Currie, 1999).

Some midwives may have adopted the ‘usual practice’ without knowledge of the literature or awareness of the debate regarding the labouring woman’s oral intake. They may have done so because they believed it was correct (Downes & Rock, 2003; Giddens, 1989). Chamberlain (1993) found that some midwives never questioned hospital policies, preferring to adhere to the values of their organisation (hospital) at the expense of their professional values in order to maintain the status quo; a remnant and expectation of nursing socialisation. This situation should be of concern to nurse leaders as these findings undermine the principles of professional practice that include the ability to self-reflect, be accountable and to practise autonomously (Bosanquet, 2002; Etuk, 2001). Foregoing these ‘privileges of professionalism’ in exchange for a comfortable, unstressed work environment may seem a better option for many midwives (Currie, 1999; Hastie, 1999).
5.4.2 Hospital protocol, midwives’ practice and high-risk labours

This study has demonstrated variation among midwives for the management of oral intake for women with low-risk pregnancies. Where the oral intake of women with high-risk pregnancies was concerned, management was found to be more in keeping with the hospital protocol. In the RPHs the ‘usual practice’ was to limit oral intake to ‘nil by mouth’ or ‘clear fluids’ in labour, while the midwives working in the URPHs were more likely to assess each woman and make decisions based on the observations. The midwives’ conservative approach was precautionary and related to the increased incidence of caesarean sections among this group of women (Enkin et al., 2000; Warner, Warner & Weber, 1993).

Although the midwives, for the most part, agreed that oral intake should be limited for labouring women with high-risk pregnancies, they were inconsistent about when (early, active or transition phase of the first stage of labour) and what limitation criteria should apply (such as nil by mouth, ice, water, clear fluid). The absence of research into the oral intake of labouring women with high-risk pregnancies curtails the development of evidence-based guidelines. No published research was identified that had investigated the timing of oral intake restrictions during labour for high or low-risk women. Likewise there is an absence of research demonstrating the influence of oral intake on the incidence of aspiration during general anaesthesia (e.g., Kubli et al., 2002; Phillips et al., 1993; Schreiner & Nicolson, 1995; Scrutton et al., 1999; Tranmer, 1999; Yiannouzis & Parnell, 1994).

Despite the absence of research associating oral intake with the incidence of aspiration, the majority of these midwives believed it unsafe (possibly dangerous) to
allow food and sometimes fluids for labouring women with high-risk pregnancies. Conversely, they believed that some form of oral intake is acceptable, safe, and even necessary for women with low-risk pregnancies. This is in spite of the fact that there is no evidence to suggest that women with high-risk pregnancies are more likely to aspirate or that the nutritional needs of these women are less than women with low-risk pregnancies. The need for emergency surgery is often unpredictable whether the woman has a low or a high-risk pregnancy (Enkin et al., 2000). The main cause of aspiration episodes in obstetrics is anaesthetist error and it can occur regardless of the woman’s risk category (Hawthorne et al., 1996; Sinclair et al., 1999).

The relative consistency among midwives regarding oral intake restrictions for women with high-risk pregnancies may be related to (1) the fact that 94% of hospitals in NSW limit oral intake for these women compared with only 39% who limit oral intake for low-risk cases (see Study 1, Chapter 4) and (2) information, opinions and research within the literature which refer to the oral intake of labouring women with low-risk pregnancies only (Chern-Hughes, 1999; Kubli et al., 2002; Ludka & Roberts, 1993; Rodwell, 1992; Scrutton et al., 1999; Yiannouzis & Parnell, 1994). The absence of debate may mean that the majority of midwives have not been exposed to any other opinion regarding oral intake for women considered high-risk. They therefore limit oral intake as a precautionary measure because of fear of the unknown.

Although the majority of midwives limit oral intake for women with high-risk pregnancies, 21% allowed these women food during the active phase of the first
stage of labour. A small number of these midwives stated that the decision to allow food was dependent on the woman’s risk factors and that oral intake was limited if there was any potential for caesarean section. These midwives believed labouring women with high-risk pregnancies need nourishment to help them labour and reduce the likelihood of medical interventions, such as caesarean section. However, there is no literature (research or opinion-based) which supports or discourages the intake of food or fluids for women with high-risk pregnancies.

Until the situation regarding the oral intake of women with low-risk pregnancies is resolved and research into the nutritional needs of labouring women is conducted, the majority of midwives will probably continue to limit oral intake for this group of women.

5.4.3 Midwives’ decision to practise contrary to hospital protocol

Approximately one-third of all the midwives in this study practised contrary to the ‘usual practice’ in their hospital for the oral intake of labouring women. In many cases, it seems that midwives were unfamiliar with the ‘usual practice’ within their hospital and practised according to their experience and knowledge of this aspect of labour management. There were, however, a number of midwives who knowingly resisted the ‘usual practice’ within their hospital which may reflect their willingness to ignore a written policy or ‘usual practice’ which is contrary to their own beliefs. Their clinical decisions in this regard may indicate that these midwives had researched this area and developed their practice accordingly; however, whether these midwives had attempted to change practice for this aspect of care through the formal channels is unknown.
Experience in midwifery models other than the standard hospital model may have influenced midwives’ decision to practise contrary to the convention. However, when the practices of midwives within the two hospital groups (Unrestricted and Restricted) were examined, it was found that irrespective of which model of midwifery care (team midwifery, birth centre, homebirth) the midwives had experienced previously, no difference was reported in their practice. This is surprising as it could be expected that midwives with experience in clinical areas with a higher level of autonomy might have researched and developed a practice rationale. Although it was evident from some responses that midwives had researched their rationale for practice, many appeared to simply follow the status quo.

The reasons provided by the midwives in this study for their practice varied, with most decisions being based on personal opinion. A large number of midwives, however, gave no reason for their practice decision. This apparent lack of evidence-based rationale suggests that decisions regarding the oral intake of labouring women may have been associated with any of the following:

- personal experiences
- anecdotal evidence
- information gained during their original midwifery education (for some midwives this was pre-1980)
- information from the midwifery literature over the past decade.
Those midwives who deliberately chose not to follow convention for their unit appeared not to be influenced by their peers (Bosanquet, 2002; Hutchinson, 1990; Olesen & Whittaker, 1968). These midwives may have felt they had a certain amount of control over their practice decisions because of their previous experiences in midwifery or the number of years they had been practising as a midwife (Hutchinson, 1990). These midwives, in their capacity as the pregnant woman’s advocate (Currie, 1999; Hutchinson, 1990), may have believed they had some autonomy over their practice decisions based on the profession’s expectation that a midwife will provide each pregnant woman with the ‘best of care’ available (Mander, 1993).

In a study of ‘rule-bending’ behaviour, Hutchinson (1990) found that midwives and nurses made an informed decision, based on their knowledge, ideology and experience, to ‘violate hospital policies’ for the benefit of the patient, and they did so knowing the possible consequences for their actions if the practice was exposed (Hutchinson, 1990). Christmas (1991) proposed that autonomy was associated with self-awareness and the ability to reflect. The midwives in this study who determined their own practice appeared to be more self-aware and had greater ability to reflect on their practice than other midwives. These qualities provided them with the confidence to question a written policy or ‘usual practice’ that did not support their own beliefs and experiences.

The society or culture to which one belongs is governed by norms or rules which ensure the smooth, orderly functioning of the group (Downes & Rock, 2003; Roach-Auleu, 2003). What is considered normal in one group may be seen as deviant in
another (Downes & Rock, 2003; Giddens, 1989). As this study demonstrated, feeding labouring women was seen as the norm in one maternity unit yet deviant in another. It is not uncommon for midwives to deviate or disregard the rules of the group at one time or another, particularly if they disagree with the existing rule and wish to substitute a new one (Giddens, 1989; Roach-Auleu, 2003). This is despite there being enormous pressure from peers to ensure that each midwife conforms to the behavioural norms and policies of the group or maternity unit (Downes & Rock, 2003; Kirkham, 1999).

By practising outside the usual hospital protocol or practice the midwife is at risk of being considered negligent, dangerous or deviant by peers (Downes & Rock, 2003; Giddens, 1989; Stewart, 2001). Some midwives may resort to ‘horizontal violence’ to enforce conformity (Kirkham, 1999). Others may also report the non-conformist to their administrators or managers so that formal punishment and disciplinary measures can be applied (Bosanquet, 2002). It has been suggested in other studies investigating the ‘culture’ of midwifery that, if the deviant midwife fails to conform, the continuous aggression displayed by other staff will eventually lead to dissatisfaction with work, low morale, and reduced confidence with the midwife leaving the hospital or even leaving the profession (Bosanquet, 2002; Kirkham, 1999).

In light of the enormous pressure placed on a midwife to follow the rules, it is surprising that some midwives risk the repercussions that their actions may bring. The midwife may believe, however, that the risk of being detected is minimal
(Huntzinger, 1995) or that the risk of being caught is outweighed by the benefit afforded the pregnant woman.

5.4.4 Midwives’ reasoning for their practice decision

The reasons posed by the midwives in this study for either allowing or limiting oral intake were examined and discussed in the light of scientific evidence in order to establish their validity. The National Health and Medical Research Council (1998a) has published a ‘Level of Evidence’ rating to define the reliability of information contained within the professional health literature (Table 23). According to the Council, the most reliable literature on which to base practice comes from systematic reviews of randomised control trials (Level 1).

Table 23 NHMRC designation of levels of evidence*

<table>
<thead>
<tr>
<th>Level of evidence</th>
<th>Study design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level I</td>
<td>Systematic review of all relevant randomised control trials</td>
</tr>
<tr>
<td>Level II</td>
<td>At least one properly designed randomised control trial</td>
</tr>
<tr>
<td>Level III.1</td>
<td>Well designed pseudo-randomised control trials (alternate allocation or some other method)</td>
</tr>
<tr>
<td>Level III.2</td>
<td>Comparative studies with concurrent controls and allocation not randomised, cohort studies, case control</td>
</tr>
<tr>
<td>Level III.3</td>
<td>Comparative studies with historical control, 2 or more single arm studies, interrupted time-series with no parallel control group</td>
</tr>
<tr>
<td>Level IV</td>
<td>Case series, either post-test or pre-test/post-test</td>
</tr>
</tbody>
</table>

* NHMRC (1998a)

Many of the views expressed by the midwives regarding their practice decisions were based on opinion literature only because there is a lack of reliable research.
with similar methodological approaches and consistent findings on which to base the management of oral intake for labouring women. Where there is a lack of research evidence, midwives are forced to gather whatever other information is available - anecdotal, hearsay, observational, personal experience, opinion and their own education relevant to the area, in order to construct a rationale that will assist in their decision-making. Their decisions, therefore, are based on what they believe is a logical answer (Allen, 1997; Crossley & Wilson, 1979).

Ideally, evidence should be available for each facet of midwifery practice in order to provide pregnant women with safe and effective care; however, as this study demonstrates, that is not the case for the management of oral intake in labour. In the following section, the five main themes that emerged from midwives’ responses to support their practice decision are discussed in relation to the level of evidence available from the analysis. The five themes were:

- fast, just in case
- eating causes vomiting during labour
- it is hospital policy
- labouring women need food, fluids or both to labour effectively
- lack of research evidence.

5.4.4.1 Fast, just in case

A number of midwives believed that labouring women should ‘fast just in case’ an emergency caesarean section is required. The main reason for the fast is to prevent
the risk of stomach content aspiration if general anaesthesia is required for surgery. This belief is consistent with opinions in the literature (Gibbs, 1986; Mendelson, 1946). However, these remain opinions and are not grounded in research evidence or the physiology of gastric emptying (see p.92).

Events are often explained by providing a cause (Conway & Munson, 1997). For example, aspiration occurred because gastric contents were regurgitated, or A caused B. A causal relationship is assumed between the consumption of food and fluid and aspiration (Conway & Munson, 1997). In the absence of any research to substantiate a causal relationship, midwives in this study chose to ‘fast’ labouring women based on research that has only indirectly addressed this topic. Researchers have investigated the association between regurgitation and the anatomical and hormonal changes of pregnancy (Douglass, 1988; Van Thiel et al., 1977) and the drugs used in the past for labour and general anaesthesia (Blitt et al., 1970; Dawson & Cockroft, 1996; Kallar & Everett, 1993; Muravchich, Burkett, & Gold, 1981; Todd & Nimmo, 1983; Vanner et al., 1992a).

Whether a woman has undergone a prolonged period of fasting or not, consuming food and fluid does not in itself cause aspiration (Sutherland, Maltby, Sale, & Reid, 1987). There are a number of predisposing factors, such as:

- having a propensity, or being stimulated, to regurgitate or vomit by an external stimuli (Hardy, 1988)

- inappropriate positioning during anaesthesia (Blitt et al., 1970; Spence, Moir, & Finally, 1967)
incorrect anaesthetist technique (Chadwick, 1996; Department of Health, 2001).

Fasting labouring women ‘just in case’ is not supported by research and further research in this area is vital.

5.4.4.2 Eating causes vomiting during labour

A number of midwives in this study believed that eating food during labour may cause women to vomit. Although research has demonstrated that women who are encouraged to eat and drink during labour are more likely to vomit (Scrutton et al., 1999; Yiannouzis & Parnell, 1994), there is no evidence to suggest an increased risk of vomiting exists during anaesthesia.

For the most part, however, midwives in the current study based their argument on personal experiences or anecdotal information which cannot be generalised (Conway & Munson, 1997). Vomiting is common during labour (Roberts & Ludka, 1993), it occurs whether women have eaten or not (Scrutton et al., 1999) and is often associated with prolonged periods of fasting (Sutherland et al., 1986). The issue of whether a woman is more likely to vomit if she eats during labour will be explored in the comparative study (Chapter 7) of this thesis.

5.4.4.3 It is hospital policy

Basing practice decisions on the authority of the hospital policy, which was in fact a convention not a written policy, was not an uncommon finding in this study. This type of rationale has been labelled an ‘appeal to an authority’ (Conway & Munson, 1997). Appealing to an authority, in this case the hospital policy, is a way of overcoming the problem of having to provide reasons to sustain an argument and to
ensure that the argument is accepted (Allen, 1997; van Hooft, Gillan, & Byrnes, 1995). Many traditional practices are maintained by authorities in this way but they are not always appropriate (Conway & Munson, 1997). Written policy and practice may be inaccurate or outdated (Burns & Grove, 2001). The contents of a hospital policy and practice should be current and based on a critical appraisal of all the available evidence; however, most information regarding the oral intake for labouring women is opinion-based (e.g., Anderson, 1998; Berry, 1997; Broach & Newton, 1988; Hazel, 1996; Ludka & Roberts, 1993).

There is a paucity of reliable research on which to base a hospital policy for any type of oral intake for labouring women. For example, the convention or ‘usual practice’ within the RPHs in this study required labouring women with high-risk pregnancies to be fasted or to be limited to sips of water or ice to suck throughout labour ‘just in case’ general anaesthesia was required. These hospitals’ practice is not based on research evidence. There is no research, obstetric or non-obstetric, which has investigated the effect of these drastic restrictions in preventing aspiration during general anaesthesia. Nor has research investigated the effect these limitations have on the labouring woman’s comfort. For example, it is believed that thirst is easily overcome by intravenous fluids (Benhamou & Auroy, 1993; Mendelson, 1946). This intervention, however, carries a number of side effects for the woman and her labour progress (for example, labour progress may be slowed by the restriction of mobility associated with intravenous infusions) (see Dumoulin & Foulkes, 1984; Gabbe, 1988; Tarnow-Mordi et al., 1981). There is a need for reliable evidence to support a hospital policy for oral intake in labour, and the best
available evidence of the time should be used as the basis for a guideline in preference to a policy when research evidence is lacking or unreliable.

5.4.4.4 *Labouring women need fluids or both food and fluids*

Despite the absence of reliable evidence many midwives in the current study believed that women need fluids to improve their labour. Others argued that they needed both food *and* fluids. Arguments supporting oral intake for labouring women are based on anecdotal evidence or assumptions founded on the physiology of the body’s use of glucose during exertion and the production of ketone bodies (e.g., Foulkes & Dumoulin, 1985; Kim & Felig, 1972; Metzger et al., 1982; Rudolf & Sherwin, 1983; Sabata et al., 1968; Scrutton et al., 1996). The best practice for this form of labour management has not been clearly demonstrated. Research in the area contains methodological differences (different aims, sample sizes and recruitment strategies) which makes comparison difficult (see p.78).

5.4.4.5 *Lack of research evidence*

Current research is essential for best midwifery practice but in the absence of reliable research, midwives must rely on their professional judgement which is based on knowledge developed through experience and current literature (Buffim, 1996). Midwives in this study identified the absence of research to be a constraining factor on their ability to assess their practice against the evidence. The five main arguments midwives used to support their practice decisions regarding this form of labour management lacked the evidence required from either
5.4.5 Evidence-based guidelines

This study has demonstrated that midwives’ decision-making is based more on common practice and opinion than on evidence. An absence of written information to inform the management of the labouring woman’s oral intake limits midwives’ ability to develop best practice. One-third of the midwives in this study practised contrary to their hospital’s convention or ‘usual practice’. The lack of reliable evidence and the conflicting information within the literature may cause less experienced and less confident midwives to feel unsure about the best practice for this aspect of labour management. This ambiguity suggests a written policy or guideline, based on the best available research evidence, is necessary, and it should be developed by all concerned (midwives, obstetricians, anaesthetists and consumers) for the wellbeing of labouring women (Humphris, 1997). Basing practice on the best available evidence is now considered standard care (Carr, 2000).

Although a policy is defined as ‘a broad, general guide to action’ (Rue & Holland, 1989, p.10), midwifery unit policies are not intended to guide practice but to regulate and control the actions and care provided by midwives (Chamberlain, 1996; Cheek & Gibson, 1996; Currie, 1999; Sleep, 1992). Policies are rarely challenged or questioned because they are seen as valuable in assisting midwifery practice, ensuring quality of care (Cheek & Gibson, 1996) and protecting against litigation (Burgum, 1997). However, policies, being regulatory, can have the effect of limiting the effectiveness of practice by not allowing for the individual needs of the
woman (Currie, 1999) or abilities and knowledge of the midwife (Chamberlain, 1993, 1996; Sleep, 1992), thereby limiting autonomous practice (Chamberlain, 1993; Cheek & Gibson, 1996; Currie, 1999; Wilkerson, 2001).

Although it is acknowledged that policies are important for clinical safety and consistency, it is also noted that obediently and unquestioningly following written policies or usual practices serves to further regulate and limit the practice of midwives without taking into account individual differences or preferences (Cheek & Gibson, 1996). The rigidity of policies can be overcome by substituting guidelines for midwifery practice, particularly in cases such as oral intake for labouring women, where evidence is weak and contradictory (Rawlins, 1999).

Although the terms policy and guideline are often used interchangeably (Lomas & Haynes, 1987) they can have differing connotations. Policies tend to control while guidelines recommend (Cheek & Gibson, 1996; Rashidian & Russell, 2003).

A guideline has been defined as a ‘systematically developed statement to assist practitioner and patient decisions about appropriate health care for specific clinical circumstances’ (Field & Lohr, 1992, p.2). The aim of guidelines is to improve patient outcomes by disseminating evidence (Rashidian & Russell, 2003), providing continuing education (van der Sanden et al., 2003) and making recommendations for clinical decision-making (Hayward, Wilson, Tunis, Bass, & Guyatt, 1995). A written guideline for the oral intake of labouring women would be preferable to a policy because its structure, in essence, is an education tool. As an education tool midwives would be provided with:

- information on the historical underpinnings of the practice
• the causes and incidence of aspiration in obstetrics

• a critique of the available studies including their limitations, recommendations, options and outcomes along with references (Farquhar, Kofa, Power, Zinberg, & Schulkin, 2002; Hayward et al., 1995; McClarey & Duff, 1997; van der Sanden et al., 2003).

The advantage of guidelines over policies is that they allow for the autonomy of midwives by permitting the use of professional judgement based on the quality of evidence provided within the guideline and the individual woman’s preferences (Currie, 1999; Humphris, 1997; Stewart, 2001). They have the potential to improve self-esteem and morale, to motivate midwives to seek the best information available and to stimulate reflection on practice (Currie, 1999).

As demonstrated in this study, clinical practices vary for the management of the labouring woman’s oral intake. One of the main complaints from practitioners is the lack of time to read, analyse and evaluate the overwhelming array of information within their professional literature (Carr, 2000; Retsas, 2000). The information regarding the labouring woman’s oral intake alone is plentiful, although reliable research is lacking. Deciphering the information is difficult for those midwives who lack the knowledge or confidence to critically assess research (Brownlee & Foy, 2000; Retsas, 2000). Information in textbooks tends to quickly become outdated (e.g., Bassell & Marx, 1987; Enkin et al., 2000; Hawkins et al., 1996; Mayes, 1953; Masani, 1964) and many journal articles are opinion-based (e.g., Crawford, 1956; Elsberry et al., 1990; Ludka & Roberts, 1993; Odent, 1994). Research articles contain methodological differences and have not answered the prime concern
regarding the relationship between oral intake and aspiration (Rodwell, 1992; Scrutton et al., 1999; Yiannouzis & Parnell, 1994). For these reasons the goal of evidence-based practice for the labouring woman’s oral intake will not be realised in the near future.

The last decade, however, has seen the introduction and continual development of electronic databases such as the Joanna Briggs Institute and the Cochrane Library which contain a collection of systematic reviews and abstracts of research on numerous midwifery practice issues (Stewart, 2001). Information contained within the Cochrane Library is updated quarterly and provides a comprehensive evaluation of quantitative research, along with conclusions regarding the benefits and risks of each intervention and the strength of the evidence (Carr, 2000). Although randomised control trials are considered to provide reliable evidence (see Table 23 - NHMRC Quality of Evidence Ratings), they are still subject to flaws in design, sample size and statistical power (Decker, 1998; Roberts, Rosof, & Thompson, 1996); information which is identified within each review (Carr, 2000).

There are two limitations to the Cochrane reviews. First, they do not include evidence provided by research designs other than randomised control trials (Renfrew, 1997; Walsh, 2000). The role of a randomised control trial is to compare interventions but these trials do not attempt to understand or take into account peoples’ experiences of the interventions (Cluett & Bluff, 2000). Second, no systematic review has been conducted for the oral intake of labouring women; however, one is currently being undertaken for the Cochrane Database by Singata and Tranmer (2003).
A guideline will assist midwives in clinical decision-making (Carr, 2000; Murphy, 1997), based on the individual woman’s risk factors, preferences and needs, to limit or allow food and fluids during labour. Until conclusive evidence is published individualising care for the labouring woman’s oral intake, a well-written guideline would better serve the needs of midwives and labouring women.

5.5 CONCLUSION

The midwives participating in this survey had differing beliefs and practices regarding oral intake for labouring women, whether they were considered to be low or high-risk. Failure to comply with the ‘usual practice’ of the unit for oral intake during labour was reported by a sizable minority, although the majority did follow the convention, albeit with some variations.

In the absence of conclusive evidence from a systematic review of a number of well-designed studies which have compared the effects of various protocols for oral intake during labour, midwives are left with uncertain information upon which to base practice. Chapter 7 will address this issue by way of a comparative trial of the labour and birth outcomes of nulliparous women who either ate food or did not eat food during their labour.

Written policies or unwritten conventions tend to regulate practice. It is inappropriate to attempt to regulate a practice which has little or no research evidence. With such division in beliefs and variation in practice among hospitals and midwives, there is need for guidelines to inform the management of oral intake for labour.
The findings from Chapter 4 suggest that the amount of time anaesthetists spend within a maternity unit may influence the type of policy and practice used for the oral intake of labouring women. The current study noted that the practice of midwives was sometimes influenced by the opinions of anaesthetists when it came to this form of labour management. Chapter 6, therefore, will investigate the beliefs and practices of obstetric anaesthetists regarding dietary restrictions and other aspiration prevention strategies used in preparation for an emergency caesarean section under general anaesthesia.

5.5.1 Study limitation and further research

This study’s findings were limited by the low response rate and it cannot be assumed that the respondents represented the ‘typical’ views held by all the midwives in the four hospitals. The poor response could have been the result of midwives feeling their practice could be questioned or that they may be subjected to retribution if other staff (anaesthetic, administration, senior peers) became aware that they were practising contrary to the hospital’s ‘usual practice’. The findings of this research are, therefore, not generalisable (Polit & Hungler 1999).

Further research is necessary to examine why some midwives do not follow their hospital’s ‘usual practice’ for the management of oral intake of labouring women established by informal agreement between midwives. The failure of so many facilities to have an endorsed written policy or guideline for this aspect of labour management also needs to be investigated. It would be of interest to investigate whether the compliance level and decision-making of midwives would be different if an endorsed written policy or guideline was available in these hospitals. The lack
of a written policy or guideline presented some ambiguities for this chapter’s
discussion.

This survey has examined the oral intake of labouring women from the midwives’
perspective. The literature provides information based on the anaesthetists’,
obstetricians’ and midwives’ view of what sustenance should be provided for
women during labour. However, there is a paucity of research which has explored
the oral intake debate from the labouring woman’s viewpoint. The comparative
study reported in Chapter 7 attempted to address this issue.
Study 3 – Preventing Aspiration During Anaesthesia

Traditionally, healthcare decisions have been controlled by the medical profession (Coombs, 2003; Griffiths & Crookes, 2000). That culture is continued in midwifery where the care of pregnant women follows the direction of obstetricians’ preferences (Sleep, 1992). The socialised and stereotypical role adopted by many nurses (Warelow, 1996) and midwives (Bosanquet, 2002; Chamberlain, 1993) has the effect of maintaining the dominance of doctors (Hartley, 1999). Even today, where the formation of multidisciplinary teams within the healthcare arena is meant to neutralise power distinctions, doctors often assume, or by implication are given the lead role in decision-making (Griffiths & Crookes, 2000; Warelow, 1996).

Anecdotally, anaesthetists have directed much of the decision-making regarding oral intake for labouring women. A minority of women require general anaesthesia during childbirth, and when complications occur, anaesthetists are responsible for
the outcomes of anaesthesia. During the first half of the 20th century general anaesthesia was commonly administered to women for pain relief during labour, the birth process, and for caesarean section (Crawford & Oppit, 1976; Mendelson, 1946; Morley, 1955). While aspiration was problematic during this time (Mendelson, 1946; Morley, 1955), today it is extremely rare, occurring mainly during mismanagement of the anaesthetic process (American Society of Anesthesiologists, 1998; Department of Health, 2001; Hawthorne et al., 1996). Despite this evidence, obstetric and anaesthetic textbooks continue to recommend that every labouring woman be permitted no more than sips of water throughout labour as an aspiration prevention strategy for general anaesthesia (e.g., Hawkins, Chestnut, & Gibbs, 2001; Hawthorne et al., 1996). However, there is no evidence to support restricting oral intake.

Chapter 2 of this thesis provided historical information along with an account of the developments in anaesthetic agents and refinements to anaesthetic procedures over the past 50 years. These changes have improved outcomes and reduced complications. Oral intake restrictions for labour, however, have remained relatively unchanged over the past 50 years as research into its safety and efficacy as an aspiration prevention strategy had not been conducted before the late 1990s. As a consequence of the paucity of studies undertaken on this topic there is little evidence demonstrating the effect of dietary regimes as an aspiration preventative (e.g., Kubli et al., 2002; Scrutton et al., 1999). Therefore, current aspiration prevention strategies used by anaesthetists, with particular reference to dietary restrictions before emergency general anaesthesia, will be explored in this study.
6.1 AIM

The aim of this study was to explore the practices and views of obstetric anaesthetists, within four Sydney hospitals, regarding their aspiration prevention strategies for induction of general anaesthesia for a caesarean section.

The following objectives were the basis for data collection from these anaesthetists:

- to determine consistency for pre-operative ‘fasting’ requirements before caesarean section surgery, both elective and emergency
- to determine the importance of, and rationale for, an empty stomach before an emergency caesarean section
- to explore the types of aspiration prevention strategies used in preparation for an emergency caesarean section (dietary, pharmacological, and technical)
- to determine dietary recommendations for labouring women with an epidural anaesthetic.

6.2 METHOD

6.2.1 Study design and setting

An exploratory survey design was used to collect data from obstetric anaesthetists employed in four public hospitals in Sydney, NSW. The four hospitals selected had been recruited to participate in the comparative trial being conducted to examine the fourth aim of this study (Chapter 7). The usual practice among midwifery staff
within two of these hospitals was to restrict oral intake during labour while the other two allowed food and fluids at will for labouring women. Demographic and statistical information regarding these four hospitals can be found in Table 13 (see p.120).

6.2.2 Instrument

A questionnaire (Appendix D) was designed to investigate anaesthetists’ attitudes, views and practices on a number of aspects pertaining to general anaesthesia for a caesarean section, and in particular, oral intake restrictions. It also sought information on the type of drugs and techniques employed by these anaesthetists to prevent aspiration of gastric contents during induction of general anaesthesia.

Lastly, one item focused on the anaesthetists' preferences regarding oral intake for labouring women who have an epidural anaesthetic in situ. Items for this questionnaire were generated from the anaesthetic literature and represented its diversity of opinion. The content and purpose of the questionnaire was critiqued and further improved by experts in midwifery and research to ensure instrument validity.

A four-point Likert scale (1 ‘not important’ to 4 ‘vitally important’) was used (Beanland et al., 1999). A common problem with five-point Likert scales is that the neutral response tends to become the most frequent, making the data difficult to interpret (Beanland et al., 1999; Polit & Hungler, 1999). Therefore, a four-point rather than a five-point Likert scale was used, forcing respondents to take a position.
Closed-ended questions provided statistical information and led the respondent into a corresponding open-ended question (Polit & Hungler, 1999). Open-ended questions gave the respondents an opportunity to explore practice beyond the closed questions, thus providing background and rationale to practice (Beanland et al., 1999; Polit & Hungler, 1999).

6.2.3 Participants and procedure

Following ethics approval and consultation with the head of the anaesthetic department at each hospital, a list of all anaesthetists who performed obstetric anaesthesia was obtained. All anaesthetists (n = 56) who practised obstetric anaesthesia within four public hospitals in Sydney, NSW were surveyed between June 2000 and July 2000. The questionnaire (Appendix D) and an explanatory note were posted to them at their hospital’s address. A return addressed envelope was included with each questionnaire yielding a response rate of 54% (N = 30).

6.2.4 Data analysis

Data from the completed questionnaires were collated and descriptive statistics derived. Closed-ended, dichotomous responses were tabulated and frequencies obtained while means and standard deviations were calculated for the responses from the Likert scale.

Open-ended responses were analysed using content analysis (Beanland et al., 1999). The method of content analysis allowed an objective, efficient and quantitative description of the open-ended responses (Burns, 1997). The responses to the open-ended questions were read several times to enable the investigator to become
Chapter 6 – Preventing Aspiration During Anaesthesia

familiar with the content. The data were hand coded and themes developed. The themes were placed into categories according to the views expressed by the anaesthetists. The frequencies and percentages for each category were calculated (Polit & Hungler, 1999; Weber, 1990). To enhance reliability of the results a second person also coded the text and confirmed the findings, providing a 100% agreement (Weber, 1990).

6.3 RESULTS AND DISCUSSION

This section reports and discusses the anaesthetists’ ranges of opinions about (1) dietary restrictions for women before general anaesthesia for caesarean section (elective and emergency), (2) dietary restrictions for labouring women with an effective epidural anaesthetic and (3) strategies (drugs and procedures) to minimise regurgitation and/or the effect of aspiration if it occurred.

6.3.1 Dietary restrictions before general anaesthesia

Three areas were explored regarding dietary restrictions before general anaesthesia for caesarean section: (1) type of restriction required, (2) the necessity of these restrictions in an emergency situation, and (3) the importance of an empty stomach.

6.3.1.1 Type of dietary restriction

No consensus was found for ‘best practice’ in the management of oral intake for women who may require an elective or emergency caesarean section, although most anaesthetists preferred a ‘fasting’ regime. The type of dietary restrictions required for both elective and emergency caesarean section are discussed followed by a
content analysis of the open-ended responses regarding the necessity of these
restrictions in an emergency situation. All respondents in this survey required
women booked for an elective caesarean section to fast (that is, no oral intake) for at
least four to six hours before elective general anaesthesia. Four anaesthetists (13%) stated they allowed clear fluid until two hours before surgery.

For emergency caesarean section patients, however, 15 anaesthetists (50%) stated they preferred a fasting time of six to eight hours. Two of these anaesthetists allowed clear fluids up until two hours before surgery. One of these anaesthetists worked in a hospital that had a practice which restricted labouring women’s oral intake (RPH) while the other worked at a hospital that allowed these women to eat and drink as desired (URPH). Six anaesthetists (20%) did not respond to this question while nine (30%) stated that defining a fasting time was impractical and not always feasible in a true emergency situation.

The timing and type of dietary restriction recommended for pregnant women in preparation for, or anticipation of, obstetric general anaesthesia centres around gastric emptying. The longer fasting period requested for emergency surgery may be attributed to the belief that labouring women (women more likely to require emergency surgery) have delayed gastric emptying (Nimmo et al., 1975); however, this only applies to women under the effect of narcotics (Nimmo et al., 1975). Fasting times appear to be estimates deduced from the physiological process of gastric emptying and fasting pH levels rather than informed by research (e.g., Maltby, Lewis, Martin, & Sutherland, 1991; O’Sullivan, 1993; Tortora & Anagnostakos, 1990). No research can be located to substantiate preoperative
‘fasting’ requirements for obstetric or non-obstetric patients. Nevertheless, despite significant advancements in the general anaesthetic process, anaesthetists continue to insist on stringent limitations to oral intake (Ludka & Roberts, 1993; Sigurdsson & McAteer, 1996).

6.3.1.2 Necessity in an emergency

A content analysis of the open-ended responses expanding anaesthetists’ views on dietary restrictions for emergency caesarean section women produced the following three themes: (1) ‘You have no choice with an emergency’, (2) ‘Fasting is best’ and (3) ‘Prefer no solid foods.’ Four anaesthetists provided more than one of these views.

6.3.1.2.1 ‘You have no choice in an emergency’

While the majority of anaesthetists (n = 21, 70%) acknowledged that an emergency general anaesthesia may pose particular problems for anaesthetists if the woman’s oral intake has not been restricted during labour, they agreed that surgery would proceed. One anaesthetist expressed this situation succinctly: ‘Emergency surgery is just that. It involves defined calculated risks. There is no difference between emergency…caesarean section and being run over by a bus’ (R.5).

Anaesthetists calculate the risk factors, select the most appropriate anaesthetic and conduct anaesthesia in a manner that minimises the risk of aspiration (Oberoi & Phillips, 2000). Anaesthesia, therefore, can be performed regardless of stomach contents or substituted with an epidural anaesthetic if the risk of aspiration is considered to be high (Petring, Adelhof, Erinmadsen, Angelo, & Jelert, 1984; Ong et
Anaesthesia is performed in emergency situations regardless of stomach contents, therefore dietary restrictions (particularly ‘fasting’) may be unnecessary, especially in the case of all labouring women.

One anaesthetist was very definite in his opposing response ‘…[If the] patient is referred to [the] operating theatre with [a] full stomach we can say ‘no’ for the emergency LSCS [lower segment caesarean section]’ (R.2). In practice, the situation is rarely a ‘textbook’ case. As the stomach is never empty (Guyton, 1986), to suggest that surgery should be delayed to await gastric emptying may be impractical and, in fact, dangerous in an emergency situation given the extremely rare incidence of aspiration. Further, if the caesarean section was being performed for ‘fetal distress’, a condition which could place a baby at risk of morbidity or mortality if delivery was not immediate, the woman’s state of ‘fasting’ would not be the most important consideration; the wellbeing of the baby takes precedence.

6.3.1.2.2 ‘Fasting is best’

Ten anaesthetists (33%) stated that ‘fasting is best’ for labouring women, citing the potential for general anaesthesia should intervention be required. An example of this view was provided by one anaesthetist: ‘[Fasting is] very unlikely to produce morbidity or mortality since adequate volume replacement and maintenance can be achieved intravenously. Regurgitation or aspiration has very significant morbidity and mortality’ (R.15). Another anaesthetist commented that, ‘[Women] do not need nutrition during labour contrary to what many appear to believe’ (R.2).
Each anaesthetist is considered an expert in their field where aspiration prevention strategies for general anaesthesia are concerned and it is expected that, as experts, they are ‘in a position to know’ (Conway & Munson, 1997). Aspiration, however, is extremely rare with the last documented mortality case occurring in Australian obstetrics in 1987 (NHMRC, 1991) and only 16 cases have been recorded since 1967 (NHMRC, 1972, 1976, 1979, 1981, 1987). Considering the rarity of aspiration in obstetrics and, as no anaesthetist in this study reported an aspiration experience, it is unlikely that any of these anaesthetists in this study has ever been exposed to this event in obstetrics. While no respondent elaborated on whether they had reviewed their practice to take account of improvements in anaesthetic techniques and drugs, until there is more convincing evidence to support oral intake for labouring women, anaesthetists may considered it prudent to continue with fasting regimes.

Intravenous therapy, although maintaining hydration, does not provide nutrition (Newton, Newton, & Broach, 1988). Research has demonstrated that intravenous therapy is restrictive, uncomfortable and may hamper a woman’s labour both physically and emotionally (Broach & Newton, 1988; Davis & Riedmann, 1991). Intravenous therapy has been found in the past to be detrimental to women and babies (e.g., Ames et al., 1975; Lawrence et al., 1982; Schwartz & Jones, 1978) and no research has provided reliable information as to the correct type, volume, and flow rate for administration to labouring women.

6.3.1.2.3 ‘Prefer no solid foods’

A small number of anaesthetists were more flexible towards dietary restrictions. Three respondents (10%) expressed the view that they ‘prefer no solid foods’ for
labouring women, suggesting an awareness and acceptance of women being fed during labour: ‘I do feel exasperated that the practice has shifted from fluids or light intake only to allowing any oral intake...What is the benefit of allowing women to eat full meals in labour?’ (R.21). The usual stringent ‘nil by mouth’ or ‘clear fluids only’ requests made by anaesthetists were modified by responses such as, ‘I...would prefer the patient not to have had a recent meal’ (R.28); ‘Free fluids are very different to solids...’ (R.8).

6.3.1.2 Pre-operative fasting for caesarean section

In response to the question ‘How important is it for the stomach to be empty at the time of a caesarean section’, the majority of anaesthetists (n = 24, 80%) stated it was important or vitally important. Three anaesthetists (14%) stated that an empty stomach is not necessary before general anaesthesia. These anaesthetists were spread between three of the four hospitals (RPH = 1, URPH =2); therefore, this belief was not isolated to anaesthetists in one hospital but was scattered among the hospitals. In addition, 22 anaesthetists (73%) supported their practice with a rationale. A content analysis of these rationales revealed the following two similar, yet subtly different themes, (1) ‘An empty stomach is necessary, but...’ and (2) ‘Emergencies must be treated as if they have a full stomach’.

6.3.1.2.1 ‘An empty stomach is necessary, but...’

Six responding anaesthetists (27%) reported that it is impossible to predict that the stomach is empty regardless of how long a person has been fasting. ‘An empty stomach is necessary, but...’, therefore, referred to responses regarding the inability
of the stomach to be empty. Examples of these comments were, ‘emergency caesarean section patients can never be guaranteed to have an empty stomach and anaesthetic is adjusted to the degree of risk’ (R.4) and that ‘[pregnant women] never have an empty stomach despite fasting...’ (R.9).

The aim of dietary restrictions during labour or before surgery is based on the belief that it better ensures an empty stomach if general anaesthesia is required, thereby assisting in the prevention of an aspiration episode (Mendelson, 1946). However, a period of fasting does not ensure the stomach is empty (Roberts & Shirley, 1974; Sutherland et al., 1986) and may increase the risk of aspirating highly acidic gastric secretions (Tortora & Anagnostakos, 1990). In addition, since fasting was first recommended (Mendelson, 1946), there have been significant developments in drugs and procedures for anaesthesia and further research is required to determine contemporary best practice.

6.3.1.2.2 ‘Emergencies must be treated as if they have a full stomach’

Almost 60% (n = 13) reported that they assume all people requiring emergency general anaesthesia have a full stomach and treat them accordingly. ‘Emergencies must be treated as if they have a full stomach’ referred to the anaesthetists’ belief that a pregnant woman has a predisposition toward aspiration when the stomach contains food and fluids at the time of general anaesthesia. The anaesthetists believed that pregnant women are at increased risk because… ‘[a] pregnant woman has delayed gastric emptying and invariably the pH is low. Aspiration can cause severe Mendelson’s syndrome’ (R.2); ‘All emergency caesarean section patients are assumed as having full stomachs...’ (R.28).
If every woman requiring an emergency caesarean section is anaesthetised as if she has a full stomach, then aspiration is unlikely (Oberoi & Phillips, 2000; Schaut, Khona, & Gross, 1997). Statistics have shown that aspiration-related maternal mortality occurs when the anaesthetist fails to employ all recommended precautions (e.g., American Society of Anesthesiologists, 1998; Department of Health, 1991; 2001; Hawthorne et al., 1996).

Anaesthetists’ views regarding dietary restrictions for women requiring a caesarean section varied. Although their stated aim for dietary restrictions is to minimise the risk of aspiration during surgery, a strategy unsupported by research, the majority of anaesthetists agreed that the nature of stomach contents are always unknown and therefore treated as full when inducing a pregnant woman for general anaesthesia, especially in an emergency situation. No anaesthetist referred to any research as a basis for his/her preference or practice.

6.3.2 Epidural anaesthesia and dietary restrictions for labour

Information was sought about the anaesthetists’ views on dietary restrictions for women undergoing an effective epidural anaesthetic during their labour. Not only did anaesthetists differ regarding what they believed was the best diet for these women, but the individual anaesthetist’s view varied according to the reason for the epidural anaesthetic (Table 24). Eighteen (60%) allowed clear fluids only for these women, although the anaesthetists were more lenient regarding dietary restrictions for those women whose epidural was for pain relief only.
Individually, anaesthetists appeared to have randomly selected a dietary regime which they believed suitable for labouring women with epidural anaesthesia.

Dietary restrictions were introduced to reduce the risk of aspiration during general anaesthesia; however, epidural anaesthesia does not inhibit the ‘gag’ reflex (Conklin, 1990), therefore aspiration is unlikely (Petring et al., 1984; Wilson, 1978). Usually an effective epidural anaesthetic during labour supersedes the need for general anaesthesia if emergency surgery is necessary, although some anaesthetists may prefer to continue dietary restrictions just in case general anaesthesia is required.

### 6.3.3 Strategies to minimise aspiration and its effect

#### 6.3.3.1 Drugs used to minimise aspiration effect

There was no consensus about ‘best practice’ for gastric-altering drugs for general anaesthesia. The antacid, sodium citrate, was prescribed by 29 of the 30 anaesthetists before a woman’s transfer to the operating theatre for an emergency caesarean section. Nineteen anaesthetists administered sodium citrate only to alter the stomach contents while one anaesthetist used ranitidine only. The remainder of
anaesthetists administered other drugs in conjunction with sodium citrate. These
drugs neutralized the stomach contents (H2 receptor antagonists such as ranitidine),
reduced gastric acid secretion (omeprazole) or increased gastric emptying
(metoclopramide) - see Table 25.

Table 25  Pre-operative pharmacological strategies employed by anaesthetists for emergency
caesarean section patients (N = 30)

<table>
<thead>
<tr>
<th>Anti-acid therapy</th>
<th>n</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antacid only (sodium citrate)</td>
<td>19</td>
<td>63.3</td>
</tr>
<tr>
<td>H2 receptor antagonist only (ranitidine)</td>
<td>1</td>
<td>3.3</td>
</tr>
<tr>
<td>H2 receptor antagonist + sodium citrate</td>
<td>4</td>
<td>13.3</td>
</tr>
<tr>
<td>Gastrointestinal stimulant (metoclopramide) + sodium citrate</td>
<td>3</td>
<td>10.0</td>
</tr>
<tr>
<td>Gastrointestinal stimulant + sodium citrate + ranitidine</td>
<td>2</td>
<td>6.7</td>
</tr>
<tr>
<td>Gastric acid secretion inhibitor (omeprazole) + sodium citrate + metoclopramide IVI</td>
<td>1</td>
<td>3.3</td>
</tr>
</tbody>
</table>

There was no consistent practice among anaesthetists, even within the same hospital,
for the administration of agents before, or during, a caesarean section to minimise
the effect of aspiration. These findings reflect the literature (e.g., Burgess &
Crowhurst, 1989; Sweeney & Wright, 1986). Although H2 receptor antagonists are
considered the preferred antacid for obstetrics (Thomas, 1994), they are of little
value in an emergency situation because of their slow onset (O’Sullivan, 1990).
Omeprazole is also not appropriate in emergency situations as it takes at least 30
minutes for effect (Rocke, Rout, & Gouws, 1994). Metoclopramide (Maxalon),
although effective in accelerating gastric emptying without affecting gastric acid
production (Swonger & Matejski, 1991), has yet to be proved efficient and safe for
obstetric use (Kluger & Short, 1999). It is argued that no drug or combination of
drugs offers a reliable and consistent reduction in pH or gastric content (Kluger & Willemsen, 1998; Rowe, 1997), nor do they reduce the possibility of regurgitation and aspiration (Stuart et al., 1996). Nevertheless, anaesthetists may believe it better to administer an additional drug than to rely on sodium citrate alone.

6.3.3.2 Procedures used to minimise aspiration

When information was requested regarding any other precaution used to prevent aspiration, all anaesthetists reported using the rapid sequence induction technique which is considered the linchpin of aspiration prevention (Kallar & Everett, 1993; Oberoi & Phillips, 2000; Soreide, 1997). Some anaesthetists expanded on their response by briefly mentioning one or more of the components of the rapid sequence induction process (such as cricoid pressure, endotracheal intubation) which they considered to have particular importance.

6.4 CONCLUSION

This chapter has provided information regarding the views and practices of obstetric anaesthetists. The findings from this survey demonstrate a lack of agreement on ‘best practice’ for general anaesthesia and epidural anaesthesia. Practice varied for both dietary restrictions and pharmacological strategies for altering gastric contents.

The causes of anaesthesia-related aspiration episodes are multifactorial for pregnant women who require an emergency caesarean section and, while anaesthetists in this study were concerned about the stomach contents, they provided no evidence to support their practice. While anaesthetists continue to base their argument for
restricting oral intake on Mendelson’s (1946) research, inconsistencies will continue to exist. Research into the effect of various dietary regimes consumed by pregnant women before general and epidural anaesthesia which is based on current anaesthetic drugs and techniques is necessary to establish reliable information.

6.4.1 Limitations of the study and future research

This study contained a sample of obstetric anaesthetists (N = 30) representing 54% of the anaesthetists approached; therefore, the results are not generalisable. A larger sample size, using hospitals that provide different levels of care, would provide more reliable results. It is not known why only half of the anaesthetists responded to this survey. It may have been that the responding anaesthetists were more interested in the issue being studied or that they were more research focused. The anaesthetists who did not respond may have felt uncomfortable about a midwife questioning their practice.

Future research should investigate anaesthetists’ knowledge of the oral intake policy and ‘usual practice’ for labouring women within their hospital’s maternity unit and their views regarding this form of labour management. Research should specify the different meanings of fasting (such as nil by mouth, ice, clear fluid, no solid food) to acquire more specific information.

Well-designed research is required to explore the oral intake of labouring women with low-risk pregnancies and the effect this has on labour and birth outcomes. Chapter 7 presents the results of a comparative trial conducted to examine this issue.
Study 4 – Effect of Eating on Labour Duration and Incidence of Medical Intervention

Surveys of hospitals (Chapter 4), midwives (Chapter 5) and anaesthetists (Chapter 6) have found disagreement over the dietary intake recommendations for labouring women. Many midwives believe that the length of labour is shortened when labouring women are given unrestricted access to food and fluids and lengthened when dietary restrictions are applied (e.g., Lewis, 1992; Pengelley & Gyte, 1998; Rodwell, 1992). They argue that dietary restrictions during labour may also increase medical intervention rates (Lewis, 1998; Ludka & Roberts, 1993; Pengelley & Gyte, 1998). These concerns are based on ‘evidence’ from knowledge of physiology, research that indirectly addressed this topic, anecdotal information and opinion. Further, anaesthetists have concerns about allowing women to eat and to drink during labour. They are concerned about the risk of gastric content aspiration if a general anaesthetic were required during labour (Boyle, 1997; Burchman, 1996;
Oberoi & Phillips, 2000). Their argument is based on an understanding of pathophysiology and established practices and preferences frequently established in a clinical environment using drugs and procedures no longer used in contemporary obstetric practice (Brownridge, 1994). Anaesthetists have also expressed the opinion that labouring women do not need food or fluids during labour (see p.171). There is no reliable research evidence, however, to support either argument. The disagreement between these two professions may be attributed to their differing clinical priorities in the care of labouring women. Midwives seek to reduce labour duration and medical interventions, while anaesthetists seek to reduce risk during general anaesthesia.

Beyond the views of individual practitioners, the issue has major policy implications for hospitals and providers of maternity services. At an institutional level there appears to be no consensus over the dietary requirements of labouring women. Clinicians in some hospitals allow labouring women to eat while others do not (Baker, 1996; Michael et al., 1991; Parsons, 2001). The personal needs and natural desires of labouring women appear to have been overlooked in the pursuit of unconfirmed outcome improvements. Research comparing labour and birth outcomes for large samples of women should drive policy and practice relating to eating during labour. However, such studies are few in number and their results conflict (Rodwell, 1992; Scrutton et al., 1999; Tranmer, 1999; Yiannouzis & Parnell, 1994).

While the effect hospital policies or usual practices for food intake during labour may have on birth outcomes could be tested using a randomised control trial it was
considered impractical for three reasons. First, one-third of the midwives working within the participating hospitals did not follow their hospital’s ‘usual practice’ for this aspect of labour management (Chapter 5). During the data collection process of this current study it was noted that most food intake occurred at home while women were in the early phase of labour regardless of the hospital’s convention. Finally, a randomised control trial was not only impractical but also unethical as it would require some women to eat even if unable, or to be refused food if they wanted to eat (Polit & Hungler, 1999). Some problems in midwifery are better observed and analysed rather than controlled (Babbie, 2004). The inability of previous randomised control trials to agree on the effect of food consumption during labour may be attributed to the artificiality of this design. The current study, therefore, combined a naturalistic approach and an experimental comparative trial with concurrent controls in order to approximate the labouring women’s actual eating behaviour. The advantage of this design is that it provides a better understanding of labouring women’s oral intake needs; however, it comes at a methodological cost (Pelto, 2003). The inability to control variables to the same extent as a randomised control trial is seen by some to reduce the credibility of causal inferences (Pelto, 2003). The information gained from this naturalistic comparative trial, however, will reveal a more ‘real world’ focus (Polit & Hungler, 1999).

The comparison for this study was made between the women who ate food during their labour, hereafter referred to as the ‘Eating group’ and women who did not eat any food during labour, hereafter referred to as the ‘Non-eating group’ regardless of the ‘usual practice’ of the hospital of birth.
7.1 OPERATIONAL DEFINITIONS FOR LABOUR

The definitions, terms and cervical dilatation measurement used to describe the phases of the first stage of labour differ among authors (e.g., Impey, Hobson, & O’Herlihy, 2000; Cassidy, 1999; Enkin et al., 2000; Rouse, Owen, & Hauth, 1999). For example, Cassidy (1999) states that the early (also referred to as latent) phase of the first stage of labour ends when the cervix has dilated to 3 cm, while Rouse et al. (1999) quoted a cervical dilatation of 4 cm. For the purpose of the current study the following terms and measurements have been used to identify the different phases and stages of labour (also see Figure 3).

<table>
<thead>
<tr>
<th>First stage of labour</th>
<th>The period of time between the commencement of regular contractions (documented by the women in this study) and full dilatation of the cervix. It includes three phases: early, active and transition.</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Early phase</td>
<td>The period between the commencement of regular contractions (documented by the women in this study) and the commencement of the active phase of the first stage of labour. That is, 0 to 3 cm cervical dilatation inclusive. The time estimated and recorded in the participant’s medical record by their midwife to mark the commencement of the established (active) phase of labour was the endpoint used for this study.</td>
</tr>
<tr>
<td>- Active phase</td>
<td>The commencement of the established phase of the first stage of labour (3 to 7 cm cervical dilatation inclusive). The midwife caring for each participant estimated and recorded the commencement of this phase of labour in the participant’s medical record.</td>
</tr>
</tbody>
</table>
Chapter 7 – Effect of Eating on Labour Duration and Medical Intervention

- **Transition phase**
  The last phase of the first stage of labour (7 to 10 cm inclusive).

- **Established phase**
  Active and transition phases of the first stage of labour combined (3 to 10 cm cervical dilatation). The midwife caring for each participant estimated and recorded the commencement of the established phase of labour in the participant’s medical record.

**Second stage of labour**
The period of time from full dilatation of the cervix to the birth of the baby.

**Hospital-estimated length of labour**
Number of hours between the commencement of the active (established) phase of labour (3 cm cervical dilatation) – as documented by hospital staff – and the birth of the baby. The duration of this labour period served as a major outcome variable for the study.

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**Figure 3** Terminology describing the course of labour in relation to cervical dilatation

<table>
<thead>
<tr>
<th>Early phase</th>
<th>Established phase</th>
<th>Second stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 cm</td>
<td>3 cm</td>
<td>10 cm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Birth</td>
</tr>
</tbody>
</table>

Hospital-estimated length of labour
(as measured by hospital staff)
7.2 AIM

The aim of this study is to compare outcomes for women who ate food during their
labour (Eating group) with women who did not (Non-eating group).

7.2.1 Independent variable

The effect of eating food during the first stage of labour was used as the independent
variable.

7.2.2 Outcomes of interest

- Maternal outcomes
  - length of labour
  - maternal blood loss

- Newborn outcomes
  - newborn Apgar score at 5 minutes
  - incidence of Special Care Nursery admission

- Incidence of medical interventions
  - artificial rupture of membranes
  - medical augmentation of labour
  - intravenous therapy for hydration
- pain relief measures: pethidine intramuscular injection and epidural anaesthesia
- forceps or ventouse delivery.

7.3 HYPOTHESES

Nulliparous women ingesting food (solid, semi-solid, and any liquid food that is not considered a clear fluid, such as milk drinks, icecream and yoghurt [tea and coffee containing milk were included as clear fluid in this study]) during the first stage of their labour shall have a significant decrease in the length of their labour and a reduction in the use of medical interventions compared with women who do not ingest any food during their labour.

To test this hypothesis, the following specific hypotheses were tested:

1. Nulliparous women ingesting food during the first stage of their labour will have a significant decrease in the length of their labour compared with women who do not ingest any food during their labour.

2. Nulliparous women ingesting food during the first stage of their labour will have a significant reduction in the use of medical interventions compared with women who do not ingest any food during their labour.

3. Nulliparous women ingesting food during the first stage of their labour will have a significant improvement in birth outcomes compared with women who do not ingest any food during their labour.
4. The newborn infants of nulliparous women ingesting food during the first stage of their labour will have a significant improvement in birth outcomes compared with newborn infants of women who do not ingest any food during their labour.

7.4 METHOD

7.4.1 Study design and setting

This was a prospective, comparative trial with concurrent controls using self-report data from 331 nulliparous women who gave birth to their babies at four public hospitals in Sydney, Australia between February 2000 and August 2000.

7.4.2 Ethics approval

Four hospitals agreed to participate in this study and ethics approval was obtained from each Human Ethics Committee. Approval was also obtained from the Human Ethics Committee of the University of Western Sydney (Appendix E).

7.4.3 Sample

The four participating hospitals were local, public hospitals with similar birth rates and a multicultural clientele (see Table 13 on p.120). None of the hospitals had a written policy covering oral intake for labour, although the ‘usual practice’ at two hospitals was for ‘clear fluids only’ for women with low-risk pregnancies. These two hospitals will hereafter be referred to as ‘Restricted Practice Hospitals’ (RPH). Women confined at the other two hospitals were allowed to consume food and fluids
as they desired. These hospitals are hereafter referred to as ‘Unrestricted Practice Hospitals’ (URPH).

Three hundred and thirty one consecutive women who agreed to participate in this study were recruited from the four participating hospitals.

7.4.3.1 Inclusion criteria

Women were eligible for inclusion in the study if they were:

- nulliparous (first baby)
- English-speaking
- without any known risk factors
- allowed to labour (i.e., did not undergo a caesarean section [elective] before the onset of labour).

The study was restricted to nulliparous women because these labours tend to be longer, and they are more likely to require medical interventions than multiparous women (Williams, 1999). Being English-speaking was necessary for consent and the ability to keep a record of all food and fluid consumed during labour.

Data from 114 of the women recruited was excluded from the analyses for the following reasons:

- Sixty-one women had their labour started artificially by cervical ripening agents, syntocinon infusion or a combination of these agents. The length of labour may be shortened by these artificial means (Kruse, 1993)
• Twenty-three women had their labour terminated by emergency caesarean section. Emergency caesarean sections have a number of unreliable outcomes (such as, no maternal blood loss is recorded at birth in the patient’s medical record)

• Nineteen women had labour started artificially and terminated by caesarean section

• Eleven women provided data which conflicted with their midwife regarding the commencement of the early and established phases of the first stage of labour.

The final sample size was 217 women. All women drank some form of fluid during their labour; however, it was the consumption of food which was of interest for this study. Women who ate any type of food during their labour formed the basis for the selection of the ‘Eating group’ (n = 123). Women who did not eat any food during their labour formed the basis for the selection of the ‘Non-eating group’ (n = 94).

The women who did eat during labour were categorised into three groups according to when they ate food during the first stage of labour:

1. Women who ate during the early phase ONLY

2. Women who ate during the established phase ONLY

3. Women who ate during BOTH the early and established phases.
Subgroup analyses were conducted to determine whether outcomes differed according to the time of food intake during the first stage of labour (early, established or both).

7.4.3.3 Sample size

To adequately test the hypothesis that a policy of unrestricted access to food and fluids decreases the length of labour, with a power of 90% and a two-tailed alpha of 0.05, the calculated sample size was 95 per group. Therefore, the current study should have an adequate chance of detecting a moderate effect size in the relevant population.

7.4.4 Instruments

There were three sources of data used for collection of data in this study. The first source was an instrument referred to as (1) a ‘Food and Fluid Record’ form (Appendix F) which was used by each woman during the course of her labour. The other two sources of data were (2) the Hospital Birth Register and (3) a semi-structured interview.

7.4.4.1 The food and fluid record

The Food and Fluid Record form was developed for the study (Appendix F). Two items of information were collected from this form: (1) the woman’s estimate of the time her early labour started and (2) the time, type and amount of all food and fluid the woman consumed throughout her labour. The form was completed by the woman, her support person or midwife.
7.4.4.2 Hospital birth register

Following each birth the midwife or doctor is required to complete the specified details of the women’s pregnancy, labour, birth and perinatal outcomes in a Hospital Birth Register. These data are completed by all NSW public and private hospitals as well as homebirths, and form the basis of the Midwives Data Collection records by the Department of Health in NSW (NSW Health, 2001). Specific data collected from the Hospital Birth Register for this study were:

- the length of labour as measured from the onset of regular contractions in combination with cervical dilatation of 3 cm (commencement of the established phase of the first stage of labour) to the birth of the baby (end of second stage of labour). The timing of the commencement of the established phase is estimated by hospital staff using information provided by the woman regarding the timing, strength and frequency of her contractions before hospital admission and objective data obtained by way of cervical dilatation assessment (Cassidy, 1999)

- medical interventions used during the labour process
  - medical augmentation of labour with syntocinon intravenous infusion
  - artificial rupture of membranes (surgical augmentation of labour)

- drugs used during the labour process
  - pethidine injection
  - epidural anaesthesia
• type of birth
  - unassisted vaginal birth
  - forceps or ventouse extraction delivery

• maternal blood loss at birth

• newborn outcomes
  - the baby’s Apgar score at five minutes and
  - baby’s admission to Special Care Nursery following birth.

7.4.4.3 Semi-structured interview

A convenience sub-sample of the first 94 women who agreed to respond to an interview (Eating group = 47, Non-eating group = 47) were questioned by the investigator within two weeks of their birth either by telephone or in person. Each woman was asked, ‘Were you hungry at any time throughout your labour?’ Additional information was also sought as to when and why the woman was or was not hungry during her labour.

7.4.5 Procedure

Nulliparous women, who met the inclusion criteria, were approached in the antenatal clinic at or after 36 weeks gestation, by either the investigator or a midwife employed in the clinic, and given an explanation of the study as well as an ‘Information Form’ to read (Appendix G). Women were encouraged to take the Information Form home and discuss the study with their significant others before
Chapter 7 – Effect of Eating on Labour Duration and Medical Intervention

giving consent. Signed, informed consent was obtained from each study participant (Appendix H). One copy was kept by the woman and a copy was also placed in her medical files. Recruitment details were logged by placing each woman’s medical record addressograph label in the trial’s log book at the time of recruitment. The log book was kept in a locked filing cabinet and was only accessible to the researcher. Outcome details were completed after the birth.

All participants were given a ‘Food and Fluid Record’ form at the time of recruitment. Each form had been allocated a number between 1 and 331 which corresponded with the log book. The investigator or a midwife instructed each woman on the procedure for completing the record, emphasising the information to be included. First, each woman was requested to write the date and time that her labour contractions became regular (this provided a starting point for the measurement of the woman’s estimate of her early phase of labour). To differentiate between pre-labour and the early phase of the first stage of labour, participants were asked to record the time regular contractions commenced in their labour. This time was used as an approximation of the commencement of the early phase of labour. Second, the form was to be completed throughout the labour process by the participant, her support person or persons, the midwife or a combination of these people. Finally, information was given on how to record the date, time, description and amount of food and fluid intake on the Food and Fluid Record form, with each intake being recorded at the time of consumption.

The midwives at each hospital were requested to collect the Food and Fluid Record forms following each birth. The form was to be placed in a box specifically
provided and located at the midwives’ desk in each labour ward for this purpose.

The Food and Fluid Record form was collected by the investigator within two weeks of each birth. Each woman included in the study was contacted, either in person while in hospital or by telephone if they had been discharged from hospital, to verify that the form was complete to the best of their knowledge. Any missing information recalled was added to the form at the time of contact. It was at this stage that women were invited to participate in the semi-structured interview. Those women who agreed provided information regarding their state of hunger during labour which was recorded at the bottom of their Food and Fluid Record form.

7.4.6 Overview of data analysis

Data analysis was performed using STATISTICA statistical package (Statsoft, 2004). The analysis consisted of five distinct stages: (1) sample description, (2) factors influencing eating behaviour, (3) eating, progress and length of labour, (4) eating, medical interventions and birth outcomes, (5) hunger during labour. Each stage compared four groups of women who either:

- ate during the early phase of the first stage of labour only (n = 82)
- ate during the established phase of the first stage of labour only (n = 10)
- ate during both the early and established phases of the first stage of labour (n = 31)
- did not eat at all during labour (Non-eating group, n = 94).
7.4.6.1 Sample description

Demographic differences between the four eating groups were compared using 1-way ANOVA tests (maternal age and gestation) and a chi-square test (ethnicity) to identify pair-wise differences between the group means.

7.4.6.2 Factors influencing eating

To examine the association between the four eating groups and factors that may influence eating behaviour during labour, two-way crosstabulation and chi-square test results are presented for:

- the time of day that labour commenced (partitioned into six-hour intervals)
- the time of day food was eaten during labour (partitioned into 12-hour intervals)
- hospital of birth (Restricted Practice Hospital or Unrestricted Practice Hospital)
- incidence of vomiting
  - between the women who ate during their labour (aggregate data for eating groups) and the non-eating group
  - subgroup analysis for each of the four eating groups for the three phases of the first stage of labour.

Two comparisons of these variables were conducted: the first comparing the four eating groups, and a second, two-group analysis comparing those who ate at any time during the first stage of labour with those who did not eat at all. Follow-up standardised residuals examined differences between the groups for each significant
result. Standardised residuals > ± 1.96 were interpreted as significant deviations from the null hypothesis expected frequencies (consistent with 1.96 as a threshold value for probabilities <.05 on a normal distribution).

For those women who ate food, descriptive information is provided regarding the type of food eaten during both phases of the first stage of labour (early and established).

7.4.6.3 Eating, progress and length of labour

A set of Bonferroni adjusted 1-way ANOVA tests compared the four groups, and follow-up Tukey Hierarchical Significant Difference (HSD) tests for unequal ns (Spjotvoll/Stoline) were used to identify pair-wise differences between the groups where the overall ANOVA test was significant for any of the following variables:

- the number of hours from the start of regular contractions (as documented by the women) to the women’s hospital admission. This was to determine the length of time women laboured at home before transferring to hospital

- the women’s cervical dilatation on admission to hospital

- the length of the *early phase* of the first stage of labour. This was determined by measuring the number of hours between the start of regular contractions (as documented by the women) and the start of the active (established) phase of the first stage of labour (as documented by the midwives)

- the length of the *hospital-estimated* labour (from the commencement of the established phase of first stage of labour to the baby’s birth). This ANOVA
identified the overall difference in labour duration *without* controlling for other likely predictors.

Descriptive statistics are presented for all five predictors (the length of the early phase of labour, women’s eating behaviour, maternal age, fetal position and the mothers’ ethnic background) to be tested against the hospital-estimated labour duration in the hierarchical multiple regression. A hierarchical multiple regression then tested the relationship between eating during the first stage of labour and the hospital-estimated labour duration while controlling for the other four predictor variables. The eating group predictors involved a comparison between women who ate during the early phase only, those who ate during the established phase only, and those who ate during both the early and established phases of labour, against the women who did not eat at all (non-eating group). Fetal position involved a comparison between the occipito-lateral (OL) and occipito-posterior (OP) positions against the occipito-anterior (OA). Ethnicity compared Asian, Middle Eastern and Polynesian backgrounds against Caucasian, with dummy-variable coding used for these categorical variables. The pair-wise regression analysis was performed using 164 to 217 subjects following the removal of missing data (fetal position = 29; length of early phase labour = 53). Missing data for the early phase of labour variable was attributed to an incorrect assessment of the commencement of the established phase of labour by midwives. On some records the time for commencement of the early phase of labour recorded by the women was similar to the time recorded by midwives for the completion of the early phase of labour.
The first step of the hierarchical regression included all predictors except eating behaviour during the first stage of labour. The second step added eating behaviour to determine its incremental effect and significance as a predictor of the hospital-estimated labour duration.

Previous research has not identified the effect fetal position may have on eating behaviour during labour. The possibility of an interactive effect between eating during the first stage of labour and fetal position on subsequent labour duration was explored using a 2-way factorial ANCOVA while controlling for other continuous predictors: early phase of labour duration, maternal age and ethnicity.

7.4.6.4 Eating, medical intervention and birth outcomes

The relationship between eating during the first stage of labour and the incidence of medical interventions and adverse birth outcomes was examined using chi-square tests and Cramer’s phi. The chi-square tests compared the four eating groups for the following medical interventions and birth outcome of 217 subjects.

- medical augmentation
- artificial rupture of membranes
- intravenous therapy for hydration
- pethidine injection
- epidural anaesthesia for labour
- forceps or ventouse delivery
• admission of the newborn to a Special Care Nursery facility.

A hierarchical log-linear analysis further investigated a finding involving the incidence of epidural anaesthesia. Other significant results for chi-square tests on birth outcomes were interpreted via standardised residuals from the 2-way crosstabulations to identify table cells with frequencies that were highly inconsistent with the null hypothesis.

Descriptive statistics for the two ordinal scale variables, baby’s Apgar score at five minutes and maternal blood loss at birth are presented along with a 1-way ANOVA for the continuous variable, maternal blood loss, to compare the means between the four eating groups. Kruskall-Wallis tests, based on the skewness of these two variables, examined the medians to compare for homogeneity of the groups.

7.4.6.5 Hunger during labour

Women’s retrospective accounts of their state of hunger during labour were obtained from the post-birth semi-structured interviews. These were obtained from women in the Eating and Non-eating groups and analysed using content analysis (Beanland et al., 1999; Weber, 1990).

7.4.7 Type I error rate

As a consequence of the multiple chi-square tests used in this study, there is an increased chance of a Type 1 error (Polit & Hungler, 1999). However, because of the exploratory nature of the study, an alpha of .05 was accepted as there was more
interest in the study’s ability to detect a difference when one exists than to miss a
difference between groups by applying a stringent alpha level.

7.5 RESULTS

Data from the 217 women were included in the analyses (114 women were excluded
from the original sample because medical interventions influenced the course of
their labour [i.e., 103 women commenced labour artificially and / or underwent a
caesarean section, and 11 provided information which conflicted with their midwife
regarding the timing of the established phase of labour]).

7.5.1 Sample description

There was no difference between the four groups (eating in early phase only, eating
in established phase only, eating in both early and established phases of labour, and
non-eating) for ethnicity, maternal age and gestation (Table 26). The majority of
women in the study were Caucasian, with small numbers identifying as Asian,
Polynesian and Middle Eastern.
## Table 26 Eating and Non-eating group sample description (N = 217)

<table>
<thead>
<tr>
<th></th>
<th>Eating in early phase only (n = 82)</th>
<th>Eating in established phase only (n = 10)</th>
<th>Eating both early &amp; established (n = 31)</th>
<th>Non-eating group (n = 94)</th>
<th>Differences between groups</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(%)</td>
<td>(%)</td>
<td>(%)</td>
<td>(%)</td>
<td></td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>74</td>
<td>70</td>
<td>68</td>
<td>72</td>
<td>$\chi^2 = 3.69$, df=9, $p = .9304$</td>
</tr>
<tr>
<td>Asian</td>
<td>12</td>
<td>20</td>
<td>19</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Polynesian (Maori/ Islander)</td>
<td>2</td>
<td>0</td>
<td>6</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Middle Eastern</td>
<td>11</td>
<td>10</td>
<td>6</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Age (years)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$F(3, 213)=2.22$, $p = .0865$</td>
</tr>
<tr>
<td>&lt; 20</td>
<td>7</td>
<td>10</td>
<td>3</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>20–29</td>
<td>59</td>
<td>50</td>
<td>87</td>
<td>62</td>
<td></td>
</tr>
<tr>
<td>30–34</td>
<td>14</td>
<td>40</td>
<td>7</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>&gt; 34</td>
<td>2</td>
<td>0</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>25.38</td>
<td>26.00</td>
<td>25.77</td>
<td>23.84</td>
<td></td>
</tr>
<tr>
<td>SD</td>
<td>4.63</td>
<td>5.06</td>
<td>3.53</td>
<td>5.39</td>
<td></td>
</tr>
<tr>
<td>Gestation at birth</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$F(3, 213)=0.35$, $p = .7883$</td>
</tr>
<tr>
<td>(weeks)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 37</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>37–41</td>
<td>99</td>
<td>80</td>
<td>100</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>&gt; 41</td>
<td>0</td>
<td>20</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>39.88</td>
<td>39.67</td>
<td>39.97</td>
<td>39.79</td>
<td></td>
</tr>
<tr>
<td>SD</td>
<td>1.02</td>
<td>0.87</td>
<td>1.15</td>
<td>1.12</td>
<td></td>
</tr>
</tbody>
</table>

* Percentages refer to groups.
7.5.2 Factors influencing eating

Other than comparing women who consumed food with those who did not for the effect on labour duration and medical interventions during labour (Scrutton et al., 1999; Tramner, 1999; Yiannouzis & Parnell, 1994), no study has reported the influence that common factors of labour may have on labouring women’s eating behaviour. Three such factors were analysed to assess their relationship with the incidence of food intake during labour: (1) the time of day that labour commenced, (2) the time of day food was eaten, (3) the hospital in which the women birthed (restrictive or unrestrictive), and (4) the incidence of vomiting. Descriptive information is provided regarding (5) the time of day food was eaten and (6) the type of food eaten by the three groups who ate during the first stage of labour.

7.5.2.1 Time of day labour commenced

For analysis the time of day was grouped into 6 hourly intervals in which the early phase of the first stage of labour commenced. The difference between the four time periods was significant, $\chi^2 = 19.62$, df = 3, $p = .0204$, with the majority of women commencing labour between midnight and 0600 hours (Table 27). Standardised residuals suggest starting labour after the evening meal (1800 hrs) boosted the number of women who did not eat during their labour (+2.02) while reducing the number of women who ate during the early phase only (-2.15). Starting labour after 0600 hours boosted the number of women who ate during both the early and established phases of their labour (+1.99). No other standardised residual was noteworthy, ranging between -1.47 and +1.22.
Table 27 Comparison of eating behaviour and the timing of the start of early labour

<table>
<thead>
<tr>
<th>Commencement of labour at 6-hourly intervals</th>
<th>Eating early only group (n = 82) (%)</th>
<th>Eating established only group (n = 10) (%)</th>
<th>Eating both early &amp; established (n = 31) (%)</th>
<th>Non-eating group (n = 94) (%)</th>
<th>Total per time period (N = 217) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AM 0000 – 0600</td>
<td>55</td>
<td>60</td>
<td>48</td>
<td>49</td>
<td>52</td>
</tr>
<tr>
<td>AM 0600 – 1200</td>
<td>11</td>
<td>0</td>
<td>19</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>PM 1200 – 1800</td>
<td>23</td>
<td>10</td>
<td>13</td>
<td>15</td>
<td>17</td>
</tr>
<tr>
<td>PM 1800 – 0000</td>
<td>11</td>
<td>30</td>
<td>19</td>
<td>32</td>
<td>22</td>
</tr>
</tbody>
</table>

When the timing of the onset of the early phase of labour was examined as two time periods, day (0600 – 1800 hours) and night (1800 – 0600 hours), and compared with women who ate at any time during their labour (3 eating groups combined) and women who did not eat at all, significantly more women, 74% (n = 160), were found to have commenced labour during the night, $\chi^2 = 4.34$, df = 1, $p = .0373$. Of the 160 women, 81% (n = 76) were from the non-eating group and 68% (n = 84) were from the three eating groups.

7.5.2.2 Time of day food was eaten

Women who consumed food during their labour were more likely to do so if they were labouring during the day (between the hours of 0600 and 1800, 72% [n = 156]), than if they laboured during the night (between 1800 and 0600 hours [n = 51]), $\chi^2 = 11.91$, df = 1, $p = .0077$. 

7.5.2.3  Hospital of birth

Of the 217 women included in the analysis, 113 (52%) birthed at the two hospitals where food intake was allowed during labour (Unrestricted Practice Hospitals) and 104 (48%) birthed at the hospitals which restricted women to clear fluids (Restricted Practice Hospitals). Significantly more women who birthed at the URPHs ate food during the first stage of labour (n = 82; 67%) than women who birthed at the RPHs (n = 41; 33%), $\chi^2 = 31.63$, df = 3, $p < .0001$. Standardised residuals suggest women are over-represented in both the RPHs and URPHs compared to frequencies that would occur if hospital practice was unrelated to eating during labour (Table 28).

Birthing at a RPHs appeared to boost the likelihood of a woman not eating during her labour while birthing at an URPH boosted the likelihood of a women eating in both the early and established phases of labour.

<table>
<thead>
<tr>
<th>Type of hospital practice</th>
<th>Eating early only group (n = 82)</th>
<th>Eating established only group (n = 10)</th>
<th>Eating both early &amp; established (n = 31)</th>
<th>Non-eating group (n = 94)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Restricted (n = 104)</td>
<td>- n 34</td>
<td>- 3</td>
<td>- 4</td>
<td>- 63</td>
</tr>
<tr>
<td></td>
<td>- % 41</td>
<td>- 30</td>
<td>- 13</td>
<td>- 67</td>
</tr>
<tr>
<td></td>
<td>- residual -0.85</td>
<td>-0.82</td>
<td>-2.82</td>
<td>2.67</td>
</tr>
<tr>
<td>Unrestricted (n = 113)</td>
<td>- n 48</td>
<td>- 7</td>
<td>- 27</td>
<td>- 31</td>
</tr>
<tr>
<td></td>
<td>- % 59</td>
<td>- 70</td>
<td>- 87</td>
<td>- 33</td>
</tr>
<tr>
<td></td>
<td>- residual 0.81</td>
<td>0.79</td>
<td>2.70</td>
<td>-2.57</td>
</tr>
</tbody>
</table>
Vomiting during labour was unrelated to whether or not women ate food, $\chi^2 = 0.20$, $df = 3, p = .9774$. Twenty-nine per cent ($n = 64$) of the study participants vomited at least once during the first stage of their labour. The number of women who vomited during labour was equal between the women who ate food (29%, $n = 36$) and those who did not (30%, $n = 28$). Episodes of vomiting occurred from 10 minutes to 24 hours after the last food intake. No association was found between the four groups for the incidence of vomiting and the phase of labour in which it occurred, $\chi^2 = 12.22, df = 12, p = .4284$ (Table 29). Standardised residuals showed none to exceed the threshold level $\pm 1.96$; however, the standardised residual 1.80 for eating in the early phase of labour suggested a trend towards vomiting during the active phase of the first stage of labour. All other standardised residual levels ranged from $-1.03$ to $+1.46$ and were unremarkable.

<table>
<thead>
<tr>
<th>Phase of first stage labour</th>
<th>Incidence of vomiting per group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Eating early only group ($n = 82$)</td>
</tr>
<tr>
<td>Did not vomit</td>
<td>(n)</td>
</tr>
<tr>
<td>Early phase</td>
<td>59</td>
</tr>
<tr>
<td>Active phase</td>
<td>13</td>
</tr>
<tr>
<td>Transition phase</td>
<td>5</td>
</tr>
<tr>
<td>2 or more phases</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>0</td>
</tr>
</tbody>
</table>
7.5.2.5 Type of food eaten during the first stage of labour

Fifty-seven per cent (n = 123) of women included in the study ate food during their labour. The following section provides descriptive information regarding the type and amount of food eaten during both phases of the first stage of labour: (1) early and (2) established.

7.5.2.5.1 Early phase

Eating during this phase of labour usually occurred at home. Full meals such as meat and vegetables, spaghetti bolognaise, hot dogs, meat pies, fish and chips, steak, bacon and potato cakes, and McDonalds® meals (such as Big Mac®, chicken burger and fries, apple pie) were consumed by 26% (n = 32) of these women. The remaining 74% (n = 91) consumed light meals such as toast, sandwiches, soup, cereal with milk, biscuits, fruit, cake, ice cream, yoghurt and custard. The Non-eating group had clear fluids only, such as water, cordial, juice, tea or coffee.

7.5.2.5.2 Established phase

Food intake slowed once women entered the established phase of labour. The largest amount of food was consumed at the beginning of this phase of labour (between 4 and 5 cm cervical dilatation). Only one woman was able to eat a full meal at this time in her labour (RPH). From 6 to 7 cm cervical dilatation women consumed very small amounts of light foods only, usually amounting to one or two mouthfuls. From 8 to 10 cm cervical dilatation only 2% of women (n = 3) consumed food. For two of these women this was the first food intake during their labour. Both women were under the effect of epidural anaesthesia at the time of...
eating, one consumed a muffin (size not recorded) while the other ate a cheese and chicken sandwich. Appendix I provides an overview of the foods consumed by women during this phase of labour. The Non-eating group consumed no more than clear fluids throughout this phase of labour.

To summarise, 57% of the sample (n = 123) ate food during the first stage of labour. Women were more likely to consume food when they laboured during the day and when they birthed their baby at an URPH. Food intake decreased as labour progressed. Full meals were consumed during the early phase of labour by 26% of the Eating group. All other food intake was limited to light snacks sometimes amounting to no more than one or two mouthfuls. The incidence of vomiting was comparable between both groups.

7.5.3 Eating, progress and length of labour

Previous research has examined the effect of eating during the established phase of labour and the length of labour (Scrutton et al., 1999; Tramner, 1999; Yiannouzis & Parnell, 1994). However, the influence of food intake during various phases of labour on the progress of labour until the time of hospital admission has not been considered. The relationship between eating and the progress and length of labour at the time of hospital admission and the subsequent labour duration was investigated by four Bonferroni-adjusted, 1-way ANOVAs comparing (1) labour progress for those women who ate and those who did not. This was followed by a hierarchical multiple regression to examine the relationship between (2) eating during labour and the hospital-estimated labour duration while controlling for other relevant variables. Lastly, a factorial ANCOVA was used to determine if there was
an interactive effect between (3) the position of the fetus and eating behaviour on the length of labour while controlling for age, ethnicity and early labour duration.

7.5.3.1 Eating during labour and labour progress

To determine the effect of eating during the first stage of labour and the progress and duration of labour four outcomes were analysed: (1) the number of hours from the start of labour to the hospital admission, (2) the woman’s cervical dilatation at the time of hospital admission, (3) the length of the early phase of labour and (4) the length of the hospital-estimated labour. Three of the following analyses contained all 217 subjects; however, only 164 subjects were analysed for the length of the early phase of labour because of missing data (see p.197).

Descriptively, the women who ate food during both the early and established phases of labour appeared to have, on average, the longest period between the start of their labour and hospital admission, early phase of labour and hospital-estimated labour length. Women in the Non-eating group experienced the shortest average period for each of these outcomes. These women were also further progressed in labour, according to their cervical dilatation, on admission to hospital while women who ate during the early phase only were the least progressed for this measurement (Table 30).
### Table 30 Descriptive statistics for the progress of labour between groups

<table>
<thead>
<tr>
<th>Eating Groups</th>
<th>Start of labour to hospital admission (in hours) (n = 217)</th>
<th>Dilatation at hospital admission (in cm) (n = 217)</th>
<th>Start of labour to end of the early phase of labour (in hours) (n = 164)</th>
<th>Hospital-estimated labour (in hours) (n = 217)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eating during early phase of labour only (n = 82)</td>
<td>M 8.72 SD 6.67 Min 0 Max 32.00 Mdn 6.50</td>
<td>M 2.74 SD 1.45 Min 0 Max 7.00 Mdn 3.00</td>
<td>M 9.99 SD 8.14 Min .018 Max 38.50 Mdn 7.00</td>
<td>M 9.75 SD 4.40 Min 2.20 Max 22.82 Mdn 9.37</td>
</tr>
<tr>
<td>Eating during established phase only (n = 10)</td>
<td>M 4.60 SD 1.94 Min 1.00 Max 8.00 Mdn 4.75</td>
<td>M 3.70 SD 1.83 Min 1.00 Max 7.00 Mdn 4.00</td>
<td>M 8.23 SD 10.00 Min 1.47 Max 25.67 Mdn 3.50</td>
<td>M 10.38 SD 3.32 Min 2.80 Max 14.12 Mdn 10.74</td>
</tr>
<tr>
<td>Eating during both early &amp; established phases (n = 31)</td>
<td>M 10.50 SD 11.08 Min 0 Max 58.50 Mdn 9.00</td>
<td>M 3.42 SD 2.06 Min 1.00 Max 10.00 Mdn 4.00</td>
<td>M 12.81 SD 13.58 Min 0.27 Max 57.53 Mdn 8.00</td>
<td>M 11.03 SD 5.26 Min 2.47 Max 22.10 Mdn 10.62</td>
</tr>
<tr>
<td>Non-eating Group (n = 94)</td>
<td>M 4.20 SD 4.18 Min 0 Max 20.00 Mdn 3.00</td>
<td>M 3.83 SD 2.45 Min 0 Max 10.00 Mdn 3.00</td>
<td>M 6.45 SD 7.63 Min 0.17 Max 48.50 Mdn 4.00</td>
<td>M 7.40 SD 2.97 Min 2.17 Max 16.27 Mdn 7.31</td>
</tr>
</tbody>
</table>

#### 7.5.3.1.1 Number of hours from start of labour to hospital admission

There were significant differences between at least some of the four groups for the number of hours women spent at home in labour before transferring to hospital, $F(3, 213) = 11.21, p < .0001$. Follow-up Tukey HSD tests found that the Non-eating group had a significantly lower mean for this period of labour when compared with
women who ate during either the early phase of labour only or during both the early and established phases, \( p = .0001 \) and \( p = .0008 \) respectively. Women who ate during the early phase of labour spent significantly more time at home before admitting themselves to hospital than women in the Non-eating group and women who ate during the established phase of labour only (Table 30). Compared with women who did not eat during labour, women who ate during the early phase laboured, on average, 5.5 hours longer at home before hospital admission. The length of time women spent at home before hospital admission is an outcome that has not been reported previously.

7.5.3.1.2 Cervical dilatation at the time of hospital admission

According to cervical dilatation on admission to hospital, women who ate during their labour tended to transfer to hospital earlier than the Non-eating group, with 89% being admitted to hospital by 4 cm cervical dilatation compared with 68% of the Non-eating group (Table 31).

<table>
<thead>
<tr>
<th>Cervical Dilatation</th>
<th>Eating during early phase only (n = 82) (%)</th>
<th>Eating during established only (n = 10) (%)</th>
<th>Eating both early &amp; established (n = 31) (%)</th>
<th>Non-eating group (n = 94) (%)</th>
<th>Total Sample (N = 217) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 2 cm</td>
<td>40</td>
<td>30</td>
<td>52</td>
<td>23</td>
<td>38</td>
</tr>
<tr>
<td>3 – 4 cm</td>
<td>45</td>
<td>50</td>
<td>41</td>
<td>45</td>
<td>46</td>
</tr>
<tr>
<td>5 – 7 cm</td>
<td>15</td>
<td>10</td>
<td>7</td>
<td>22</td>
<td>14</td>
</tr>
<tr>
<td>8 – 10 cm</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>10</td>
<td>2</td>
</tr>
</tbody>
</table>
The women’s cervical dilatation was significantly different between at least two of the four groups, $F(3, 213) = 4.26, p = .0061$. Although women who ate during the early phase of labour stayed at home, on average, twice as long before transferring to hospital than the women who did not eat, follow-up Tukey HSD tests found that the Non-eating group had a significantly higher mean cervical dilatation, 3.8 cm, on admission to hospital when compared with women who ate during the early phase of labour only, 2.7 cm, $p = .0037$. No other pair-wise comparisons between any eating group were significant for cervical dilatation, $p \geq .5607$. The women who did not eat progressed significantly further in their labour according to the mean admission cervical dilatation measurement (Table 30), an outcome not reported before.

7.5.3.1.3 The length of the early phase of labour

When the four groups were compared for the length of the early phase of labour significant differences emerged, $F(3, 213) = 3.44, p = .0182$. A follow-up Tukey HSD test found that women who ate food during both the early and established phases of labour had a significantly longer mean early phase of labour when compared with women who did not eat at all, $p = .0389$. No other pair-wise comparisons were significant for duration of the early phase of labour, $p \geq .1612$. On average, the women who ate food laboured for two to six hours longer in the early phase of labour than the women who did not eat at all (Table 30).

7.5.3.1.4 Eating during labour and hospital-estimated length of labour

There was a difference between the four eating groups for the mean hospital-estimated length of labour, $F(3, 213) = 9.30, p < .0001$. A follow-up Tukey HSD
test demonstrated that women who ate during the early phase only or during both the early and established phases of labour, on average, laboured for 2 to 4 hours longer respectively during the hospital-estimated length of labour when compared with women who did not eat at all, $p = .0008$ and $p = .0017$ (Table 30). All other pairwise comparisons were nonsignificant, $p \geq .3278$. Although the minimum hospital-estimated length of labour was similar between the four eating groups, the maximum mean length was longer by 6 hours for women who consumed food during the early phase of labour (Table 30).

Contrary to the study’s hypothesis (see p.186), eating food during labour, particularly the early phase, was associated with both a longer early phase of labour and a longer hospital-estimated length of labour.

### 7.5.3.2 Predicting relationship between eating during labour and hospital-estimated length of labour

Although univariate analysis demonstrated that eating food lengthens both the early phase of the first stage of labour and the hospital-estimated labour, this type of analysis does not control for potentially confounding variables. A hierarchical multiple regression was used to predict the unique, direct effect that eating food has on the hospital-estimated labour length when five predictor variables are controlled: (1) maternal age, (2) ethnicity, (3) eating behaviour during labour (early only, established only, both early & established, non-eating), (4) fetal position during labour (OA, OL, OP) and (5) the length of the early phase of labour.
Ethnicity was dummy coded because categorical predictor variables, such as ethnicity, cannot be entered directly into a regression model (Stoekburger, 2003). Caucasian ethnicity was used as the reference group for the other three ethnic groups. The three new ethnic categories were contrasted with the Caucasian group (Cohen & Cohen, 1983). Dummy coding was also used for the variables *fetal position* and *eating during labour* with the anterior fetal position and non-eating group being the reference groups.

### 7.5.3.2.1 Descriptive statistics for labour length predictors

A total of 217 women were included for the following descriptive statistics of the eating groups. Missing data allowed 183 women only in the descriptive statistics for fetal position and 164 women for the length of the early phase of labour (pair-wise deletion removed 29 women who did not have the fetal position for labour recorded in their medical records and 53 women who were unable to provide an estimate of the early phase of their first stage of labour). The majority of women (72%) were Caucasian. The mean length of the early phase of the first stage of labour was 9.18 hours, the mean maternal age of the sample was 24.8 years (Table 32) and the fetus most commonly assumed the occipito-lateral position for labour (Table 33).
Chapter 7 – Effect of Eating on Labour Duration and Medical Intervention

Table 32  
Descriptive statistics for maternal age and gestation

<table>
<thead>
<tr>
<th>N = 217</th>
<th>M</th>
<th>SD</th>
<th>Min</th>
<th>Max</th>
<th>Mdn</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal Age (in years)</td>
<td>24.80</td>
<td>4.91</td>
<td>16.00</td>
<td>41.00</td>
<td>24.00</td>
</tr>
<tr>
<td>N = 164</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length of the early phase of first stage labour (in hours)</td>
<td>9.18</td>
<td>9.46</td>
<td>0.17</td>
<td>57.53</td>
<td>6.50</td>
</tr>
</tbody>
</table>

Descriptively, the Polynesian ethnicity was associated with a longer labour than the other three ethnic groups. This descriptive impression is tested against Caucasian ethnicity in the forthcoming regression analysis (Table 34). Women who ate during both the early and established phases of the first stage of labour experienced the longest mean labour length while women who did not eat at all had the shortest mean labour duration. Women whose fetus assumed an occipito-anterior position for labour experienced the shortest mean labour length while women whose fetus assumed the occipito-posterior position experienced the longest mean labour (Table 33).
Table 33 Descriptive statistics for predictors ethnicity, eating and fetal position in relation to hospital estimated length of labour

<table>
<thead>
<tr>
<th></th>
<th>Hospital-estimated length of labour (in hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
</tr>
<tr>
<td>Caucasian</td>
<td>157</td>
</tr>
<tr>
<td>Asian</td>
<td>32</td>
</tr>
<tr>
<td>Polynesian</td>
<td>9</td>
</tr>
<tr>
<td>Middle Eastern</td>
<td>19</td>
</tr>
<tr>
<td>Eating in early phase only</td>
<td>82</td>
</tr>
<tr>
<td>Eating in established phase only</td>
<td>10</td>
</tr>
<tr>
<td>Eating in both early &amp; established phases</td>
<td>31</td>
</tr>
<tr>
<td>Non-eating group</td>
<td>94</td>
</tr>
</tbody>
</table>

|                      |      |      |      |
| OA position of fetus | 46   | 26   | 6.95 | 2.99 | 2.20 | 15.53| 6.22 |
| OL position of fetus | 85   | 46   | 9.09 | 4.02 | 2.57 | 19.53| 8.75 |
| OP position of fetus | 52   | 28   | 11.54| 4.50 | 3.77 | 22.82| 11.03|

7.5.3.2.2 Multivariate statistics for predicting labour length

The zero-order correlation matrix upon which the following hierarchical multiple regression is based is located in Appendix J. The hierarchical regression analysis contained a sample of between 164 to 217 women (fetal position not recorded for 29 women and estimate of the early phase of labour not provided by 53 women). Using this regression analysis to control for other likely predictors of hospital-estimated labour duration, it was found that the length of the early phase of the first stage of labour, the women’s age and ethnic group and fetal position significantly predicted subsequent labour duration, $F(7, 131) = 3.99$, $p = .0005$. For this initial model,
which omitted the women’s eating or abstinence, multiple $R = .42$, with adjusted $R^2 = .13$ and $SE$ of the estimate = 3.89, indicating that these five predictors accounted for only 13% of hospital-estimated labour duration variance.

The second stage of the analysis added the three eating group variables, which recorded whether or not the women ate during the early phase only, the established phase only, or both the early and established phases of the first stage of labour. Adding these variables increased the prediction of the hospital-estimated labour significantly, $p < .0001$, with multiple $R = .51$. The eating variables increased the adjusted $R^2$ by only .07 to give a final value of $R^2 = .20$, indicating the eating factor accounted for an additional 7% of the hospital-estimated labour duration. The second-stage final model as a whole was significant, $F(10, 128) = 4.53$, $p < .0001$, with $SE$ of estimate = 3.72. Table 34 and Table 35 show regression results, and the zero-order ($r$), partial ($pr$) and semi-partial correlations ($sr$) between predictors and hospital-estimated labour for the second-stage model which included eating. The significant predictors were: (1) eating during the early phase of labour only, (2) eating during both the early and established phases of labour compared with the non-eating group and (3) the OP fetal position compared with OA. Eating during the early phase of labour alone added just over 2 hours to the hospital-estimated labour duration, while eating during both the early and established phases of labour added 3.5 hours. The OP position added an average of nearly 4 hours to the hospital-estimated labour duration. Maternal age, gestation, OL fetal position compared with OA, and Asian, Polynesian or Middle Eastern ethnicity compared with Caucasian, all had no significant direct effect on subsequent labour duration. Importantly, the apparent effect of eating during the early phase of labour on the
hospital-estimated labour length identified in the above ANOVA was maintained when the regression analysis controlled for other predictors. Eating during the early phase of labour was associated with an increased hospital-estimated labour duration independent of other measured factors in this study.

Table 34  Regression summary for dependent variable: hospital-estimated length of labour in hours

<table>
<thead>
<tr>
<th>Predictors</th>
<th>N</th>
<th>B</th>
<th>SE of B</th>
<th>Beta</th>
<th>SE of Beta</th>
<th>t (128)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>5.66</td>
<td>1.70</td>
<td></td>
<td>3.3</td>
<td>.0011</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maternal Age</td>
<td>217</td>
<td>0.03</td>
<td>0.08</td>
<td>0.03</td>
<td>0.07</td>
<td>0.4</td>
<td>.6649</td>
</tr>
<tr>
<td>Asian</td>
<td>217</td>
<td>0.03</td>
<td>0.08</td>
<td>0.31</td>
<td>0.92</td>
<td>0.3</td>
<td>.7388</td>
</tr>
<tr>
<td>Polynesian</td>
<td>217</td>
<td>0.08</td>
<td>0.08</td>
<td>1.76</td>
<td>1.62</td>
<td>1.1</td>
<td>.2786</td>
</tr>
<tr>
<td>Middle Eastern</td>
<td>217</td>
<td>0.00</td>
<td>0.08</td>
<td>0.02</td>
<td>1.14</td>
<td>0.0</td>
<td>.9829</td>
</tr>
<tr>
<td>Eating early phase only</td>
<td>217</td>
<td>0.25</td>
<td>0.09</td>
<td>2.16</td>
<td>0.74</td>
<td>2.9</td>
<td>.0043 *</td>
</tr>
<tr>
<td>Eating established phase only</td>
<td>217</td>
<td>0.12</td>
<td>0.08</td>
<td>2.28</td>
<td>1.57</td>
<td>1.5</td>
<td>.1492</td>
</tr>
<tr>
<td>Eating both early &amp; established phases</td>
<td>217</td>
<td>0.29</td>
<td>0.09</td>
<td>3.49</td>
<td>1.02</td>
<td>3.4</td>
<td>.0008 *</td>
</tr>
<tr>
<td>Length of early phase of first stage labour</td>
<td>164</td>
<td>0.15</td>
<td>0.08</td>
<td>0.07</td>
<td>0.04</td>
<td>1.9</td>
<td>.0569</td>
</tr>
<tr>
<td>OL position</td>
<td>183</td>
<td>0.13</td>
<td>0.10</td>
<td>1.11</td>
<td>0.83</td>
<td>1.3</td>
<td>.1854</td>
</tr>
<tr>
<td>OP position</td>
<td>183</td>
<td>0.43</td>
<td>0.10</td>
<td>3.97</td>
<td>0.91</td>
<td>4.4</td>
<td>&lt;.0001 *</td>
</tr>
</tbody>
</table>

*  $p < .01$

Partial and semipartial correlations show the unique, correlational relationships to the hospital-estimated length of labour. The OP position of the fetus during labour had the highest partial correlation followed by eating during both the early and established phases of labour (Table 35). All correlations were low with the exception of the OP position (Wilson & McCormick, 1992).
Chapter 7 – Effect of Eating on Labour Duration and Medical Intervention

Table 35 Partial and semipartial correlations between hospital-estimated length of labour and predictors

<table>
<thead>
<tr>
<th>Variables</th>
<th>Correlation</th>
<th>Partial correlation</th>
<th>Semipartial correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal age</td>
<td>0.12</td>
<td>0.04</td>
<td>0.03</td>
</tr>
<tr>
<td>Asian</td>
<td>0.02</td>
<td>0.03</td>
<td>0.03</td>
</tr>
<tr>
<td>Polynesian</td>
<td>0.04</td>
<td>0.10</td>
<td>0.08</td>
</tr>
<tr>
<td>Middle Eastern</td>
<td>0.03</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Eating during early phase</td>
<td>0.15</td>
<td>0.25</td>
<td>0.22</td>
</tr>
<tr>
<td>Eating in established phase</td>
<td>0.08</td>
<td>0.13</td>
<td>0.11</td>
</tr>
<tr>
<td>Eating in early &amp; established phases</td>
<td>0.20</td>
<td>0.29</td>
<td>0.26</td>
</tr>
<tr>
<td>Length of early phase labour</td>
<td>0.04</td>
<td>0.17</td>
<td>0.15</td>
</tr>
<tr>
<td>OL position</td>
<td>0.03</td>
<td>0.12</td>
<td>0.10</td>
</tr>
<tr>
<td>OP position</td>
<td>0.34</td>
<td>0.36</td>
<td>0.33</td>
</tr>
</tbody>
</table>

- Significant at $p < .01$

7.5.3.3 Predicting relationship between fetal position and eating during labour

A separate 2-way factorial ANCOVA was performed to determine whether there was a relationship between the fetal position and eating during labour and the length of labour when the early phase of labour duration, maternal age and gestation period were controlled, $F(5, 125) = 1.66, p = .1481$. No association was found between fetal position and eating during labour on subsequent labour duration.

7.5.4 Eating, medical interventions and birth outcomes

It was hypothesised that eating during labour reduced the incidence of medical interventions and improved birth outcomes (see p.186). The four eating groups were compared for the incidence of medical interventions during labour and various birth outcomes using chi-square tests and Cramer’s phi (Polit & Hungler, 1999) – see Table 36. As maternal blood loss and newborn Apgar scores were ordinal scales,
they were analysed separately. There were 217 cases included in all but one univariate analysis. The maternal blood loss variable had 214 cases because of missing data.

The percentage of women in the four eating groups who experienced medical interventions and various birth outcomes during their labour are shown in Table 36. Chi-square tests found women who ate food during their labour had a significantly higher rate of medical augmentation and epidural anaesthesia. However, regardless of the significance level, using 0.4 as the threshold for a moderate effect for a Cramer’s phi, the strength of the relationship is very low (Statsoft, 2004).

Kruskall-Wallis nonparametric tests found no significant difference between the four eating groups for the newborn 5-minute Apgar score and maternal blood loss at birth indicating the population median for the four groups was homogenous (Table 36). Median tests conducted on these two variables were also nonsignificant, $\chi^2 \geq 0.49$, $df = 3$, $p \geq .6291$. Maternal blood loss, being a continuous variable, was also tested using a 1-way ANOVA which demonstrated that there was also no significant difference between the group means, $F(3, 210) = 1.34$, $p = .2631$. 
Chapter 7 – Effect of Eating on Labour Duration and Medical Intervention

Table 36 Comparison of medical interventions between eating groups (N = 217)

<table>
<thead>
<tr>
<th>Eating early only group (n = 82)</th>
<th>Eating established only group (n = 10)</th>
<th>Eating both early &amp; established (n = 31)</th>
<th>Non-eating group (n = 94)</th>
<th>( \phi )</th>
<th>( \chi^2 )</th>
<th>( p )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical augmentation</td>
<td>30 (40)</td>
<td>42 (26)</td>
<td>18 (18)</td>
<td>.17</td>
<td>8.62</td>
<td>.0348 *</td>
</tr>
<tr>
<td>Artificial ruptured membranes</td>
<td>44 (30)</td>
<td>39 (26)</td>
<td>39 (26)</td>
<td>.11</td>
<td>6.88</td>
<td>.0758</td>
</tr>
<tr>
<td>Pethidine (IMI)</td>
<td>56 (61)</td>
<td>61 (52)</td>
<td>61 (52)</td>
<td>.07</td>
<td>2.00</td>
<td>.6316</td>
</tr>
<tr>
<td>Epidural anaesthesia</td>
<td>12 (29)</td>
<td>29 (12)</td>
<td>29 (12)</td>
<td>.17</td>
<td>10.54</td>
<td>.0145 *</td>
</tr>
<tr>
<td>Intravenous therapy for hydration</td>
<td>16 (0)</td>
<td>16 (12)</td>
<td>16 (12)</td>
<td>.07</td>
<td>2.41</td>
<td>.4917</td>
</tr>
<tr>
<td>Forceps/Ventouse</td>
<td>23 (23)</td>
<td>23 (16)</td>
<td>23 (16)</td>
<td>.09</td>
<td>3.92</td>
<td>.2698</td>
</tr>
<tr>
<td>Admission to Special Care Nursery</td>
<td>5 (3)</td>
<td>3 (7)</td>
<td>3 (7)</td>
<td>.06</td>
<td>1.63</td>
<td>.6530</td>
</tr>
</tbody>
</table>

\( df = 3 \)

<table>
<thead>
<tr>
<th>5-minute Apgar score</th>
<th>Skew</th>
<th>H (3, 217)</th>
<th>( p )</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Mean</td>
<td>8.99</td>
<td>8.70</td>
<td>8.74</td>
</tr>
<tr>
<td>- SD</td>
<td>0.60</td>
<td>0.95</td>
<td>1.06</td>
</tr>
<tr>
<td>- Min</td>
<td>6.00</td>
<td>7.00</td>
<td>6.00</td>
</tr>
<tr>
<td>- Max</td>
<td>10.00</td>
<td>10.00</td>
<td>10.00</td>
</tr>
<tr>
<td>- Median</td>
<td>9.00</td>
<td>9.00</td>
<td>9.00</td>
</tr>
</tbody>
</table>

Maternal blood loss (mL)

| - Mean               | 241.98   | 256.00     | 294.83 | 234.57 |
| - SD                 | 148.84   | 146.53     | 193.35 | 121.16 |
| - Min                | 50.00    | 60.00      | 100.00 | 50.00 |
| - Max                | 1200.00  | 500.00     | 1100.00| 800.00 |
| - Median             | 200.00   | 200.00     | 250.00 | 200.00 |

\( ^* p < .05 \)

On further examination of the significant medical augmentation effect, the standardised residuals showed none of the eating groups to exceed the threshold
level for significance of a standardised residual outside the range -1.96 to +1.96. However, the standardised residual -1.69 for medical augmentation and women who did not eat at all during labour (i.e., less likely to require augmentation) and the standardised residual +1.58 for medical augmentation and the group of women who ate during both the early and established phases of labour (i.e., more likely to require augmentation) shows a trend for medical augmentation to be associated with these two groups. All other standardised residuals were unremarkable ranging from –0.47 to +1.03.

The significant association between epidural anaesthesia and eating during the established phase of labour required further examination. As shown on page 203, hospital policy regarding oral intake is strongly associated with eating during labour. Beyond these findings, the epidural rate during labour was three times greater in one URPH when compared with the other three hospitals in the study (see p.120). As a result, the apparent effect of eating during labour on the incidence of epidural anaesthesia could be an artefact of the hospital. To examine this issue further, a hierarchical log-linear analysis was conducted on the 3-way cross-tabulation involving hospital policy, eating and epidural to determine whether the epidural-by-eating effect held when controlling for the hospital policy. This analysis found that the observed 3-way table could be reproduced from a model which allowed for a relationship between eating behaviour and hospital policy (see p.204), and a relationship between hospital policy and epidural but, crucially, without any relationship between eating and the incidence of epidural ($\chi^2 = 5.76, df = 6, p = .4507$). Therefore, the eating-by-epidural effect seen in the 2-way cross-tabulation
disappears when the hospital policy is included in the model. More specifically, according to the log-linear analysis, the marginal association (i.e., not controlling for hospital policy) between eating and epidural was significant ($\chi^2 = 10.01, df = 3, p = .0185$) whereas the partial association (which accounts for hospital policy) was not significant ($\chi^2 = 5.65, df = 3, p = .1299$). This analysis suggests that other differences in hospital practice among the eating groups could readily account for the apparent association between eating and epidural, and there appears to be no relationship between eating and epidural that is independent of the hospital.

To summarise, no medical intervention or birth outcome was found to be associated with eating during labour on univariate analysis, which was upheld when further examined for influential effects or differences between the individual groups.

7.5.5 Women’s retrospective account of hunger during labour

A convenience sub-sample of 94 women (RPH n = 47; URPH n = 47) from among the total sample (N = 217) was interviewed, either in person or by telephone, within two weeks of their birth experience. Each woman was asked one main question: ‘Were you hungry at any time throughout your labour?’ These women were further probed for information about when they were hungry or not hungry, and why they did or did not eat during labour.

A content analysis was used to analyse the views of the women regarding their need for, or disinterest in, food during their labour (Cavanagh, 1997; Weber, 1990). The responses to the open-ended questions were read several times to ensure familiarisation with the content. The data were hand coded and themes derived.
Chapter 7 – Effect of Eating on Labour Duration and Medical Intervention

The themes were placed into two categories pertaining to the views expressed by the women. The frequencies and percentages for each category were calculated (Weber, 1990). The text was coded by a second person using the same coding method to provide inter-rater reliability (Weber, 1990) which gave 100% agreement.

Thirty-two per cent of women responded that they were hungry at some period during their labour while 68% stated that they were not hungry at any time during their labour. Fewer women complained of hunger if they birthed at an URPH (Table 37).

Table 37 Comparison of women who experienced hunger in the RPHs and URPHs (N = 94)

<table>
<thead>
<tr>
<th></th>
<th>Hungry (n = 30)</th>
<th>Not hungry (n = 64)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(n) (%)</td>
<td>(n) (%)</td>
</tr>
<tr>
<td>Restricted practice hospital (RPH)</td>
<td>21 70</td>
<td>26 41</td>
</tr>
<tr>
<td>Unrestricted practice hospital (URPH)</td>
<td>9 30</td>
<td>38 59</td>
</tr>
</tbody>
</table>

The majority of women, 93% (n = 28), who stated that they had been hungry, laboured between 0600 hours and 1800 hours. Only one woman who laboured overnight stated that she was hungry. Seven women complained of being hungry during both the early and established phases of the first stage of their labour (Table 38).
Table 38  Descriptive statistics for time of day, stage of labour and women’s experience of hunger

<table>
<thead>
<tr>
<th>Hungry during labour (N = 30)</th>
<th>Time of day</th>
<th>(n)</th>
<th>(%)</th>
<th>(n)</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0600 – 1800</td>
<td>1800 – 0600</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Early phase of labour</td>
<td>25</td>
<td>3</td>
<td>83</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Established phase of labour</td>
<td>10</td>
<td>3</td>
<td>33</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

Of the women who stated that they were hungry during their labour 50% (n = 15) reported that they had requested food and had been refused by staff. One woman birthed at an URPH while 14 birthed at RPH. The remaining 50% of women, despite stating that they had been hungry during labour, added that they did not want to eat anything because they were experiencing nausea, a quick labour or too much pain.

Responses to the interview question provided two categories: ‘I was hungry’ (32%) and ‘I was not hungry’ (68%) during labour.

7.5.5.1  ‘I was hungry’

Of the respondents (R.) who reported being hungry during their labour only two (7%) stated they ate any food: for example, ‘I felt hungry all the way through my labour so I ate’ (R.156, RPH); ‘I didn’t eat at first because you shouldn’t eat in labour but I was hungry so I had 2 shortbread biscuits…a little later I was still hungry so I ate a ‘Snickers’ bar [chocolate] ’ (R.251, URPH).
The remaining 28 women stated that they did not eat despite feeling hungry during their labour. There were three reasons given for not eating when hungry: (1) not allowed to eat, (2) unable to eat, (3) caesarean section risk.

7.5.5.1.1 Not allowed to eat

The most common reason (54%) given for not eating when hungry during labour centred around the respondent not being allowed to eat (RPH n = 14; URPH n = 1). One woman commented, ‘I had nothing to eat all day because of hospital policy, but I did feel hungry around lunchtime and thirsty’ (R.27, RPH). A response from another woman was, ‘I was starving all morning, I begged the midwife for food’ (R.49, RPH).

As a result of the RPHs’ ‘usual practice’ labouring women were not permitted any food. When two of the women complained of being hungry and were refused anything to eat they obtained food by other means, unbeknown to their midwife.

The first of these women recounted the following: ‘I was starving all the way through labour but not allowed to eat. My family went out and bought me McDonald’s but the midwife wouldn’t let them bring it into me…so my boyfriend snuck in an apple pie in his pocket’ (R.40, RPH). This woman had a cervical dilatation of only 2 cm (early phase of labour) and had not eaten any dinner when this incident occurred at 2200 hours. Her baby was not born for another 12 hours.

The second woman had laboured at home in prelabour for 24 hours and had not eaten for 17 hours before coming to the hospital. Her cervical dilatation was approximately 4 cm at the time of the incident and she did not birth for another ten
hours. This woman reported: ‘I was starving but not allowed to eat when I was in hospital, I was even refused a biscuit. I was so upset... that my husband bought me a sandwich from the shop, but the midwife would not let me have it’ (R.124, RPH).

7.5.5.1.2 Unable to eat

The second most common reason (43%) for not eating when hungry during labour was that labour was too fast, too painful, or the woman was too busy to eat (RPH n = 6; URPH n = 6). Two examples provided were, ‘I felt hungry but the pain turned me off eating’ (R.1, RPH); ‘The labour was very quick, there was not enough time to think about eating or drinking’ (R.300, URPH). In short, these women were not able to eat because their labour was too intense.

7.5.5.1.3 Caesarean section risk

When one woman was refused food at an URPH a medically-indicated reason was given: ‘I wasn’t allowed to eat because my baby was in distress and they thought I might have to have a caesar [caesarean section]’ (R.160). A caesarean section did not eventuate in this case but the midwife had observed a factor which called for risk management: this included restricting oral intake in anticipation of a general anaesthetic.

7.5.5.2 ‘No, I was not hungry’

Sixty-eight per cent of the interviewees stated they were not hungry during their labour. These women did not want to eat even when food was provided: for example, ‘I didn’t feel like eating anything’ (R.117, RPH). Another woman
explained that, ‘It was suggested that I eat something about dinner time but I just couldn’t’ (R.258, URPH). One woman stated that she ‘had no desire to eat or drink and what I had, I was forced to have [by my mother] ’ (R.73, RPH).

Twelve per cent of these women stated their reason for not wanting any food during labour was that they were experiencing nausea or vomiting: for example, ‘I wasn’t hungry during labour…the gas made me vomit’ (R.127, RPH); ‘No, I wasn’t hungry. The gas made me feel nauseous but I did not vomit’ (R.197, URPH). In short, many women were just not interested in food during their labour.

Of the 94 women interviewed retrospectively, one-third reported they were hungry during their labour; half these women, however, said they did not want to eat any food because they were nauseous or having a quick labour. The remaining women who stated they were hungry were denied food by their midwife. In the majority of cases these women were patients at the RPHs.

7.6 DISCUSSION

This comparative study aimed to investigate the maternal and newborn outcomes of low-risk, nulliparous women by comparing those who voluntarily ate food during labour with women who chose not to eat. It was hypothesised that the hospital-estimated length of labour, the incidence of medical interventions and various birth outcomes would be reduced by the consumption of food during labour.

Women were recruited at the end of pregnancy and assigned to either the eating or non-eating group following birth, depending on whether they ate food or did not eat
food during the first stage of their labour. This study expands on previous research findings in that it allowed an observation of the naturally occurring eating behaviour of women from the commencement of their early phase of labour to the birth of their baby. All other studies randomly assigned women to groups, Eating or Non-eating, and all but one recruited their subjects on admission to hospital in established labour (Rodwell, 1992; Scrutton et al., 1999; Yiannouzis & Parnell, 1994) with the result that women may have eaten whether or not they were hungry or nauseated. Women were found more likely to eat food during the early phase of the first stage of labour in the current study. Only a small percentage of women chose to eat any food during the established phase. The results demonstrated that:

1. Women who ate food during the early phase of labour had a 2-hour longer hospital-estimated labour, $p = .0043$.

2. Women who ate food during both the early and established phases of labour had a longer early phase of labour, $p = .0389$, and a 3.5-hour longer hospital-estimated labour duration, $p = .0008$.

3. The hospital-estimated labour was also longer (4 hours) when the fetus assumed the occipito-posterior position during labour, $p < .0001$, independent of whether or not the woman ate during labour.

4. Eating food during labour was not associated with the incidence of medical interventions or birth outcomes.

5. There was no difference in the number of women who vomited regardless of eating behaviour or the timing of the last food intake ($p = .9774$).
6. Birthing at a hospital that allowed food during labour, \( p \leq 0.001 \), and labouring during the day instead of the night, \( p = 0.0204 \), increased the likelihood of food consumption during labour. The incidence of eating decreased as labour progressed, regardless of the hospital of birth.

7. Women tended to feel hungry if they had a long labour and were not interested in eating when they had a short labour or were nauseated.

This discussion considers the factors which may have influenced the women’s decision to eat or not eat, the association between eating food during labour and the length of labour, and the incidence of medical interventions and vomiting.

7.6.1 Who ate what, when, and why

Of the 217 women included in this study 57% ate food during the first stage of their labour. The majority of women who ate food did so while at home, during the day and around customary meal and snack times. The majority of women who ate did so during the early phase of labour only (67%), a finding supported by previous research (Tranmer, 1999). Women may have eaten during this phase of labour because their contractions were mild, they were in the comfort of their own home, foods of their choice were available and their normal daily routine included eating at regular intervals. Although a quarter of the women who ate food during the early phase of their labour consumed full meals, the majority ate small to scant portions of light foods only. The amount of food eaten during this time was most likely regulated by the intensity of their labour. A slow, weak labour may have allowed
women to feel comfortable eating a full meal, whereas food intake was naturally reduced to smaller portions of light-type foods as their labour intensified.

Women were also less likely to eat during labour when: (1) labour was ‘too quick’ or ‘too painful’, (2) they were experiencing nausea or vomiting and (3) the ‘usual practice’ at the hospital of birth did not allow any food. Two-thirds of the women interviewed following their birth stated they were not hungry during their labour. The women who reported not eating because their labour was ‘too painful’ or ‘too quick’ tended to have the shorter labours. A rapid labour, intense painful contractions and nausea and vomiting are known appetite suppressants. Hypothalamic neurons inhibit appetite during labour in response to metabolic cues such as pain, anxiety (Malick, Jakubowskim, Elmquist, Saper, & Burstein, 2001) and nausea (Tortora & Anagnostakos, 1990); therefore, it is not surprising that women experiencing these symptoms were not interested in eating.

Although most food intake occurred while the women were at home, it was of interest to note that women who birthed at the hospitals allowing food during labour were more likely to eat during the early phase of their labour than the women who birthed at hospitals which restricted oral intake. This would suggest that many women, regardless of the hospital of birth, had been informed about the consumption of food during labour. Prenatal education by hospital staff, either through childbirth classes or during their antenatal visits, is the most likely explanation for this finding.
7.6.2 Eating and its association with labour length

The hypothesis that eating shortened labour was not supported by the results. Enkin et al. (2000) has suggested that ingestion of food during labour diverts a portion of the blood supply required for uterine contractility to the stomach for digestion of food, thus reducing the strength of uterine contractions. This assumption has been untested and is not supported by evidence.

Yiannouzis and Parnell (1994) also found that women who ate were more likely to experience longer labours. Their study, however, analysed the established phase of labour only. It may be that the longer labour found in their study was not the result of eating during the established phase of labour as they had assumed, but the result of eating during the early phase of labour: the period not investigated. These researchers acknowledged that food eaten at home before hospital admission may have impacted on their findings (Yiannouzis & Parnell, 1994).

The length of labour was also found to be longer among the women in the current study when the baby assumed the posterior position for labour, although this association is well-known (Fitzpatrick et al., 2001; William, 1999a). The possibility that fetal position may have an effect on eating behaviour, however, was not found in this study. Therefore, the posterior position of the baby during labour did not stimulate women’s eating behaviour: eating occurred regardless of the baby’s position.
7.6.3   Eating, medical interventions and birth outcomes

The hypothesis that eating food would reduce medical intervention was also not
supported by the results. There was no association between eating food during
labour and the incidence of medical interventions or type of birth outcome
measured; a finding supported by previous research (Scrutton et al., 1999; Tranmer,
1999; Yiannouzis & Parnell, 1999).

7.6.4   Eating behaviour and the incidence of vomiting

Some midwives do not allow labouring women food because they believe this will
cause vomiting (Parsons, 2004). This study has shown that, when women are
permitted to choose their oral intake, there is no difference in the rate of vomiting
between those who eat during labour and those who do not. The increased incidence
of vomiting among the eating groups in past studies may have resulted from
labouring women being encouraged to eat contrary to their desire because of
experimental group allocation (Yiannouzis & Parnell, 1994; Scrutton et al., 1999).
Another factor which may have increased the rate of vomiting in these studies was
the high epidural rate, in particular, Scrutton’s et al. (1999) study which had a 90%
epidural rate for labour. The role of epidural anaesthesia in labour is to remove the
pain sensation associated with labour, this in turn removes the accompanying
appetite suppressant effect of labour pain. Epidural anaesthesia, therefore, provides
the opportunity for labouring women to eat more food. The increased vomiting rate
found among the women who ate food in these two studies may be attributed to an
unnatural intake of food during labour.
Vomiting is known to be a common feature of labour regardless of whether women have eaten or not (Roberts & Ludka, 1993; Yiannouzis & Parnell, 1994). It is most commonly associated with rapid progression of labour (Roberts & Ludka, 1993) and it is believed that women often vomit as labour reaches the active phase of the first stage of labour and contractions subsequently intensify (McNabb, 2002). One reason given by women in the current study for either not eating during labour or for discontinuing food intake was that they felt nauseated or had experienced an episode of vomiting. The intensity of labour once women reach the active phase may have been the reason many women ceased eating once they reached this phase of their labour.

The concern surrounding vomiting is associated with the induction of general anaesthesia where the anaesthetist may inadvertently stimulate the ‘gag’ reflex. Restricting oral intake, however, does not prevent vomiting and does not ensure an empty stomach; instead the stomach fills with highly acidic fluid (Guyton, 1986; Miller et al., 1983; Sandhar et al., 1989). In the current study, a number of women who did not eat any food during their labour reported vomiting ‘green fluid’. This study found that vomiting is a common occurrence during labour and is unrelated to food intake.

7.6.5 Eating and the incidence of aspiration

Although it was not the aim of this study to identify the occurrence of aspiration among the women who underwent a caesarean section, no episode of aspiration was noted in the medical record of any woman recruited to this study. The sample size of this study and the number of women who underwent a general anaesthetic,
however, were too small to identify a relationship between eating and aspiration. Aspiration is a rare event, therefore a large sample is required to produce sufficient power to identify an association (Kraemer & Thiemann, 1987). This study, therefore, did not provide any information on the safety of food intake during labour where the incidence of aspiration was concerned.

7.6.6 Trial limitations and further research
Future studies could examine volitional eating using a larger sample size to increase the number of women who eat during the established phase of labour. The small number of women in the group who ate during this phase of labour reduced the generalisability of the findings.

Other studies could investigate how various amounts and types of food affect labour duration, yielding dose-response data indicating sensible limits to eating for labouring women. Some food groups may be more appropriate for labouring women than others. Food characteristics such as energy density, bulk, speed of digestion and glycaemic index may differently influence birth outcomes. Therefore, some types and quantities of food, but not others, may be appropriate for some women during labour. Although the current study reported the type and amount of food eaten by women, a nutritionalist or dietician would be required to determine the exact type and kilojoule intake of the foods. It was beyond the scope of this study to undertake that type of analysis.
7.7 CONCLUSION

This comparative study explored the effect of food intake during the first stage of labour on labour and birth outcomes of nulliparous women. An advantage of this study’s design was that it allowed women to choose whether or not they ate during labour. It also allowed the frequency and timing of food intake by labouring women to be quantified.

The major findings in this study were:

- eating during early labour was associated with an increase in the length of the hospital-estimated length of labour

- eating during both the early and established phases of the first stage of labour was associated with an increase in both the early phase and the hospital-estimated length of labour

- women tended to eat during labour when at home, when the contractions were weak and labour was slow and around usual meal and snack times; women did not eat when labour was intense and progressing rapidly

- eating was not associated with medical interventions, adverse birth outcomes or the incidence of vomiting during labour.

Although a randomised control trial is the preferred design to test the effect of an intervention, it was not considered appropriate to expect women to eat during their labour if they were unable, or to be refused food when they were hungry. The current study found that the majority of women were not interested in eating
especially during the established phase of labour. If women are encouraged to eat as a consequence of randomisation, the hospital-estimated length of labour, gastric volume and incidence of vomiting could be further increased.

For a clinician to deny a hungry labouring woman food is not an easy decision. Denying food in this situation is known to be stressful for these women (Enkin et al., 2000). This study found no compelling evidence to support eating during labour for any reason other than the woman’s wishes. Eating during labour did not improve any of the measured outcomes and brought a slight increase in the subsequent labour duration. This finding, along with anaesthetists’ concern for aspiration during general anaesthesia, precludes any general recommendation that labouring women should eat. However, if a labouring woman is hungry and is showing no sign of complications that may lead to general anaesthesia, there is no reason for the midwife to object to the woman eating, although the woman should be informed that eating may increase labour duration.

7.7.1 Clinical recommendations

- Women should be provided with information regarding (a) the lack of research to inform policy regarding oral intake during labour, (b) the anaesthetist’s concern for aspiration during general anaesthesia, (c) the statistical risk of general anaesthesia in the hospital of birth, and (d) the risk of mortality and morbidity from aspiration during labour
• As there does not appear to be a safety issue and there is no conclusive evidence to support any detrimental effects on the labour and birth process, all women should be given the choice to eat or not to eat according to their own wishes.

• Women should not be denied food for fear of vomiting either during labour or during general anaesthesia. They should also not be denied food because it may make labour shorter. All women should be allowed to respond to their natural desire for oral intake throughout their labour.
General Conclusion and Recommendations

This thesis used data from four original studies to describe the situation regarding oral intake for labouring women from a New South Wales perspective and to expand the research evidence available regarding this aspect of labour management. A multidisciplinary approach was taken involving midwives, midwifery unit managers, anaesthetists and labouring women.

8.1 Overview of the four studies

Specifically, the findings from these studies show that approximately 80% of hospitals in NSW do not have a formal written policy for the management of oral intake during labour. Management of this aspect of labour varies among these hospitals regardless of whether a written policy or a convention, developed by the staff within the midwifery unit, is used to determine care. With such variation among hospitals it was not surprising to find that one-third of the midwives working...
within four of these hospitals did not follow the convention or ‘usual practice’ within their hospital when it came to the labouring woman’s oral intake. These midwives either did not agree with, or were unaware of, their hospital’s usual practice for this aspect of labour management.

The majority of New South Wales hospitals which cater for moderate to high-risk pregnancies and labours restrict oral intake for labouring women. This may be in response to the greater presence and input anaesthetists have within these midwifery units. The views of anaesthetists regarding this aspect of care were, therefore, of interest. The majority of surveyed anaesthetists, despite contemporary drugs, techniques and monitoring systems for general anaesthesia, continue to recommend all women ‘fast’ during labour as an aspiration prevention strategy; yet its benefit for this purpose has not been investigated.

The lack of evidence to support any practice is the basis of the confusion and inconsistencies experienced by the hospitals and midwives participating in this research when deciding on ‘best’ practice for oral intake during labour. The lack of research evidence is also the reason that the majority of anaesthetists in this study were unwilling to relax their views regarding the restriction of oral intake for labouring women. The inconsistency among hospitals and midwives, the small percentage of hospitals with a written policy for this aspect of labour management, and the fact that most surveyed anaesthetists’ believed that labouring women should fast, strongly suggests the need for further research in this area.
The research design used to investigate the effect of oral intake on labouring women’s birth outcomes in this research was a naturalistic, comparative trial with concurrent controls which found:

- the length of labour was on average 2 hours longer among the women who ate food during the early phase of the first stage of labour and 3.5 hours longer when they ate during both the early and established phases of labour
- the rate of medical interventions and incidence of various birth outcomes were unaffected by volitional food intake
- the rate of vomiting during labour was also unaffected by volitional food intake
- the pattern of food intake during labour was consistent with women’s normal meal and snack times
- the majority of women who chose to eat did so during the early phase of labour only; few were interested in eating once their labour had established
- the majority of women interviewed stated they were not hungry during their labour either because they ate food as desired or they did not want to eat. Some, although hungry, were prevented from eating by their midwife.

The comparative study was able to substantiate some midwives’ belief that most women are not interested in eating food once their labour has established. Although the findings were unable to demonstrate that eating food during labour improves labour and birth outcomes, it did not find that this practice had any harmful effect on
mothers or babies. The information in this thesis does not support universal fasting or stringent dietary restrictions such as ice or sips of water for labouring women. In the absence of reliable research to support any dietary regime, labouring women should be allowed to rely on their instincts following information from their health provider regarding the available evidence and the anaesthetists’ concerns.

8.2 Eating during labour and evidence-based practice

Oral intake may be restricted during labour by a hospital’s policy or ‘usual practice’, a midwife’s belief, or the anaesthetist’s preferred protocol. Almost 60% of women in this study’s comparative trial chose to eat food during their labour with a number of women reporting they ate because they were hungry. This suggests that eating food, for many women, is a normal and possibly important part of labour. Although research exists comparing various types of oral intake and their effect on birth outcomes, the methodologies vary and the findings conflict (e.g., Rodwell, 1992; Scrutton et al., 1999; Tranmer, 1999; Yiannouzis & Parnell, 1994). This leaves healthcare professionals and labouring women without any reliable research evidence on which to base the management for this aspect of labour. The variety of beliefs and practices regarding the labouring woman’s nutritional requirements among hospitals, midwives and anaesthetists within this thesis is therefore understandable. It also identifies the problems which arise when there is limited research evidence to guide practice: a lack of formal policies, inconsistent practices, intra and interprofessional conflict.

The practice of restricting oral intake to prevent vomiting during labour is not supported by the findings of this study. The benefits to women of restricting oral
intake during labour to prevent vomiting during an induction of general anaesthesia appears not to have been investigated. However, in this study, anaesthetists who believed fluids and even a light diet are safe during labour were in the minority. In this era of evidence-based practice, well-designed research is essential to determine the effect oral intake has, if any, on the incidence of aspiration during general anaesthesia, and whether the risk-benefit ratio substantiates the continuation of oral intake restrictions.

8.3 Encouraging evidence-based clinicians

The lack of relevant, good quality research to inform practice is the cause of the inconsistencies found in practice among hospitals (Parsons, 2001), midwives (Parsons, 2004), and anaesthetists (Chapter 6) in this thesis. It is also an obstacle in the implementation of evidence-based practice for many midwifery practices (Hicks, 1993; Le May, Mulhall, & Alexander, 1998; Webster et al., 2003).

Midwives have been reluctant to participate in research, and when they do, they have failed to publish their findings (Hicks, 1993). The three unpublished randomised control trials investigating labouring women’s oral intake were all midwifery-led studies (Rodwell, 1992; Tranmer, 1999; Yiannouzis & Parnell, 1994). The chief investigator of one of the unpublished studies stated that publishing her work was discouraged by her medical colleagues (Katie Yiannouzis, personal communication, December 2003). Hicks (1993) believes the lack of publication may also partly be attributed to rejection of submitted articles by journals, suggesting a need for research training to ensure methodological rigour in research designs (Webster et al., 2003).
There is growing pressure for midwives to use research findings in their practice; therefore, barriers need to be addressed at both individual and organisational levels to make evidence-based midwifery practice a reality (Veeramah, 2004). The gross inconsistencies among practitioners for this one aspect of labour management – oral intake for labour – identifies the necessity for further research to determine the best practice for women. The majority of midwives in this study based their practice for this aspect of labour on their beliefs, knowledge, experience or the hospital’s ‘usual practice’. No anaesthetist (Chapter 6) and only three midwives (Parsons, 2004) referred to research evidence. To provide the ‘best practice’ for birthing women in all aspects of midwifery care, it is essential that health professionals are aware of the research evidence available, its validity and appropriateness to practice. To this end the following recommendations are provided.

**Development of evidence-based clinical guidelines:**

1. A multidisciplinary team with representatives from peak midwifery and medical professional groups should develop a nationwide evidence-based recommendation for oral intake during labour (DeBourgh, 2001; Gerrish & Clayton, 2004) with international comparisons (Kitson, 2001).

2. Each health facility should establish a working group of midwives and medical clinicians to develop local policy for oral intake during labour based on guidelines developed by the peak professional organisations.
Monitoring of practice:

3. All health facilities providing obstetric care should review current policy on oral intake during labour.

4. All facilities providing obstetric care should ensure all staff are familiar with the policy by way of inservice education.

Information for clients:

5. Information leaflets should be developed by the peak professional organisation and distributed to every hospital and birth facility to provide women with information on the available evidence regarding oral intake during labour.

6. Midwifery units should provide each woman with the information leaflet during pregnancy.

7. Midwives should allow labouring women to choose their oral intake needs based on their knowledge of the available evidence and anaesthetists’ concerns.

Organisation responsibilities:

8. Each midwifery unit should be supplied with sufficient computer terminals on a 24 hours usage basis which have access to a variety of health related databases (such as Medline and CINAHL, the Joanna Briggs Institute for Evidence-based Nursing and Midwifery, and the Cochrane Database of Systematic Reviews [Flemming & Cullum, 1997; Sandall, 1998]).
9. A Midwifery Research Development Unit (Le May et al., 1998; Nagy, Lumby, McKinley, & Macfarlane, 2001) should be provided for each Area Health Service nationally.

10. A mentoring system, conducted by the Midwifery Research Development Unit, should be developed to support midwives who wish to perform research (Kitson, 2001; Webster et al., 2003).

11. Role responsibilities for some midwives should be restructured to include research (Hicks, 1993).

Education of clinicians:

12. Every midwife should be educated in evidence-based practice, from accessing databases to performing research projects and disseminating their findings (Flemming & Cullum, 1997; Webster et al., 2003).

13. Workshops should be designed to demonstrate how to implement research evidence in the workplace and how to write appropriate, reader-friendly, evidence-based guidelines for practice (Sandall, 1998).

14. Clinical midwifery consultants and midwifery educators with appropriate research experience and education, should conduct regular one-to-one and group education programs on every aspect of evidence-based practice for all midwives under their jurisdiction (Kitson, 2001).
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Contributions to the Field Arising From Work Undertaken in this Thesis

Peer reviewed publications

International


National


### Appendix A

Causes of anaesthetic-related maternal deaths in Australia, 1964-1993

<table>
<thead>
<tr>
<th>Years</th>
<th>Anaesthetic deaths</th>
<th>Causes</th>
<th>Further information</th>
</tr>
</thead>
<tbody>
<tr>
<td>1964-1966</td>
<td></td>
<td>Unable to locate this triennial report</td>
<td></td>
</tr>
<tr>
<td>1967-1969</td>
<td>13</td>
<td>3 x Inhalation of gastric contents 3 x C/S* – no cricoid pressure applied during induction of anaesthesia in any of the inhalation cases.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 x cardiac arrest</td>
<td>Cardiac arrest caused by inadequate post-operative care and supervision.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 x bilateral pneumothorax and surgical emphysema</td>
<td>Cardiac arrest during C/S*. Inexperience anaesthetist.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4 x pulmonary oedema</td>
<td>Cardiac arrest during manual removal of placenta. Inexperience anaesthetist.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 x pudendal block (xylocaine) – circulatory collapse.</td>
<td>General practitioner administered anaesthetic. Inappropriate sized endotracheal tube ➜ inadequate ventilation ➜ failed reintubation ➜ tracheostomy.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Unable to determine cause from information provided.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Second case of pudendal block was followed by self-administered ether. No further details given.</td>
</tr>
<tr>
<td>1970-1972</td>
<td>10</td>
<td>5 x Inhalation of gastric contents</td>
<td>Faulty cuff on endotracheal tube was the cause of one inhalation case.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 x caudal anaesthesia (Xylocaine) ➜ convulsions.</td>
<td>One inhalation case occurred with 2nd GA; C/S* ➜ severe PPH ➜ hysterectomy.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 x asphyxia – asthmatic woman - mucous blocked bronchial tubes during general anaesthesia (GA).</td>
<td>Elective forceps delivery under LA.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 x cardiac arrests (no details given)</td>
<td>Inexperienced anaesthetists led to difficulties with intubation.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Most anaesthetics were not given by a specialist anaesthetist.</td>
</tr>
<tr>
<td>Year</td>
<td>Cases</td>
<td>Events</td>
<td></td>
</tr>
<tr>
<td>----------</td>
<td>-------</td>
<td>------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>1973-1975</td>
<td>4</td>
<td>1 × Inhalation of gastric contents (\text{C/S}^*) for fetal distress. No cricoid pressure applied during induction of anaesthesia in the inhalation case.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 × cardiac arrest (\text{Anaesthetic appeared to be a contributing factor in all 3 cardiac arrests. Clinical notes were very meagre.})</td>
<td></td>
</tr>
<tr>
<td>1976-1978</td>
<td>5</td>
<td>1 × Inhalation of gastric contents (\text{Inhalation occurred with the 2\textsuperscript{nd} anaesthetic performed for hysterectomy following C/S}^*) due to uncontrolled PPH.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 × cardiac arrests (\text{Cardiac arrest caused by esophageal intubation during manual removal of placenta. Cardiac arrest after leaving theatre caused by incomplete reversal of anaesthesia. Cardiac arrest following forceps delivery &amp; PPH. Had been given 4% Halothane to inhale during delivery.})</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 × forcep delivery with caudal anaesthetic (\text{The caudal anaesthetic was given by a GP/Obetrician; patient sustained 4 grand mal seizures following 2\textsuperscript{nd} dose of 5% Marcain and died.})</td>
<td></td>
</tr>
<tr>
<td>1979-1981</td>
<td>7</td>
<td>3 × Inhalation of gastric contents (\text{Inhalation incidents attributed to error in anaesthetic technique in all 3 cases.})</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 × Cardiac arrest following GA. (\text{Cardiac arrests following failed intubation in all 3 cases.})</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>1 × death attributed to either epidural or ritodrine infusion (\text{26 weeks gestation primigravida, premature labour} \Rightarrow \text{preterm birth.})</td>
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<tr>
<td>1982-1984</td>
<td>3</td>
<td>1 × Inhalation of gastric contents (\text{Inhalation incident attributed to error in anaesthetic technique})</td>
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<tr>
<td></td>
<td></td>
<td>1 × Cardiac arrest following GA. (\text{Anaphylactic response to anaesthetic drug})</td>
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<td></td>
<td>1 × Cardiac arrest following Epidural. (\text{Cardiac arrest attributed to IV Duranest anaesthetic.})</td>
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<tr>
<td>Year</td>
<td>Incidents</td>
<td>Events</td>
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<td>------------</td>
<td>-----------</td>
<td>-----------------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>1985-1987</td>
<td>5</td>
<td>2 x Inhalation of gastric contents</td>
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<td></td>
<td></td>
<td>Both inhalation incidents occurred in elective caesarean section cases – details unclear in one case. The other case was complicated by severe pre-eclampsia.</td>
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<td></td>
<td></td>
<td>1 x toxic level of Bupivicaine anaesthetic.</td>
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<td>Bupivicaine overdose following epidural in labour → GA for C/S → epidural top-up for post-operative pain.</td>
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<td></td>
<td>1 x pulmonary failure.</td>
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<td></td>
<td>Hypoxaemia following difficult intubation.</td>
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<td></td>
<td>1 x attributed to anaesthesia (no details available).</td>
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<tr>
<td>1988-1990</td>
<td>2</td>
<td>1 x Cardiac arrest.</td>
<td></td>
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<td></td>
<td>Elective C/S* – difficult intubation for 110Kg diabetic women with severe pre-eclampsia.</td>
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<td></td>
<td>Inadequate oxygenation pre and during C/S* following two oesophageal intubations.</td>
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<tr>
<td></td>
<td></td>
<td>1 x pulmonary failure.</td>
<td></td>
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<tr>
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<td></td>
<td>Emergency C/S* – difficult intubation for 93Kg woman. The tracheal intubation caused a tear in her trachea.</td>
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<tr>
<td>1991-1993</td>
<td>3</td>
<td>1 x laryngospasm after extubation</td>
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<td></td>
<td>Laryngospasm followed a difficult intubation of a women with acute pre-eclampsia</td>
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<tr>
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<td></td>
<td>1 x Cardiac arrest following GA.</td>
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<td>Cardiac arrest attributed to anaphylactic shock caused by high levels of suxamethonium IgE antibodies in the blood.</td>
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<td></td>
<td>1 x Cardiac arrest following local anaesthetic.</td>
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<td>Caudal anaesthetic for pain relief in labour. Convulsions following 2nd dose of bupivicaine</td>
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<tr>
<td>1994-1996</td>
<td>1</td>
<td>1 x Hypoxia brain damage, cause unknown.</td>
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<td></td>
<td>Patient found unconscious 16 hours after C/S. Death occurred 3 days later.</td>
<td></td>
</tr>
</tbody>
</table>

*Caesarean section

*Postpartum haemorrhage

Appendix B

ORAL INTAKE IN LABOUR

Nurse Unit Managers’ Survey

Nursing Unit Manager
1999
Maternity / Labour Ward
___________ Hospital

17th December

Re: Midwifery research (‘Oral Intake in Labour’)

Dear Sir or Madam:

My name is Myra Parsons, I am a midwife at Westmead Hospital in Sydney. I have commenced a Master of Nursing (Honours) Degree at the University of Western Sydney, Nepean investigating the effect of the food and fluids intake of labouring women on their labour and birth outcomes. I am conducting an observational study which includes 200 women birthing their babies at four Sydney hospitals during 2000. Two of these hospitals encourage labouring women to eat and drink as desired during their labour in the belief that it improves labour and birth outcomes. The other two hospitals restrict oral intake to clear fluids once labour is established. Recruitment commences in February 2000.

At present I am writing to every Maternity Unit in NSW to inquire as to their practice/policy regarding oral intake for labouring women for statistical purposes. Would you mind assisting me in this endeavour by answering the following questions. All information provided and locations will be kept in the strictest confidence with only overall statistics used.

Does your maternity unit have a written policy regarding what food or fluids labouring women are permitted during labour? (Circle) YES / NO

What is the usual practice in your maternity unit regarding what and when a labouring woman can eat or drink once labour is established?

____________________________________________________________________
____________________________________________________________________

If the labouring woman is ‘high risk’ (such as previous C/S or breech presentation) what is the usual policy in regards food and fluid intake?

____________________________________________________________________
____________________________________________________________________
What is the average annual birth rate at your hospital?

Thank you for your kind assistance. I hope to finish my research by the end of 2001. If so, I will be publishing the results in the ACMI Journal, hopefully, in 2002. I will be most grateful if you could return this form to me as soon as possible please.

**Investigator Contact Details**

Myra Parsons
7 Jordana Place
Castle Hill NSW 2154
Ph: 9899 5090 (h)
9845 8029 (w)
Fax: 9899 5090
Email: parsons@rivernet.com.au
Appendix C

ORAL INTAKE IN LABOUR

Midwives’ Survey

30th March 2000

As you are probably aware by now I am conducting a research in your hospital’s Maternity Unit titled ‘Oral Intake in Labour’ as part of a Master’s program at the University of Western Sydney, Nepean. This study will observe the oral intake of labouring women from the time of their last pre-labour meal to the birth of their baby. The information obtained will be compared with their labour and birth outcomes. Every midwife at the four hospitals participating in this study have been invited to complete this questionnaire.

Information provided by this questionnaire will be included in the Master’s thesis and any articles produced. Anonymity and confidentiality regarding the source of the information is assured and only the overall statistics will be used. Would you mind completing this questionnaire and returning it at your earliest convenience to your Nursing Unit Manager.

Do you fast women with **HIGH RISK** pregnancies during labour *(e.g., trial of scar; breech presentation)*?

Why / Why not? _________________________________________

If you answered ‘NO’, what would you allow/recommend these women to eat and/or drink?

In early labour:_______________________________________
In established labour:________________________________
In transition:_________________________________________

Do you fast women with **LOW RISK** pregnancies during labour?  

YES / NO

Why / Why not? _________________________________________

If you answered ‘NO’, what would you allow/recommend these women to eat and/or drink?

In early labour:_______________________________________
In established labour:________________________________
In transition: ______________________________________________________

Does your maternity unit have a written policy regarding oral intake for labouring women?  
If ‘YES’ what does the policy state? ____________________________________________

If ‘YES’ do you follow the written policy?  
Please comment: ____________________________________________________________

Does your maternity unit have a verbal policy regarding oral intake for labouring women?  
If ‘YES’ what is the verbal policy? ____________________________________________

If ‘YES’ do you follow the verbal policy?  
Please comment: ____________________________________________________________

How many years have you been a practising midwife? _______ years

Do you or have you worked in a Birth Centre  
Do you or have you worked in Team Midwifery/ Case Load  
Do you or have you practised as a homebirth midwife

Thank you for your assistance with this questionnaire.

**Investigator Contact Details**

Myra Parsons  
7 Jordana Place  
Castle Hill NSW 2154  
Ph: 9899 5090 (h)  
Fax: 9899 5090  
Email: parsons@rivernet.com.au
Appendix D

ORAL INTAKE IN LABOUR

Anaesthetists’ Survey

30th March 2000

As notified by the Head of your Anaesthetic Department, I am conducting a research in your hospital’s Maternity Unit titled ‘Oral Intake in Labour’ as part of a Master’s program at the University of Western Sydney, Nepean. This study will observe the oral intake of labouring women from the time of their last pre-labour meal to the birth of their baby. The information obtained will be compared with their labour and birth outcomes. This questionnaire has been sent to every consultant and registrar of Anaesthetics involved with obstetric anaesthesia at the four hospitals participating in this study.

The literature conveys differences of opinion regarding the need for the stomach to be empty pre-operatively, either for elective surgery or for a Caesarean Section (elective or emergency). Your opinion in this debate is sought. Would you mind completing this questionnaire and returning it at your earliest convenience in the pre-addressed stamped envelope enclosed.

Information provided by this questionnaire will be included in the Master’s thesis and any articles produced. Anonymity and confidentiality regarding the source of the information is assured and only the overall statistics will be used.

What is your preferred minimum pre-operative fasting time for patients undergoing:
Elective surgery .........................hrs
Elective C/S ..............................hrs
Emergency C/S .........................hrs
If you have stated different fasting times for the above patients please comment?

_______________________________________________________________________
_______________________________________________________________________
______________________________________________________________

How important is it for you that the patient’s stomach is empty in the case of an emergency caesarean section? (please circle)

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Important</td>
<td>Somewhat Important</td>
<td>Important</td>
<td>Vitally Important</td>
</tr>
</tbody>
</table>
What is/are your other prevention strategies for reducing gastric volume and pH for an emergency C/S?

**Gastric Antacid (type; common name)**
A regime during labour: yes / no  
Briefly describe the regime:

Pre-operatively: yes / no  
Briefly describe the regime:

**H₂ Antagonist (type; common name)**
A regime during labour: yes / no  
Briefly describe the regime:

Pre-operatively: yes / no  
Briefly describe the regime:

**Gastrointestinal Stimulants (type; common name)**
A regime during labour: yes / no  
Briefly describe the regime:

Pre-operatively: yes / no  
Briefly describe the regime:

**Gastric Acid Secretion Inhibitor (type, common name)**
A regime during labour: yes / no  
Briefly describe the regime:

Pre-operatively: yes / no  
Briefly describe the regime:

**Emptying the Stomach**
yes / no  
Briefly describe the regime:

**Nothing**
yes / no  
Please comment:
Appendix C

Other (please elaborate)

A regime during labour: yes / no  Briefly describe the regime:

Pre-operatively: yes / no  Briefly describe the regime:

What other precautions would you need to take during the induction of general anaesthesia for an emergency C/S to prevent regurgitation and aspiration of stomach contents and why?

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

What would you permit as oral intake for labouring women with an epidural block in situ for pain relief only?

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

What would you permit as oral intake for labouring women with an epidural block in situ for medical/obstetric reasons who may require an emergency C/S if complications arise?

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

Your assistance with this information is greatly appreciated.

Investigator Contact Details

Myra Parsons  Ph: 9899 5090 (h)
7 Jordana Place  9845 8029 (w)
Castle Hill NSW 2154  Fax: 9899 5090
Email: parsons@rivernet.com.au
Appendix E

South Eastern Sydney Human Ethics Committee
The St. George Hospital & Community Health Service

Gray Street
Kogarah NSW 2217
AUSTRALIA

Telephone (02) 93501111
Facsimile: (02) 93503960
Our Ref: 99/95

1st November 1999

Professor S. Nagy
Nursing Academic Unit
P. O. Box 3515
Parramatta NSW 2124

Dear Dr Professor Nagy,

RE: Qoral intake in labour
(99/95 Nagy)

The South Eastern Sydney Area Health Service Ethics Committee
Southern Section considered your application at its most recent meeting held 26th October, 1999.

The Committee agreed to approve the study however advise that
Parents and Guardians can’t consent therefore the ‘Parental (or Guardian) Information Statement and Consent Form’ is not required.
Subjects 14-16 years of age can consent, to this study.

The Committee requires a brief six month progress report on research it has approved and a final report at the conclusion of the study. (Estimated duration of the project 2 years)

These reports should:
- be accompanied by abstracts of any articles or publications
  (if any arising out of the study).
- Confirm security of records.
- Confirm compliance with approved consent procedures and documentation.

The investigator should also report immediately to the Ethics Committee anything which might affect ethical acceptance of the protocol, including:

- Adverse effects on subjects

- Proposed changes in the protocol

- Unforeseen events that might affect continued ethical acceptability of the project.

I look forward to placing your first report before the Committee and wish you well in this study.

Yours sincerely,

Roselyn Drake
Secretary
South Eastern Sydney Area Health Service
Ethics Committee, Southern Section

The St. George Hospital is a Teaching Hospital of the South Eastern Sydney Area Health Service
25 February 2000

Myra Parsons
7 Jordana Place
Castle Hill NSW 2154

Dear Myra

Re: Oral Intake in Labour Registration No HE 2000/011

The Committee has reviewed your application to the Human Ethics Committee, South Western Sydney Area Health Service and subsequent approval.

It was agreed to formally note this approval which will expire 25 October 2000.

You are advised that the Committee should be notified of any further change/s to the research methodology should there be any in the future. You will be required to provide reports on the ethical aspects of your project.

The Protocol No. HE 2000/011 should be quoted in all future correspondence about this project. Please contact the Research Ethics Co-ordinator, Kay Buckley on 47 360 1679 if you require any further information.

The Committee wishes you well with your project.

Yours sincerely

Associate Professor Elizabeth Deane
Chairperson
UWS Nepean Human Ethics Review Committee
Ms. M. Parsons,
7 Jordana Place,
CASTLE HILL NSW 2154

Dear Ms. Parsons,

Project No: 99/119 - Oral intake in labour.

The SWSAHS Research Ethics Committee wishes to acknowledge receipt of your application with regard to the above project, which was considered at their meeting held on Monday, 25th October, 1999.

The Committee classified this as a Category A project and approved it to proceed subject to the following:

(i) The description contained in Appendix C (Food and Fluid Record) should be amended. as the amount of food supposedly consumed appears to be excessive;

(ii) Approval for this study can only be granted for a period of 12 months, after which time a progress report is required for consideration of a further 12 months approval;

(iii) Concerns were raised by the Committee that this project has the potential to alter patient’s normal behaviour during labour. In this regard, the Committee requested confirmation that all appropriate staff, e.g., midwives, obstetricians and obstetric anaesthetists have been informed of this study.

Once the above issues have been addressed and acknowledged by the committee, the project may proceed.

Yours sincerely,

DR. C. PAIN,
Deputy Chairperson,
SWSAHS Research Ethics Committee.
For: Mr. C. Froud,
Acting Chief Executive Office
Appendix F

‘Food and Fluids Record’
Oral intake in labour study

My labour started (regular contractions):- DATE: ____________ TIME: ____________

What was the date and time of the last meal you ate before your labour started?
Date:__________ Time: ____________ What did you eat?______________________
_____________________________________________________________________

Please write everything you eat and drink, from the time your labour contractions begin until the baby is born, on the chart below.

A teacup = approx. 120 mls
A styrofoam cup = 200 mls.
A coffee mug = 250 mls.

<table>
<thead>
<tr>
<th>DATE</th>
<th>Time</th>
<th>Type of fluid</th>
<th>Amt</th>
<th>Description and amount of food you eat</th>
<th>Dilatation of your cervix</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example</td>
<td>6.30pm</td>
<td>Cup of Tea</td>
<td>120ml</td>
<td>2 sausages, cup of cooked rice, cup of carrots and broccoli. 2 scoops of ice-cream with ½ banana</td>
<td></td>
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<td>20/4/00</td>
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<tr>
<td>‘</td>
<td>9pm</td>
<td>Orange juice</td>
<td>200ml</td>
<td>1 montecarlo biscuit</td>
<td></td>
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</tbody>
</table>


<table>
<thead>
<tr>
<th>DATE</th>
<th>Time</th>
<th>Type of fluid</th>
<th>Amt</th>
<th>Description and amount of food you ate</th>
<th>Dilatation of your cervix</th>
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Appendix G

Information sheet

‘ORAL INTAKE IN LABOUR’ STUDY

Research Investigation
The investigator is exploring and measuring the timing and effect of the intake of food and fluids during labour, for women having their first baby, and comparing it to the length of their labour and the medical assistance required during the labour.

What will I have to do?
If you volunteer to join this study, you will be given a form to take home and asked to keep a record of everything you eat and drink throughout your labour. Your support person could do this for you. After your baby is born, the midwife performing the study will use the details of your birth (e.g., how many hours you laboured and what kinds of medical assistance you may have required during your labour) and link them with your eating and/or drinking pattern during your labour. This will be compared with the details to other women in the study. No special measurements or tests will occur, just the routine observations and tests which are performed for every labouring woman. Our data of birth will come from the standard information kept in your medical record.

How do I Join the Study
If you agree to join the study, you will be asked to sign a consent form. This will inform the researcher of your willingness to join the study and allow the researcher access to your birth records in order to collect data for the study. You will also be given the form to complete during your labour to itemise the food and fluids you consume throughout your labour.

The decision to participate in this study is entirely yours and at all times your anonymity, confidentiality and privacy will be strictly adhered. The study will be reported in a way that will not disclose the identity of any of the participants.

You have the right not to participate in, or subsequently withdraw from the study. Any decision not to participate will not affect your current or future treatment or your relationship with the South Western Sydney Area Health Service or any other institution co-operating in this study or any person treating you.

RESEARCH MIDWIFE
Myra Parsons
7 Jordana Place, Castle Hill 2154
Phone: 9899 5090 (h)
9845 8029 (w)

SUPERVISOR
Professor Sue Nagy
Clinical Science Department
New Childrens Hospital, Westmead
Phone: 9845 3023

Any questions regarding this study, please feel free to ask any of the midwives or contact the researcher.
Appendix H

........................................SYDNEY AREA HEALTH SERVICE
..................................................HOSPITAL

SUBJECT CONSENT FORM

(Title of project: ORAL INTAKE IN LABOUR STUDY)

You are making a decision whether or not to participate. Your signature indicates that you have decided to participate having read the information provided.

_______________________________      ____________________________
Signature of subject        Signature of witness

_______________________________      ____________________________
Please PRINT name        Please PRINT name

_______________________________
Date

_______________________________
Signature of investigator

Please PRINT name

REVOCATION OF CONSENT

I hereby wish to WITHDRAW my consent to participate in the research proposal described on the Information Sheet and understand that such withdrawal WILL NOT jeopardise any treatment or my relationship with the ......................Hospital or my medical attendants.

_______________________________      ____________________________
Signature         Date

_______________________________
Please PRINT name

The section for Revocation of Consent should be forwarded to Myra Parsons, 7 Jordana Place Castle Hill 2154.
# Appendix I

Food consumed by women during the established phase of the first stage of labour

<table>
<thead>
<tr>
<th>Type of foods consumed</th>
<th>Portion Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roast meal (meat and vegetables) + fruit salad</td>
<td>Full meal (one woman only).</td>
</tr>
<tr>
<td>Shepherd's pie</td>
<td>Portion not stated (one woman only).</td>
</tr>
<tr>
<td>Cereal and milk</td>
<td>A couple of spoonfuls to one full bowl.</td>
</tr>
<tr>
<td>Sandwich (egg, cheese, salmon, tomato or peanut butter)</td>
<td>A few bites, half a sandwich or one whole sandwich.</td>
</tr>
<tr>
<td>Toast</td>
<td>A bite, half slice, one slice or two slices</td>
</tr>
<tr>
<td>Croissant</td>
<td>A few bites to one whole croissant</td>
</tr>
<tr>
<td>Crumpets</td>
<td>A few bites, one to three crumpets</td>
</tr>
<tr>
<td>Cereal bar (apricot)</td>
<td>A few bites to one whole bar</td>
</tr>
<tr>
<td>Pancake</td>
<td>One</td>
</tr>
<tr>
<td>Muffin</td>
<td>1 to 2 mouthfuls</td>
</tr>
<tr>
<td>Hash Brown (McDonalds)</td>
<td>Half portion</td>
</tr>
<tr>
<td>Chips (hot)</td>
<td>4 chips only</td>
</tr>
<tr>
<td>Biscuit</td>
<td>One or two bites to one whole biscuit</td>
</tr>
<tr>
<td>Fruit – stewed or fresh</td>
<td>Half an apple, a banana or some sultanas</td>
</tr>
<tr>
<td>Confectionery and chocolates (‘Snakes’, ‘M &amp; Ms’, ‘minties’, boiled lollies)</td>
<td>2 or 3 lollies up to one small packet</td>
</tr>
<tr>
<td>Milkshake</td>
<td>One glass</td>
</tr>
</tbody>
</table>
## Appendix J

Correlations between predictors and hospital-estimated length of labour

<table>
<thead>
<tr>
<th></th>
<th>Maternal Age</th>
<th>Asian</th>
<th>Polynesian</th>
<th>Middle Eastern</th>
<th>Eating early only</th>
<th>Eating established only</th>
<th>Eating both early + established</th>
<th>Length early labour</th>
<th>Hospital-estimated labour</th>
<th>OL fetal position</th>
<th>OP fetal position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal Age</td>
<td>1.00</td>
<td>.11</td>
<td>.06</td>
<td>−.12</td>
<td>.93</td>
<td>.05</td>
<td>.08</td>
<td>.02</td>
<td>.12</td>
<td>.02 *</td>
<td>.01</td>
</tr>
<tr>
<td>Asian</td>
<td>.11</td>
<td>1.00</td>
<td>−.09</td>
<td>−.13</td>
<td>−.06</td>
<td>.03</td>
<td>.05</td>
<td>.11</td>
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* Significant at $p < .05$.  ** Significant at $p > .01$