Occurrence and predictors of food insecurity in a sample of pregnant women recruited from an Australian hospital

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Abstract

Aims: The aim of this study is to explore the occurrence of food insecurity among pregnant women in Australia.

Methods: This cross-sectional, self-reported study included two measures of food insecurity (the US Department of Agriculture Household Food Security Survey Module and single item measure), use of emergency and community food assistance, health conditions, eating habits during pregnancy, and professional nutritional advice and health seeking behaviours. Participants were recruited using (1) an advertisement posted on social media and (2) flyers with a QR code linked to the online survey, made available for women to take from clinic rooms at a hospital in Melbourne, Victoria. Data were analysed using basic statistics, spearman's rho correlation coefficients, and linear regression to identify factors that may be associated with food insecurity among pregnant women in Australia; the study was open between May 2021 and March 2022.

Results: Three hundred and three valid responses were received from pregnant women in Australia. Food insecurity was determined to be 14.5% (US Department of Agriculture Household Food Security Survey Module) and 6.3% (single item used). Food insecurity was significantly associated with income, education level and age.

Conclusions: Results indicate a high prevalence of food insecurity among pregnant women. Routine screening and referral of food insecure pregnant women should be considered in antenatal care settings.

K E Y W O R D S

food security, measurement, pregnancy

1 | INTRODUCTION

Food insecurity, defined as inadequate access to healthy, affordable and culturally appropriate food, is a significant

social determinant of health. In high-income countries like Australia, food insecurity is primarily driven by material hardship and inadequate financial resources.^{1,2} The public health implications of food insecurity are

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multiple and serious. Food insecurity is associated with increased risks of chronic conditions including type 2 diabetes,³ and cardiovascular disease,⁴ and is strongly linked with overweight and obesity,⁵ a concept known as the *Food Insecurity–Obesity Paradox*.^{6,7} While other high-income countries regularly monitor food insecurity through national and regional surveys,^{8,9} the prevalence of food insecurity in Australian households is rarely monitored. Estimates of food insecurity in the Australian general population range from approximately 5% (in a survey conducted in 2012),¹⁰ to around 13% (in a survey conducted in 2020).¹¹ However, based on people who are accessing emergency and community food, the number of food insecure individuals could be as high as 4.8 million people, or around 18% of the population.¹²

Food insecurity is a gendered issue, impacting women more than men. Women are more likely than men to take roles involved in food provision and are directly affected by difficulties in accessing and affording nutritious food.¹³ Food insecurity is a more common experience for single mothers¹ and among women of reproductive age (18-44) than other age groups.¹⁴ While food insecurity is both an outcome and a predictor of poor health and wellbeing across the lifespan, food insecurity during pregnancy can be especially problematic and has only recently begun to be screened in antenatal healthcare settings. A recent cross-sectional online survey was conducted to examine the relationship between household food insecurity and diet quality among 1540 pregnant women in Australia between August 2022 and March 2023, finding that 42% of the sample of pregnant women were food insecure.¹⁵ This same study also found that food insecurity was associated with poorer prenatal diet quality, and very low food security was associated with a lower dietary variety.¹⁵ Studies from the United States, where food insecurity is more regularly monitored, indicate between 10% and 45% of pregnant women experience food insecurity.^{16,17}

It is well established that long-term health is shaped by the environment in early life,^{16,18} and evidence suggests that food insecurity during pregnancy adversely impacts the health of the mother and her foetus. For example, there is some evidence to suggest that food-insecure pregnant women, compared to those who are food-secure, are more likely to have excessive gestational weight gain,^{19,20} develop gestational diabetes and enter preterm labour,²¹ and experience mental health concerns such as stress, anxiety and depression, compared to food-secure women.^{22,23} These maternal complications have been found to be associated with poor health outcomes for mothers and offspring, both in the short and long-term.²⁴ Pregnant women who gain excessive gestational weight have associated adverse health outcomes including hypertension, hyperlipidaemia, and need for caesarean delivery.^{18,24} Excess gestational weight gain is a strong predictor of large-for-gestational age babies,

which in turn predispose offspring to be overweight in later life.^{18,24} The long-term, intergenerational sequela associated with food insecurity during pregnancy emphasises the importance of addressing this as a key determinant of maternal and offspring health. This body of research linking food insecurity with poor maternal and child health highlights the importance of considering pregnant women as a population group highly vulnerable to food insecurity, particularly as food insecurity relates to low or reduced income, a common occurrence among households with young children.²⁵

A recent small Australian study suggests that food insecurity can be overwhelming for pregnant women, leaving them to make poor dietary choices or choices based on convenience or low cost.²⁶ While there is increasing interest in research that explores the experience of food insecurity in this population group,^{15,26} there remain challenges in understanding the most suitable measurement approach as people who are food insecure are often reluctant to voluntarily disclose their hardship and experience feelings of embarrassment, shame and guilt.^{2,27}

Given the health implications of food insecurity among pregnant women, and limited Australian data, there is a need for Australian research that investigates the prevalence of food insecurity among pregnant women. While smaller in scope than other Australian research,¹⁵ this investigation allows for further understanding of the extent of food insecurity in pregnancy, and can contribute to the development of strategies that can be embedded in the antenatal healthcare system. The aim of this study is to explore the occurrence of food insecurity among pregnant women in Australia and to document some factors that may contribute to food insecurity.

2 | METHODS

This cross-sectional study, using self-reported data, was undertaken with pregnant women between May 2021 and March 2022. Advertisements for the survey included both paid (2×5 day campaigns on Facebook) and researchergenerated ads that were posted online (Facebook and Twitter/X); flyers with a QR code linking to the online survey were also available for women to take from dietetics clinic rooms at a large maternity hospital in Melbourne, Victoria; a method successfully employed in previous research that recruited pregnant women.²⁶ Paid Facebook advertisements were targeted at women between 18 and 45 years old in Australia. Only women who were pregnant and were in Australia were eligible to participate.

Participants are referred to as 'pregnant women' here. While gender or sex were not reported, the recruitment materials and methods targeted women. The authors acknowledge that not all pregnant people identify as women or mothers.

This research was conducted in accord with prevailing ethical principles and reviewed by the Human Research Ethics Committees at the Royal Women's Hospital and Deakin University (Protocols: Project 21/30 and 2021-344). The current study adheres to the STROBE checklist for reporting cross-sectional studies (Appendix S1).

All data were collected via an online survey, hosted by Qualtrics, which included approximately 40 questions (see Appendix S2). There were no forced responses, so participants were able to skip questions, some questions had a 'prefer not to say' response, prefer not to say responses are considered to be a 'no' in the analysis, and missing data is considered missing. The survey was offered in the five languages to increase our understanding of the level of food insecurity among a diverse population, and to address a research gap in our understanding of food insecurity among non-English speaking pregnant women: English, Arabic, traditional Chinese, Vietnamese, Oromo, and Hindi. These are the main language groups of the women who attend the largest maternity hospital in Victoria. All surveys were first created in English, then automatically translated into the chosen language before being checked by a fluent bilingual speaker. This was to enable increased participation of non-English speaking women, as there is evidence to suggest that non-English speaking women have limited access to health care.²⁸ The inclusion of non-English speaking women in Australian research is an ongoing limitation of much of the research related to food security, and this translation was an attempt to reach these often 'hard to reach' populations.

Sample size calculations were performed in STATA 16.1 statistical package. A sample size of 303 women was sufficient to estimate a true food insecurity prevalence of 10% at a precision confidence interval of $\pm 3.4\%$.

Questions existed across several domains and were all self-reported (see Appendix S2 for the full survey)

- 1. Demographic questions including (annual household) income, welfare benefits currently claimed, education, age, gestational age, number of previous pregnancies (parity), housing, household size and composition.
- 2. Two measures of food insecurity. (1) The US Department of Agriculture Household Food Security Survey Module-10, a validated survey consisting of 10 questions that can explore the overall experience of household food insecurity in the past 12 months by investigating uncertain, insufficient, or inadequate food access, availability and utilisation.²⁹ The US Department of Agriculture Household Food Security Survey Module-10 is considered the gold standard in food security research,³⁰ the 10-item survey was chosen (rather than the 18 item form) as not

all women had children in their home; the 10 items comprise the standard adult questions, excluding the questions that relate solely to the situation of children. (2) The single-item measure, often incorporated into population-level health surveys, asking 'In the last 12 months was there any time you have run out of food and not been able to purchase more?³¹

- 3. Past or current use and frequency of emergency and community food assistance as it has been suggested as an indicator of food insecurity.³²
- 4. Health conditions (both diagnosed during current and pre-pregnancy), as well as height and weight as recorded during the first antenatal visit and self-reported pre-pregnancy.
- 5. Eating habits during pregnancy, including consumption of fruit and vegetables, and changes in preferences, which have been suggested to be influenced by food insecurity.³³
- 6. Professional nutritional advice and health seeking behaviours, as there is some evidence demonstrating that during pregnancy women seek out health-related information from a range of sources.³⁴

Categorical data were reported as frequencies and percentages, while continuous data were presented as means, medians and standard deviations. Spearman's rho correlation coefficients were conducted to determine the strength of correlation between food security (both the US Department of Agriculture Household Food Security Survey Module-10 and the single item), age, prepregnancy BMI, income, parity (number of past births), education level, pregnancy health condition, receipt of government welfare, and Socio-Economic Indexes for Areas (SEIFA). Chi-squared tests were used to calculate differences between observed and expected frequencies (see Appendix S1) for age, pre-pregnancy BMI, income, parity, education level, country of birth, pregnancy health condition (any condition), receipt of government welfare, and SEIFA. These same variables were compared using backwards stepwise linear regression. This method was chosen to yield a parsimonious and interpretable model, due to the progressive removal of variables that do not contribute significantly to the model. In this regression, both correlation coefficient magnitude and p-value (p < 0.05) were taken into account when considering which variables should be included as covariates in the regression model. All statistical tests were two-sided, and significance was considered at p < 0.05 for all tests. Statistical analyses were performed with SPSS version 26.

Responses from the US Department of Agriculture Household Food Security Survey Module were used to calculate two measures of food security. The first was to create one score for the level of food security for a household.³⁵ The food security status of each household was determined by the number of food insecure conditions and behaviours that the household reports; households were classified as food secure if they reported no food insecure conditions. Food insecure households were also classified as having marginal food security if they reported one or two food insecure conditions, low food security if they reported between three and five food insecure conditions, or very low food security if they reported six or more food insecurity conditions. For regression and correlation analyses, the binary measure (food secure, or food insecure including marginal, low or very low food security) was used as there is evidence to suggest that adverse health implications begin well before an individual or household reaches the severe hunger stage.^{36,37} Data from the single item are provided in 'yes/no' format. Households were considered food secure (negative response) or food insecure (affirmative response).

To determine socio-economic status, the Australian Bureau of Statistics SEIFA deciles (Index of Relative Socio-Economic Disadvantage) were used to characterise areas of relative disadvantage. Areas with a high index value (8–10) have relatively less disadvantage which may indicate there are few families with low incomes, or people who have little training or who work in unskilled occupations. Areas with low values (1–3) indicate more relative disadvantage and may have more low-income families, people with little formal training, and people who work in unskilled occupations.³⁸

Self-reported pre-pregnancy weight and height were analysed using BMI, calculated as weight (kg) divided by height (m) squared (kg/m²). For the purpose of regression and correlation analyses, the BMI was recoded into four categories³⁹: underweight (under 18.5 kg/m²), normal weight (18.5–24.9 kg/m²), overweight (25–29.9 kg/m²) and obesity (30 kg/m²+). Diet factors and other pregnancy-related questions were collected as part of the demographic information and are calculated using means and standard deviations or frequencies where appropriate.

3 | RESULTS

Of the 449 surveys that were attempted, 66 were not included as the respondent did not consent to the study or no questions were answered, 29 were not included as the participant was not currently pregnant, and 49 were excluded as they did not respond to the food security questions, leaving 303 responses that have been included in this analysis. The general characteristics of the sample are detailed in Table 1.

Surveys were offered in five languages; most participants completed the survey in English (n = 297, 98%), three in Arabic, two in Vietnamese and one in Oromo. Women were on average 32.6 years old (SD 4.88, range 18-45 years), were living in a household with an income over AU120,000 (n = 188, 62.0%), and almost one in six (n = 40, 13.2%) in receipt of government welfare benefits. Most women were born in Australia or New Zealand (n = 232, 77.7%), and had achieved a university level education (n = 228, 75.2%). Most women said that they were able to afford to eat a healthy diet during their pregnancy (n = 286, 94.4%), while 22 (7.3%) said that a healthcare professional had advised them to take a nutrition supplement they were unable to afford; only four women were advised to eat something they were unable to afford. Most women (n = 194, 64.1%) were comfortable with their healthcare provider asking them about their ability to afford to eat well during their pregnancy; however, most women (n = 212, 70.0%) said they did not expect to be asked. Only 16 (5.3%) have ever used or were currently accessing emergency and community food assistance. Two-thirds of women (n = 236, 77.9%) said that the COVID-19 pandemic had not impacted their ability to eat a healthy diet.

The US Department of Agriculture Household Food Security Survey Module tool assessed 14.5% (95% CI 10.8– 19.0) of respondents as food insecure; of this, 11.9% (95% CI 8.5–16.1) were estimated to have marginal or low food security, and 2.6% (95% CI 1.9–5.1) were estimated to have very low food security (Table 2). The single item assessed 6.3% (95% CI 3.8–9.7) of respondents as being food insecure; this tool is unable to distinguish levels of food security. Food insecurity for both the binary US Department of Agriculture Household Food Security Survey Module-10 and the single item was significantly associated with age 18–24 years, income below \$AU50 000, a BMI of 18.5–24.9 kg/m², and education above year 12 but below university level (e.g. certificate or diploma) (see Appendix S1).

Table 3 shows spearman's rho correlations between food insecurity as measured by the binary United States Department of Agriculture (USDA) 10-item tool and the single item, and a range of demographic and health factors. Food insecurity as measured by the US Department of Agriculture Household Food Security Survey Module was negatively correlated with income (rs = -0.449), education (rs = -0.202) and receipt of welfare (rs = 0.254). The single item was negatively correlated with income (rs = -0.334), education (rs = -0.157), and was positively correlated with being in receipt of government welfare payments (rs = 0.180).

Stepwise backward logistic regression showed that low income was associated with food insecurity measured by the binary US Department of Agriculture Household

TABLE 1 Self-reported general characteristics of the sample.

Characteristics $(n = 303)$	n (%)
Gestation	
First trimester	60 (19.8)
Second trimester	106 (35.0)
Third trimester	135 (44.6)
No response	2 (0.7)
Parity	
0	189 (62.4)
1	87 (28.7)
2	17 (5.6)
3+	5 (1.7)
No response	5 (1.7)
Grouped maternal age (years)	
18–24	18 (5.9)
25-29	58 (19.1)
30-34	104 (34.3)
35+	113 (37.3)
No response	10 (3.3)
State of residence	
Victoria	199 (65.7)
New South Wales	48 (15.8)
Queensland	28 (9.3)
South Australia	12 (3.9)
West Australia	11 (3.6)
Tasmania	2 (1)
Annual income (AUD)	
0-50 000	24 (7.9)
50 001-70 000	13 (4.3)
70 001–90 000	19 (6.3)
90 001–120 000	43 (14.2)
120 000+	188 (62.0)
No response/prefer not to say	16 (5.3)
Welfare ^a	
Receiving any welfare	40 (13.2)
Payment types	1((40))
Parenting payment	16 (40)
Healthcare card	12 (29)
Job seeker	7 (19)
Carer payment	2(8)
Austudy	2(6)
Disability support	1 (8)
SEIFA ^b	9 (25)
Low	64 (21.1)
Middle	112(37.0)
High	12(37.0) 124(40.9)
	(Continues)
	(Continues)

TABLE 1 (Continued)

Characteristics $(n = 303)$	n (%)					
Country of birth						
Australia and New Zealand	232 (77.7)					
Europe and UK	18 (5.9)					
Asia	29 (13.0)					
Americas	11 (3.6)					
Africa	9 (3.0)					
Middle East	3 (1.0)					
No response	1 (0.3)					
Living situation						
Spouse/partner	281 (92.7)					
Alone	12 (4.0)					
Parents/family/friends	8 (2.6)					
No response	2 (0.7)					
Education						
Year 12	19 (6.3)					
Diploma or certificate	59 (19.5)					
Graduate diploma	36 (10.6)					
Bachelor's degree	93 (30.7)					
Postgraduate degree	99 (32.7)					
No response	1 (0.3)					
Children in the home						
0	188 (62.0)					
1	91 (30.0)					
2+	23 (7.6)					

^aParticipants could chose more than one welfare type.

^bAreas with a high index SEFIA indices (8–10) have relatively less disadvantage which may indicate there are few families with low incomes, or people who have little training or who work in unskilled occupations, these are classified here as *high*. Areas with low values (1–3) indicate more relative disadvantage and may have more low-income families, these are classified here as *high*, those with values of 4–7 are classified here as *middle*.

Food Security Survey Module, with participants under the age of 25 (OR 4.36, 95% CI 1.58–12.03, p = 0.002), with a household income of below \$AU50 000 (OR 9.455, 95% CI 3.90–22.9, p = <0.001), and being in receipt of government welfare assistance (OR 4.81, 95% CI 2.29– 10.11, p = 0.001). When considering the single item question, a number of factors were found to be significant predictors of food insecurity. These factors included an education level of a certificate or diploma (OR 3.49, 95% CI 1.35–8.99, p = 0.006) and annual income under \$AU50 000 (OR 7.22, 95% CI 2.41–21.62, p = <0.001).

Women reported a range of health conditions and influences on their pregnancy diet (Table 4). Respondents had an average pre-pregnancy BMI of 25.5 kg/m² (SD 5.33) in the range of 15.9-44.8 kg/m². Women reported a range of

health conditions that had been diagnosed either prior to or during their current pregnancy. Women reported being newly diagnosed with iron deficiency (n = 64, 21.1%), vitamin D deficiency (n = 44, 14.5%), diabetes (n = 25, 8.2%), depression and/or anxiety (n = 19, 6.3%), or hypertension (n = 7, 2.3%) during their current pregnancy, while depression and/or anxiety (n = 83, 27.4%), vitamin D deficiency (n = 72, 23.8%) or iron deficiency (n = 76, 25.1%) were more commonly diagnosed in the period prior to their current pregnancy.

Around one in five (n = 77, 25.4%) women reported eating a pregnancy diet that they perceived to be

TABLE 2 Food insecurity as measured by the single item and the United States Department of Agriculture 10-item Household Food Security Survey Module (n = 303).

Prevalence of food insecurity	Single item n (%)	10-item USDA n (%)
Food secure	283 (93.4)	259 (85.5)
Food insecure	19 (6.3)	44 (14.5)
Level of food insecurity (%)		
Food secure	283 (93.4)	259 (85.5)
Marginal food security	NA	25 (8.3)
Low food security	NA	11 (3.6)
Very low food security	NA	8 (2.6)

Note: For the 10-item USDA HFSSM (United States Department of Agriculture, Household Food Security Survey Module), households were classified food secure if they reported no food insecure conditions. Food insecure households were classified as having marginal food security if they reported one or two food insecure conditions, low food security if they reported between three and five food insecure conditions, or very low food security if they reported six or more food insecurity conditions.

healthier than their pre-pregnancy diet, with women eating 2.28 serves of fruit and 3.22 serves of vegetables on average each day. Food choices during pregnancy were mostly motivated by wanting to have a healthy pregnancy (n = 282, 93.1%), followed by the ability to prepare foods quickly (n = 229, 75.5%), and considering the preferences of other family members (n = 185, 61.1%). When seeking out information about food and eating during their pregnancy, most women turned to the internet (n = 226, 74.6%).

4 | DISCUSSION

This study aimed to determine the occurrence of food insecurity among pregnant women in Australia. Findings of this study suggest that food insecurity among the sample of pregnant women was over 14%. This study used the US Department of Agriculture Household Food Security Survey Module to determine food security, a widely used survey measure considered the gold standard.³² While the level of food insecurity in this study is lower than a recent study,¹⁵ it is higher than most general population estimates.^{10,11} The findings from this study are similar to a recent Canadian study finding that 12.8% of 626 pregnant women were food insecure,⁴⁰ and a recent study from the United States where 18.6% of 426 pregnant women were identified as food insecure.⁴¹

Food insecurity has been measured several ways by researchers over several decades. Food insecurity in this study was calculated as a binary measure (food secure or not). While there is potential for food insecurity to be overestimated when employing this method, there is

TABLE 3 Spearman's rho correlations between (binary) food insecurity and demographic and health factors.

		2	3	4	5 Pre-	6	7	8	9 Preg	10
		Age	Income	SEIFA	pregnancy BMI	Single item	Parity ≥1	Education level	health concern	Welfare
1	USDA 10	-0.160**	-0.449**	-0.113	0.160**	0.519**	0.073	-0.202**	0.012	0.254**
2	Age		0.192**	0.126*	-0.025	-0.083	0.209**	0.246**	0.014	-0.117*
3	Income			0.253**	-0.145*	-0.334**	-0.085	0.230**	0.034	-0.449**
4	SIEFA				-0.012	-0.042	-0.045	0.130*	-0.037	-0.121*
5	Pre-pregnancy BMI					0.134*	0.039	-0.254**	-0.067	0.110
6	Single item						0.058	-0.157**	-0.034	0.180**
7	Parity ≥1							-0.018	-0.043	0.273**
8	Education level								0.092	-0.179**
9	Preg health concern									-0.012
10	Welfare									

Abbreviations: Preg, pregnancy; SEIFA, Australian Bureau of Statistics' Socio-Economic Indexes for Areas; USDA, United States Department of Agriculture. *p < 0.05.**p < 0.001. **TABLE 4** Self-reported health conditions and influences on diet (*n* (%) unless otherwise indicated).

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Health condition and diet ($n = 303$)	n (%) unless otherwise indicated
Pre-pregnancy BMI kg/m ²	25.5 (SD 5.33), range 15.9–44.08
Diabetes (any type: Type 1, 2 or gestational)	
Pre-pregnancy	3 (1.0)
Current pregnancy	25 (8.2)
Hypertension	
Pre-pregnancy	5 (1.7)
Current pregnancy	7 (2.3)
Iron deficiency	
Pre-pregnancy	76 (25.1)
Current pregnancy	64 (21.1)
Vitamin D deficiency	
Pre-pregnancy	72 (23.8)
Current pregnancy	44 (14.5)
Depression and/or anxiety	
Pre-pregnancy	83 (27.4)
Current pregnancy	19 (6.3)
Pregnancy diet	
Less healthy	87 (28.7)
Same	138 (45.5)
Healthier	77 (25.4)
Daily fruit intake	2.28 serves (SD 1.34), range 0-10
Daily vegetable intake	3.22 serves (SD 1.65), range 0-10
Influence on food choices	
Wanting a healthy pregnancy	282 (93.1)
Foods that can be quickly prepared	229 (75.5)
Family food preference	185 (61.1)
Pregnancy related cravings	182 (60.1)
Price	131 (43.3)
Foods that can be stored	120 (39.6)
Easy transport	90 (29.7)
Information about pregnancy food	
Internet	226 (74.6)
Midwife/obstetrician/GP	141 (46.5)
Social media	81 (26.7)
Books	55 (18.2)
Smart phone app	83 (27.4)
Family	54 (17.8)
Friends	47 (15.5)
Dietitian	59 (19.5)
I don't seek out information	21 (6.9)
Other	23 (7.6)

evidence to suggest that any level of food insecurity can be harmful during pregnancy. For example, a study from the United States found that marginal food security is positively associated with adverse health outcomes compared with those who are food secure.³⁷ The same study found that marginal food insecurity was associated with poorer caregiver health. It is possible that this is an overestimate, which if adopted could have implications for resource allocation,³⁶ however, given the serious implications for households who are food insecure, in a wellresourced high-income country such as Australia, the benefits may outweigh the challenges.

Income is a key factor influencing food insecurity. This study found that both low income and middle income households (up to \$AU93 000⁴²), those in receipt of welfare, and below university level of education were all associated with food insecurity. This is consistent with other work that has explored the factors that influence food insecurity among non-pregnant populations. For example, there has been a significant body of work exploring the impact of poverty or low income on food insecurity.^{43–45} In general, this previous work has found that low-income households employ a range of strategies to manage their food insecurity,^{26,46,47} all of which has been made more difficult during the COVID-19 pandemic.^{48,49} For these households, acquiring sufficient food is compromised by competing non-negotiable expenses, including housing costs, transportation and fuel costs and utilities. In Australia, the median household income is almost \$93 000 per year.⁴² This study found that households with an income between \$20 000 and \$70 000 a seven times greater risk of food insecurity while households with an income between \$70 000 and \$90 000 a four times greater risk of food insecurity, suggesting that many average Australian households are at risk of food insecurity.⁵⁰ Further compounding this is the 13% of Australians who live below the poverty line.⁵¹ While Australia has a social welfare system to support those experiencing financial hardship, these payments are often insufficient to cover basic costs of living. In 2021, 26% of Australians aged over 16 years received some form of income support.⁵² A recent report from the Australian Council of Social Services found that among welfare recipients, health and wellbeing activities are often foregone because of a lack of finances, with many respondents skipping meals in order to save money.⁵³ The present study found an association between pregnant women who were in receipt of government assistance and food insecurity. This is supported by other research that found 80% of households who are food insecure are also in receipt of some form of government assistance.54

Ensuring adequate food and nutrition security for women during pregnancy is essential for their health and the health of their foetus,¹³ and the implications of food insecurity during pregnancy can be severe and long lasting. Nutritional requirements increase during and after pregnancy to meet the needs of both the mother and baby, making pregnant and post-partum women especially vulnerable to the negative impacts of food insecurity.²³ While almost one quarter of women in this study were deficient in vitamin D and/or Iron, most were not eating sufficient fruits or vegetables, and while most reported taking a nutrient supplement, it is unclear if these were targeted for these deficiencies. Future research may consider exploring these and other diet behaviours on the severity of food security. Pregnancy can be a physically and mentally demanding time where food insecurity can exacerbate stress,^{23,26} and some studies have found that, when associated with food insecurity, the period can lead to reduced quality of life and poor psychosocial outcomes.¹⁷ Given that this study found that more than 1 in 10 pregnant women were food insecure, alongside these implications of food insecurity during pregnancy, there is a real need to identify women who are food insecure and to find solutions to food insecurity and hunger.

While there are clear findings of this present study, they must be interpreted in the context of the study design. The study was open to all pregnant women across Australia, meaning that specific local context across states and regional areas is not able to be detailed. The relatively small sample size infers the results cannot be generalised to the broader population. However, as this was one of the first studies in Australia to analyse data addressing this critical nutrition issue in antenatal care, results are influential in terms of guiding future maternity care and clinical practice. An associated limitation here is that some of the surveys contained missing or incomplete data. While the survey was not long, it is possible that some participants may have experienced survey fatigue and therefore were unable or unwilling to complete the whole survey. While there was a sufficient sample size for the purpose of the survey, a larger sample would yield more generalisable results. Second, while the study was provided in several languages that are spoken by many women in Australia, only a very small number of responses were received from non-English speaking women. As a result, the prevalence of food insecurity among these women is likely to be underreported. In future work, particular effort will be made to include non-English-speaking women in the sample. There are limitations when asking participants to self-report health behaviours, especially when it comes to self-reporting of diet.⁵⁵ Future research might employ some further validation measures to explore the impact of pregnancy diet on food security severity. Finally, the reference period for the assessment of food insecurity was 12 months; while this is a common reference period and is widely used in studies exploring food insecurity, and covers the preconception period,⁵⁶ it is possible that this length could introduce some recall bias; future work might consider a shorter recall period.

This is only the second published research in over a decade to measure the occurrence of food insecurity among pregnant women in Australia. Given the very serious implications of food insecurity on health and wellbeing during and beyond pregnancy and the important and well understood role of diet on the health and wellbeing outcomes of the child,³³ there is a need for the implementation of routine screening and referral of food insecure pregnant women in antenatal care settings.

AUTHOR CONTRIBUTIONS

FHM was the principal investigator in charge of planning and executing the research project, she developed the study, performed all statistical analyses, and wrote the paper. JZ and PvdP assisted with statistical analysis and with initial and final drafting.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

ETHICS STATEMENT

This research was conducted in accord with prevailing ethical principles and reviewed by the Human Research Ethics Committees at the Royal Women's Hospital and Deakin University (Protocols: Project 21/30 and 2021-344).

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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