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Australian midwives and provision of nutrition education during pregnancy: a cross sectional survey of nutrition knowledge, attitudes, and confidence

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Abstract

Background: Maternal nutrition during pregnancy affects the health of the mother and the baby. Midwives are ideally placed to provide nutrition education to pregnant women. There is limited published research evidence of Australian midwives' nutrition knowledge, attitudes and confidence. Aim: To investigate Australian midwives' nutrition knowledge, attitudes and confidence in providing nutrition education during pregnancy. Methods: Members of the Australian College of Midwives (n = 4770) were sent an invitation email to participate in a web-based survey, followed by two reminders. Findings: The completion rate was 6.9% (329 of 4770). The majority (86.6% and 75.7%, respectively) highly rated the importance of nutrition during pregnancy and the significance of their role in nutrition education. Midwives' nutrition knowledge was inadequate in several areas such as weight gain, dairy serves and iodine requirements (73.3%, 73.2% and 79.9% incorrect responses, respectively). The level of confidence in discussing general and specific nutrition issues ranged mostly from moderate to low. The majority of the midwives (93%) provided nutrition advice to pregnant women. This advice was mostly described as 'general' and focused on general nutrition topics. Only half of the midwives reported receiving nutrition education during midwifery education (51.1%) or after registration (54.1%). Conclusion: Australian midwives' attitudes towards nutrition during pregnancy and their role in educating pregnant women about it were positive but their knowledge and confidence did not align with these attitudes. This could be due to minimal nutrition education during midwifery education or during practice. Continued education to improve midwives' nutrition knowledge and confidence is essential.

Keywords

education, during, pregnancy, australian, cross, midwives, sectional, survey, knowledge, attitudes, confidence, provision, nutrition

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Key words: Nutrition, knowledge, pregnancy, midwifery, education

Word count: 249

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Problem or Issue	Poor prenatal nutrition is linked to negative short and long maternal and foetal outcomes. Pregnant women do not meet dietary recommendations and may not receive effective nutrition education. Australian midwives are well positioned to provide nutrition education to pregnant women but their knowledge of nutrition and confidence to provide nutrition education have not been reported.
What is Already Known	International research has reported positive attitudes of midwives towards nutrition during pregnancy but limited knowledge, confidence and nutrition education.
What this Paper Adds	Evidence that Australian midwives have positive attitudes towards nutrition during pregnancy but inadequate nutrition knowledge and variable confidence, possibly due to not receiving nutrition education themselves, either before or after registration.

1 Introduction

It is increasingly recognised that maternal nutrition during pregnancy affects the health of the mother and the baby. Suboptimal nutrition during pregnancy has been linked to excess gestational weight gain.[1] Excess gestational weight gain and maternal obesity are associated with a greater risk of adverse maternal and foetal outcomes such as gestational diabetes, gestational hypertension, preeclampsia, caesarean delivery, high retention of postpartum weight, depression, low rates of breastfeeding, still births and perinatal deaths, birth defects, neonatal care admission, and macrosomia in addition to increased risk of developing childhood obesity and chronic diseases later in life.[2-4]

The most recent national Australian data reported that the majority of Australian women do not meet Australian dietary recommendations despite perceiving their diet to be healthy.[5] Pregnancy has been suggested as an influential "teachable moment" to promote healthy nutrition.[6] Pregnant women usually have contact with health care providers, and they tend to be more interested in, and actively seeking nutrition information.[7] However, a recent review identified that limited nutrition education is often provided to pregnant women within antenatal care settings in developed countries (including Australia), despite health care providers (including midwives) acknowledging its importance.[8] Inadequate time,

resources and education were identified by health care providers as barriers towards the provision of nutrition education during pregnancy. [8]

In Australia midwives are key providers of primary antenatal care. The Australian College of Midwives' (ACM) philosophy acknowledges midwifery as a women centred profession, which is based on a relationship between women and their midwives, and has the ability to affect the health and wellbeing of the mothers and the society in a positive way.[9] Through the provision of antenatal care, midwives work with women and support them in making informed decisions that can impact positively on their health and the health of their babies.

In the Essential Competencies for Basic Midwifery Practice of the International Confederation of Midwifery (ICM),[10] it is indicated that midwives should have knowledge of maternal and foetal nutritional requirements, and the skills to assess maternal status and provide advice accordingly. The Australian National Competency Standards also indicate that midwives have a public health role that encompasses the promotion of wellness of women, their families and the community, although the case of nutrition is not specifically addressed.[11] This places expectations on midwives to be knowledgeable about nutrition during pregnancy, and to have a role in the provision of nutrition education to pregnant women.

Clinical guidelines for antenatal care in Australia have been set to provide standard guidance for all health care providers involved in the provision of antenatal care (including midwives). The Australian National Antenatal Care Guidelines Module One was published in December 2012,[12] followed by Module Two in 2014.[13] The guidelines cover the provision of nutrition guidance to pregnant women, advice on supplements and the management of nutrition related issues such as nausea and vomiting.

A review investigating the role of midwives in nutrition education in developed countries (including Australia), reported midwives' agreement on the importance of nutrition during pregnancy, and their significant role in educating women about it. However, it also reported that midwives' nutrition knowledge was inadequate.[14] This review highlighted midwives' lack of confidence in discussing some

nutrition related issues such as vegetarian diets, diets of women from different religions or backgrounds and diets of women with previous medical conditions such as gestational diabetes.[14] In some Australian qualitative studies, midwives pointed out they are main providers of nutrition advice, however they lack confidence and communication skills in approaching sensitive topics such as weight management and obesity.[15, 16]

Currently there are limited published quantitative data about the nutrition knowledge of Australian midwives, their attitudes towards the importance of nutrition during pregnancy and their views of their role in providing nutrition education to pregnant women, and their confidence in discussing general and specific nutrition related issues. This study aimed to address this gap.

2 Methods

2.1 Design

The design of the research was a cross-sectional study using a web-based survey.

2.2 Research questions

1. What are midwives' attitudes towards nutrition during pregnancy and their role in educating pregnant women about nutrition?
2. What do Australian midwives know about general nutrition during pregnancy?
3. What are the factors associated with midwives' general knowledge of nutrition during pregnancy?
4. How confident do midwives feel in providing general and specific nutrition related advice?
5. Are dietitians' services available for midwives and do midwives refer to dietitians?

2.3 Sampling and administration

A convenience sample of members of the Australian College of Midwives (ACM) was recruited for this study. Recruitment occurred through placing an invitation with a link to the survey in the ACM newsletter, and an invitation email via the ACM office to its 4770 members in August 2012, followed by two email reminders sent at monthly intervals. The first page of the online survey was an information sheet and consent statement. Respondents implied their consent by accessing and completing the web survey. A sample size calculation was attempted to estimate the minimum number of respondents required to have sufficient statistical power. The estimated minimum sample size required was 356. The calculation was based on a total population of 4770, margin error of 5 and a confidence level of 95%.[17]

2.4 Survey development

The survey used in the study was developed by the researchers based on previous literature[18-20] and the key issues related to nutrition in pregnancy. Two dietitians and two academics (from public health nutrition and midwifery) reviewed the survey. Further consultation with a professional statistician was sought before commencing data collection to confirm the appropriateness of the survey design to achieve the aims of the study. The survey was first piloted with five colleague researchers and then with five practising midwives. Necessary modifications such as adding a few questions, modifying existing ones and reducing ambiguity were undertaken. The survey was created online using Survey Monkey Software (SurveyMonkey Inc. Palo Alto, California, USA. www.surveymonkey.com).

2.5 Survey structure

The survey included four main sections:

2.5.1 Section 1: Nutrition education

Respondents were asked whether they received nutrition information or education during their midwifery education and after registration as midwives. Questions also covered details of this education but these data will be reported elsewhere.

2.5.2 Section 2: Attitudes and confidence towards the provision of nutrition education during pregnancy

In this section, respondents were asked to rate, using a five -point scales, the importance of nutrition during pregnancy (very important, moderately important, important, slightly important and not important at all) and their role in providing nutrition education to pregnant women (very significant, moderately significant, significant, slightly significant, not at all significant). They were also asked whether they provide nutrition advice to pregnant women and if so: to rate how confident they feel in discussing general or specific nutrition issues with pregnant women (for example, very confident, moderately confident, confident, slightly confident and not at all confident); when they discuss these issues; and what sources they usually use as the basis of this advice. Their thoughts about receiving more nutrition information or education and having specific guidelines tailored to the nutrition education needs of midwives were also explored and will be presented elsewhere.

2.5.3 Section 3: Pregnancy general nutrition knowledge

Twelve items were included to determine the respondents' general knowledge of nutrition during pregnancy. Two main types of items were included; single-answer items (n=8) and multiple- answer items (n=4). The single-answer items included questions about the respondents' knowledge of: average change in energy requirements during pregnancy; if there is a difference in the energy requirements for pregnant women during the three trimesters of pregnancy; the range of healthy weight gain during pregnancy for a woman who commenced her pregnancy at normal weight; the most important vitamin supplement for vegetarian pregnant women; when women should take folic acid supplements and the amount of folic acid supplements needed daily during pregnancy; the recommended number of serves of

dairy foods required per day to meet pregnant women's requirements for calcium; and iodine requirements per day for a pregnant woman.

The four multiple- answer items included questions about: foods that should be avoided in pregnancy as a risk of listeria; food sources of iron; advice to minimise the effect of nausea and vomiting during pregnancy; and foods to assist with resolving constipation during pregnancy. The respondents were instructed to choose the correct answer from the given options. The 'I do not know' option was added to prevent guessing when the respondents were not sure of their answers and was coded as 'incorrect' answer in the statistical analysis.[21]

Each single-item question had one correct answer and was given a score of one for each correct answer, giving them a total score of eight. Multiple- answer items had more than one correct answer and a score of one was given to each correct answer in each question, giving them a score of 12. The answers to the multiple-answer items were independent of each other. If the question had three correct answers, the respondent obtained a score of three out of three if all correct answers were chosen, and two out of three if two correct answers were chosen and so on. An overall score of 20 was given to the knowledge section combining the score of the single and multiple answer items.

2.5.4 Section 4: Demographic characteristics

This section of the survey collected demographic data of the respondents including their gender, age category, midwifery education, years of experience and principal state or territory of work. The survey was designed for and promoted as being for practising midwives who are actively involved in providing antenatal care either in hospitals or independently; therefore, respondents were asked to indicate their place of practice, level of maternity services and areas of maternity practice.

2.6 Data analysis

Data from the survey were analysed using the Statistical Package of the Social Sciences Software (SPSS) version 22 (Armonk, NY: IBM Corp). Descriptive statistics were used to summarise the data. The effect

of demographic characteristics on midwives' knowledge was assessed using bivariate analyses such as independent t test (for variables with two categories) and one-way ANOVA (for variables with more than two categories). Multiple regression analysis was used to explain the variance in nutrition knowledge. Significant differences were identified at $P < 0.05$. The "I do not recall" option in the two questions about whether midwives received nutrition education during midwifery education or after their registration was combined with the "No" option in the independent t test and Multiple regression analysis. All eight Australian states were listed in the original survey. However, due to small numbers of respondents from some states and for analysis purposes, the eight states were combined into three categories (New South Wales, Queensland and other) in the analysis. The category 'Other' included: South Australia, Tasmania, Victoria, Western Australia, Australian Capital Territory and Northern Territory. Likewise, the five – point scales (for example, very confident, moderately confident, confident, slightly confident and not at all confident) were reduced to three categories (high confidence (including, very confident), moderate confidence (combining, moderately confident and confident) and low confidence (combining, slightly confident and not at all confident). This combination reflected further consideration of the terms used in the scale, as it was unclear how the participants may have interpreted 'moderately confident' and 'confident', and thus the responses to these two terms were combined. Spaces were provided for some questions to enable respondents to elaborate on their answers or provide further information. The data provided within these spaces were analysed using content analysis[22].

2.7 Ethical approval

The study obtained ethical approval from the University of Wollongong and Illawarra Shoalhaven Local Health District Health and Medical Human Research Ethics Committee (HREC) (HE12/009, 5th of April, 2012).

3 Findings

3.1 Demographic characteristics

Of the 4770 members of the Australian College of Midwives, 393 midwives responded to the survey and 329 completed it and were included in the final analysis. Excluded were one hard copy response from the pilot phase, the first electronic response because of a problem in the setting up of the survey, 61 incomplete surveys and 1 duplicate.

The demographic characteristics of the respondents are shown in Table 1. Only four respondents were males. Approximately three quarters of the midwives (74.8%, n= 246) were aged 41 and older and 69.6 % (n= 229) had work experience of more than 10 years. Midwives from New South Wales and Queensland represented 52.9% (n= 174) of the respondents. Slightly more than half of the midwives (53.2%, n= 175) gained their midwifery education through hospital-based training. In the "other, please specify" space, 33.7% of the midwives (n=111) reported having additional qualifications with midwifery and nursing related qualifications being the most frequently reported. The majority of the midwives worked in public hospitals (86.6%, n= 285) and 67.7% (n= 223) worked in regional and territory referral hospitals. In terms of areas of midwifery practice, 41.3% (n= 136) of the midwives rotated through antenatal, birthing suite and postnatal areas; and 29.2% (n=96) worked either in antenatal care only or worked in antenatal care and birth suite or antenatal care and postnatal but did not rotate through all areas.

3.2 Attitudes of midwives towards the importance of nutrition and their role in providing nutrition education during pregnancy

Table (2) shows the attitudes of midwives towards the importance of nutrition during pregnancy and their role in educating women about it. When asked about the importance of nutrition during pregnancy, 86.6% (n=285) of the midwives thought it was of high importance while 13.4% (n=44) thought it was of moderate importance. Three quarters of the midwives (75.7%, n=249) considered the role they can play in

providing nutrition education for pregnant women to be of high significance, while 23.7% (n=78) considered its significance as moderate. Only 0.6% (n=2) considered their role to be of a low significance.

3.3 The provision of nutrition related advice by midwives and their confidence in discussing general and specific nutrition related issues

The provision of nutrition related-advice to pregnant women by midwives in the study is shown in Table (3). The majority of the respondents provided nutrition advice to pregnant women (93%, n= 306). The pattern of engaging with pregnant women in discussing nutrition issues for those midwives tended to take place at the first antenatal visit for most of the respondents (71.6%, n= 219) and less than half of the midwives provided nutrition advice at every antenatal visit (47.4%, n=145). Nearly sixty percent (59.5%, n= 182) discussed nutrition only when the woman had a medical condition requiring nutrition intervention, such as gestational diabetes. The three information sources most used by the midwives as the basis of their nutrition advice was other health professionals, such as dietitians (81.4%, n=249), followed by general knowledge (75.5%, n=231) and midwifery education (62.7%, n=192).

Midwives who answered "yes" to the question about the provision of nutrition advice were asked to specify the nutrition advice they provided and 83.3% (n = 255) of the midwives included written information.

Content of the advice: The three most frequent topics midwives provided nutrition advice about were: healthy eating, micronutrients and food safety. Recommended weight gain/weight management, advice related to the management of common pregnancy discomfort (e.g. nausea and vomiting, indigestion, heart burn and constipation), nutrition for diabetes (management/prevention), nutrition for breastfeeding and alcohol were specified less frequently. The least mentioned topics by midwives were fluid intake, coffee and vegetarian diet. Micronutrients advice varied as well; the most frequently mentioned micronutrient was iron, followed by folate and calcium. Iodine and vitamin D were less frequently mentioned. The least

mentioned nutrients were vitamin B12, fish oil, magnesium and zinc. Some midwives referred to providing advice about micronutrients without any specification.

Type of the advice: Midwives frequently referred to the nutrition advice or information they provided as "general" or "basic", for example:

> *"Very basic advice on well-balanced diet and the foods to avoid during pregnancy" (MW242)*

"Specific" advice was also frequently indicated. It referred to either topics midwives focused on when providing nutrition advice or advice that was only directed to pregnant women with specific issues such as obesity, diabetes or following special diets such as vegetarian or vegan.

> *"Eat a healthy, fresh and balanced diet. And give more specific advice for i.e. anaemia, morning sickness, constipation, indigestion etc." (MW146)*

Midwives also indicated they provided general advice to all pregnant women and referred those with specific issues to dietitians. A few midwives (n=10) provided specific advice that fitted the context of care they provided or was related to other roles they undertook, such as working with women from indigenous backgrounds or with gestational diabetes.

Extent and approach of the advice: The extent of topics covered by midwives within their nutrition advice varied. The topics ranged from one topic to several topics. Midwives either included details of how they provided nutrition advice or were ambiguous and wrote general comments. A small number of the midwives specified they discussed women's current diets (n=10), individualised their advice (n=7) or provided culturally sensitive advice (n=6). Few midwives (n=5) indicated that they only provided advice if women asked them or if there was a concern or a problem.

Midwives (n=16) either indicated the use of brochures to enhance the provision of nutrition advice or perceived the provision of brochures alone as sufficient for general nutrition advice.

"I give them the booklets and handouts related to nutrition that cover most things and then discuss specific things related to their needs….." (MW81)

Midwives (n=8) included comments on barriers that might affect the provision of nutrition advice such as: limited time; limited resources; limited availability of further education; model of care; and difficulties in communicating with obese women about nutrition.

3.4 Pregnancy general nutrition knowledge

Table (4) displays the distribution of correct and incorrect responses to the knowledge questions for both single and multiple- answer items. The single answer nutrition knowledge question with the highest percentage of correct answers (93.6%, n=308) was when women should take folic acid supplements. A large proportion of the respondents also chose the correct answers for the questions about: the amount of folic acid supplements needed daily during pregnancy; if there was a difference in the energy requirements for pregnant women during the three trimesters of pregnancy; and the most important vitamin supplement for vegetarian pregnant women (67.5, 63.8 and 62.3%, respectively). Half (50.5%, n=166) of the midwives provided incorrect answers to the question about average change in energy requirements during pregnancy. The questions with the least correct answers were: the range of healthy weight gain during pregnancy for a woman who commenced her pregnancy at normal weight; the daily recommended number of serves of dairy foods, and iodine requirements per day for a pregnant woman (73.3%, 73.2% and 79.9% incorrect responses, respectively). Two comments were also included that questioned official dietary advice, for example the following negative comment relating to the daily recommended number of serves of dairy foods to meet pregnant women's needs for calcium.

"I preferred not to answer the Q [question] about how many serves of dairy to give adequate calcium - because I don't believe dairy is healthy for anyone." (MW167)

For multiple-answer items (Table 4), the question about foods to assist with resolving constipation during pregnancy was answered correctly by the majority of the respondents (94.8%, n=312) who ticked both

correct options. Almost two thirds of the respondents (63.8%, n=210) were able to tick all the correct answers for the advice to minimise the effect of nausea and vomiting during pregnancy. In regard to foods that should be avoided as a risk for listeria in pregnancy, the foods were highly recognised individually and 77.8% (n=256) of the respondents chose all the correct answers. In terms of food sources of iron, only 59% (n=194) and 11.2% (n=37), respectively of the midwives recognised legumes and seafood as sources of iron and only 9.1% (n=30) of the respondents ticked all the correct answers.

The mean of the total score was 13.64 out of possible 20 (± SD 2.04). The minimum score was 7 and maximum score was 18. In terms of the significant difference between the means of the groups, higher scores were achieved by midwives in independent midwifery practice (*M*=14.75, *SD*= 1.94) compared to those working in public hospitals (*M*=13.54, *SD*= 2.04, *P*=0.010); in regional hospitals (*M*=13.96, *SD*= 1.94) compared to those working in rural hospitals (*M*=12.92, *SD*= 2.18, *P*=0.025); by those who reported receiving nutrition information or education during their midwifery education (*M*=13.96, *SD*= 2.01) compared to midwives who did not (*M*=13.30, *SD*= 2.03, *P*=0.003) and by those who reported high level of confidence (*M*=14.48, *SD*= 1.90) in providing general- related nutrition advice compared to those who reported moderate (*M*=13.70, *SD*= 2.01) and low levels of confidence (*M*=13.15, *SD*= 1.94, *P*=.006). In the multiple regression analysis these significant variables were entered simultaneously into the model (n=306). All variables had independent significant effects on nutrition knowledge scores apart from level of maternity services which approached the significant level (P=0.06). The model accounted for a significant 7% of the variability in midwives' nutrition knowledge scores (R^2=.077, adjusted R^2= .065, *F* (4, 301) =6.320, *P*=0.000).

3.5 Nutrition education

Slightly over half (51.1%, n=168) of the midwives in the study reported they had received nutrition information or education during their midwifery education, while 28% (n=92) said "No" and 21% (n=69) did not recall receiving this education. Similarly slightly over half (54.1%, n=178) reported they received

nutrition education after being registered as a midwife, while 42.2% (n=139) said “No” and 3.6 (n=12) did not recall receiving this education.

3.6 Confidence in providing general and specific nutrition related advice

The level of confidence of midwives in providing general and specific nutrition-related advice to pregnant women is presented in Table (5). The majority of the midwives (70.9%, n=217) had a moderate level of confidence in providing ‘general-related nutrition advice’ to pregnant women. In terms of specific nutrition issues, the level of confidence ranged from moderate to low. Midwives had a moderate level of confidence in discussing ‘weight gain and obesity’, ‘nutrition for breastfeeding’, ‘providing advice on vitamins’ and ‘diabetes’. The areas where midwives had a low level of confidence were discussing vegetarian diets, vegan diets, diets of women with previous or complex medical conditions and diets of women from ethnic or minority groups.

3.7 Availability of dietitians’ services and referral to dietitians

The availability of dietitians’ services and referral to dietitians are exhibited in Table 3. Dietitians’ services or support were available for 83.3% (n=274) of the respondents and of those 88.7% (n=243) made referrals to the dietitians. Midwives were asked if they reported making referrals to the dietitians to specify for what conditions; 188 midwives provided answers to this question. The most common conditions for which referrals to dietitians were made were diabetes and obesity. Other weight related issues (inadequate/excessive weight gain, underweight, and weight loss), complex medical conditions and dietary concerns were mentioned less frequently. The least mentioned conditions were common symptoms of pregnancy (morning sickness, anaemia and constipation), special diets (for example, vegetarian/vegan) and others such as women’s request.

Although dietetic services or support was indicated as available and used by the majority of midwives, the midwives (both those who do and do not make referrals) provided comments that indicated issues around

accessing these services. The most common issue was that referral was predominately restricted to women with gestational diabetes. Other issues included: high demand for dietitians' services; limited time allocations; limited funds for full time staff; limited availability of dietitians in remote areas and lack of time for midwives to make referral to dietitians.

4 Discussion

This study reports on five key areas relating to the provision of nutrition education by Australian midwives. The majority of the Australian midwives in this study highly rated the importance of nutrition during pregnancy and the significance of their role in providing nutrition education. They reported providing nutrition advice to pregnant women, mainly focussing on topics such as healthy eating, micronutrients and food safety; however their general knowledge of nutrition was found to be inadequate in a number of areas. Their low level of knowledge was not unexpected, as only half of the midwives reported receiving nutrition information or education during their midwifery education or during practice. Most of the midwives had a moderate level of confidence in providing a range of nutrition advice to pregnant women but were not so confident in discussing special diets. For complex issues such as diabetes and obesity the midwives referred women to dietitians but there were a number of barriers limiting referral for other nutrition related issues.

The high rating by the majority of midwives of the importance of nutrition during pregnancy and the significance of their role in nutrition education is similar to previous findings.[19] However, these positive views did not align with the midwives' own knowledge of general nutrition during pregnancy, which was overall inadequate. Prior studies have also found midwives' knowledge of nutrition to be inadequate.[18, 20, 23] A contrary finding has been reported by Elias et al[19] who found New Zealand midwives to be knowledgeable of nutrition and highly confident in educating pregnant women about it. A possible explanation is that in New Zealand, midwives are the Leading Maternity Carers who provide continuity

of care for the vast majority of women during pregnancy.[24] For this reason, they might be more proactive in learning about nutrition and they may perceive it as their role to educate women about nutrition. Similarly in our study midwives in independent midwifery practice had significantly higher mean scores of nutrition knowledge compared to midwives working in public hospitals. The use of different tools to evaluate midwives' knowledge might be another explanation for the discrepancy in reported knowledge levels between Australian and New Zealand midwives.

The majority of the midwives in the study provided nutrition advice to pregnant women. This is similar to earlier research in the United Kingdom and New Zealand.[25, 26] The discussion of nutrition issues with pregnant women was reported to primarily take place at the first antenatal visit for the majority of midwives, which is in line with the Standards of Maternity Care of Australia and New Zealand (2014).[27] Only about half of the midwives discussed nutrition at every antenatal visit. Discussing nutrition at every antenatal visit is a recommendation of the recent Australian Antenatal Care Guidelines.[13] However, a possibility for this finding could be that only midwives who work in a continuity of care model are well placed to provide nutrition advice at every antenatal visit as they see pregnant women throughout their pregnancy. How to incorporate nutrition discussions into every antenatal visit, across all models of care, needs further examination.

Sixty percent of the midwives discussed nutrition with the woman only if she had a medical condition such as gestational diabetes. This finding was further confirmed through some midwives' comments that they only provided specific advice to women with special issues (such as diabetes and obesity) or provided advice only if women asked them or there was a concern. Although midwifery philosophy is based on viewing pregnancy and birth as normal events and promoting wellbeing[9], the rising rates of obesity and diabetes might have shifted the focus of midwifery from promoting health and wellbeing to managing risks. Lack of time (reported previously[8] and pointed out by few midwives in this study) may also limit the extent of advice provided by midwives, and force them to prioritise advice given to nutrition related issues with perceived immediate risks and effects on the health of the mother and baby such as

gestational diabetes. Reemphasising midwives' role in public health and wellness promotion within midwifery education and during practice as pointed out by the National Australian Competency Standards is crucial, [11] so midwives provide nutrition advice for all pregnant women and not only those with medical conditions such as gestational diabetes.

Midwives' low level of knowledge of the average change in energy requirements during pregnancy (an increase by 1400-1900kJ /day) and the healthy weight gain for a woman who commenced her pregnancy at normal weight (11.5-16 Kg), was of concern given the complications associated with excessive weight gain during pregnancy. On average there is only a slight increase in the energy requirements of pregnant women and thus emphasis should be placed on improving the quality of dietary intake rather than the quantity.[28] Highlighting this piece of information to pregnant women might contribute to the prevention of excessive weight gain during pregnancy.

Midwives were found to lack knowledge of appropriate weight gain during pregnancy. Australia does not have specific weight gain guidelines. The Institute Of Medicine guidelines are widely accepted and have been adopted as weight gain recommendations in Australia but midwives did not appear to be aware of this. A recent Australian research study found that health care providers (including midwives) had low awareness of Institute Of Medicine guidelines, with 25% not providing any gestational weight gain advice in accordance with pregnant women Body Mass Index (BMI) category.[29] Failure to provide weight gain advice by health care providers has been linked to pregnant women gaining weight outside the recommendations of the Institute Of Medicine guidelines.[30]

Midwives varied in their knowledge of nutrient requirements during pregnancy. The timing of folic acid supplement was widely known (93.6% responded correctly), perhaps as a result of long-standing public health campaigns. However, 33 % of the respondents answered incorrectly when asked about the amount of folic acid supplements needed daily during pregnancy. The level of professional knowledge of nutrient recommendations can be affected by inconsistencies in official guidance. In the case of recommended

folic acid supplementation, at the time of designing this study, the National Health and Medical Research Council's (NHMRC) recommended dose for folic acid supplement during pregnancy was 400μg/day[31]; therefore it was coded as the correct answer. However, at the time of collecting the data the National Antenatal Care Guidelines Module One had been released recommending a dose of 500μg/day[12], even though the NHMRC recommendations continued to be 400μg/day. Both answers were then recorded as correct, but inconsistent official guidance will cause confusion, both in terms of health care providers and what advice they should be giving, and for women in terms of what advice to follow.

Midwives' knowledge of vitamin B12 and iodine was low, perhaps due to lower levels of publicity as compared to other nutrients such as folic acid. The Standards of Maternity Care of Australia and New Zealand (2014) recommend that vegetarian and vegan pregnant women should be supplemented with vitamin B12 during pregnancy as they are at risk of vitamin B12 deficiency, which may lead to neurological adverse outcomes in the infants.[27] Midwives need to be aware of such recommendations to advise vegetarian and vegan pregnant women accordingly.

Iodine has a very important role in the development of the foetal brain and the nervous system and even mild deficiency during pregnancy can result in long term adverse outcomes.[32] The NHMRC recommends pregnant women to have dietary intake of 220μg of iodine per day.[31] NHMRC recommends also a supplementation of 150μg/day to all pregnant women to meet increased requirements that might not be met through diet alone.[33] Mild iodine deficiency among Australian pregnant women has been reported[32]. Pregnant women reported health care providers as their main source of information about iodine, but a small proportion received such advice.[34] Midwives in this study also less frequently commented they provided advice on iodine compared to other nutrients such as iron, folate and calcium. Health care providers (including midwives) need to be aware of all aspects of knowledge related to iodine (for example, its importance in pregnancy, the increased requirements and necessity of supplementation) to educate pregnant women about them.

The questions of food related knowledge such as the recommended number of serves of dairy per day was answered poorly by the majority of the midwives. The correct answer at the time of the study was two serves per day where a serve equals: a glass of milk (250mL), a tub of yogurt (200g) or 2 slices of cheese (40g). The Australian dietary Guidelines were revised and published in 2013[35] and the recommended number of dairy serves was increased to two and a half serves per day, again reflecting evolving nutrition advice and reinforcing that health care providers need to be vigilant to ensure their levels of knowledge remains current. Two midwives in the study provided comments that questioned the nutritional role of dairy products. These responses reflected the respondents' personal views, not the official, evidence-based dietary guidance that should inform their practice. Low levels of formal nutrition education and professional oversight of the nutrition education being provided may result in health care providers providing personal perspectives rather than evidence-based guidelines. The Australian Dietary Guidelines[35] recommend dairy products as part of a balanced diet and an excellent source of calcium and many other important nutrients (reduced fat varieties are recommended). Other alternative sources for calcium are recommended for people who do not consume dairy.

Midwives identification of multiple food sources and multiple risky foods was varied; with most respondents highly recognising the answers individually but not ticking all correct answers. For example, foods that should be avoided because they pose a risk of listeria in pregnancy (i.e. soft cheeses, pre-prepared salads and cold meats) were highly recognised individually but not all respondents identified all three foods. Listeria is a food borne disease that can cause adverse effects on the health of the unborn baby,[36] and midwives need to be aware of all foods that could carry the risk of listeria to educate pregnant women about them.

Regarding food sources of iron, although iron was the most frequent micronutrient midwives mentioned they provided advice about, only 59% recognised legumes and very few (11.2%) recognised seafood as good sources of iron. All pregnant women have increased requirements of iron, which might place them at increased risk of developing iron deficiency anaemia.[37] Legumes are good sources of iron especially for

vegetarian and vegan women who do not consume animal foods, and this information needs to be recognised by all midwives when advising vegetarian or vegan women.

The factors that had significant links to midwives' nutrition knowledge in bivariate analyses included: nutrition education or information received during midwifery education, principal place of practice, level of maternity services and confidence in providing general nutrition advice. Although nutrition education provided during midwifery education is insufficient on its own, it establishes basic knowledge and skills that midwives can build on during practice. Therefore, midwifery education needs to ensure that its nutrition content covers those basic knowledge and skills. The difference in knowledge levels between midwives working in public hospitals and independent midwives could be due to variance in models of care. Independent midwives provide continuity of care throughout pregnancy; they may be more active in acquiring nutrition knowledge as they may feel a high level of responsibility for the overall advice they provide to pregnant women. Public hospital antenatal care is provided by a variety of practitioners where midwives may not see the same women twice during pregnancy. Therefore they may lack resources to either update their knowledge or provide nutrition advice to pregnant women. Midwives in rural hospitals also had lower knowledge compared to midwives in regional hospitals. This is not surprising as midwives in rural hospitals usually work in isolation and might not have the support of dietitians, which midwives in our study cited as the most used source of nutrition information. These results indicate a need for continuous education and updates for midwives in public hospitals especially rural hospitals.

The significant factors combined (including: nutrition education or information received during midwifery education, principal place of practice, level of maternity services and confidence in providing general nutrition advice) explained 7% of the variation in midwives' knowledge in the model of multiple regression. Although the proportion of variance is small, it is significant and needs to be taken into consideration. It is likely that there are other factors than those included in this exploratory study that exert greater impacts on midwives' knowledge. Future studies would be needed to confirm our findings and also to identify further factors affecting midwives' knowledge in greater depth.

The confidence level of most midwives ranged from moderate to low in discussing specific nutrition issues. These results were to some extent anticipated as they were comparable with earlier studies.[18, 19] The qualitative comments of midwives identified that topics such as weight gain/weight management, diabetes and vegetarian/vegan diets were less frequently specified as part of nutrition advice provided by the midwives compared to general topics. In regard to 'weight gain/obesity', barriers such as perceived low priority of gestational weight gain, sensitivity of the issues for both midwives and pregnant women, lack of resources, education and communication skills were also reported in the literature as affecting midwives' ability to discuss these topics with pregnant women.[15, 16]

Another possible explanation for low level of confidence in discussing specific nutrition related issues is that some of these issues might be perceived by the midwives as out of their scope of knowledge and practice, and should be referred to dietitians who are the experts in the area of nutrition. However, as was identified from midwives' comments in this study, referral to dietitians (for issues other than gestational diabetes and to a lesser extent obesity) is limited, mainly due to limited access to dietitians even if the referral was made. This is a health system issue that needs to be addressed, so midwives can confidently refer pregnant women with nutrition education needs out of their scope of knowledge to dietitians as required. Given the rising rates of obesity, it is vital that midwives are equipped to provide nutrition education and support to all pregnant women. Our study identified health professionals such as dietitians as the most frequently used source of nutrition advice for midwives, therefore, (with their current limited access to pregnant women), dietitians could contribute to enhancing maternal and foetal health by educating midwives via the provision of regular education sessions, updates and resources.

Midwives' inadequate level of pregnancy general nutrition knowledge (in several areas) and moderate to low levels of confidence in discussing general and specific nutrition related issues observed in this study could reflect that they had not received adequate nutrition information or education about these issues. Indeed, in this study, only half of the midwives reported receiving nutrition education during midwifery education and during practice. Midwives need to be equipped with adequate nutrition education both

while obtaining their basic qualifications and during practice, if they are expected to discuss healthy nutrition with pregnant women as outlined in the new Antenatal Care Guidelines (model one[12] and two[13]), and fulfil their role in improving the health of mothers and future generations.

4.1 Limitations

A number of limitations of this study are identified. Not all Australian midwives had the opportunity to respond to the survey as not all Australian midwives are members of the ACM. The completion rate was 6.9% of the 4770 midwives but the number of respondents (n=329) was very close to the estimated required sample size (n=356) and provided sufficient power to detect statistical significance. The response rate was also comparable to previous research conducted with this group.[38] Online surveys are known to have a significantly lower response rate compared to paper surveys.[39] The frame of convenience sampling of the study has some inherent limitations as midwives who chose to undertake the survey might have been more interested, motivated or knowledgeable about nutrition than the rest of the population. Recall bias cannot be totally excluded, especially in terms of receiving nutrition information or education during midwifery education, as three quarters of the responding midwives were aged 41 and older, and may have undertaken their midwifery education a long time ago. Some midwives also reported difficulty in listing everything they included in their advice. Taking in consideration the feedback from the piloting of the survey (that the survey was long), the knowledge part was kept short and general. It might have not been reflective of all aspects of nutrition during pregnancy.

Although the survey was meant for practising midwives, the emails were sent through the ACM officers and the researchers had no control over who responded to the invitations. It is possible that some of the respondents were not currently practising midwives. Therefore, these results cannot be generalised and need to be interpreted with caution. Nevertheless, the sample characteristics were similar to midwives' workforce characteristics in 2012 in terms of gender and age.[40] This study, thus, highlights that the

nutrition knowledge of this sample of mature Australian midwives appears to be inadequate in several areas and would benefit from further education and support.

4.2 Future research

A comprehensive validated survey examining midwives' knowledge of Australian dietary guidelines[35] is warranted. Midwives' knowledge of and their adherence to the National Antenatal Care Guidelines would also benefit from further exploration.[12, 13] Semi-structured interviews are needed to gain in depth understandings of midwives' role and approaches in the provision of nutrition advice during pregnancy and barriers which might impact on this role.

5 Conclusion and practical implications

Nutrition during pregnancy is important and midwives play a key role in providing nutrition education to pregnant women. However, the results of this study indicate that the opportunity to support women during this time may be lost due to low levels of knowledge, variable levels of confidence and passive approaches to nutrition education during antenatal visits. As nutrition education during midwives' professional education was one of the significant links to nutrition knowledge levels, professional education requirements should be re-examined to bring them in line with evidence-based nutrition guidelines and clinical practice guidelines. Continued nutrition education to support midwives in practice (especially in public and rural hospitals) is equally important and could be provided through official organizations such as the ACM, to ensure currency of midwives' nutrition knowledge

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References

1. Uusitalo U, Arkkola T, Ovaskainen M-L, Kronberg-Kippilä C, Kenward MG, Veijola R, Simell O, Knip M, Virtanen SM. Unhealthy dietary patterns are associated with weight gain during pregnancy among finnish women. *Public Health Nutr* 2009; **12**(12): 2392-9.
2. Langford A, Joshu C, Chang JJ, Myles T, Leet T. Does gestational weight gain affect the risk of adverse maternal and infant outcomes in overweight women? *Matern Child Health J* 2011; **15**(7): 860-5.
3. Guelinckx I, Devlieger R, Beckers K, Vansant G. Maternal obesity: Pregnancy complications, gestational weight gain and nutrition. *Obes Rev* 2008; **9**(2): 140-50.
4. Marchi J, Berg M, Dencker A, Olander EK, Begley C. Risks associated with obesity in pregnancy, for the mother and baby: A systematic review of reviews. *Obes Rev* 2015; **16**(8): 621-38.
5. Malek L, Umberger W, Makrides M, Zhou SJ. Adherence to the Australian dietary guidelines during pregnancy: Evidence from a national study. *Public Health Nutr* 2015: 1-9.
6. Phelan S. Pregnancy: A "teachable moment" for weight control and obesity prevention. *Am J Obstet Gynecol* 2010; **202**(2): 135. e1-. e8.
7. Szwajcer EM, Hiddink GJ, Maas L, Koelen MA, Van Woerkum CM. Nutrition-related information-seeking behaviours of women trying to conceive and pregnant women: Evidence for the life course perspective. *Fam Pract* 2008; **25**(S1): i99-i104.
8. Lucas C, Charlton K, Yeatman H. Nutrition advice during pregnancy: Do women receive it and can health professionals provide it? *Matern Child Health J* 2014; **18**(10): 2465-78.
9. *ACM*. Philosophy for midwifery. 2004 [cited 2015 September 7]; Available from: http://www.midwives.org.au/scripts/cgiip.exe/WService=MIDW/ccms.r?pageid=10019
10. ICM. 2010. Essential competencies for basic midwifery practice. International Confederation of Midwives, http://www.internationalmidwives.org/assets/uploads/documents/CoreDocuments/ICM%20Essential%20Competencies%20for%20Basic%20Midwifery%20Practice%202010,%20revised%202013.pdf.
11. ANMC. National competency standards for the midwife. Canberra; 2006.
12. Australian Health Ministers' Advisory Council. 2012. Clinical practice guidelines: Antenatal care – module 1. Canberra. Australian Government Department of Health and Aging, http://www.health.gov.au/antenatal.
13. Australian Health Ministers' Advisory Council. 2014. Clinical practice guidelines: Antenatal care – module ii. Canberra. Australian Government Department of Health and Aging, http://www.health.gov.au/antenatal.
14. Arrish J, Yeatman H, Williamson M. Midwives and nutrition education during pregnancy: A literature review. *Women Birth* 2014; **27**(1): 2-8.
15. Willcox JC, Campbell KJ, Pligt P, Hoban E, Pidd D, Wilkinson S. Excess gestational weight gain: An exploration of midwives' views and practice. *BMC Pregnancy Childbirth* 2012; **12**.

16. Schmied VA, Duff M, Dahlen HG, Mills AE, Kolt GS. 'Not waving but drowning': A study of the experiences and concerns of midwives and other health professionals caring for obese childbearing women. *Midwifery* 2011; **27**(4): 424-30.
17. *Raosoft*. Sample size calculator. 2004 [cited 2011 November 20]; Available from: http://www.raosoft.com/samplesize.html
18. Mulliner CM, Spiby H, Fraser R. A study exploring midwives' education in, knowledge of and attitudes to nutrition in pregnancy. *Midwifery* 1995; **11**(1): 37-41.
19. Elias S, Green T. Nutrition knowledge and attitudes of New Zealand registered midwives. *Nutr Diet* 2007; **64**(4): 290-4.
20. Barrowclough D, Ford f. A nutrition open-learning pack for practising midwives. *Nutr Food Sci* 2001; **31**(1): 6-12.
21. Sarmugam R, Worsley A, Flood V. Development and validation of a salt knowledge questionnaire. *Public Health Nutr* 2014; **17**(5): 1061-8.
22. Elo S, Kyngas H. The qualitative content analysis process. *J Adv Nurs* 2008; **62**(1): 107-15.
23. Symon A. Midwives' nutrition knowledge: An evaluation. *Pract Midwife* 2002; **5**(10): 24-5.
24. Ministry of Health. 2015. Report on maternity, 2012. Wellington. Ministry of Health, http://www.health.govt.nz/publication/report-maternity-2012.
25. Farrar D. Nutrition advice in pregnancy. *Pract Midwife* 2013; **16**(9): 13-7.
26. Pan SYA, Obstetrics P, Dixon L, Paterson H, Norma Campbell R, MM R. New zealand lmc midwives' approaches to discussing nutrition, activity and weight gain during pregnancy. *NZCOM J* 2014; **50**: 24-9.
27. RANZCOG. Standards of maternity care in Australia and New Zealand. The Royal Australian and New Zealand College of Obstetricians and Gynaecologists, East Melbourne, Victoria, Australia; 2014.
28. Williamson CS. Nutrition in pregnancy. *Nutr Bull* 2006; **31**(1): 28-59.
29. Wilkinson SA, Stapleton H. Overweight and obesity in pregnancy: The evidence–practice gap in staff knowledge, attitudes and practices. *Aust N Z J Obstet Gynaecol* 2012; **52**(6): 588-92.
30. Cogswell ME, Scanlon KS, Fein SB, Schieve LA. Medically advised, mother's personal target, and actual weight gain during pregnancy. *Obstet Gynecol* 1999; **94**.
31. NHMRC. 2006. Nutrient reference values for Australians and NewZealand including recommended dietary intakes. Canberra. National Health and Medical Research Council, http://www.nhmrc.gov.au/guidelines-publications/n35-n36-n37.
32. Hynes KL, Otahal P, Hay I, Burgess JR. Mild iodine deficiency during pregnancy is associated with reduced educational outcomes in the offspring: 9-year follow-up of the gestational iodine cohort. *J Clin Endocrinol Metab* 2013; **98**(5): 1954-62.
33. *NHMRC*. Iodine supplemntation for pregnanct and breastfeeding women. 2010 [cited 2012 May 4]; Ref no. 45:[Available from: https://www.nhmrc.gov.au/guidelines-publications/new45
34. Martin JC, Savige GS, Mitchell EKL. Health knowledge and iodine intake in pregnancy. *Aust N Z J Obstet Gynaecol* 2014; **54**(4): 312-6.
35. *NHMRC*. Australian dietary guidelines. 2013 [cited 2015 February 20]; Available from: http://nhmrc.gov.au/guidelines-publications/n55
36. Swaminathan B, Gerner-Smidt P. The epidemiology of human listeriosis. *Microbes Infect* 2007; **9**(10): 1236-43.
37. Puolakka J, Janne O, Pakarinen A, Jarvinen PA, Vihko R. Serum ferritin as a measure of iron stores during and after normal pregnancy with and without iron supplements. *Acta Obstet Gynecol Scand Suppl* 1980; **95**: 43-51.
38. Biro MA, Cant R, Hall H, Bailey C, Sinni S, East C. How effectively do midwives manage the care of obese pregnant women? A cross-sectional survey of Australian midwives. *Women Birth* 2013; **26**(2): 119-24.
39. Yetter G, Capaccioli K. Differences in responses to web and paper surveys among school professionals. *Behav Res Methods* 2010; **42**(1): 266-72.

40. Australian Institute of Health and Welfare. 2013. Nursing and midwifery workforce 2012. National Health Workforce Series. 6. HWL 52. Canberra. AIHW.

Table 1: Characteristics of the respondents [(a)]

Characteristics	Number of responses (n)	Percentage (%)
Gender		
Female	325	98.8
Male	4	1.2
Age		
21-30 years	28	8.5
31-40 years	55	16.7
41-50 years	95	28.9
Older than 50 years	151	45.9
Education		
Bachelor degree of Midwifery	74	22.5
Hospital-based training Midwifery	175	53.2
Initial midwifery postgraduate degree	80	24.3
Years of experience		
Less than 2 years	22	6.7
2-5 years	30	9.1
6-10 years	48	14.6
More than 10 years	229	69.6
Principal state or territory of work		
New South Wales (NSW)	96	29.2
Queensland (Qld)	78	23.7
South Australia (SA)	30	9.1
Tasmania (Tas.)	8	2.4
Victoria (Vic.)	58	17.6
Western Australia (WA)	40	12.2
Australian Capital Territory (ACT)	8	2.4
Northern Territory (NT)	11	3.3
Principal place of practice		
Public hospital	285	86.6
Private hospital	16	4.9
Independent midwifery practice	28	8.5
Level of maternity services		
Community	53	16.1
Rural hospital	53	16.1
Regional hospital	113	34.3
Tertiary referral	110	33.4
Area of midwifery practice[(b)]		
Antenatal care	96	29.2
Birthing (labour) suite	54	16.4
Postnatal	89	27.1
Rotation through all the above areas	136	41.3
Group practice (case load or team midwifery)	67	20.4
Independent midwifery practice	28	8.5

[(a)]Total number = 329
[(b)]Multiple responses allowed

Table 2: Attitudes of midwives towards the importance of nutrition and their role in providing nutrition education during pregnancy [(a)], % (n)

The question	High importance	Moderate importance	Low importance
How important do you think nutrition is during pregnancy?	86.6% (n=285)	13.4% (n=44)	-
	High significance	**Moderate significance**	**Low significance**
How would you rate the role that midwives can play in providing nutrition information or education for pregnant women?	75.7% (n=249)	23.7% (n=78)	0.6% (n=2)

[(a)]**Total number = 329**

Table 3: Provision of nutrition related-advice to pregnant women by midwives in the study and the availability of dietitians' services and conditions for referral, n (%)

	n	%
Do you provide any nutrition-related advice to pregnant women? [(a)]		
Yes	306	93.0
No	23	7.0
On what occasions do you discuss nutrition issues with pregnant women? [(b)*]		
At the first antenatal visit	219	71.6
If the pregnant women has a medical condition requiring nutrition intervention, such as gestational diabetes	182	59.5
At every antenatal visit	145	47.4
Only when the pregnant women asks questions	72	23.5
I only rarely discuss nutrition issues with pregnant women	16	5.2
What information sources do you use as the basis for this advice? [*]		
Other health professionals, such as dietitians	249	81.4
General knowledge	231	75.5
Midwifery education	192	62.7
Governmental or official websites	165	53.9
Midwifery journals	161	52.6
Textbooks	119	38.9
Internet	110	35.9
Other [(c)]	49	16.0
Media (e.g. Television, newspaper)	23	7.5
Magazines	16	5.2
Do you have a dietitian's services or support for pregnant women at your hospital?[(a)]		
Yes	274	83.3
No	55	16.7
If yes do you make referrals to the dietitian? [(d)]		
Yes	243	88.7
No	31	11.3

[(a)] n=329

[(b)] n=306 (Number varies from total number because only midwives who provide nutrition-related advice answered this section)

[(c)] Other sources included: other scientific, medical , naturopathic and diabetes journals, booklets from hospitals or dietitians, governmental handouts, clinical guidelines, policies and protocols, midwives' personal life style, personal experience with dietitians and alternative health professionals such as naturopaths and herbalists, nutrition or complementary medicine and naturopathic courses, workshops, books, gym, and nutrition readings.

[(d)] n=274 (only midwives who had dietitian's support or services answered this question)

[*] Multiple responses allowed

Table 4: The distribution of correct and incorrect/do not know answers of the knowledge questions (single -answer items and multiple-answer items [a, b]

(Single -answer items) Abbreviated form of the question. n (%)	Correct answer	Incorrect answer
1.Average change in energy requirements during pregnancy	163 (49.5)	166 (50.5)
2.Is there a difference in the energy requirements for pregnant women during the three trimesters of pregnancy?	210 (63.8)	119 (36.2)
3.The range of healthy weight gain during pregnancy for a woman who commenced her pregnancy at normal weight	88 (26.7)	241 (73.3)
4.The most important vitamin supplement for vegetarian pregnant women	205 (62.3)	124 (37.7)
5.When should women take folic acid supplements	308 (93.6)	21 (6.4)
6.The amount of folic acid supplements needed daily during pregnancy	222 (67.5)	107 (32.5)
7.The recommended number of serves of dairy foods required per day to meet pregnant women requirements for calcium	88 (26.7)	241 (73.3)
8.Iodine requirements per day for a pregnant woman	66 (20.1)	263 (79.9)
(Multiple answer-items)	**n**	**%**
1.Foods that should be avoided as risk for listeria		
Soft cheeses	325	98.8
Hard cheeses	6	1.8
Pre-prepared salads	292	88.8
Cold meats	275	83.6
I do not know	1	0.3
Respondents who ticked all the 3 correct answers	256	77.8
Respondents who ticked 2 correct answers	52	15.8
Respondents who ticked at least 1 correct answer	20	6.1
Respondents who did not tick any correct answers	1	0.3
2. Food sources of iron		
Red meat	322	97.9
Legumes	194	59.0
Sea food	37	11.2
Green leafy vegetables	307	93.3
I do not know	0	0.0
Respondents who ticked all the correct answers	30	9.1
Respondents who ticked 3 correct answers	158	48.0
Respondents who ticked 2 correct answers	125	38.0
Respondents who ticked at least 1 correct answer	16	4.9
3.Advice to minimise the effect of nausea and vomiting during pregnancy		
Drink plenty of fluids with meals	57	17.3
Avoid fatty or spicy foods	278	84.5
Eat large quantities of food at meal times	2	0.6
Minimise odours while cooking	240	72.9
Eat large snacks every few hours	45	13.7
Have some dry toast or biscuits before getting out of bed in the morning	314	95.4
I do not know	2	0.6
Respondents who ticked all the correct answers	210	63.8
Respondents who ticked 2 correct answers	86	26.1
Respondents who ticked at least 1 correct answer	30	9.1
Respondents who did not thick any correct answers	3	0.9
4.Foods to assist with resolving constipation during pregnancy		
Fluids	313	95.1
Dairy foods	1	0.3
Fruits and vegetables	328	99.7
Meat	1	0.3
I do not know	0	0.0
Respondents who ticked all the correct answers	312	94.8
Respondents who ticked at least 1 correct answer	17	5.2

[a]n = 329

[b]Multiple responses allowed

Table 5: level of confidence of midwives in providing general and specific nutrition-related advice to pregnant women[(a)], n (%)

	Number of midwives who answered the questions[(b)]	High confidence	Moderate confidence	Low confidence
1.General related- nutrition advice	306	50 (16.3)	217 (70.9)	39 (12.7)
2.Weight gain and obesity	306	58 (19.0)	182 (59.5)	66 (21.6)
3.Providing advice on vitamins	305	37 (12.1)	194 (63.6)	74 (24.3)
4.Vegetarian diets (ovo-lactovegetarian-no animal meats)	304	20 (6.6)	101(33.2)	183 (60.2)
5.Vegan diets (no animal products)	305	13 (4.3)	73 (23.9)	219 (71.8)
6.Diabetes	304	36 (11.8)	175 (57.6)	93 (30.6)
7.Diets of women with previous or complex medical conditions	304	9 (3.0)	87 (28.6)	208 (68.4)
8.Diets of women from ethnic or minority groups	229	10 (3.3)	88 (29.4)	201 (67.2)
9.Post-natal nutrition (breastfeeding)	304	68 (22.4)	205 (67.4)	31 (10.2)

[(a)] n = 306 (the number varies from total number because only midwives who provide nutrition-related advice answered this section)
[(b)] Numbers vary because of missing values