

The Relationship Between Diet Quality, Nutrition Self-Efficacy and Sources of Nutrition Information in Australian Pregnant Women: A Cross-Sectional Analysis

American Journal of Health Promotion
2025, Vol. 0(0) 1–10
© The Author(s) 2025




Article reuse guidelines:

sagepub.com/journals-permissions

DOI: 10.1177/08901171251336931

journals.sagepub.com/home/ahp



Akela Phillips, BFSHN¹, Tamara Bucher, PhD^{1,2,3}, Penta Pristijono, PhD¹, and Sasha Fenton, PhD, APD^{3,4} 

Abstract

Purpose: To assess diet quality and nutrition self-efficacy in pregnant women, the relationship between diet quality and nutrition self-efficacy, and differences in diet quality and self-efficacy when information obtained from health and non-health professionals.

Design: Observational cross-sectional study.

Setting: Online survey.

Sample: Australian pregnant women.

Measures: Australian Eating Survey measured diet quality, Ralf Schwarzer and Britta Renner nutrition self-efficacy scale measured nutrition self-efficacy.

Analysis: Spearman's correlation measured the association between diet quality and nutrition self-efficacy. Linear regression examined the influence of nutrition self-efficacy on diet quality. T-tests examined differences in diet quality and nutrition self-efficacy scores in groups who did/did not obtain nutrition information from health professionals.

Results: Participants (n = 171) (mean (SD) age 32.5 (3.9) years, 81.9% born in Australia) reported a mean diet quality score of 33.9 (8.7) out of 73 and mean nutrition self-efficacy score of 14.7 (3.7) out of 20. A moderate positive linear relationship was observed between diet quality and nutrition self-efficacy ($r_s = 0.27, P < .001$). Nutrition information was obtained by 88%, most commonly via the internet. Diet quality scores were not significantly different when nutrition information was obtained from health professionals ($t(24) = -0.823, P = .32$), however, nutrition self-efficacy scores were significantly higher ($U = 856, z = 2.18, P = .03$).

Conclusion: Pregnant women report poor diet quality. Improving nutrition self-efficacy may be effective for improving diet quality. Evidence-based nutrition information should be accessible via the internet and promoted by health authorities.

Keywords

pregnant women, pregnancy, diet quality, dietary intake, self-efficacy, nutrition information

Indexing keywords

pregnancy, diet, nutrition, self-efficacy

¹School of Environmental and Life Sciences, College of Engineering, Science and Environment, University of Newcastle, Ourimbah, NSW, Australia

²Department of Health Professions, Division of Nutrition and Dietetics, Bern University of Applied Sciences, Bern, Switzerland

³Food and Nutrition Research Program, Hunter Medical Research Institute, New Lambton Heights, NSW, Australia

⁴School of Health Sciences, College of Health, Medicine and Wellbeing, University of Newcastle, Callaghan, NSW, Australia

Corresponding Author:

Sasha Fenton, School of Health Sciences, College of Health, Medicine and Wellbeing, University of Newcastle, University Dr, Callaghan, NSW 2308, Australia.

Email: sasha.fenton@newcastle.edu.au

Purpose

During pregnancy, the consumption of a high-quality diet that meets energy and nutrient requirements is needed to support foetal growth and development, reduce the risk of birth defects, achieve healthy weight gain, and reduce pregnancy and birth complications.¹⁻⁴ Diet quality can be defined as “the nutritional adequacy of an individual’s dietary pattern and how closely this aligns with national dietary guidelines”⁵ and can be measured via diet quality indices which provide an overall diet quality score.⁶ In previous studies in pregnant women, dietary assessment has mostly focused on intake of individual nutrients or types of foods, rather than on overall diet quality.^{7,8} This is not without merit, given that consuming single nutrients in appropriate amounts assists in the prevention of certain nutrient deficiencies and abnormalities, for example folic acid consumption to prevent neural tube defects.⁹ In reality though, nutrients are not consumed in isolation, but rather as foods and beverages, eaten in combinations to form meals. As nutrients have been shown to act synergistically when consumed together, ie, they demonstrate a cumulative impact on the human body,⁹ assessing the diet as a whole and evaluating the diet quality of pregnant women is important to quantify the risk of adverse health outcomes for themselves and their offspring.⁵

The ‘Nutrition self-efficacy’ concept was developed from Albert Bandura’s concept of self-efficacy. It describes the belief in achieving nutritional goals set for oneself, and the ability to use this information,^{10,11} such as following healthy eating patterns and choosing foods that are nutritionally beneficial. There are many intrapersonal, interpersonal and environmental factors that can influence dietary behaviours, of which nutrition self-efficacy is considered one.¹² Higher nutrition self-efficacy during pregnancy may correlate with higher diet quality, but currently there is limited research regarding the relationship between nutrition self-efficacy and maternal diet quality. A 2014 study in the United States with 75 women who had previously been pregnant, with gestational diabetes, reported that higher self-efficacy was significantly associated with higher diet quality.¹² Other studies that have investigated maternal self-efficacy have examined this construct in relation to their child’s diet quality and dietary intake.¹³⁻¹⁵ More broadly, the relationship between self-efficacy and diet quality has been investigated in young adults, and found to be significant.¹⁶ To the best of our knowledge, there is no study on the assessment of the relationship between nutrition self-efficacy and diet quality in pregnant women. This relationship in contemporary pregnant women is important to elucidate, as improving nutrition self-efficacy may be an effective strategy for improving pregnant women’s overall diet quality.

For health promotion to be effective, high-quality and accurate information is imperative. Nutrition information provided to women from health professionals throughout their pregnancy has the potential to mediate higher nutrition self-

efficacy which then may correlate with a higher diet quality during pregnancy.¹⁷ Information presented through digital channels, including social media, smartphone applications and the internet, can be inaccurate and/or of poor quality, and may have negative implications on women’s nutrition knowledge and diet quality.¹⁸⁻²⁰ For example, a study which evaluated the quality and accuracy of nutrition-related information posted by popular Australian Instagram accounts reported that the information is often inaccurate and of sub-optimal quality and suggested that the public should be sceptical of the credibility.²¹ Knowledge on the most common sources pregnant women use to obtain nutrition information could inform future health promotion initiatives and positively influence diet quality in this population. Therefore, research is warranted in contemporary pregnant women.

To the best of our knowledge, no research has investigated the relationship between diet quality, nutrition self-efficacy, and sources used to obtain pregnancy nutrition information in pregnant women. The objectives of this study were to, (1) Assess the diet quality, dietary intake and nutrition self-efficacy in a contemporary sample of Australian pregnant women, (2) Assess the relationship between diet quality and nutrition self-efficacy in the sample, and (3) Assess the pregnant women’s sources of pregnancy nutrition information and evaluate differences in diet quality and nutrition self-efficacy scores in women who obtained nutrition information from health professionals and women who did not. We hypothesised that pregnant women who have a higher nutrition self-efficacy score will have a higher diet quality score, and a significant difference will be observed in nutrition self-efficacy scores and diet quality scores in pregnant women who received nutrition information from health professionals, relative to pregnant women who did not.

Methods

Study Design

The current study is a primary data analysis of an observational cross-sectional study. Ethics approval was granted by the Human Research Ethics Committee of the University of Newcastle (H-2023-0225). All participants provided informed consent to participate. Reporting of this study adheres to the Strengthening the Reporting of Observational Studies in Epidemiology - Nutritional Epidemiology (STROBE-nut) guidelines (Supplemental Table 1).²²

Sample and Recruitment

Participants were eligible to participate if they reported being pregnant, ≥ 18 years of age, and resided in Australia. Participants were recruited September to December 2023 from across Australia, primarily via sponsored Facebook advertisements. The study was also promoted to participants via social media posts and the Hunter Medical Research Institute

(HMRI) website. Participants were incentivised to participate by having the opportunity to enter a draw to win a gift card at Baby Bunting.

Measures

Data were collected via a 171-item online survey hosted on the QuestionPro platform (Version 13, QuestionPro Inc, Austin Texas).

Diet Quality

Diet quality was assessed using the Australian Recommended Food Score (ARFS), a food-based diet quality score calculated as a single continuous variable based on responses to a food frequency questionnaire (FFQ).⁵ The ARFS measures dietary variety within core food groups recommended in the Australian Guide to Healthy Eating (AGHE),²³ and was derived from a subset of 70 questions from the Australian Eating Survey (AES). The ARFS includes eight sub-scales, of which 20 questions relate to vegetables, 12 to fruit, 12 to breads and cereals, 10 to dairy foods, seven to meat, six to meat alternatives, two to spreads/sauces and one to water. Most food items are awarded one point for a consumption frequency of once per week or more, with exception of red meat and some dairy foods (eg, ice-cream, frozen yoghurt), where a limit is applied for higher intakes as they are associated with higher saturated fat intake and disease risk. For these foods, zero points are awarded for a higher frequency of consumption (e.g., more than four times per week for red meat). Additional points are awarded for greater consumption of vegetables, healthier choices of breads (e.g., brown, multigrain), and milk. Participants who indicate they follow a vegetarian eating pattern are assigned a zero score for the meat subscale, with double points awarded for each of the meat alternatives questions. An additional point is also awarded if soybeans, tofu, other beans and lentils were reported as consumed once per week or more. The total score, ranging from zero to 73, is calculated by summing the points for each food item, with higher scores indicating a higher diet quality.²⁴ The ARFS questions and scoring are available at [Supplemental Table 2](#). The total score is categorised into the following groups; 'needs work' (<33 points), 'getting there' (33-38 points), 'excellent' (39-46 points), and 'outstanding' (47+ points). The ARFS has been validated and shown high level of reliability and consistency in evaluating diet quality and estimating fruit and vegetable intakes among Australian adults.^{5,24}

Dietary Intake

Dietary intake was measured using the AES. The AES is a self-administered, validated semi-quantitative FFQ consisting of 120 questions, including beverages, milk and dairy foods, breads and cereals, sweet and savoury snacks, main meals, vegetables, fruit, and other foods.²⁵ In addition, the AES

contains 15 questions relating to age, height, weight, use of nutritional supplements, and intake-related behaviours.²⁵ The questions asked are based on the individual's food intake over the last three to six months. Responses were assessed using a Likert Scale with response options ranging from 'never' to up to 'seven times per day'. Standard portion sizes for each food item in the AES were derived from the most recent National Nutrition Survey data.²⁶ Nutrient intakes from the AES FFQ were computed using data in the AUSNUT 2011-13 database.²⁷ Participants' usual daily servings of vegetables, fruits, grains (cereals), meat and alternatives, and dairy foods (nutrient-dense core foods) were derived from the AES and compared with AGHE food group servings. Macro- and micronutrient intakes captured from the AES for each participant were compared to the respective Nutrient Reference Values (NRVs) to determine adequacy of intake.²⁸ Total contribution of energy intake from core and non-core foods were derived from the nutrient-dense core foods and discretionary foods that are high in saturated fat, added sugars, added salt and/or alcohol. The AES has been validated in the adult population and demonstrated high level of accuracy in estimating nutrient intake and fruit and vegetable intakes.^{29,30}

Nutrition Self-Efficacy

Nutrition self-efficacy was assessed using the Ralf Schwarzer and Britta Renner Nutrition Self-Efficacy scale which includes five questions on an individual's perspective of their daily nutrition needs.³¹ Each question is scaled from 1 'very uncertain' to 4 'very certain' with a total score out of 20. A higher score on the nutrition self-efficacy scale indicates a higher level of nutrition self-efficacy.

Sources Used for Obtaining Pregnancy Nutrition Information

A series of questions developed for this study were asked to identify if the participant obtained pregnancy nutrition information and if so the sources of nutrition information used, and the frequency in which they were used. To identify the different sources used, a question was asked with the options of 'General Practitioner (GP)', 'Obstetrician', 'Midwife', 'Dietitian/Nutritionist', 'Social media', 'Smart phone applications (apps)', 'Internet', 'Family and friends' and 'Other'. Participants were also asked about the frequency that they use/d their most used source of pregnancy nutrition information.

Socio-Demographic Characteristics

Socio-demographic data were collected including age, height, weight, education level, nationality, marital status and income, and health-related data such as parity, gestation length and smoking status.

Analysis

Data were analysed using SPSS statistical software (Version 29, IBM Corp, NY USA). Socio-demographic characteristics, diet quality (ARFS), dietary intake, nutrition self-efficacy and sources of pregnancy nutrition information are reported as a mean (SD) for continuous variables, and as number (%) for categorical variables. To measure the strength of the association between diet quality and nutrition self-efficacy, Spearman's rank-order correlation was used, due to the non-normal distribution of the nutrition self-efficacy scores. Correlation strength was described as weak <0.2, moderate 0.2-0.6, or strong >0.6, as previously identified within dietary validation studies.^{30,32} To examine the influence of nutrition self-efficacy on diet quality, linear regression analyses were conducted using an unadjusted model, and a model adjusted for BMI, household income and qualification. Mean comparison tests (independent t test and Mann-Whitney U test) were conducted to investigate differences in mean diet quality scores and nutrition self-efficacy scores for groups who obtained pregnancy nutrition information from at least one health professional compared to those who only obtained nutrition information from other sources (i.e., not any health professional). The level of statistical significance was set at $P < .05$.

Results

Of the 330 participants that expressed interest in participating in the study, 159 did not satisfy the inclusion criteria or complete the survey and were excluded from the study. To ensure quality of the data, the responses of participants who take less than half the median time to complete are commonly excluded.³³ Of the 171 completed survey responses, no responses were below half the median time taken, therefore, the current study included 171 participants.

Socio-Demographic Characteristics

The socio-demographic characteristics of the 171 pregnant women are summarised in Table 1. The mean (SD) age of the participants was 32.5 (3.9) years. More than half of the participants ($n = 102$, 59.6%) were pregnant with their first child, and the mean (SD) gestation period was 21.5 (9.8) weeks. The mean (SD) pre-pregnancy BMI of the participants was 26.1 (6.0) kg/m², with approximately half ($n = 84$, 49.4%) classified in the 'healthy' category. The mean (SD) current BMI of the participants was 27.9 (5.8) kg/m², with 33.9% ($n = 58$) classified in the 'healthy' category. The majority of the participants ($n = 140$, 81.9%) were born in Australia and reported to have completed a tertiary degree.

Diet Quality and Dietary Intake

The participants' diet quality scores (total and subscales) are summarised in Table 2. The mean (SD) total ARFS (diet

quality score) of the sample was 33.9 (8.7) out of 73 (range 8.0-57.0), which is categorised as 'getting there'. The participants reported consuming two-thirds (66.6%) of their total energy intake from nutrient-dense healthy core foods, and one-third (33.4%) of their total energy intake from energy-dense, nutrient-poor foods.

The participants' dietary intake is summarised in Table 3. The results indicated that in terms of healthy core foods the pregnant women met the recommendation for serves of fruit per day, but not for vegetables, breads and cereals, dairy foods or meat. In terms of macronutrient intake, the pregnant women consumed the recommended intakes for carbohydrate and protein, exceeded the recommendation for total fat and saturated fat, and did not meet the recommended intake for dietary fibre. Out of the key micronutrients, the mean consumption per day of dietary folate equivalents and zinc met the recommendations, whereas the sample did not meet the recommendations for iodine or iron.

Nutrition Self-Efficacy

The participants' mean (SD) nutrition self-efficacy score was 14.7 (3.7) points out of 20.0. The nutrition self-efficacy scores ranged from 5.0-20.0 points.

The Relationship Between Diet Quality and Nutrition Self-Efficacy

A correlation analysis showed a moderate positive linear relationship between diet quality and nutrition self-efficacy ($r_s = 0.27$, $P < .001$). In both the unadjusted and adjusted linear regression analyses, nutrition self-efficacy significantly predicted the diet quality score (Unadjusted model: ($F_{(1, 169)} = 11.51$, $P < .001$, $R^2 = 0.064$, $\beta = 0.602$, $SE = 0.177$; Adjusted model: ($F_{(15, 155)} = 2.69$, $P = .001$, $R^2 = 0.207$, $\beta = 0.541$, $SE = 0.185$). In the adjusted model, the average expected increase in diet quality score was 0.541 points ($SE 0.185$) for each one unit increase in nutrition self-efficacy score. The R^2 (0.207) suggests that nutrition self-efficacy can explain 20.7% of the change in the diet quality score.

Sources of Pregnancy Nutrition Information

A total of 137 participants (80.1%) reported obtaining pregnancy nutrition information. With regard to the nutrition information sources used by the participants, the most common source was the internet ($n = 112$, 65.5%), followed by the participants' General Practitioner ($n = 80$, 46.8%) and Midwife ($n = 60$, 35.1%). Pregnancy nutrition information was obtained from a Dietitian/Nutritionist by 18.1% ($n = 31$) of participants. When nutrition information sources were categorised as health professionals (general practitioners,

Table 1. Socio-Demographic and Health Characteristics of Participants (n = 171).

Characteristic	Mean	SD	n	%
Age (years)	32.5	3.9		
Gestation length (weeks)	21.5	9.8		
First pregnancy				
Yes			102	59.6
No			69	40.4
BMI (pre-pregnancy) (kg/m ²)	26.1	6.0		
Underweight (<18.5)			6	3.5
Healthy (18.5-24.99)			84	49.4
Overweight (25.0-29.99)			44	25.7
Obese (>30.0)			37	21.8
BMI (current) (kg/m ²)	27.9	5.8		
Underweight (<18.5)			1	0.6
Healthy (18.5-24.99)			58	33.9
Overweight (25.0-29.99)			56	32.7
Obese (>30.0)			56	32.7
Smoked cigarettes during pregnancy				
No			168	98.2
Yes			3	1.8
Birth country				
Australia			140	81.9
Other country			31	18.2
Language spoken at home				
English			165	96.5
Other			6	3.5
Identify as Aboriginal or Torres Strait Islander				
No/Not reported			170	99.4
Yes			1	0.6
Highest qualification completed				
School Certificate/High School Certificate			10	5.8
Trade/Certificate/Diploma			20	11.7
University Degree/Higher University Degree			140	81.9
Other			1	0.6
Obtained a nutrition qualification or studying nutrition				
No			154	90.1
Yes			17	9.9
Annual household gross income (AUD)				
Up to \$50,000			6	3.5
\$50,001-\$100,000			31	18.2
>\$100,000			127	74.2
Not reported			7	4.1
Marital status				
Married or De facto			160	93.6
Other			11	6.4

Abbreviation: BMI, Body Mass Index.

obstetricians, midwives, dietitians and nutritionists) and non-health professionals (internet, social media, smartphone applications, friends/family, other source), of the 137 participants, the data showed that 84.7% (n = 116) had obtained nutrition information from at least one health professional, and 15.3% of participants (n = 21) had obtained nutrition information from non-health professionals only.

Differences in Diet Quality scores in Pregnant Women who Obtain Nutrition Information from Health Professionals and Women who do not

An independent samples t-test indicated that the mean diet quality scores were not significantly different in participants who obtained nutrition information from one or more health

Table 2. Australian Recommended Food Score (ARFS) (n = 171).

	Mean	SD	Range (min, max)	
Total diet quality (ARFS 0-73)	33.9	8.7	8.0	57.0
Vegetables (ARFS 0-21)	12.0	4.2	0.0	21.0
Fruit (ARFS 0-12)	5.9	2.7	0.0	11.0
Meat (ARFS 0-7)	2.5	1.3	0.0	7.0
Meat alternatives (ARFS 0-6)	2.4	1.4	0.0	5.0
Breads and cereals (ARFS 0-13)	5.6	2.0	1.0	11.0
Dairy foods (ARFS 0-11)	3.8	1.8	0.0	8.0
Water (ARFS 0-1)	0.8	0.4	0.0	1.0
Extras (ARFS 0-2)	0.8	0.8	0.0	2.0

Note: The total score out of 73 can be categorised as: 'needs work' (<33 points), 'getting there' (33-38 points), 'excellent' (39-46 points), 'outstanding' (47+ points).

Abbreviation: ARFS, Australian Recommended Food Score.

professional (median = 35, n = 116) compared to the participants who did not obtain nutrition information from any health professionals (median = 37, n = 21), ($t_{(24)} = -0.823$, $P = .32$).

Differences in Nutrition Self-Efficacy Scores in Pregnant Women who Obtain Nutrition Information from Health Professionals and Women who do not

A Mann-Whitney U test indicated that the mean nutrition self-efficacy score was significantly higher in the participants who obtained nutrition information from one or more health professional (median = 15, n = 116) compared to the participants who did not obtain nutrition information from any health professionals (median = 13, n = 21), ($U = 856$, $z = 2.18$, $P = .03$, $r = -0.19$).

Discussion

The objective of this study was to examine the relationship between diet quality, nutrition self-efficacy and sources of nutrition information in a sample of Australian pregnant women. The results showed that pregnant women had a mean diet quality score of 33.9 points out of 73, categorised as 'getting there' but requiring improvement.³⁴ This finding is consistent with the dietary intake results which showed that overall alignment with dietary recommendations was poor with inadequate intake of four out of five healthy core food groups (vegetables, breads and cereals, meat, and dairy foods) and excessive intake of fat, including saturated fat. The mean nutrition self-efficacy score reported by the participants was 14.7 points out of 20 and a moderate positive relationship between diet quality and nutrition self-efficacy was found, with nutrition self-efficacy significantly predicting the diet quality score. In terms of pregnancy nutrition information, 80% of participants reported obtaining information, with most

Table 3. Mean Dietary Intake of Participants (n = 171).

Food Groups				
Food Group	AGHE recommendation (Serves/day)	Mean	SD	
Vegetables	5	1.5	1.0	
Fruit	2	3.5	1.7	
Meat and meat alternatives	3.5	3.1	1.6	
Breads and cereals	8.5	2.0	1.2	
Dairy foods	2.5	2.2	1.3	
Nutrients				
Macronutrients	NRV (Unit/day)	Mean	SD	
Carbohydrate (% Energy)	AMDR 45%-65%	44.9	6.5	
Total fat (% Energy)	AMDR 20%-35%	36.9	4.9	
Saturated fat (% Energy)	AMDR ≤10%	13.9	2.6	
Protein (% Energy)	AMDR 15%-25%	17.7	2.8	
Dietary Fibre (g)	AI 28	27.1	9.4	
% Energy from core foods	—	66.6	11.5	
% Energy from non-core foods	—	33.4	11.5	
Micronutrients				
Dietary folate eq. (µg)	EAR 520	521.5	200.1	
Iodine (µg)	EAR 160	125.3	54.6	
Zinc (mg)	EAR 9	11.1	3.7	
Iron (mg)	EAR 22	10.4	3.4	

Abbreviations: AGHE, Australian Guide to Healthy Eating; AMDR, Acceptable Macronutrient Distribution Range; AI, Adequate Intake; EAR Estimated Average Requirement; NRV Nutrient Reference Value.

of these obtaining pregnancy nutrition information from one or more health professionals and 15% obtaining information from non-health professionals only. Participants' diet quality scores were not significantly different when obtaining nutrition information from at least one health professional, compared to obtaining nutrition information from non-health professionals only, however, their nutrition self-efficacy scores were significantly higher.

The ADG, NRV and AGHE are national dietary recommendations that are in place to ensure that pregnant women optimise and maintain their overall health.^{23,28,35} Aligning intake with dietary recommendations supports metabolic changes during pregnancy,³⁶ and can reduce adverse health outcomes in the mother,³⁷ fetus, and child in later stages.^{34,38} The overall diet quality score in the sample of 33.9 points out of 73, categorised as 'getting there', is consistent with other studies in Australian pregnant women^{39,50} reporting diet quality scores between 32 and 44 points. The diet quality score is also consistent with scores reported in the Australian general population, despite pregnancy being considered a period of increased motivation for healthy eating.^{34,40} The current study provides further evidence that pregnant women report inadequate intakes of most food groups, with this sample only meeting the recommendation for serves of fruit. This aligns

with a cross-sectional web-based survey with 857 Australian pregnant women,⁷ in which the sample only met the recommendation for fruit intake. In the current study, daily consumption from food of key pregnancy micronutrients folate and zinc met the EAR, whereas intake of iodine and iron did not. Other studies in Australian pregnant women have also reported inadequate intake of iodine and iron.^{8,41} The suboptimal diet quality and poor alignment with dietary recommendations in this sample of pregnant women and others highlights an urgent need for further research to identify and address intrapersonal, interpersonal and environmental barriers to meeting dietary recommendations, due to the increased risk of adverse health outcomes that are associated with inadequate intakes.⁴¹

In the current study, the association between diet quality and nutrition self-efficacy was assessed and a moderate positive relationship was observed. Regression analyses found that nutrition self-efficacy significantly predicted the diet quality score. While there is a paucity of literature on this relationship, a cross-sectional study in 75 women in the United States who had been pregnant within the last five years also reported that having a higher nutrition self-efficacy was significantly associated with a higher diet quality.¹² While additional research is needed in larger samples, these findings support our hypothesis that pregnant women who have a higher nutrition self-efficacy score, have a higher diet quality score, suggesting the importance of improving an individual's nutrition self-efficacy as a potential mediator for improved diet quality.

To the best of our knowledge, no other research has examined differences in diet quality scores in relation to sources of pregnancy nutrition information. In the current study, 80% of women reported that they did obtain pregnancy nutrition information, with the internet being the most common source of information. This correlates with reports that the internet is the primary source of nutrition information for Australians.⁴² In a cross-sectional survey conducted in the UK it was reported that before and during pregnancy, women preferred to use the internet rather than see a health professional to obtain nutrition information, however the uptake of obtaining nutrition information from health professionals increased during pregnancy.⁴³ Moreover, a mixed-methods study which included a survey and content analysis in pregnant women in the years of 2008, 2011, 2014 and 2018, showed a significant increase in the use of the internet for obtaining nutrition information.⁴⁴ In the current study, around one-quarter of the pregnant women reported using social media to obtain nutrition information.⁴⁵ A 2024 cross-sectional study in 142 women in Australia who were either currently pregnant or who had recently given birth found that two-thirds of the women obtained pregnancy nutrition information from social media platforms.⁴⁶ Overall, there has been a significant increase in the use of the internet and social media for obtaining nutrition information in Australia and around the world in recent years.^{30,47} Experts have noted concerns regarding

potential misinformation of nutrition information, due to suboptimal quality and accuracy.⁴² A systematic review of seven studies, found that most pregnant women did not discuss the health information found on the internet with any health professional.⁴⁷ In the current study, it was found that less than half of the pregnant women sought nutrition information from their general practitioner or midwife, and very few from their obstetrician or dietitian/nutritionist. Health professionals should be aware of the increasing uptake of obtaining nutrition information from the internet and ensure they provide pregnant women with evidence-based nutrition information where possible.^{42,48}

In terms of the differences in diet quality and nutrition self-efficacy scores in pregnant women based on nutrition information sources, the current analysis found that there were no significant differences in the diet quality scores of pregnant women who obtained nutrition information from at least one health professional compared to those who did not obtain nutrition information from any health professionals. However, in this study there was a significant difference in the nutrition self-efficacy scores in the pregnant women who obtained nutrition information from health professionals compared to those who did not, with a higher nutrition self-efficacy score in those who sought information from health professionals. This might suggest that obtaining nutrition information from a health professional validates belief in the women that they can adhere to dietary recommendations. However, the poor diet quality scores in this sample indicate that higher nutrition self-efficacy associated with obtaining information from health professionals did not translate to higher diet quality scores. In light of these findings, it is recommended that further research is conducted to understand the specific barriers pregnant women face in converting higher nutrition self-efficacy to improved diet quality.

A strength of the current study is that it is the first study, to our knowledge, to analyse the relationship between diet quality, nutrition self-efficacy and sources of nutrition information in pregnant women. The study provides new knowledge which can be used as a foundation for future research on the same topic. Additionally, the use of validated dietary assessment tools, the ARFS and AES, to measure diet quality and dietary intake is a strength in the current study.^{5,24} The study should also be interpreted in the context of some limitations. Firstly, participants were primarily recruited via social media posts and paid advertising, which may limit the generalisability of the findings. Future studies may need to consider additional recruitment strategies beyond online methods to broaden the group of participants, such as advertising in antenatal clinics and hospital waiting rooms and community noticeboards. Also, the sample of participants in this study were more highly educated in comparison to the wider pregnant and non-pregnant Australian population, and which may also limit the generalisability of the results. Self-reported dietary intake also has limitations, such as recall bias and social desirability bias.³² However, to help mitigate

potential social desirability bias all responses were collected anonymously to reduce the likelihood of participants providing socially desirable answers. In addition, the use of well-established and validated questionnaires may also have minimized social desirability bias.³² These methods are suggested in future research in pregnant women. The use of a social desirability measure such as the Marlowe-Crowne Social Desirability Scale Short-Form⁴⁹ could also be warranted, to account for potential confounders in statistical models, however, lengthy data collection surveys can add burden to the participant, decreasing motivation to complete.³² A further limitation in this study is that the diet quality score (ARFS) used in this study is modelled on foods representative of Australian foods, which may not be generalisable to countries outside of Australia. Australian pregnant women have reported to have poor diet quality and were not consuming adequate nutrients. Finally, the analysis did not account for supplement intake or any sickness during the participants' pregnancy, which may be useful to consider in future research.

So What?

What is Already Known on This Topic?

Australian pregnant womens' dietary intake is poorly aligned with dietary recommendations set out in the Australian Dietary Guidelines and Australian Guide to Healthy Eating.

What Does This Article Add?

This is the first study to investigate the relationship between diet, quality, nutrition self-efficacy and sources of nutrition information in Australian pregnant women.

What Are the Implications for Health Promotion Practice or Research?

Our findings suggest the need for evidence-based pregnancy nutrition information to be highly accessible via the internet and for health professionals to focus on providing evidence-based nutrition information at all available opportunities. Improving nutrition self-efficacy may be effective for improving diet quality. Further research is needed to elucidate the specific barriers pregnant women face in converting higher nutrition self-efficacy to improved diet quality.

Author Contributions

Conceptualization: TB, SF, AP. Methodology: TB, SF. Formal analysis: TB, SF, AK. Writing – original draft preparation: AP. Writing – review and editing: AK, SF, TB, PP. All authors read and approved the final manuscript. This study was undertaken as partial

requirement for award of the degree of Bachelor of Food Science and Human Nutrition (Honours program) at the University of Newcastle, Australia.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

Ethical Statement

Ethical Considerations

Ethics approval was granted by the Human Research Ethics Committee of the University of Newcastle (H-2023-0225).

Consent to Participate

All participants provided written informed consent to participate.

ORCID iD

Sasha Fenton  <https://orcid.org/0000-0002-4611-5810>

Data Availability Statement

The data that support the findings of this study may be available on request from the corresponding author (SF).

Supplemental Material

Supplemental material for this article is available online.

References

1. Aubert A, Chen L-W, Shivappa N, et al. Predictors of maternal dietary quality and dietary inflammation during pregnancy: an individual participant data meta-analysis of seven European cohorts from the ALPHABET consortium. *Clin Nutr*. 2022; 41(2022):1991-2002. doi:10.1016/j.clnu.2022.06.042
2. Chen J, Gemming L, Hanning R, Allman-Farinelli M. Smartphone apps and the nutrition care process: current perspectives and future considerations. *Patient Educ Counsel*. 2018;101(4): 750-757. doi:10.1016/j.pec.2017.11.011
3. Gete D, Waller M, Mishra G. Effects of maternal diets on preterm birth and low birth weight: a systematic review. *Br J Nutr*. 2020;123(4):446-461. doi:10.1017/s0007114519002897
4. Kibret K, Chojenta C, Gresham E, Tegegne T, Loxton D. Maternal dietary patterns and risk of adverse pregnancy (hypertensive disorders of pregnancy and gestational diabetes mellitus) and birth (preterm birth and low birth weight) outcomes: a systematic review and meta-analysis. *Public Health Nutr*. 2018;22:1-15. doi:10.1017/s1368980018002616
5. Collins CE, Burrows TL, Rollo ME, et al. The comparative validity and reproducibility of a diet quality index for adults: the

- Australian Recommended Food Score. *Nutrients*. 2015;7(2): 785-798. doi:10.3390/nu7020785
6. Wirt A, Collins C. Diet quality--what is it and does it matter? *Public Health Nutr*. 2009;12(12):2473-2492. doi:10.1017/S136898000900531x
 7. Malek L, Umberger W, Makrides M, Zhou S. Adherence to the Australian dietary guidelines during pregnancy: evidence from a national study. *Public Health Nutr*. 2016;19(7):1155-1163. doi:10.1017/S1368980015002232
 8. Slater K, Rollo ME, Szewczyk Z, Ashton L, Schumacher T, Collins C. Do the dietary intakes of pregnant women attending public hospital antenatal clinics align with Australian Guide to healthy eating recommendations? *Nutrients*. 2020;12(8):2438. doi:10.3390/nu12082438
 9. Townsend JR, Kirby TO, Sapp PA, Gonzalez AM, Marshall TM, Esposito R. Nutrient synergy: definition, evidence, and future directions. *Front Nutr*. 2023;10:1279925. doi:10.3389/fnut.2023.1279925
 10. Badolato M, Shelnutt K, House L, Chambers K, Mathews A. P043 nutritional self-efficacy and motivation to learn about growing and preparing food in adolescents are interrelated. *J Nutr Educ Behav*. 2022;54(7, Supplement):S38. doi:10.1016/j.jneb.2022.04.083
 11. Olander E, Smith D, Darwin Z. Health behaviour and pregnancy: a time for change. *J Reprod Infant Psychol*. 2018;36(1): 1-3. doi:10.1080/02646838.2018.1408965
 12. Ferranti E, Narayan K, Reilly C, et al. Dietary self-efficacy predicts AHEI diet quality in women with previous gestational diabetes. *Diabetes Educ*. 2014;40(5):688-699. doi:10.1177/0145721714539735
 13. Campbell K, Hesketh K, Silverii A, Abbott G. Maternal self-efficacy regarding children's eating and sedentary behaviours in the early years: associations with children's food intake and sedentary behaviours. *Int J Pediatr Obes*. 2010;5(6):501-508. doi:10.3109/17477161003777425
 14. Rohde JF, Bohman B, Berglind D, et al. Cross-sectional associations between maternal self-efficacy and dietary intake and physical activity in four-year-old children of first-time Swedish mothers. *Appetite*. 2018;125:131-138. doi:10.1016/j.appet.2018.01.026
 15. Spence AC, Campbell KJ, Crawford DA, McNaughton SA, Hesketh KD. Mediators of improved child diet quality following a health promotion intervention: the Melbourne InFANT Program. *Int J Behav Nutr Phys Activ*. 2014;11(1):137. doi:10.1186/s12966-014-0137-5
 16. Sexton-Dhamu MJ, Livingstone KM, Pendergast FJ, Worsley A, McNaughton SA. Individual, social-environmental and physical-environmental correlates of diet quality in young adults aged 18-30 years. *Appetite*. 2021;162:105175. doi:10.1016/j.appet.2021.105175
 17. Shahry P, Kalhori S, Esfandiari A, Zamani-Alavijeh F. A comparative study of perceived social support and self-efficacy among women with wanted and unwanted pregnancy. *Int J Community Based Nurs Midwifery*. 2016;4(2): 176-185.
 18. Bert F, Gualano M, Brusaferrero S, et al. Pregnancy e-health: a multicenter Italian cross-sectional study on Internet use and decision-making among pregnant women. *J Epidemiol Community Health*. 2013;67(12):1013-1018. doi:10.1136/jech-2013-202584
 19. Skouteris H, Savaglio M. The use of social media for preconception information and pregnancy planning among young women. *J Clin Med*. 2021;10(9):1892. doi:10.3390/jcm10091892
 20. Smith M, Mitchell AS, Townsend ML, Herbert JS. The relationship between digital media use during pregnancy, maternal psychological wellbeing, and maternal-fetal attachment. *PLoS One*. 2020;15(12):e0243898. doi:10.1371/journal.pone.0243898
 21. Denniss E, Lindberg R, Marchese LE, McNaughton SA. #Fail: the quality and accuracy of nutrition-related information by influential Australian Instagram accounts. *Int J Behav Nutr Phys Activ*. 2024;21(1):16. doi:10.1186/s12966-024-01565-y
 22. Lachat C, Hawwash D, Ocké MC, et al. Strengthening the reporting of observational studies in epidemiology-nutritional Epidemiology (STROBE-nut): an extension of the STROBE statement. *PLoS Med*. 2016;13(6):e1002036. doi:10.1371/journal.pmed.1002036
 23. Australia National Health and Medical Research Council. Australian dietary guidelines. 2022. <https://www.eatforhealth.gov.au/guidelines>. Accessed January 12, 2023.
 24. Ashton L, Williams R, Wood L, et al. Comparison of Australian recommended food score (ARFS) and plasma carotenoid concentrations: a validation study in adults. *Nutrients*. 2017;9(8): 888. doi:10.3390/nu9080888
 25. Collins CE, Boggess MM, Watson JF, et al. Reproducibility and comparative validity of a food frequency questionnaire for Australian adults. *Clin Nutr*. 2014;33(5):906-914. doi:10.1016/j.clnu.2013.09.015
 26. Australian Bureau of Statistics. National nutrition survey: nutrient intakes and physical measurements, Australia; 1995. <https://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/4805.0Main+Features11995?OpenDocument>. Accessed December 1, 2023.
 27. Food Standards Australia and New Zealand (FSANZ). AUS-NUT 2011-13 food nutrient database. <https://www.foodstandards.gov.au/science-data/monitoringnutrients/ausnut-2011-13>. Accessed December 1, 2023.
 28. Australian Government National Health and Medical Research Council. Nutrient reference Values for Australia and New Zealand. <https://www.eatforhealth.gov.au/nutrient-reference-values>. Accessed January 24, 2023.
 29. Burrows TL, Hutchesson MJ, Rollo ME, Boggess MM, Guest M, Collins CE. Fruit and vegetable intake assessed by food frequency questionnaire and plasma carotenoids: a validation study in adults. *Nutrients*. 2015;7(5):3240-3251. doi:10.3390/nu7053240
 30. Schumacher TL, Burrows TL, Rollo ME, Wood LG, Callister R, Collins CE. Comparison of fatty acid intakes assessed by a cardiovascular-specific food frequency questionnaire with red blood cell membrane fatty acids in hyperlipidaemic Australian adults: a validation study. *Eur J Clin Nutr*. 2016;70(12): 1433-1438. doi:10.1038/ejcn.2016.144

31. Schwarzer R, Renner B. *Health-Specific Self-Efficacy Scales*. Freie Universität Berlin. <https://userpage.fu-berlin.de/~health/healself.pdf>
32. Tang JS, Haslam RL, Ashton LM, Fenton S, Collins CE. Gender differences in social desirability and approval biases, and associations with diet quality in young adults. *Appetite*. 2022;175:106035. doi:10.1016/j.appet.2022.106035
33. Greszki R, Meyer M, Schoen H. The impact of speeding on data quality in nonprobability and freshly recruited probability-based online panels. In: Callegaro M, Baker R, Bethlehem J, Göritz AS, Krosnick JA, Lavrakas PJ, eds. *Online panel research : a data quality perspective*. 1 ed. Wiley; 2014:238-262.
34. Williams RL, Rollo ME, Schumacher T, Collins CE. Diet quality scores of Australian adults who have completed the healthy eating quiz. *Nutrients*. 2017;9(8):880. doi:10.3390/nu9080880
35. Danielewicz H, Myszczyzyn G, Debinska A, Myszkal A, Boznanski A, Hirnle L. Diet in pregnancy-more than food. *Eur J Pediatr*. 2017;176(12):1573-1579. doi:10.1007/s00431-017-3026-5
36. Picciano M. Pregnancy and lactation: physiological adjustments, nutritional requirements and the role of dietary supplements. *J Nutr*. 2003;133(6):1997s-2002s. doi:10.1093/jn/133.6.1997S
37. Schoenaker D, Soedamah-Muthu S, Callaway L, Mishra G. Prepregnancy dietary patterns and risk of developing hypertensive disorders of pregnancy: results from the Australian Longitudinal Study on Women's Health. *Am J Clin Nutr*. 2015;102(1):94-101. doi:10.3945/ajcn.114.102475
38. Abdollahi S, Soltani S, de Souza RJ, Forbes SC, Toupchian O, Salehi-Abargouei A. Associations between maternal dietary patterns and perinatal outcomes: a systematic review and meta-analysis of cohort studies. *Adv Nutr*. 2021;12(4):1332-1352. doi:10.1093/advances/nmaa156
39. Maneschi K, Geller T, Collins CE, Gordon A, Grech A. Maternal diet quality and nutrient intakes across preconception and pregnancy are not consistent with Australian guidelines: results from the pilot BABY1000 study. *Food Sci Nutr*. 2023;11(7):4113-4123. doi:10.1002/fsn3.3401
40. Whatnall M, Clarke ED, Adam MTP, et al. Diet quality of adolescents and adults who completed the Australian healthy eating Quiz: an analysis of data over six years (2016-2022). *Nutrients*. 2022;14(19):4072. doi:10.3390/nu14194072
41. Wilkinson S, Schoenaker D, de Jersey S, et al. Exploring the diets of mothers and their partners during pregnancy: findings from the Queensland Family Cohort pilot study. *Nutr Diet*. 2022;79(5):602-615. doi:10.1111/1747-0080.12733
42. Denniss E, Lindberg R, Marchese L, McNaughton S. #Fail: the quality and accuracy of nutrition-related information by influential Australian Instagram accounts. *Int J Behav Nutr Phys Activ*. 2024;21(1):16. doi:10.1186/s12966-024-01565-y
43. Funnell G, Naicker K, Chang J, Hill N, Kayyali R. A cross-sectional survey investigating women's information sources, behaviour, expectations, knowledge and level of satisfaction on advice received about diet and supplements before and during pregnancy. *BMC Pregnancy Childbirth*. 2018;18(1):182. doi:10.1186/s12884-018-1834-x
44. Lobo S, Lucas CJ, Herbert JS, et al. Nutrition information in pregnancy: where do women seek advice and has this changed over time? *Nutr Diet*. 2020;77(3):382-391. doi:10.1111/1747-0080.12589
45. Thomas G, Lupton D. Threats and thrills: pregnancy apps, risk and consumption. *Health Risk Soc*. 2016;17(7-8):495-509. doi:10.1080/13698575.2015.1127333
46. Hussain I, Hartney N, Sweet L. A survey of Australian women's digital media usage in pregnancy and labour and birth. *BMC Pregnancy Childbirth*. 2023;23(1):688. doi:10.1186/s12884-023-06003-8
47. Sayakhot P, Carolan-Olah M. Internet use by pregnant women seeking pregnancy-related information: a systematic review. *BMC Pregnancy Childbirth*. 2016;16(1):65. doi:10.1186/s12884-016-0856-5
48. Silva P, Araújo R, Lopes F, Ray S. Nutrition and food literacy: framing the challenges to health communication. *Nutrients*. 2023;15:4708. doi:10.3390/nu15224708
49. Reynolds WM. Development of reliable and valid short forms of the marlowe-crowne social desirability scale. *J Clin Psychol*. 1982;38(1):119-125. doi:10.1002/1097-4679(198201)38:1<119::AID-JCLP2270380118>3.0.CO;2-I
50. Ooi KJ, et al. The Relationship Between Potential Listeria monocytogenes Exposure and Diet Quality and Dietary Intake During Pregnancy: A Cross-Sectional Analysis in Australian Women. *Journal of Human Nutrition and Dietetics*. 2025;38(2). doi:10.1111/jhn.70032