Sources of nutrition information for Indonesian women during pregnancy: how is information sought and provided?

Widya Rahmawati[1,2,]* 🆔, Paige van der Pligt[1], Jane C Willcox[3,4,5] 🆔 and Anthony F Worsley[1]

[1]Institute for Physical Activity and Nutrition, School of Exercise and Nutrition Sciences, Deakin University, Geelong, VIC 3220, Australia: [2]Department of Nutrition Science, Faculty of Medicine, Universitas Brawijaya, Malang, East Java 65145, Indonesia: [3]School of Allied Health, College of Science, Health and Engineering, La Trobe University, Bundoora, Australia: [4]School of Human Movement and Nutrition Sciences, University of Queensland, St Lucia Brisbane, Australia: [5]Centre for Quality and Patient Safety Research – Epworth HealthCare Partnership, Institute of Health Transformation, School of Nursing & Midwifery, Deakin University, Burwood, VIC, Australia

Abstract

Objective: Adequate and appropriate nutrition education is expected to contribute towards preventing risk of child stunting and maternal overweight/obesity. Understanding women's information-seeking behaviours is an important key step for health professionals and departments of health in order to improve the development of optimal and targeted nutrition education during pregnancy. This study investigated the experience of Indonesian women in seeking and receiving nutritional information during pregnancy and its relationship to women's socio-demographic and pregnancy characteristics.
Design: An online cross-sectional study.
Setting: Malang City, Indonesia.
Participants: Women who had given birth within the past 2 years (*n* 335).
Results: All women in this study sought or received food and nutrition information from multiple sources, including social and health professional contacts and media sources. The women frequently discussed nutrition issues with their family, particularly their husband (98·2 %) and mother or mother-in-law (91·6 %). This study identified four groups of sources based on women's search habits. Women from high socio-economic strata were more likely to discuss food and nutrition issues or received nutrition information from obstetricians, their family or online sources (adjusted $R^2 = 26·3$ %). Women from low socio-economic strata were more likely to receive nutrition information from midwives, health volunteers or Maternal and Child Health books (adjusted $R^2 = 14·5$ %).
Conclusions: A variety of nutrition information sources needs to be provided for women from different socio-economic strata. Involvement of family members in antenatal nutrition education may improve the communication and effectiveness of young mothers' dietary and nutrition education.

Indonesia is a large country with a severe Double Burden of Malnutrition (DBM)[1]. While the prevalence of stunting of children under 5 years of age in Indonesia is high (30·8 %), the prevalence of maternal overweight and obesity is also high (44·4 %)[2]. The development of household Double Burden of Malnutrition (childhood stunting and overweight or obese mothers) begins during pregnancy[3,4]. Poor nutrition during pregnancy[3] leading to low gestational weight gain (GWG) and low birth weight[5]

has been found to contribute to the development of childhood stunting in Indonesia[6]. Medium- and long-term effects of low birth weight include childhood stunting[6], adverse neurodevelopmental and physical health outcomes[7], suboptimal health status, educational achievement and productivity later in life[8]. In contrast, excessive GWG was associated with large birth weight and caesarean delivery[9]. Excessive GWG also negatively impact on post-partum weight retention[4] and maternal

Corresponding author: Email wrahmawati@deakin.edu.au, wrahmawati.fk@ub.ac.id

and childhood obesity[10]. Therefore, addressing nutrition intervention during pregnancy is essential to prevent DBM in Indonesia.

Previous work in Indonesia has shown that low nutrition literacy is an important cause of childhood stunting and maternal overweight within households[11]. A mother's lack of knowledge of nutrition during pregnancy was associated with suboptimal GWG[12] and anaemia during pregnancy[13]. Nutrition education is required to improve the nutrition and health status of mother and child[14–18]. Further studies have reported that nutrition education interventions have the capacity to increase knowledge and practice towards prevention of low birth weight[14], anaemia during pregnancy and lactation[15], limit excessive GWG[17], optimise post-partum weight loss[18] and improve complementary feeding practices[16].

Women's nutrition information-seeking behaviour, including actively seeking and/or passively obtaining nutrition information[19], is an important determinant for improving their nutrition awareness during pregnancy[20]. Women who receive more nutrition information may filter the information they receive and then translate it into healthy eating behaviour[21]. A review of literature which included twenty-nine studies from twelve predominantly high-income countries showed, overall, a positive association between nutritional knowledge and dietary intake[22]. Consequently, further work is needed in low middle-income countries as providing reliable nutrition education for pregnant women has a capacity to optimise antenatal care and best outcomes for women and their offspring in such settings.

As a country with a high prevalence of childhood stunting (>30 %)[2,23], the Indonesian government developed a new strategy in 2013 to reduce rates of stunting. This strategy included integrated antenatal care which involves nutrition counselling during antenatal care visits[23–25]. The Indonesia National Basic Health Research (RISKESDAS) reported that 74 % of pregnant women in Indonesia received antenatal care services at least four times during their pregnancy[2]. However, there was limited information about the implementation of nutrition education in antenatal care. In Central Java Province, pregnant women have previously reported that they receive health or nutrition information from midwives (88–90 %) or doctor (7·2–7·9 %)[26]. Similarly, in Malang city and district, in a study of over 700 pregnant women, approximately one-third of pregnant women reported they received nutrition information during their pregnancy from health care providers[27]. The previous studies did not investigate women's experience on information-seeking and provision of antenatal nutrition education. Further research to investigate the nutrition education provided by health providers during antenatal nutrition education is necessary.

A number of studies involving pregnant women in Australia[28], the UK[29], the USA[30], Iran[31], Nigeria[32] and Ghana[33] have shown that women's education and socio-economic backgrounds influence their experience in searching for nutrition information. Pregnant women from higher education and socio-economic levels are more likely to receive nutrition information from formal and informal sources[32], including the Internet[28,31]. While women from low socio-economic levels are less likely to sought nutrition information from the Internet[30,33], but more likely to receive information from family and social worker[29]. In addition, a study conducted by The World Bank in Indonesia has found that the utilisation of health service of Indonesian population vary greatly by their socio-economic background[34]. Therefore, this study aimed to investigate the experience of Indonesian women in seeking and obtaining nutritional information during pregnancy and its relationship to women's socio-demographic and pregnancy characteristics.

Methods

Study design

The study reported in this paper is a part of a mixed-method study investigating Indonesian women's need for antenatal nutrition education in Malang, Indonesia[35]. A cross-sectional study was conducted from January to March 2020. An online questionnaire was administered to women who had given birth within the past 2 years and who were living in Malang City, Indonesia. This study sought to determine women's reported experience in obtaining nutritional information during pregnancy.

Subject recruitment

To be included in this study, respondents had to be 18 years of age or above, had given birth to a live baby in the last 24 months, lived in the area of Malang City, Indonesia, for a minimum of 3 years, were Bahasa speaking and had access to the Internet. Respondents were excluded if they suffered from chronic disease or were taking any medications. The sample size was calculated using a formula for the 'estimation of a population proportion with a specified relative precision'[36] and using SSize software[37]. Based on surveys with pregnant women in the study area in 2012–2016[27], we anticipated that the likely proportion of women who received information about nutrition for pregnancy in Malang, Indonesia, was 60·8 %[27]. At a confidence level of 95 % and relative precision of 10 %; this derived a minimum sample size of 248. However, this study included 335 women who completed the online survey during 40 d of data collection (21 January – 1 March 2020).

Procedure

Flyers advertising the study were posted on the first author's social media sites (such as Facebook, Twitter, Instagram and WhatsApp) and public social media groups in Malang City, Indonesia. Women who wished to participate in the survey were provided with a Qualtrics link

which contained the information page, a Plain Language Statement and screening questions (see online Supplemental file 1). Once a woman met the eligibility requirements, she was guided to an electronic consent form. If the woman consented to participate, she was directed to the questionnaire. The respondents were allowed to answer survey questions over several occasions, if they wished, but had to complete the survey within a 2-week time frame. Qualtrics recorded the IP address of each respondent. Once a respondent had completed the questionnaire or was excluded from the study, she could not visit the questionnaire further. The first author's email and contact phone number were available to support respondents if they had any questions or experienced communication difficulties.

The questionnaire

The questionnaire was constructed on the basis of information obtained from the literature[31,38] and a previous qualitative study of pregnant women's information seeking in Malang City, Indonesia[35]. The questions were arranged into two sections: (1) questions related to the sources and frequency of obtaining food and nutrition information during pregnancy (henceforth, food and nutrition information) and (2) women's socio-demographic and pregnancy characteristics. Firstly, women were asked: *'In your last pregnancy, how often did you discuss foods or nutrition for pregnancy with the following persons?'* and, *'How often did you read about or get food and nutrition advice from the sources below during your last pregnancy?'* These questions were followed by a list of sixteen possible food and nutrition information sources (Table 1). The present study aimed to assess the frequency of women's seeking or receiving nutrition information, either: (1) never; (2) once or twice during pregnancy; (3) approximately once in each trimester up to once in every month during pregnancy (three to ten times during pregnancy) or (4) more than ten times during pregnancy. The decision on the frequency of seeking/receiving food and nutrition information is based on the findings from our previous study[35] in which it was evident that many women either never received food and nutrition information from health providers or only once or twice during their pregnancy.

Secondly, the women's trust in various information sources was assessed by the question: *'Among food and nutrition information sources below, what source did you trust most? (Choose one only)'* This question was followed by 15 possible sources and one 'other sources' option. Thirdly, several questions were related to the women' socio-demographic and pregnancy characteristics, including age, the number of pregnancies, household composition, working status as well as education and income levels.

Quality control

Two main techniques were used to control the quality of the questionnaire. Firstly, independent Indonesian-English speakers reviewed questionnaire translation from English to Indonesian. The translation was back-translated by two independent Indonesian-English translators. The back-translation from Indonesian to English was conducted to ensure that the Indonesian version of the questionnaire did not change in meaning of the questions and response scales from the original questionnaire, which was developed in English. Secondly, the questionnaire was

Table 1 Reported frequencies and trust of women-seeking/receiving nutrition information (n 335)

Source of food and nutrition information	Frequency receiving information during pregnancy				The most trusted sources (%)
	% never	% 1–2 times	% 3–10 times	% > 10 times	
Social or health professional contacts					
Husband	1·8	9·0	18·8	70·4	0·9
Mother (in-law)	8·4	21·2	24·8	45·7	5·7
Friends	6·6	27·2	33·4	32·8	0·9
Obstetrician	10·7	26·9	37·3	25·1	62·3
Sibling/relatives	11·3	32·5	30·7	25·4	0·0
Midwife	18·8	37·9	33·4	9·9	11·6
Neighbours	30·7	39·7	20·0	9·6	0·0
Health volunteers	38·8	31·3	21·5	8·4	0·9
Nutritionist	47·8	34·9	13·4	3·9	11·6
Other people*	63·3	21·5	8·7	6·6	0·0
Media sources					
The Internet	3·6	9·6	26·6	60·3	2·7
Social media	3·6	14·3	26·9	55·2	0·6
Books	4·8	26·0	38·8	30·4	2·4
TV/radio	21·8	40·3	23·0	14·9	0·0
Magazines/newspapers	48·1	33·7	13·1	5·1	0·0
Leaflets	53·4	32·8	12·8	0·9	0·3
Other media†	55·5	26·3	10·4	7·8	0·0

*Other people, including people that women did not know well or met in public places or social media platforms, intern, yoga trainer, food product marketer.
†Other media, including parenting apps, community meetings, advertisements as well as food and supplement labels.

pre-tested three times (not included in the final data collection) to evaluate question order and women's understanding of the questions and the administrative feasibility of the questionnaire. These pre-test cohorts included nine Indonesian women residents in Melbourne and ten women residents in Malang, Indonesia. Based on the results of the pre-tests, amendments were made to the final questionnaire, such as revision of difficult-to-understand questions, updating the order of the questions, and the addition of some response choices.

Data analysis

All participants' responses were transferred from Qualtrics to the Statistical Package for Social Science (SPSS, version 26) for further analysis. First, cross-tabulation (χ^2) analyses (Table 2) were performed to assess the relationships between individual socio-demographic variables (Table 3) and frequencies of seeking/receiving food and nutrition information from each source (Table 1).

Second, to reduce the number of dependent variables and to identify latent variables underlying the manifest source variables, an exploratory principal component analysis with varimax rotation was performed on the response frequencies from the sixteen information sources.

Four factors were derived from this analysis: Factor 1 (family, online and obstetric sources); Factor 2 (friends and relatives); Factor 3 (mass media and nutritionists) and Factor 4 (maternal health resources). Factor scores were calculated automatically by the Factor analysis program. The internal reliabilities of the factors were computed by using Cronbach's α to indicate the consistency of participants' responses to the items loading (> 0·4) on each factor[39] (Table 4).

Third, bivariate correlations were conducted to assess the correlation between each information source factor and socio-demographic and pregnancy characteristics (data not shown). Thus, multiple regression analyses were carried out to investigate socio-demographic and pregnancy predictors of the derived source factors (Table 5). The dependent variables for regression analysis were four sources of information factors mentioned above. The independent variables were socio-demographic characteristics that significantly correlated with each dependent variable, i.e. women's age, education levels, income levels and working status.

To achieve normal distribution of the factor scores, reverse and logarithm transformation (^{10}Log (the maximum possible value + 1) – original variable) was performed from Factor 1 (family, online and obstetrics sources). Similarly, SQRT transformation [SQRT of the lowest value + original

Table 2 Statistically significant differences in the frequencies of obtaining food and nutrition information by education levels, working status and income levels (*n* 335)

Source of food and nutrition information	Education levels (%)			Income levels (%)			Working status (%)		
	Low *n* 139	High *n* 196	P	Low *n* 154	Medium-to-high *n* 181	P	No *n* 189	Yes *n* 146	P
Social or health professional contacts									
Midwife									
Never	10·1	25·0	0·002	13·0	23·8	0·035	12·7	26·7	0·002
1–2 times	40·3	36·2		38·9	37·0		38·1	37·7	
≥ 3 times	49·6	38·8		48·1	39·2		49·2	35·6	
Health volunteers									
Never	24·5	49·0	<0·001	29·9	46·4	0·007	32·3	47·3	0·012
1–2 times	35·2	28·6		37·0	26·5		32·8	29·4	
≥ 3 times	40·3	22·4		33·1	27·1		34·9	23·3	
Obstetricians									
Never	21·6	3·1	<0·001	20·1	2·8	<0·001	15·3	4·8	0·001
1–2 times	36·0	20·4		39	16·6		30·2	22·6	
≥ 3 times	42·4	76·5		40·9	80·6		54·5	72·6	
Friends									
Never	11·5	3·1	<0·001	9·7	3·9	<0·001	10·6	1·4	<0·001
1–2 times	38·1	19·4		37·7	18·2		31·7	21·2	
≥ 3 times	50·4	77·5		52·6	77·9		57·7	77·4	
Husband*									
0–2 times	17·3	6·1	0·001	17·5	5·0	<0·001	12·7	8·2	NS
≥ 3 times	82·7	93·9		82·5	95·0		87·3	91·8	
Media sources									
The Internet									
Never	7·2	1·0	<0·001	6·5	1·1	0·011	3·7	3·4	NS
1–2 times	14·4	6·1		11·7	7·7		11·1	7·5	
≥ 3 times	78·4	92·9		81·8	91·2		85·2	89·0	
Social media									
Never	3·6	3·6	<0·001	3·9	3·3	0·018	4·2	2·7	NS
1–2 times	24·5	7·1		20·1	9·4		17·5	10·3	
≥ 3 times	71·9	89·3		76·0	87·3		78·3	87·0	

*'Never' category was combined with the 'once to twice' category into '0–2 times' category to meet χ^2 test requirement.

Table 3 Characteristics of participants (n 335)

Characteristics	%
Women' age (mean 30 ± 4·8 years)	
19–30 years old	57·6
30·1–46 years old	42·4
Education levels	
Primary school or junior high school	6·9
Senior high school	34·6
With a university degree	58·5
Working status	
Not working outside their home	56·4
Working outside their home	43·5
Family income levels	
Low income (≤ minimum wage*)	46·0
Medium income (1–2 x minimum wage)	36·1
High income (≥ 3 x minimum wage)	17·9
Family composition	
Living with husband (nuclear family)	53·4
Living with husband and parents (extended family) in one household	43·0
Single parent	3·6
Number of pregnancies in their last pregnancy	
First pregnancy	46·9
Second pregnancy	37·6
Third pregnancy or above	15·5

*Monthly minimum wage of Malang City in 2019 is IDR 2 895 500 (≈ 196·38 USD).

variable] was performed on Factor 3 (mass media and nutritionist). Factor 4 (maternal and health resources) did not need transformation because this factor was normally distributed. Finally, Factor 2 (friends and relatives) was not associated with any socio-demographic characteristics, therefore this factor was not analysed by multiple regression analysis.

Results

Participant characteristics

From the 456 women who completed the screening questions, 335 women fully completed the questionnaire and were eligible for data analysis (Fig. 1).

The socio-demographic and pregnancy characteristics of the participants are presented in Table 3. The mean age of women was 30·0 ± 4·8 years old. The mean of the women's most recent child's age was 10·3 ± 6·5 months. Characteristics of respondents are evenly distributed based on age, pregnancy experience, education levels, employment status, economic levels and the type of family. More than half of the participants had a university degree. Almost half of the participants were working outside their home, had a family income at a minimum regional salary level or below and were living with their husband and their parents or their extended family in one household. Nearly half of the women's last pregnancy was their first pregnancy.

Reported frequencies of women seeking/receiving nutrition information

All the women in this study sought or received food and nutrition information from multiple sources (at least from two 'social or health professional contacts' and two media sources). On average, women sought or received nutrition information from eight (2–10) types of 'social or health professional' information sources and five (2–7) types of media sources. Overall, 317 (94·6 %) respondents discussed nutrition information topics with five 'social or health professional' sources, and 293 (87·5 %) women sought nutrition information from at least four types of media sources (data not shown).

Table 1 shows the frequency of obtaining food and nutrition information from 'social or health professional' and media sources and women' perceptions of the importance of the sources. More than half of the women discussed food and nutrition issues with their husband or their mother or mother-in-law with a frequency more than ten times during pregnancy. About one-third of the women discussed food and nutrition information with obstetricians, midwives, friends or sibling/relatives with a frequency discussion 3–10 times during pregnancy. In addition, about one-third of respondents discussed food and nutrition topics with nutritionists, health volunteers or neighbours once or twice during their pregnancies. However, this study did not assess what topics women discussed with regard to each information source.

More than half of the women sought or received food and nutrition information from the Internet or social media at least ten times during pregnancy. About one-third of them sought food and nutrition information from books, including MCH books, with a frequency of seeking 3–10 times during pregnancy. Further, over one-third of women received food and nutrition information from the TV/radio, magazines/newspapers or leaflets at least once or twice during their pregnancies.

While the frequency of exposure to food and nutrition information came mostly from family and friends, the Internet and social media, exposure was low to the three most trusted food and nutrition information sources which were obstetricians (62·3 %), midwives (11·6 %) and nutritionists (11·6 %) (Table 1).

Socio-demographic comparisons of the frequency of information seeking across sources

Women's socio-demographic characteristics, such as education, income and working status, were associated with the frequency of accessing nutrition information from different sources. Table 2 shows the statistically significant differences between varying levels of education, income and working status groups.

Women who had a university degree or medium-to-high-income strata, compared with those who did not, were more likely to discuss with, or obtain nutrition information from an obstetrician, their husband, friends, the Internet and social media. However, they were less likely to receive nutrition information from midwives and health volunteers. The analysis of women's information-seeking behaviour by working status showed that women who

Table 4 Four factors derived from the frequency of food and nutrition information from sixteen sources

Source of information	Factor 1 Family, online and obstetrics sources	Factor 2 Friends and relatives	Factor 3 Mass media and nutritionists	Factor 4 Maternal health resources
The Internet	0·672			
Social media	0·693			
Obstetrician	0·585			
Husband	0·628			
Mother or mother-in-law	0·500			
Friends		0·584		
Sibling/relatives		0·645		
Neighbours		0·790		
Other people		0·727		
Magazines/newspapers			0·756	
TV/radio			0·635	
Nutritionist			0·591	
Leaflets			0·567	
Midwife				0·777
Books, including MCH book				0·701
Health volunteers				0·638
Cronbach's α	0·67	0·78	0·67	0·63
% of variance accounted for the factor	28·9 %	11·0 %	8·6 %	6·9 %

Table 5 Results of the multiple linear regression analyses of the information source factor scores (n 335)

| Dependent variables	Independent variables	Multiple regression analyses			
		β coefficient	95 % CI	SE	P
Family, online and obstetrics sources	(Constant)	−0·504	−0·608, −0·400	0·053	<0·001
	Women' age	−0·009	−0·012, −0·006	0·001	<0·001
	Education levels	0·044	0·026, 0·062	0·009	<0·001
	Family income	0·023	0·013, 0·034	0·005	<0·001
Maternal health resources	(Constant)	2·287	1·444, 3·131	0·429	<0·001
	Women' age	−0·023	−0·044, −0·002	0·011	0·017
	Education levels	−0·308	−0·439, −0·178	0·066	<0·001
	Working status	−0·402	−0·616, −0·188	0·109	0·001
Mass media and nutritionists	(Constant)	1·306	1·207, 1·405	0·050	<0·001
	Family income	0·043	0·017, 0·069	0·013	0·001
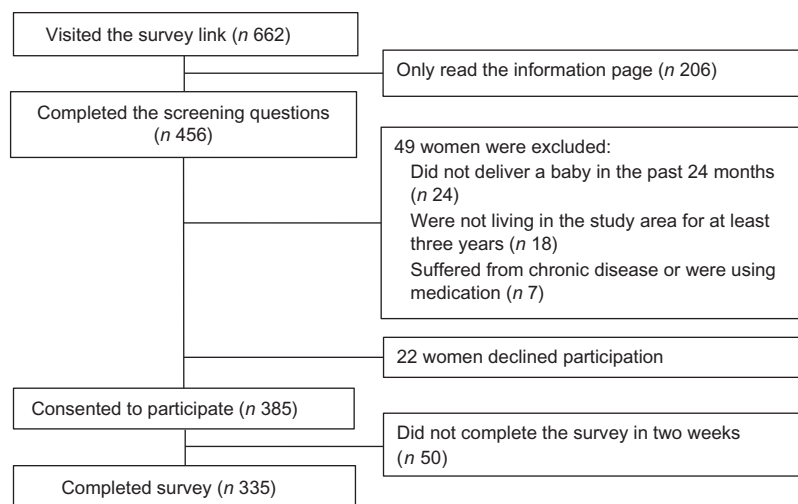
Fig. 1 Flow diagram of study recruitment

were not working outside their homes were more likely to discuss nutrition topics with a midwife or a health volunteer. They were less likely to discuss these issues with an obstetrician, friends or husband (Table 2).

In comparison with women aged 30–46 years, younger women (< 30 years) were more likely to discuss with or obtain nutrition information (at least three times during their pregnancy) from their mothers or mothers-in-law (78·2 % v. 59·9 %, P = 0·001), the Internet (92·8 % v. 78·9 %, P < 0·001) and social media (89·1 % v. 72·5 %, P < 0·001). Similarly, compared with multiparous women, nulliparous women were more likely to discuss with or obtain food and nutrition information (at least three times during their pregnancy) from their mothers or mothers-in-law (80·9 % v. 61·2 %, P < 0·001), the Internet (95·5 % v. 79·2 %, P < 0·001), social media (91·7 % v. 73·6 %, P < 0·001) and books (76·4 % v. 62·9 %, P < 0·013). Further, compared with women who were living in their nuclear family, women who were living with their extended family in one household were more likely to discuss food and nutrition issues (at least three times during their pregnancy) with their mother or mother-in-law (81·9 % v. 60·9 %, P < 0·001) and the Internet (92·4 % v. 81·6 %, P = 0·019). In addition, women with pregnancy problems sought nutrition information (once or twice during pregnancy) more than women without pregnancy problems (39·8 % v. 25·4 %, P = 0·012; data not shown).

Results of the factor analysis

The exploratory principal components analysis with varimax rotation of the source frequencies derived four factors: (1) 'Family, online and obstetric sources'; (2) 'Friends and relatives'; (3) 'Mass media and nutritionist' and (4) 'Maternal health resources'. Total variance explained from these four factors was 53·3 % (Table 4).

Multiple regression analyses of the factor scores

Further analysis was carried out to predict women's tendency to seek nutrition information from four groups of nutrition information sources. The results suggested that three groups of nutrition information sources (Factors 1, Factor 3 and Factor 4) can be partly predicted by women's socio-demographic characteristics (Table 5). There were no significant associations with Factor 2 (friends and relatives).

Factor 1 (family, online and obstetric sources) was negatively associated with women' age and positively with education levels and family income (adjusted R^2 = 26·2 %). Younger women or mothers with higher education or income levels more frequently sought information from 'Family, online and obstetric sources'. The frequency of receiving food and nutrition information from 'Maternal health resources' (Factor 4) was negatively associated with women's age, education levels and working status (adjusted R^2 = 14·9 %). In other words, younger women, less educated women, or non-working women were more likely to obtain

food and nutrition information from midwives, health volunteers and books. The frequency of receiving food and nutrition information from 'Mass media and nutritionists' (Factor 3) was positively associated with family income. Women who had higher incomes were more likely to receive food and nutrition information from the mass media (TV/radio, magazines/newspapers and leaflets) and nutritionists than those on lower incomes.

Discussion

This study is the first in-depth study to investigate the experience of Indonesian women in obtaining nutritional information during pregnancy and its relationship to the socio-demographic of respondents. The study demonstrated three key findings. Firstly, women sought nutrition information from various sources. Secondly, women's social demographic characteristics were correlated with their frequency of searching for various nutrition sources. Thirdly, family members were frequently consulted.

Women sought and obtained nutrition information from various sources

This study found that frequency of seeking or obtaining nutrition information from informal sources (family, friends, digital media and mass media) was higher than that from formal sources (obstetricians, midwives and nutritionists). The opportunity for discussion with health providers was in line with their current antenatal schedule in Indonesia, such as minimum four pregnancy visits throughout pregnancy[25]. The percentage of women seeking or receiving information from formal sources was similar to the study of Wijaya-Erhardt et al. in Central Java, Indonesia[26]; however, the percentage of women in this current study who discussed nutrition information topics with their family and friends was greater than that of the Wijaya-Erhardt et al.'s study[26]. The difference might be due to women in the current study being from higher socio-economic levels than the previous study[26]. Our study found that women with higher education and income levels were more likely to discuss nutrition topics with their husband and friends compared to those with lower education or income levels.

Although participants reported that they trusted the information from obstetricians, midwives and nutritionists, they received information from those sources less frequently than from family, friends and online media. This finding suggests that antenatal nutrition education should not only be delivered by traditional antenatal care, alongside digital channels such as the Internet or social media. As more than 95 % of respondents in this study engaged with the Internet and social media, those online media are potential channels to share nutrition advice to pregnant women in Indonesia. However, health authorities also need to ensure the reliability of the information provided

on the Internet. A study by Storr *et al.*[40] has found that government web pages in several countries (Australia, New Zealand, the UK, the USA and India) provided more accurate nutrition information rather than other sources[40]. Governments have a responsibility to regularly review and update the information they offer in their web pages to ensure that it is accurate and comprehensive[40]. This strategy could be adopted in Indonesia. For example, the Ministry of Health or local Department of Health might develop a reliable nutrition information website or social media platform for the guideline of both health providers and pregnant women.

Women's socio-demographic characteristics influence women' nutrition information sources

The factor analysis grouped the various sources of food and nutrition information into four categories: (1) Family, online and obstetrics sources; (2) Friends and relatives; (3) Mass media and nutritionists and (4) Maternal health resources.

The multiple regression analyses of the factor scores showed that women from high socio-economic strata were more likely to seek or discuss nutrition information from 'Family, online and obstetrics sources'. This finding was consistent with Hall *et al.*'s (2018) findings that showed that the Indonesian middle class increasingly seeks health services from private facilities rather than government facilities[41]. Our previous qualitative study found that pregnant women from medium-to-high economic strata who reported their pregnancies to obstetricians were less likely to receive nutritionist counselling and nutrition education sessions provided by the health centres[35]. This finding suggests that during antenatal visits, obstetricians should refer women to nutritionists or reliable nutrition websites[38,42]. The available guidelines for pregnant women[43,44] do not provide detailed and adequate food and nutrition guidelines during pregnancy. For example, there is a lack of information about recommended weight gain during pregnancy or ways to overcome morning sickness. The absence of detailed guidelines could in part increase the chance of inadequate information being delivered to pregnant women. Therefore, the local Department of Health and health professionals need to work to ensure pre- and post-natal nutrition information is accessible, accurate and up to date to ensure women are best supported in attaining optimal nutrition-related health during pregnancy.

In contrast, women from low socio-economic strata were more likely to search for nutrition information from 'Maternal health resources' such as midwives, MCH books and health volunteers. Resources such as the MCH books were developed by the Indonesian Ministry of Health and can be accessed by pregnant women attending government antenatal care providers in the countries. However, nutrition information provided in the MCH book and nutrition leaflets for pregnant women[43,44] received by pregnant women in the study area lacks much of the information that women say they require. For example, there were no information about recommended portion size during pregnancy, food group replacement options and recommended weight gain during pregnancy. Improvement in the information provided in MCH book and nutrition leaflets is essential so that all pregnant women can easily access the most up-to-date and relevant information needed.

Health volunteers are potential sources of nutrition education for women from low socio-economic backgrounds who may not have access to the Internet. However, the quality of the information provided by health volunteers needs to be considered, as most of them do not to have a nutrition or health education background[45,46]. A study of a number of health volunteers in Yogyakarta, Indonesia, revealed that most health volunteers had low education levels and training experience[45]. Iswarawanti revealed that training for health volunteers in Indonesia is usually carried out sporadically because of the lack of local government resources[47]. Further, a narrative review on the role of community health volunteers in Ethiopia, Niger and Mali has shown that community health volunteers have important role to support formal health workers in improving health promotion and basic health services to children[48]. Dynes *et al.*'s study in Ethiopia has shown that training programmes to community health volunteers, health extension worker and traditional birth attendance have improved the knowledge of participants towards the provision of safe care during pregnancy, birth and the early postnatal period[49]. Therefore, adequate and well-designed training for health volunteers[46] is crucial to ensure they can deliver nutrition education to pregnant women.

Information seeking from family sources

Our study found that family sources, particularly husbands and mothers or mothers-in-law, were frequently consulted by young mothers. The high proportion of women who discussed nutrition topics with their family and friends is consistent with Indonesian culture where women live closely together and are strongly influenced by their families and the community around them. This finding is reinforced by other studies with Indonesian women. For example, a qualitative study in Wonosobo, Indonesia, reported that pregnant women usually obeyed their mother's or mother-in-law's advice to avoid certain food taboos during pregnancy and after delivery[50]. Another study in Banten, Indonesia, also showed that pregnant women usually sought approval from their mother or mother-in-law before buying or eating some foods[51]. Pregnant women in Bali took their family's advice without question because women trusted their family and wanted them to be happy[52]. In addition, a national survey in Indonesia also showed that family support was able to significantly increase the likelihood of less-educated women adhering to the consumption of Fe-folic acid supplementation[53]. These

findings and ours are in contrast to other studies in Australia[38], and some developed countries[54] that found the Internet was a more important source of information rather than health providers and the family. This difference might be because of the different living arrangements of women in Indonesia compared with women in Western countries: many Indonesian women were living together with their husband and their extended family in one household.

These findings show the importance of involving family members in Indonesian antenatal nutrition education programmes, particularly women's husbands and mothers or mothers-in-law living together with women in one household. This involvement aims to provide up to date nutrition knowledge to women's families, so that women's families would not provide pregnant women with misleading or outdated nutrition advice. Further, women's families are expected to reinforce women to adhere to a healthy diet, particularly women from low-socio-economic backgrounds. One study by Wiradnyani *et al.* (2016) has revealed that less-educated Indonesian women need more support from their family to reinforce them in the adoption of healthy eating behaviour rather than well-educated women[53]. Studies in Senegal[55] and Sierra Lona[56] have shown that nutrition education programmes for grandmothers have significantly improved their advice to their daughters and the nutritional practices of women during and shortly after pregnancy[55,56]. However, the different types of support that should be provided by these family members need to be explored.

Strengths and limitations of the study

There were some benefits of using an online survey compared with face-to-face interviews. This online survey was easier to administer, less expensive and time-consuming than face-to-face interviews. The other benefits of using an online survey were that respondents might feel freer to answer sensitive questions, reduced social desirability effects[57] and reduced interviewer biases[58].

The variables in this study were carefully designed based on the finding of our qualitative research in the study area[35], and the sample size enabled accurate statistical analyses to be conducted representing the views and experiences of mothers who have delivered a baby in the last 24 months in the study area. The study findings confirmed and extended the results of the qualitative study.

This study was designed to represent the population of Indonesian women in Malang, Indonesia. Malang City had a population 861 414 inhabitants in 2017 (0·33 % of Indonesian population)[59,60]. The education[2,61] and economic[60,62] levels of Malang inhabitants are also slightly higher than the broader Indonesian population[2,61,62]. Therefore, the findings of this study could not be generalised to Indonesia as a whole. Further work could be undertaken to better understand the broader population needs of women throughout Indonesia, to better represent women giving birth across Indonesia.

Among the limitations was the fact that the study was confined to women who had access to the Internet. Internet access of Indonesian population who were living in urban area of Indonesia is about 72 %[63]. Therefore, there is a potential bias for generalisability of the findings, as this study did not include women who do not have access to the internet. Despite this, the study included respondents from a range of social-economic and pregnancy backgrounds, such as different levels of education and income levels, number of pregnancies and family types (e.g. extended and nuclear family). However, future research should examine the views and experiences of women who do not have access to the Internet. Involving women who did not have access to the Internet would allow key understanding regarding experiences, views and barriers of women who have limited resources.

This study used a recall method to measure the frequency of nutrition-seeking behaviour during pregnancy. This could be viewed as a limitation given its reliance on respondents' memory and perception thereby limiting accuracy. However, similar studies have used recall to measure the frequency of nutrition-seeking behaviour during pregnancy[31,64], hence this was an appropriate approach.

Conclusion

Indonesian women frequently refer to multiple sources of food and nutrition information during their pregnancies. Four distinct groups of sources based on women's search habits and women's socio-economic characteristics were found. Family members were the most frequently sought information sources in this study; however, most women reported that they trusted their health providers (doctors, midwives or nutritionists) the most. A variety of reliable and up-to-date dietary information sources across multiple platforms need to be further developed, which can be accessed by women from different socio-economic strata in Indonesia. Involving family members in antenatal nutrition education may improve the delivery, implementation and effectiveness of young mothers' dietary and nutrition education.

Acknowledgements

Public Health Nutrition

Supplementary material

For supplementary material accompanying this paper visit https://doi.org/10.1017/S1368980021002317

References

1. Popkin BM, Corvalan C & Grummer-Strawn LM (2020) Dynamics of the double burden of malnutrition and the changing nutrition reality. *Lancet* **395**, 65–74.
2. MoH-RI (2018) *Laporan RISKESDAS Nasional 2018 (National Report of Basic Health Research 2018)*. Jakarta: Ministry of Health of the Republic of Indonesia (MOH-RI).
3. Beal T, Tumilowicz A, Sutrisna A *et al.* (2018) A review of child stunting determinants in Indonesia. *Matern Child Nutr* **14**, 1–10.
4. Nehring I, Schmoll S, Beyerlein A *et al.* (2011) Gestational weight gain and long-term postpartum weight retention: a meta-analysis. *Am J Clin Nutr* **94**, 1225–1231.
5. Aryastami NK, Shankar A, Kusumawardani N *et al.* (2017) Low birth weight was the most dominant predictor associated with stunting among children aged 12–23 months in Indonesia. *BMC Nutr* **3**, 1–6.
6. Wijayanti A & Djuwita R (2020) The relationship of low birth weight babies with stunting in toddlers aged 12–36 months in Bogor regency, 2019. *Indian J Public Health Res Dev* **11**, 420–426.
7. Luu TM, Rehman Mian MO & Nuyt AM (2017) Long-term impact of preterm birth: neurodevelopmental and physical health outcomes. *Clin Perinatol* **44**, 305–314.
8. Petrou S, Sach T & Davidson L (2000) The long-term costs of preterm birth and low birth weight: results of a systematic review. *Child Care Health Dev* **27**, 97–115.
9. Goldstein RF, Abell SK, Ranasinha S *et al.* (2017) Association of gestational weight gain with maternal and infant outcomes: a systematic review and meta-analysis. *JAMA* **317**, 2207–2225.
10. Josey MJ, McCullough LE, Hoyo C *et al.* (2019) Overall gestational weight gain mediates the relationship between maternal and child obesity. *BMC Public Health* **19**, 1062.
11. Mahmudiono T, Nindya TS, Megatsari M *et al.* (2018) Comparison of maternal nutrition literacy, dietary diversity, and food security among households with and without double burden of malnutrition in Surabaya, Indonesia. *Malays J Nutr* **24**, 359–370.
12. Willcox JC, Ball K, Campbell KJ *et al.* (2017) Correlates of pregnant women's gestational weight gain knowledge. *Midwifery* **49**, 32–39.
13. Zhang Q, Rojhani A, Gulló-Rivera A *et al.* (2018) Prevalence and knowledge of anemia among pregnant women enrolled in women, infants and children supplemental food program. *Nutr Food Sci* **48**, 990–1002.
14. Nugraheni SA, Sugihantono A, Izwardy D *et al.* (2019) Effect of training to knowledge and practices of Dasa Wisma activists as pregnant women assistants in preventing low birth weight. *Indian J Public Health Res Dev* **10**, 1720–1724.
15. Williams PA, Poehlman J, Moran K *et al.* (2020) Strategies to address anaemia among pregnant and lactating women in India: a formative research study. *Public Health Nutr* **23**, 795–805.
16. Murthy N, Chandrasekharan S, Prakash MP *et al.* (2019) The Impact of an mHealth voice message service (mMitra) on infant care knowledge, and practices among low-income women in India: findings from a pseudo-randomized controlled trial. *Matern Child Health J* **23**, 1658–1669.
17. Lamminpaa R, Vehvilainen-Julkunen K & Schwab U (2018) A systematic review of dietary interventions for gestational weight gain and gestational diabetes in overweight and obese pregnant women. *Eur J Nutr* **57**, 1721–1736.
18. LeBlanc ES, Smith NX, Vesco KK *et al.* (2021) Weight loss prior to pregnancy and subsequent gestational weight gain: prepare, a randomized clinical trial. *Am J Obstet Gynecol* **224**, 99.e1–99.e14.
19. Bookari K, Yeatman H & Williamson M (2017) Informing nutrition care in the antenatal period: pregnant women's experiences and need for support. *BioMed Res Int* **2017**, 4856527.
20. Szwajcer EM, Hiddink GJ, Koelen MA *et al.* (2005) Nutrition-related information-seeking behaviours before and throughout the course of pregnancy: consequences for nutrition communication. *Eur J Clin Nutr* **59**, Suppl. 1, S57–S65.
21. Bianchi CM, Huneau JF, Le Goff G *et al.* (2016) Concerns, attitudes, beliefs and information seeking practices with respect to nutrition-related issues: a qualitative study in French pregnant women. *BMC Pregnancy Childbirth* **16**, 306.
22. Spronk I, Kullen C, Burdon C *et al.* (2014) Relationship between nutrition knowledge and dietary intake. *Br J Nutr* **111**, 1713–1726.
23. Rokx C, Subandoro A & Galagher P (2018) *Aiming High: Indonesia's Ambition to Reduce Stunting*. Washington DC: International Bank for Reconstruction and Development/ The World Bank.
24. President-RI (2013) *Gerakan Nasional Percepatan Perbaikan Gizi (Decree of the President of Indonesia 42/2013 about National Movement for the Acceleration of Nutrition Improvement)*. Indonesia: The Ministry of State Secretariat of the Republic of Indonesia.
25. MoH-RI (2010) *Pedoman Pelayanan Antenatal Terpadu (Indonesian Integrated Antenatal Care Guidelines)*. Jakarta, Indonesia: Ministry of Health of the Republic of Indonesia (MOH-RI).
26. Wijaya-Erhardt M, Muslimatun S & Erhardt JG (2014) Effect of an educational intervention related to health and nutrition on pregnant women in the villages of Central Java Province, Indonesia. *Health Educ J* **73**, 370–381.
27. Rahmawati W, Wirawan NN, Wilujeng CS *et al.* (2016) Gambaran Masalah Gizi pada 1000 HPK di Kota dan Kabupaten Malang (Illustration of nutritional problem in the first 1000 d of life in both city and district of Malang, Indonesia). *Indones J Hum Nutr* **3**, 20–31.

28. Grimes HA, Forster DA & Newton MS (2014) Sources of information used by women during pregnancy to meet their information needs. *Midwifery* **30**, e26–e33.

29. Singh D, Newburn M, Smith N *et al.* (2002) The information needs of first-time pregnant mothers. *Br J Midwifery* **10**, 54–58.

30. Song H, Cramer EM, McRoy S *et al.* (2013) Information needs, seeking behaviors, and support among low-income expectant women. *Women Health* **53**, 824–842.

31. Kavlak O, Atan SU, Gulec D *et al.* (2012) Pregnant women's use of the internet in relation to their pregnancy in Izmir, Turkey. *Inform Health Soc Care* **37**, 253–263.

32. Anasi SNI & Allison GO (2018) Sociodemographic determinants of information sources availability and use among pregnant women in Ilisan-Remo, Ogun State, Nigeria. *J Hosp Librariansh* **18**, 47–63.

33. Owusu-Addo SB, Owusu-Addo E & Morhe ES (2016) Health information-seeking behaviours among pregnant teenagers in Ejisu-Juaben Municipality, Ghana. *Midwifery* **41**, 110–117.

34. Friedman J, Heywood PF, Marks G *et al.* (2007) *Health Sector Decentralization and Indonesia's Nutrition Programs: Opportunities and Challenges*. Washington DC: World Bank.

35. Rahmawati W, Willcox JC, van der Pligt P *et al.* (2021) Nutrition information-seeking behaviour of Indonesian pregnant women. *Midwifery* **100**, 103040.

36. Lwanga SK & Lemeshow S (1991) *Sample Size Determination in Health Studies: A Practical Manual*. Geneva: World Health Organization.

37. Lun KC & Chiam P (2000) *SSize Software, 2.0 ed*. Singapore: National University of Singapore.

38. Willcox JC, Campbell KJ, McCarthy EA *et al.* (2015) Gestational weight gain information: seeking and sources among pregnant women. *BMC Pregnancy Childbirth* **15**, 1–10.

39. Hendrie GA, Cox DN & Coveney J (2008) Validation of the general nutrition knowledge questionnaire in an Australian community sample. *Nutr Diet* **65**, 72–77.

40. Storr T, Maher J & Swanepoel E (2017) Online nutrition information for pregnant women: a content analysis. *Matern Child Nutr* **13**, 1–12.

41. Hall C, Syafiq A, Crookston B *et al.* (2018) Addressing communications campaign development challenges to reduce stunting in Indonesia. *Health* **10**, 1764–1778.

42. Bjelke M, Martinsson AK, Lendahls L *et al.* (2016) Using the Internet as a source of information during pregnancy – a descriptive cross-sectional study in Sweden. *Midwifery* **40**, 187–191.

43. MoH-RI (2015) *Buku Kesehatan Ibu dan Anak (Maternal and Child Health Book)*. Jakarta, Indonesia: Ministry of Health of the Republic of Indonesia (MoH-RI).

44. MoH-RI (2020) *Buku Kesehatan Ibu dan Anak, Bagian Ibu (Maternal and Child Health Book, for Mother)*. Jakarta, Indonesia: Ministry of Health of the Republic of Indonesia (MoH-RI).

45. Yuliani I, Murti B, Sulaeman ES *et al.* (2019) Path analysis on the determinants of health cadres ability in early detection and management of pregnancy risk factors in Sleman, Yogyakarta, Indonesia. *J Health Policy Manag* **4**, 47–58.

46. Iswarawanti DN, Muslimatun S, Basuki E *et al.* (2019) Module development and its effectiveness for improving the competencies of voluntary health workers in communicating safe complementary feeding to caregivers in Indonesia. *Malays J Nutr* **25**, 99–115.

47. Iswarawanti DN (2010) Kader Posyandu: peranan dan tantangan pemberdayaannya dalam usaha peningkatan gizi anak di Indonesia (Posyandu Cadres: their roles and challenges in empowerment for improving children nutritional status in Indonesia). *J Manaj Pelayanan Kesehatan* **13**, 169–173.

48. Leon N, Sanders D, Van Damme W *et al.* (2015) The role of 'hidden' community volunteers in community-based health service delivery platforms: examples from sub-Saharan Africa. *Glob Health Action* **8**, 27214.

49. Dynes M, Buffington ST, Carpenter M *et al.* (2013) Strengthening maternal and newborn health in rural Ethiopia: early results from frontline health worker community maternal and newborn health training. *Midwifery* **29**, 251–259.

50. Triratnawati A (2019) Food taboos and codes of conduct for pregnant women at Mount Sindoro, Wonosobo District, Central Java, Indonesia. *Ethno-medicine* **13**, 83–93.

51. Setyowati S (2010) An ethnography study of nutritional conditions of pregnant women in Banten, Indonesia. *Makara Kesehatan* **14**, 5–10.

52. Wulandari LP & Whelan AK (2011) Beliefs, attitudes and behaviours of pregnant women in Bali. *Midwifery* **27**, 867–871.

53. Wiradnyani LA, Khusun H, Achadi EL *et al.* (2016) Role of family support and women's knowledge on pregnancy-related risks in adherence to maternal iron-folic acid supplementation in Indonesia. *Public Health Nutr* **19**, 2818–2828.

54. Lagan BM, Sinclair M & Kernohan WG (2010) Internet use in pregnancy informs women's decision making: a web-based survey. *Birth* **37**, 106–115.

55. Aubel J, Toure I & Diagne M (2004) Senegalese grandmothers promote improved maternal and child nutrition practices: the guardians of tradition are not averse to change. *Soc Sci Med* **59**, 945–959.

56. Girard AW, Wee R, Simba J *et al.* (2017) A grandmother-inclusive approach to community nutrition positively impacted maternal nutrition and health seeking practices in Southern Sierra Leone. *FASEB J* **31**, 639.33.

57. Duffy B, Smith K, Terhanian G *et al.* (2005) Comparing data from online and face-toface surveys. *Int J Mark Res* **47**, 615–639.

58. Kılınç H & Fırat M (2017) Opinions of expert academicians on online data collection and voluntary participation in social sciences research. *Educ Sci Theory Pract* **17**, 1461–1486.

59. Statistics-Indonesia (2018) *Statistik Indonesia 2018 (Statistical Yearbook of Indonesia 2018)*. Jakarta, Indonesia: Badan Pusat Statistik/BPS-Statistics Indonesia.

60. Statistics-Malang (2018) *Kota Malang dalam Angka 2018 (Malang Municipality in Figure 2018)*. Malang, Indonesia: BPS Kota Malang/Statistics of Malang Municipality.

61. CHO-Malang (2014) *Profil Kesehatan Kota Malang Tahun 2014 (Malang City Health Profile Year 2014)*. Malang: CHO-Malang.

62. Sunarti E (2011) *Kependudukan dan Keluarga Sejahtera (Population and Prosperious of Family)*. Bogor, Indonesia: Institute Pertanian Bogor.

63. APJII (2017) *Infografis: Penetrasi Dan Pengguna Perilaku Internet di Indonesia (Infographic: Penetration and Behavior of Internet Users in Indonesia)*. Jakarta: APJII (Association of Indonesian Internet Service Providers).

64. Larsson M (2009) A descriptive study of the use of the Internet by women seeking pregnancy-related information. *Midwifery* **25**, 14–20.