

KNOWLEDGE OF NUTRITION DURING PREGNANCY AND ASSOCIATED FACTORS AMONG ANTENATAL MOTHERS

Lim Z.X.¹, Wong J.L.², Lim P.Y.³, Soon L.K.^{1*}

¹School of Health Sciences, Health Campus, University Sains Malaysia

²Faculty of Medicine and Health Sciences, Universiti Tunku Abdul Rahman, Bandar Sungai Long, Malaysia

³Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, Serdang, Malaysia

**Corresponding author: Soon Lean Keng, School of Health Sciences, Health Campus, Universiti Sains Malaysia
Email: soonlk@usm.my*

ABSTRACT

Background: Nutritional requirement increases during pregnancy can influence the growth, development, and health of the mother and her newborn child. Understanding the antenatal mothers' nutrition knowledge is essential to developing effective strategies to curb malnutrition and encouraging healthier dietary behaviors. The aim of this study was to assess the level and associated factors of nutritional knowledge during pregnancy among antenatal mothers in a tertiary teaching hospital in northeast Malaysia.

Materials and Methods: A cross-sectional study was done on 88 randomly selected antenatal mothers at the Obstetrics and Gynecology Clinic during their antenatal care visits. Data was collected using a pretested self-administered questionnaire between December 2015 and February 2016. The Kruskal-Wallis test was used to determine the association of selected socio-demographic variables and obstetric data with nutritional knowledge score among antenatal mothers.

Results: The mean age of the participants was 32.06 ± 5.56 years. More than half (63.6%) of the antenatal mothers had good nutritional knowledge level. Higher occupational status ($p=0.030$) and monthly household income ($p=0.016$) of participants were significantly associated with higher nutritional knowledge score.

Conclusion: These findings highlight the current knowledge gap that exists in antenatal mothers. It can be concluded that nutritional education ought to be intensified to address this issue.

Keywords: Nutritional knowledge, antenatal mothers, pregnancy, Malaysia

1.0 Introduction

Nutrition during pregnancy has a major impact on the outcome of pregnancy and accredited as an important determinant for a healthy and successful pregnancy including the life-long health of future generation (Adikari et al., 2016; Han et al., 2011; Bawadia et al., 2010; McDonald et al., 2010). Though nutrition is the intake of food necessary for optimal health, several studies have revealed that inadequate maternal nutrition could lead to malnutrition which causes poor pregnancy outcomes, such as fetal growth failure, low birth weight, preterm birth, prenatal and infant mortality and morbidity (Abu-Saad & Fraser, 2010; National Population Commission & ICF International, 2014). On the contrary, excessive nutrition intake during pregnancy can lead to complications such as preeclampsia, gestational diabetes, macrosomia, dystocia, and higher prevalence of cesarean section (Rocco et al., 2005).

Knowledge on nutrition is a vital element to ensure positive pregnancy outcome and is the integral to achieve healthy dietary behaviors and subsequently improves their diet quality (Zalilah et al., 2008; Mugyia et al., 2016). Mitra et al. (2012) highlight the importance that antenatal mothers could benefit through nutritional knowledge. Despite recommendations nutrition intake (RNI) in Malaysia exist which aim to improve the nutritional status of mothers and reduce the risks of adverse pregnancy outcomes, an increasing proportion of antenatal mothers' weight exceeded healthy range (Malaysian Dietary Guidelines, 2017). As reported by the RNI, nutritional knowledge during pregnancy is necessary to ensure optimal gestational weight gain and reduces complications, both of which are linked to positive birth outcomes and contribute to mothers' overall health. However, evidence revealed that antenatal mothers during pregnancy do not always adopt these recommendations and the reasons for this are poorly understood (Malaysian Dietary Guidelines, 2017). Research related to maternal nutrition knowledge are not abundant in the local context. Despite maternal nutrition during pregnancy is crucial in reducing maternal mortality and infant mortality which are the target area in achieving the Millennium Development Goal in Malaysia, a dearth of study has been conducted to assess the level and associated factors of nutritional knowledge during pregnancy among antenatal mothers. It is thus important to investigate this issue. This paper reports a study that sought to fill this gap in knowledge and share it at the national, regional and international level to contribute to the evidence base for informing future antenatal care when dealing with maternal nutritional knowledge.

2.0 Materials and Methods

A cross-sectional study was carried out between December 2016 and February 2017. The study population constituted randomly selected antenatal mothers aged 18 years old and above, with varying gestational ages receiving antenatal care at the Obstetrics and Gynecology Clinic, Hospital Universiti Sains Malaysia, Kelantan. Simple random sampling was undertaken using the Microsoft Excel software to recruit eligible study participants.

The calculated sample size required for this study was 88 participants. Several parameters were used for sample size calculation, and the highest estimated sample size was chosen to maximize the required sample size. A simple mean formula, $n = (1.96 \times \sigma / \Delta)^2$ was used to calculate the selected sample size, with standard deviation (σ) of 3.4 and effect size (Δ) of 0.75 referred from Mitra et al.'s (2012) study. A 10% dropout rate ($n_{calculated} / 1 -$

dropout rate) was considered in the sample size calculation to anticipate participants who will not respond to the distributed questionnaires.

Data was collected using a self-administered questionnaire, comprised of two parts, which has been tested for validity and reliability (Cronbach α knowledge = 0.819). Part I consists of questions related to socio-demographic, obstetrics and medical questions. Part II consist of 15 knowledge indicators used to evaluate the antenatal mothers' nutritional knowledge during pregnancy, assessed using a dichotomous response of 'Yes' or 'No'. A score of 1 was given for correct answer and 0 for the wrong answer. For Part II, they were scored on a scale ranging from 0 to 15 after analyzing their knowledge. The knowledge scores were categorized as good ($\geq 75\%$), moderate (51% to 74%) and poor ($\leq 50\%$) as suggested by the Technical Working Group on Research Ministry of Health, Malaysia (Norimah et al., 2008).

The study was approved by the participating hospital and local institutional ethics committee (USM/JEPeM 16110462) and performed in accordance with the ethical standards of the Declaration of Helsinki. Participants who met the research inclusion criteria were given information about the research, and participation was voluntary.

Statistical analyses were conducted using the Statistical Package Social Sciences (SPSS) software version 24. Descriptive analyses were performed, and the mean and its standard deviation were reported for numerical variables. For categorical variables, the frequency and its percentage were reported. Normality distributions were checked for numerical variables. The Kruskal-Wallis test was used to determine the association of selected socio-demographic variables and obstetric data with nutritional knowledge score among antenatal mothers. The level of significance was set at P-value < 0.05 .

3.0 Results

3.1 Participants' demographic characteristics

Table 1 summarizes the socio-demographic characteristics of 88 study participants. The mean age of the participants was 32.06 ± 5.56 years. The majority were Malay ethnicity (96.6%), employed (58%), had monthly household income RM1500 and less (37.5%), multigravida (80.7%), parity two and above (70.5%), and had university education level (44.3%). The mean gestational week was 29.23 (8.17). Sixty-two (70.5%) had parity two and above. Amongst the participants, forty-one (46.6%) were classified as normal BMI pre-pregnancy, nineteen (21.6%) as overweight, sixteen (18.2%) as obese, and twelve (13.6%) as underweight. More than three-quarter of antenatal mothers (95.5%) had received information of maternal nutrition during pregnancy. Out of 88 of the total participants, 24.4% received the sources of information from the doctor, 24% from nurses, 23.3% were mass media, 14.3% from friends, 13.2% from family members, and 0.8% were others.

Table 1: Participants' socio-demographic characteristics, obstetrics and medical data (n=88)

Variables	n (%)	Mean (SD^a)
Age (Years)	-	32.06 (5.56)
18 – 24	5 (5.7)	
25 – 29	25 (28.4)	
30 – 34	31 (35.2)	
35 and above	27 (30.7)	
Ethnicity	-	
Malay	85 (96.6)	
Chinese	2 (2.3)	
Others	1 (1.1)	
Highest education level	-	
Primary	1 (1.1)	
Secondary	34 (38.6)	
College	14 (15.9)	
Tertiary	39 (44.3)	
Occupation	-	
Housewife	33 (37.5)	
Self-employed	4 (4.5)	
Employed	51 (58.0)	
Monthly household income (RM)	-	
≤ RM 1500	33 (37.5)	
RM 1501 - 3500	30 (34.1)	
> RM 3500	25 (28.4)	
Gestational week	-	29.23 (8.17)
First trimester (1 – 12) weeks	2 (2.3)	
Second trimester (13 – 27) weeks	31 (35.2)	
Third trimester (28 – 40) weeks	55 (62.5)	
Number of pregnancies	-	
Primigravida	17 (19.3)	
Multigravida	71 (80.7)	
Parity	-	
0-1	26 (29.5)	
> 2	62 (70.5)	
Pre-pregnancy BMI (kg/m²)	-	24.30 (5.51)
Underweight (<18.5)	12 (13.6)	
Normal weight (18.5 – 24.9)	41 (46.6)	
Overweight (25.0 – 29.9)	19 (21.6)	
Obese (≥ 30.0)	16 (18.2)	

3.2 Knowledge of antenatal mothers on maternal nutrition during pregnancy

Knowledge was measured using 15 question about nutrition during pregnancy. The answers to all questions were a dichotomous answer of 'Yes' or 'No'. The mean knowledge score of the total sample was 11.8 (1.74), indicating 78.6% correct responses. More than half of

participants (63.6%) had good knowledge level, 28 (31.8%) had moderate knowledge level, and only 4 (4.5%) had poor knowledge level (Table 2).

Table 2: Knowledge on maternal nutrition during pregnancy of participants (n=88)

No.	Statement	Yes n (%)	No n (%)
1.	A balanced diet is important during pregnancy	83 (94.3)	5 (5.7)
2.	Women nutrition during pregnancy is different from others	83 (94.3)	5 (5.7)
3.	Iron is a source of vitamin	80 (90.9)	8 (9.1)
4.	The daily recommended intake of iron for a woman during pregnancy is 27 mg	61 (69.3)	27 (30.7)
5.	The daily recommended intake of protein for a woman during pregnancy is 25g	67 (76.1)	21 (23.9)
6.	During pregnancy, a woman needs more folic acid and iron than a woman who is not pregnant	84 (95.5)	4 (4.5)
7.	A pregnant woman must have at least 600 µg of folic acid from daily diet	65 (73.9)	23 (26.1)
8.	Women should get 1000 mg of calcium daily during pregnancy	65 (73.9)	23 (26.1)
9.	Omega-3 and Omega-6 fatty acids are essential for brain and retina development of fetus	83 (94.3)	5 (5.7)
10.	Nutrients deficiency during pregnancy could affect health status of mothers and baby	86 (97.7)	2 (2.3)
11.	If woman was a normal weight before pregnancy, she should gain weight between 11.5 kg and 16.0 kg during pregnancy	55 (62.5)	33 (37.5)
12.	Body mass index (BMI) of less than 18.5 kg/m ² is a suitable weight during pregnancy	33 (37.5)	55 (62.5)
13.	Additional energy needs should be tailored based on the woman's BMI before pregnancy	76 (86.4)	12 (13.6)
14.	Underweight mother can affect fetal well-being and growth	82 (93.2)	6 (6.8)
15.	Obese women are at an increased risk of several pregnancy problems	85 (96.6)	3 (3.4)

Table 3: Knowledge level on maternal nutrition during pregnancy of participants (n=88)

Knowledge Level	Frequency (%)	Mean (SD)
	-	11.80 (1.74)
Good	56 (63.6)	-
Moderate	28 (31.8)	-
Poor	4 (4.5)	-

Table 3 shows the frequency, percentage, mean and standard deviation of maternal nutrition knowledge level among antenatal mothers in the study. More than half of participants 56 (63.6%) had good knowledge level, 28 (31.8%) of them had moderate knowledge level, and only 4 (4.5%) had poor knowledge level. Mean (SD) of nutritional knowledge score was 11.80 (1.74), indicating 78.6% correct responses.

3.3 Association of socio-demographic characteristics and obstetrics data with knowledge score of participants on maternal nutrition during pregnancy

Table 4 describes the association of socio-demographic characteristics and obstetrics data with nutritional knowledge score of the 88 antenatal mothers who participated in the study. Occupation ($p=0.030$) and monthly household income ($p=0.016$) were significantly associated with nutritional knowledge score. The median of nutritional knowledge score among antenatal mothers with 3 types of occupational status was significantly different. Employed antenatal mothers have significantly higher nutritional knowledge score (Median: 13, IQR: 2) compared to a housewife (12, 2, $p=0.036$), and self-employed (13, 4, $p=1.776$). Post hoc analysis with Bonferroni's correction was done by multiplying p-value with 3 pairs of group comparison, housewife and self-employed ($p=0.534$), housewife and employed ($p=0.036$), self-employed and employed ($p=1.776$). The score between housewives and employed antenatal mothers was significantly different ($p=0.036$). Regarding the monthly household income, the median nutritional knowledge score of participants was significantly different among 3 categories. The monthly household income of participants that was $> RM 3500$ has a significantly higher nutritional knowledge score (13, 1) compared to $\leq RM 1500$ (11, 3, $p=0.018$), and $RM 1501 - 3500$ (13, 2, $p=0.786$). Post hoc analysis with Bonferroni's correction were done by multiplying p-value with 3 pairs of group comparison, $\leq RM 1500$ and $RM 1501 - 3500$ ($p=0.195$), $\leq RM 1500$ and $> RM 3500$ ($p=0.018$), $RM 1501 - 3500$ and $> RM 3500$ ($p=0.786$). It was found that the score among participants with monthly household income between $\leq RM 1500$ and $> RM 3500$ was significantly different ($p=0.018$).

Table 4: Association of socio-demographic characteristics and obstetric data with maternal nutritional knowledge score

Variables	n (%)	Median (IQR)	Chi-square statistic (df)	p-value ^b
Age			2.989 (3)	0.393
18 – 24	5 (5.68)	12 (2)		
25 – 29	25 (28.41)	12 (4)		
30 – 34	31 (35.23)	13 (2)		
35 and above	27 (30.68)	12 (2)		
Ethnicity			1.856 (2)	0.395
Malay	85 (96.59)	12 (2)		
Chinese	2 (2.27)	11 (-)		
Others	1 (1.14)	-		
Highest education level			7.052 (3)	0.070
Primary	1 (1.14)	-		
Secondary	34 (38.64)	12 (2)		
College	14 (15.91)	13 (2)		
Tertiary	39 (44.32)	13 (2)		
Occupation			7.019 (2)	0.030*
Housewife	33 (37.50)	12 (2)		

Self-employed	4 (4.50)	13 (4)		
Employed	51 (58.00)	13 (2)		
Monthly household income (RM)			8.249 (2)	0.016*
≤ RM 1500	33 (37.50)	11 (3)		
RM 1501 - 3500	30 (34.09)	13 (2)		
> RM 3500	25 (28.41)	13 (1)		
Gestational week			1.945 (2)	0.378
First trimester	2 (2.27)	-		
Second trimester	31 (35.23)	12 (2)		
Third trimester	55 (62.50)	12 (2)		
Pre-pregnancy BMI			5.328 (3)	0.149
Underweight	12 (13.64)	13 (2)		
Normal weight	41 (46.59)	12 (2)		
Overweight	19 (21.59)	12 (2)		
Obese	16 (18.18)	11 (4)		

^b Kruskal-Wallis test

* Level of significant at $p < 0.05$

4.0 Discussion

The findings of this survey of 88 Malaysian antenatal mothers provides new and valuable insight into the nutritional knowledge during pregnancy. The majority of the antenatal mothers were aged 30 and above (65.9%) and were Malay (96.6%), which is the predominant race group on the northeast coast of Peninsular Malaysia. As for the participants' employment status, nearly two-thirds of the participants were working mothers (62.5%), and having an education level up to tertiary education (60.2%). Our study results illustrated that there was a significant association between occupation and nutritional knowledge score among antenatal mothers. More than half of the employed antenatal mothers had better nutritional knowledge as compared to non-employed mothers. This finding matches those observed in Mitra et al.'s (2012) study in Malaysia which showed that antenatal mothers with better nutritional knowledge levels are significantly higher in occupational status. There are several possible explanations for this finding. Employed mothers may have better access to internet, books, and magazines as a source of information (Mitra et al., 2012) as well as opportunity to share their experiences with others in the workplace compared to housewives (El-Nagar *et al.*, 2010).

Our study revealed that there was a significant association between monthly household income and nutritional knowledge score among antenatal mothers. These findings match those observed in earlier studies (Zahara et al., 2014; Zhang et al., 2009). This also accords with See, Tey, Fauziah, and Soon (2015), who suggested that monthly household income may exhibit a positive effect on increasing antenatal mothers' knowledge during pregnancy. This finding may explain by the supposition that cost may be a barrier to attending antenatal follow-up visits among antenatal mothers from lower socioeconomic status. The challenge of cost for them was their inability to attend antenatal care, thus may contribute to low maternal nutrition knowledge as their opportunities to receive complete nutritional information are reduced.

Educational level was one of the important predicting factors for nutritional knowledge among antenatal mothers and explained that antenatal mothers with a good education was associated with higher nutritional knowledge and enhanced their understanding of information disseminated by mass media (Burchi, 2010; Daba et al., 2013; Mitra et al., 2012). A similar study conducted in Malaysia also demonstrated that antenatal mothers with higher education level may have learned more and had a better understanding when being exposed to nutrition education (Zahara et al., 2014). However, our present results did not find any association between highest education level and nutritional knowledge score among antenatal mothers. This highlighted that the ongoing efforts of antenatal health care providers in delivering nutritional information to antenatal mothers regardless of their education level greatly improved their nutritional knowledge.

More than half (63.6%) of the antenatal mothers had good knowledge of the importance of good maternal nutrition before and during pregnancy, which is in line with studies by Zahara et al. (2014), Daba et al. (2013) and Mitra et al. (2012). This finding is in agreement with that of Kever et al. (2015) on the knowledge of antenatal mothers towards dietary practices in Nigeria, where 65.31% of the participants showed good knowledge about dietary practices during pregnancy despite the high level of illiteracy among the participants. However, another study reported from Egypt at El-Menshawy Hospital showed that about half of the childbearing women did not have enough knowledge regarding the meaning, the importance, and the constituents of a well-balanced diet (Fouda et al., 2012). The possible explanation that educational background of the study participants could be the reason for the good level of nutritional knowledge demonstrated in this present study as almost all (98.8%) of them had at least secondary education. However, the current study differs from Fouda et al. (2012), where 16.1% of the antenatal mothers had primary education. This probably explains that antenatal mothers were educated in the study, and possess the ability to perceive, gaining knowledge and understanding of maternal nutrition. Our findings had provided an insight into the importance of education on nutritional information among antenatal mothers.

The present study revealed that there was no association between a gestational week and nutritional knowledge score among antenatal mothers, which is parallel with study in Western Kenya that reported gestational age was negatively associated with health knowledge score (Perumal et al., 2013). However, our finding contradicts the findings from Zahara et al. (2014) which revealed that nutritional knowledge score among Malay antenatal mothers improved as the gestational week increased. The probable reason for the discrepancy may be due to differences among study sample size as nearly all of the participants in the present study (97.7%) were in the second trimester and above, which slightly higher than that of participants (82.2%) in Zahara et al.'s (2014) study.

The result of this study revealed that antenatal mothers with higher pre-pregnancy BMI shown no association towards their nutritional knowledge score. Similarly, a study in the United Kingdom on food intake and nutrition knowledge in severely obese antenatal women reported that the study participants had lower scores in general nutrition knowledge (Mohd-Shukri et al., 2011). This similarity could be justified by the fact that overweight and obese antenatal mothers may not receive any advice for weight gain during pregnancy from healthcare professionals, which is supported by findings in Tovar et al.'s (2010) study. Adequate nutrition during pregnancy is the most important aspect of the antenatal mother's

life. During pregnancy, nutrition has impacts on the mothers' quality of life, as well as on her newborn's well-being after delivery, and consequently her family members and community (Payghan et al., 2014). Notably, a similar study done by Mitra et al. (2012) concluded that the level of nutritional knowledge was satisfactory and suggested frequent continuing education for the pregnant mother.

Our study revealed that there was no association between age and nutritional knowledge score among antenatal mothers. This interpretation differs from that of Daba et al. (2013) who found that age had a strong statistical association with nutritional knowledge of mothers during pregnancy in a bivariate analysis. The older maternal age in the present study did not increase the nutritional knowledge during pregnancy, this may suggest that the availability of nutritional information could be easily obtained from different resources such as mass media.

As for the participants' monthly household income, most of them (38.9%) was in the middle-income category while another 37.5% were in the low-income category, leading to the presence of food insecurity which subsequently affects the nutritional food intake among antenatal mothers. Regarding the obstetric data, nearly two third of the antenatal mothers (62.5%) were in the third trimester, with mean 29.23 (8.17) week, and most of them (80.7%) were in second or more pregnancy. The present study revealed that majority of the antenatal mothers (70.5%) had delivered fetus more than twice and 46.6% of them were within the normal weight, slightly lower compared to a study by Loy, Marhazlina, and Hamid (2013) in the same targeted area. These differences could be due to the different study sample recruited. Moreover, only a quarter of participants has been diagnosed with a medical history of associated disease before pregnancy.

The current study found that doctor, nurse and mass media played a major role in delivering information regarding maternal nutrition during pregnancy. This result may be explained by the fact that doctors and nurses are healthcare professionals have frequent contact with antenatal mothers during their antenatal check-up. It is somewhat surprising that antenatal mothers rarely obtained information from the dietitian but from friends and family members. For this reason, it seems possible that the lack of role of the dietitian may be explained that nutrition information was accessible for antenatal mothers with a medical condition who require the specialized intake of food sources.

Nutrition during pregnancy is a well-known factor that could affect both fetus and mothers. It is essential to ensure fetal development which could affect the well-being of newborn after delivery. Hence, making them more susceptible to nutritional deficiency during the gestational period due to their dietary behaviors influenced by nutritional knowledge (Adikari et al, 2016; Han et al., 2011; Bawadia et al., 2010; McDonald et al., 2010).

Potential generalizability of the findings was increased by random selection of antenatal mothers for participation in the study. The questionnaire was considered valid and reliable for investigating the antenatal mothers' knowledge on maternal nutrition during pregnancy. This study was limited to one tertiary teaching hospital in Northeast Peninsular Malaysia. Therefore, this study's findings may not reflect the knowledge of antenatal mothers in other settings or regions in Malaysia (for example those in West Coast Malaysia and East Malaysia).

5.0 Conclusion and recommendation

In conclusion, the knowledge level of these antenatal mothers about nutrition during pregnancy was inadequate. Therefore, nutritional education ought to be intensified to empower antenatal mothers to understand the importance of nutrition in pregnancy, a vital determinant for optimal maternal and infant health outcomes. The current study revealed that the associated factors such as occupation and monthly household income of antenatal mothers may influence the individual mother's nutritional habits during pregnancy. Realizing this association, future research in this area may help health policies to investigate to what extent these factors influenced antenatal mothers' behaviour.

Acknowledgements

The authors wish to thank the antenatal mothers who took part in this study for being generous with their time.

Declaration

Author(s) declare that the information above is correct and the manuscript submitted by us is original. We have no conflict of interest to declare and certify that no funding has been received for the conduct of this study and preparation of this manuscript.

Author(s) contribution

Author 1: Idea and concept, literature search, conduct the study, analyzing and writing the draft

Author 2: Writing draft and reviewing

Author 3: Idea and concept, data analysis and interpretation, and reviewing

Author 4: Idea and concept, data analysis and interpretation, reviewing and editing the article

References

Abu-Saad, K., & Fraser, D. (2010). Maternal Nutrition and Birth Outcomes. *Epidemiologic Reviews*, 32(1), 5-25.

Adikari, A. M. N. T., Sivakanesan, R., Wijesinghe, D. G. N. G., & Liyanage, C. (2016). Assessment of nutritional status of pregnant women in a rural area in Sri Lanka. *Tropical Agricultural Research*, 27(2), 203-211.

Bawadia, H. A., Al-Kuranb, O., Al-Bastonia, L. A., Tayyemc, R. F., Jaradatd, A., Tuurie G., Al-Beitawif, S. N., & Al-Mehaisenb, L. M. (2010). Gestational Nutrition Improves

- Outcomes of Vaginal Deliveries in Jordan: An Epidemiologic Screening. *Journal of Nutrition Research*, 30 (2): 110- 117
- Burchi, F. (2010). Child nutrition in Mozambique in 2003: the role of mother's schooling and nutrition knowledge. *Economics & Human Biology*, 8(3), 331-345.
- Daba, G., Beyene, F., Garoma, W., & Fekadu, H. (2013). Assessment of knowledge of pregnant mothers on maternal nutrition and associated factors in Guto Gida Woreda, East Wollega Zone, Ethiopia. *Journal of Nutrition & Food Sciences*, 3(6), 235-241.
- El-Nagar, A. E., Ahmed, M. H., & Belal, G. A. E.-S. (2010). Knowledge and practices of pregnant women regarding danger signs of obstetric complications. *Journal of Nursing and Health Science*, 6(1), 30-41.
- Fouda, L. M., Ahmed, M. H., & Shehab, N. S. (2012). Nutritional awareness of women during pregnancy. *Journal of American Science*, 8(7), 494-502.
- Han, Z., Mulla, S., Beyene, J., Liao, G. and McDonald, S. D. (2011) Maternal underweight and the risk of preterm birth and low birth weight: a systematic review and meta-analyses. *International Journal of Epidemiology*, 40(1), pp. 65-101.
- Kever, R. T., Martins, S. D., Lola, N., Dathini, H., Habu, H., Fatima, A. A., & Sambo, B. D. (2015). Knowledge and attitude of pregnant women towards dietary practices in Yerwa Clinic, Maiduguri Metropolitan Council; Borno State. *Journal of Research in Nursing and Midwifery*, 4(1), 12-19.
- Loy, S. L., Marhazlina, M., & Hamid, J. J. M. (2013). Association between maternal food group intake and birth size. *Sains Malaysiana*, 42(11), 1633-1640.
- McDonald, S.D., Han, Z., Mulla, S., Beyene, J. (2010). Overweight and obesity in mothers and risk of preterm birth and low birth weight infants: systematic review and meta-analyses, *BMJ*, 1-20.
- Mitra, M., Wan Abdul Manan, W. M., Affizal, A., Mohd Shukri, O., & Maryam, M. (2012). Does nutritional knowledge have a relationship with healthy dietary attitude and practices during pregnancy? *International Proceedings of Chemical, Biological & Environmental*, 39, 159-163.
- Mohd-Shukri, N., Forbes, S., Denison, F., Norman, J., Walker, B., & Reynolds, R. (2011). Food intake and nutrition knowledge in severely obese pregnant women in Scotland. *Proceedings of the Nutrition Society*, 70(OCE1).
- Mugyia, A. S. N., Tanya, A. N. K., Njotang, P. N., & Ndombo, P. K. (2016). Knowledge and attitudes of pregnant mothers towards maternal dietary practices during pregnancy at the Etoug-Ebe Baptist Hospital Yaounde. *Health Sciences and Diseases*, 17(2).
- Malaysian Dietary Guidelines. (2017). *National Coordinating Committee on Food and Nutrition*. Ministry of Health, Malaysia.

- Mugyia, A. S. N., Tanya, A. N. K., Njotang, P. N., & Ndombo, P. K. (2016). Knowledge and attitudes of pregnant mothers towards maternal dietary practices during pregnancy at the Etoug-Ebe Baptist Hospital Yaounde. *Health Sciences and Diseases*, 17(2).
- National Population Commission, & ICF International. (2014). Nigeria Demographic and Health Survey 2013. Retrieved from www.population.gov.ng/images/ndhs_data/ndhs_2013/2013_ndhs_final_report.pdf.
- Norimah, A. K., Nik Shanita, S., Safiah, M. Y., Norazliana, M. N., Zawiah, A., & Tee, E. S. (2008). Nutrition knowledge among Malaysian elderly. *Malaysian Journal of Health Sciences*, 6(2), 43-54.
- Payghan, B. S., Kadam, S. S., & Reddy, R. M. (2014). A comparative study of nutritional awareness among urban-rural pregnant mothers. *Journal of Medical and Health Sciences*, 3, 95-99.
- Perumal, N., Cole, D. C., Ouedraogo, H. Z., Sindi, K., Loechl, C., Low, J., et al. (2013). Health and nutrition knowledge, attitudes and practices of pregnant women attending and not-attending ANC clinics in Western Kenya: a cross-sectional analysis. *BMC Pregnancy Childbirth*, 13(146), 1-12.
- Rocco, P. L., Orbitello, B., Perini, L., Pera, V., Ciano, R. P., & Balestrieri, M. (2005). Effects of pregnancy on eating attitudes and disorders: A prospective study. *Journal of Psychosomatic Research*, 59(3), 175-179.
- See, P. T., Tey, C. Z., Fauziah, J., & Soon, L. K. (2015). Knowledge of pregnancy danger signs and associated factors among Malaysian mothers. *British Journal of Midwifery*, 23(11), 800-806.
- Tovar, A., Chasan-Taber, L., Bermudez, O. I., Hyatt, R. R., & Must, A. (2010). Knowledge, attitudes, and beliefs regarding weight gain during pregnancy among Hispanic women. *Maternal and Child Health Journal*, 14(6), 938-949.
- Zahara, A. M., Nuruljannah, J., Lee, Y. M., Ng, S. Y., Chua, K. Y., & Loke, W. T. (2014). Nutritional status and nutritional knowledge of Malay pregnant women in selected private hospitals in Klang Valley. *International Electronic Journal of Health Education*, 11, 119-132.
- Zalilah, M. S., Siti Sabariah, B., Norlijah, O., Normah, H., Maznah, I., Zubaidah, J., et al. (2008). Nutrition education intervention improves nutrition knowledge, attitude, and practices of primary school children: a pilot study. *Malaysian Journal of Health Sciences*, 12(2), 53-62.
- Zhang, F., Cai, Q.-X., & Yi, C. (2009). Investigation of pregnant women's nutritional knowledge in nationality rural area of Hainan and analysis of its influence factors. *Modern Preventive Medicine*, 10, 37.