

# Knowledge and awareness of folic acid usage in Saudi pregnant women in Riyadh city from 2019-2020

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## ABSTRACT

**Background:** Folic acid (FA) supplementation is an important intervention to avoid nutritional deficiencies during pregnancy and later on will have an effect on mother and fetus. Inadequate dietary intake will lead to nutritional deficiency which further requires to depend on supplementation. FA is one of the vital nutrients which is mandatory for improving pregnancy outcomes. Previous studies have documented the pregnant women who know about supplementation of FA but not consuming during pregnancy will lead to complications in their neonates. This study aimed to inspect the knowledge and awareness about supplementation of FA in Saudi pregnant women and to compare present study results with other prior studies carried out in the Saudi population. **Methods:** In this study, we have opted 406 Saudi pregnant women with the age range of 18–65 years of age through questionnaire-based research, was further assessed for FA supplementation usage during the pregnancy. Involved pregnant women have filled questionnaire and signed the consent form. **Results:** The results of this study showed 38% of women were pregnant during 31–40 years of the age range. Almost 96% of pregnant women have awareness about FA supplementation during pregnancies, and 5.9% of women had histories for not using FA supplementation and had abnormal offspring. The current study questionnaire survey confirms 55.7% of pregnant women have information about FA supplementations. Nearly 89% of women have used FA in their previous pregnancies. **Conclusion:** Saudi pregnant women has good knowledge and awareness about the usage of FA supplementation during pregnancy. Limited efforts should be implemented national wide in all the hospitals and clinics to improve the awareness about maternal nutrition during pregnancy. Nutritional counselling should be conducted in remote areas to get a perception in Saudi Arabia.

**Keywords:** Folic acid supplementation, nutrition deficiencies, Saudi pregnant women, Riyadh

## Introduction

Maternal nutrition during pregnancy plays a vital factor and the World Health Organization (WHO) has recommended the folic acid (FA) supplementation usage towards the pregnant women to prevent the anemia and fetal complications.<sup>[1-3]</sup> A mixture of a balanced diet includes carbohydrates, vitamins, proteins, and

minerals are essential during pregnancy.<sup>[4-6]</sup> Supplementation of various micronutrient consists of vitamins and minerals which will fill a gap during pregnancy.<sup>[7]</sup> The synthetic form of folate is defined as FA, mainly visible in supplements and enriched foods. Folate and FA are different forms of vitamin B9 and the natural form of vitamin B9 is folate and FA is defined as a synthetic form known as pteroylmonoglutamic acid. Both (folic acid and folate) have similar chemical structure but known to be unidentical.<sup>[8,9]</sup> Globally, two billion individuals were affected by deficiencies of vitamins and minerals known as hidden hunger; negatively impact on health and economic improvement.<sup>[10]</sup> During the time of earlier pregnancies, maternal folate inefficiency is allied with increased risks of anemia, pregnancy complications

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with offspring birth-defects.<sup>[11]</sup> The enlarged maternal folate deficiencies are abortion, toxemia of pregnancy, retarded fetal growth, abruption placenta, fetal malformation, late pregnancy bleeding, and maternal anemia.<sup>[12,13]</sup> FA deficiencies compromise most common vitamin deficiencies among females and during the pregnancy, it can result in megaloblastic in anemia in mother and neural tube defects (NTDs) in fetus.<sup>[14]</sup> Inadequate amount of FA during the time of pregnancy will lead to NTDs. Maternal folate status is intricately with NTDs; which are common congenital malformations consequences from the failure of neural tube closure during embryogenesis. NTD are multifactorial disorder with environmental and genetic predispositions. Maternal periconceptional folate intake is most significant exposure connected with NTDs. It is inter-related with the development of neural tube, which affects both brain and spinal cord is related by morbidity, fetal mortality, disability, maladjustment, and economic crisis. However, spina-bifida and anencephaly are commonly documented birth defects.<sup>[15-17]</sup> Consumption of low levels of FA during pregnancy will lead to poor pregnancy outcomes.<sup>[18-20]</sup> Regular usage of FA beforehand or through pregnancy will decrease the probabilities of NTDs and other congenital anomalies.<sup>[21]</sup> Center for Maternal and Child Enquiry jointly with Royal College of Obstetrics and Gynecology recommends overweight (29.9 kg/m<sup>2</sup>) women should consume 5 mg of FA in the regular diet.<sup>[22]</sup> Evidence shows undernutrition women before or during pregnancy increases the risk of metabolic disorders; mainly GDM and specific complications occur during labor and birth. Maternity nutrition deficiency will disturb emerging fetus. Weight gain in pregnancy is connected with healthier nutrition.<sup>[23]</sup> Pre-eclampsia (PE) or gestational hypertension are known to be common hypertensive disorders in pregnancies.<sup>[24]</sup> PE has documented the significant elevation of serum or plasma homocysteine; which could be the independent risk factors in the PE pregnant women.<sup>[25]</sup> Li *et al.*<sup>[25]</sup> studies confirmed as daily consumption of 0.4g of FA in pregnancy premises will reduce the prevention and occurrence of PE.

The fortification of FA in NTDs plays an important role. Spina-bifida, encephalocele, and anencephaly come under NTDs and it leads towards premature-death or permanent disability.<sup>[26]</sup> Consumption of regular FA will lead to lowers the NTDs. In Saudi Arabia, NTD registry was recognized in 2000 and 579 patients were enrolled since October 2000-December 2009. This register involves the patient enrolment data with diagnosed NTD with or without criteria for exclusion of age, gender, and nationalities.<sup>[27]</sup> Limited studies have been implemented in Saudi women regarding knowledge and awareness of supplementation of FA during the time of pregnancy. However, in this study, we try to opt the complete Saudi nationality women. So, the current study aims to investigate the knowledge and awareness about the supplementation of FA in Saudi pregnant women and to compare present study results with other prior studies carried out in the Saudi population.

## Methods

In this study, we have opted 504 pregnant women from Saudi Arabia and we have excluded 98 women due to non-eligibility criteria and finally, we have recruited 406 pregnant women; based on sample size calculation or Al-Akfash *et al.*<sup>[28]</sup> to involve in our research from the capital city of Saudi Arabia. The enrollment of pregnant women has filled questionnaire and signed the consent form. Simultaneously, an ethical grant (19–620) of this study was received from the institutional review board of KFMC in Riyadh. Ethical approval was obtained from Institutional Review Board from King Fahd Medical city was obtained at 11 Dec 2019. The questionnaire was elaborated with demographic information of pregnant women and awareness of FA and its uses during pregnancy. The inclusion criteria of our study subjects were previous and pregnant women with written consent and filled questionnaires from Saudi Arabia. The exclusion criteria were non-pregnant Saudi women, pregnant non-Saudi women, and unfilled survey or unsigned consent form. A questionnaire was made visible online to recruit pregnant women. Data were adapted through a questionnaire, which was filled in Arabic and English. The complete details of the questionnaire, validity, and pilot study were changed from Alreshidi *et al.*<sup>[29]</sup> studies. The questionnaire consists of 21 questions, of which six questions are related to demographic details [Table 1], and the other 15 questions are connected with the study objectives [Tables 2-4].

The collected data was drafted into the excel, and Openepi software<sup>[30]</sup> was used to perform the descriptive statistics. The characteristics of study participants were reported as frequencies

**Table 1: Clinical details of participants involved in this study**

Baseline	Characteristics	(mean±SD)	Frequency (Percentages)
Age (Years)	18-20	19.81±0.44	05 (1.2%)
	21-30	26.96±2.55	120 (29.5%)
	31-40	36.15±2.93	154 (38%)
	41-50	46.25±2.78	82 (20.2%)
	51-60	56.05±3.06	39 (9.7%)
	61-65	63.16±0.98	06 (1.4%)
	18-65 (Total)	37.58±10.17	406 (100%)
Education status	Illiterates	N/A	02 (0.5%)
	High school	N/A	86 (21.2%)
	Bachelor	N/A	278 (68.5%)
	Master	N/A	28 (6.9%)
	PhD	N/A	12 (2.9%)
Parity	0	N/A	34 (8.4%)
	1-2	N/A	137 (33.7%)
	3-4	N/A	126 (31%)
	5 and 5+	N/A	109 (26.9%)
Nationality	Saudi	N/A	406 (100%)
	Non-Saudi	N/A	00 (00%)
Employment status	Employment	N/A	197 (48.5%)
	Unemployment	N/A	209 (51.5%)
Smoking status	Smoking	N/A	08 (1.9%)
	Non-smoking	N/A	398 (98.1%)

**Table 2: Information associated with pregnancy and folic acid**

Announcement	Characteristics	Frequency (Percentages)
Current Pregnancy	Pregnant	48 (11.8%)
	Non-pregnant	358 (88.2%)
Previous Pregnancies	Yes	394 (97%)
	No	12 (3%)
Prior histories for abnormal babies	Yes	24 (5.9%)
	No	382 (94.1%)
Notorious Information about folic acid	Yes	390 (96.1%)
	No	16 (3.9%)
Having any information about folic acid	Yes	353 (86.9%)
	No	53 (13.1%)
Known folic acid as vitamins	Yes	226 (55.7%)
	No	180 (44.3%)
Do you know the role of folic acid during pregnancy	Yes	357 (87.9%)
	No	49 (12.1%)
Do you know about preconception use of folic acid?	Yes	298 (73.4%)
	No	108 (26.6%)
History of using folic acid in the past pregnancies	Yes	360 (88.7%)
	No	46 (11.3%)
Information known about supplementation of folic acid during pregnancy?	Yes	324 (79.8%)
	No	82 (20.2%)

and percentages. *P* value (<.05) will be considered as statistically significant.

## Results

In this study, 406 Saudi women were joined, and 48.5% of women are currently in employment. The mean age of the study participants involved was  $37.58 \pm 10.17$ , with the age range of 18–65 years. The involved participants have been categorized as per the age with different groups such as 18–20, 21–30, 31–40, 41–50, 51–60, and 61–65 years and mean ages are followed as  $19.8 \pm 0.44$ ,  $26.9 \pm 2.55$ ,  $36.1 \pm 2.93$ ,  $46.2 \pm 2.78$ ,  $56 \pm 3.06$ , and  $63.1 \pm 0.98$ . The complete baseline characteristics details are present in Table 1. The maximum women involved were 38% with the age range of 31–40 years and then 29.5% with 21–30 years of the age range. Lowest age ranges were in between 61–65 years for 1.5% and 18–20 years for 1.2%. The education status has been categorized into illiterates (0.5%), high schools for 21.2%, bachelors (68.5%), masters (6.9%), and PhDs for 2.9%, respectively. In this study, 8.4% of women were documented as nulliparous and 91.6% as parity. Only 1.9% of the women were found to be smoking in the involved subjects.

Table 2 is documented with the information involved with pregnancy and folic acid nutrition. The present study confirms

**Table 3: Knowledge, perception and behavior about folic acid as supplementation during pregnancy and other factors**

Declaration	Characteristics	Frequency (Percentages)
History of supplementation in previous pregnancies	Folic acid	352 (86.7%)
	Vitamins	231 (56.9%)
	Iron	324 (79.8%)
	Calcium	271 (66.7%)
	None	21 (5.2%)
Effected with comorbidity diseases	Cardiovascular diseases	02 (0.5%)
	Diabetes Mellitus	26 (6.4%)
	Hypertension	29 (7.1%)
	Obesity	27 (6.7%)
	Cancer	00 (00%)
Advantages with folic acid information	Delay in fertility	19 (4.7%)
	None	327 (80.5%)
	Prevents birth-defect	331 (81.5%)
	Prevents anemia	51 (12.6%)
	Proper growth for fetus	167 (41.1%)
Source of Information about folic acid	No information	27 (6.7%)
	Social media	91 (22.4%)
	Family and friends	113 (27.8%)
	Hospitals	121 (29.8%)
	Physician	261 (64.3%)
	Nurse	06 (1.5%)
	Awareness campaigns	43 (10.6%)
	Books	63 (15.5%)

11.8% of women were pregnant. Almost 97% of women were established as previous pregnancies, and 5.9% of them had histories for abnormal offspring. A total of 96.1% of pregnant women were overheard about the information about folic acid usage during pregnancy, and 3.9% of women were unaware of this issue. Of the 406 women, only 86.9% of them having information about folic acid supplementation, and 55.7% of women distinguish folic acid as vitamins. Moreover, 87.9% of women having information about the role of folic acid during pregnancy, and 73.4% of women recognize about preconception use of folic acid. At last, 88.7% of women were having a history of using folic acid in the previous pregnancies, and 79.8% of them having the information regarding supplementation of folic acid during pregnancy.

Altogether, 86.7% for folic acid, 56.9% for vitamins, 79.8% for iron, and 66.7% for calcium were having the history for using supplementation in the previous pregnancies, and 5.2% of the women were not having any past regarding the usage of supplementation during pregnancies. In this study, 0.5% with CVD, 6.4% with DM, 7.1% with HTN, 6.7% with obesity, and 4.7% infertility delay are affected with comorbidity diseases, and 80.5% of women were not concerned with any of the conditions including cancers. The complete details have been described

**Table 4: List of pregnancy complications**

Pregnancy Complications	Frequency (Percentages)
Gestational Diabetes Mellitus	60 (14.7%)
Pre-eclampsia	14 (3.4%)
Oligohydramnios	09 (2.2%)
Fetal Growth Restriction <10 <sup>th</sup> percentile	02 (0.5%)
Preterm labor (<34 weeks)	31 (7.6%)
Intra-partum fever	08 (02%)
None	296 (72.9%)
Other complications	
Placental previa	02 (0.5%)
Abortion	02 (0.5%)
Urinary tract infection	02 (0.5%)
Vaginal bleeding	02 (0.5%)
Still birth	0.1 (0.2%)
Increased amniotic fluid	0.1 (0.2%)

in Table 3. Moreover, 81.5% of women were prevented from birth-defects, 12.6% from anemia and 41.1% for proper growth in the fetus are prohibited with the advantage of obtained information on folic acid, and only 6.7% of them had not received any information. Majorly, 64.3% of them have obtained the information source through the physician, 29.8% from hospitals, 27.8% through family/friends, 22.4% from the source of social media, 15.5% through books, 10.6% by awareness campaigns, and 1.5% through the nurses.

Table 4 describes the list of pregnancy complications effected through pregnancies. Almost 72% of women were not affected by any difficulties during pregnancies. Majorly, 14.7% of women were concerned with GDM and then with the preterm labor in 7.6% of women. PE, oligohydramnios, fetal growth restriction, and intra-preterm fever were obtained for 3.4%, 2.2%, 0.5%, and 2%, respectively. Other complications were recorded as minorly with abortion, UTI, placental previa; vaginal bleeding was documented for 2% of each and stillbirth and increased amniotic fluid as 1% of each in both.

## Discussion

The present study aims to explore the association between knowledge and awareness about the supplementation of FA in Saudi pregnant women and also to compare extant study results with other studies implemented in the Saudi population. The current study results have confirmed maternal knowledge towards the usage of supplementation during pregnancy, nominal awareness about the FA supplementation, complications associated with FA supplementations, the role of FA during pregnancy, lack of FA in the prior pregnancies affected by comorbidities as well as the fetal complications and how information was obtained about the supplementations. Right now, pregnancy women in Saudi Arabia have adequate information regarding FA supplementations. An earlier study carried out in Saudi Arabia in 2008 by Kari *et al.*<sup>[31]</sup> in female college students regarding the FA supplementation during pregnancy is known to be only in 12% of them.

Lack of micronutrients and its deficiencies are commonly observed in women during pregnancy and supplements will be recommended to avoid the association of associated malabsorption diseases, high fertility rates, to avoid neural tube defects in the pregnancies, limited knowledge towards the intake of nutrition during pregnancy.<sup>[32]</sup> One of the possible factors might be socioeconomic differences of these study settings, ethnicity, and time phrase. Our study had performed when the pregnant women were at 20 weeks of gestation and Kassa *et al.*<sup>[33]</sup> have performed during the third semester. World Health Organization is also powerfully recommending to use the supplements for iron and FA orally during pregnancy to lowers the risks of micronutrient deficiencies.<sup>[34]</sup> Consumption of supplementation of FA is one of the important involvements to avoid the nutritional deficiencies during the pregnancy in the women as well as complications occurs in the new born offspring. The job of primary care physician's is to recommend the FA supplementation and pregnant women should have adequate knowledge towards the usage. Family physicians are known to be the primary care providers for one of the important of source for gathering the information and care for child-bearing women.<sup>[35]</sup>

In this study, maximum information obtained about FA supplementation is through physicians (64.3%) and next from a various source in the hospital premises (29.8%). However, other studies have also conveyed similar results.<sup>[8,29]</sup> Limited studies have been carried out in various regions in the kingdom and all the studies concluded maximum pregnant women have sufficient knowledge regarding supplementations of FA. Apart from FA, women are also using the vitamins, calcium, and iron supplementations during the time of pregnancy. In our study, during the pregnancy, almost 95% of women were using these supplementations to avoid maternal (anemia, peripheral neuropathy) and fetal (congenital abnormalities and NTD) complications. Though, other global countries have limited knowledge regarding supplementation of FA during pregnancy.<sup>[36-39]</sup>

FA supplementation is an essential element in the human life required for replication of DNA and enzymatic reactions comprise amino-acid synthesis and vitamin metabolism. It is used during the pregnancy for growth and improvement of the fetus.<sup>[40]</sup> In our study, women had developed the GDM, PE, oligohydramnios, FGR, pre-term labor, and intrapartum fever are limited complication developing during pregnancy. However, these complications may/may not connect with the supplementations directly although other factors might be involved, such as obesity, maternal age, ethnicity, self, and family histories. However, other complications such as placental previa, abortions, UTI, PV, stillbirth, and increase in amniotic fluids are associated with a lower number and our study was in agreement within the prior studies.<sup>[33,41-43]</sup>

Numerous questionnaire and hospital-based studies have been carried out in different locations in Saudi pregnant women in the national wide survey. Nzila *et al.*<sup>[44]</sup> conducted a study in the

pregnant women affected with malaria and in their review, they concluded as preserving adequate folate levels will decrease the prevalence of NTDs. Alreshidi *et al.*<sup>[29]</sup> studies have conducted the survey from Riyadh city and confirms 42.2% of pregnant women knows about supplementation of FA. Almost 80% of were known about prevention of NTDs and 46.8% of pregnant women consumed FA during pregnancy. Alodan *et al.*<sup>[14]</sup> studies performed at Security forces hospitals in Riyadh city and concluded as pregnant women had 80% of knowledge about FA supplementation but 53% of women only consumed the FA during pregnancy. Al-Rakaf *et al.*<sup>[45]</sup> also performed a similar study in pregnant women from Prince Sultan Hospital in Riyadh and confirmed the same conclusion from Alreshidi and Alodan *et al.*<sup>[14,29]</sup> studies. Our research is also found to be in accordance with the earlier studies. An earlier research by Albader *et al.*<sup>[46]</sup> carried out in Riyadh city and AbdRabou *et al.*<sup>[47]</sup> studies carried out in Sakaka city were also confirms the similar conclusions from the prior studies carried in Saudi Arabia. Ahmad *et al.*<sup>[48]</sup> from Taibah University in Madinah and Al-Holy *et al.*<sup>[49]</sup> in the University of Hail in Al-Hail performed a questionnaire-based study and concluded as women had limited knowledge about FA supplementations in married and unmarried women. Maximum studies implemented in different cities in Saudi Arabia has found the similar confirmation as pregnant women have knowledge about FA supplementation and almost 50% of women were not achieving and further effects the NTDs for their neonates.

The strength of this study is that it has been involved in completely 100% of Saudi nationality women. Another advantage of this study was a questionnaire-based study made simple to enroll the interested participants without any burden to participate in this study. The limitation of this study is with a low sample size.

In conclusion, this study confirms Saudi pregnant women have a good awareness about the usage of FA supplementation during pregnancy. However, in our study, 99.5% of women were found to be educated and high awareness was documented in our study. Nutritional counselling should be conducted in remote areas to get a perception in Saudi Arabia about the awareness of FA supplementation. Limited efforts should be implemented national wide in all the hospitals and clinics to improve the knowledge about maternal nutrition during pregnancy.

### Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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### Conflicts of interest

There are no conflicts of interest.

### References

1. Kamau MW. Time for change is now: Experiences of participants in a community-based approach for iron and folic acid supplementation in a rural county in Kenya, a qualitative study. *PLoS One* 2020;15:e0227332.
2. Gebremichael TG and Welesamuel TG. Adherence to iron-folic acid supplement and associated factors among antenatal care attending pregnant mothers in governmental health institutions of Adwa town, Tigray, Ethiopia: Cross-sectional study. *PLoS One* 2020;15:e0227090.
3. Mida LA. Knowledge, attitude and practice of physicians regarding periconceptional folic acid. *Université d'Ottawa/University of Ottawa*; 2020.
4. Abdullah Alblowi S, Hameed Alomayri MJEJoHM. Assessment of knowledge, awareness, and behavior of folic acid use among females during the childbearing period in Tabuk City-2017. *Egypt J Hosp Med* 2018;70:1242-7.
5. Moradi M, Fazeli N, Khadivzadeh T, Esmaily H. Application of health belief model to assess knowledge and attitude of women regarding preconception care. *J Midwifery Reprod Health* 2020;8:2146-54.
6. Srinivasan K, Thomas S, Anand S, Jayachandra M, Thomas T, Strand TA, *et al.* Vitamin B-12 supplementation during pregnancy and early lactation does not affect neurophysiologic outcomes in children aged 6 years. *J Nutr* 2020;nxaa123. doi: 10.1093/jn/nxaa123.
7. Li D, Huang L, Yang W, Qi C, Shang L, Xin J, *et al.* Knowledge, attitude and practice level of women at the periconceptional period: A cross-sectional study in Shaanxi China. *BMC Pregnancy Childbirth* 2019;19:326.
8. Kamau M, Mirie W, Kimani S, Mugoya I. Effect of community based health education on knowledge and attitude towards iron and folic acid supplementation among pregnant women in Kiambu County, Kenya: A quasi experimental study. *PLoS One* 2019;14:e0224361.
9. Gomes F, Bergeron G, Bourassa MW, Dallmann D, Golan J, Hurley KM, *et al.* Interventions to increase adherence to micronutrient supplementation during pregnancy: A protocol for a systematic review. *Ann N Y Acad Sci* 2020. doi: 10.1111/nyas.14319.
10. Hisam A, Rahman MU, Mashhadi SF. Knowledge, attitude and practice regarding folic acid deficiency; A hidden hunger. *Pak J Med Sci* 2014;30:583.
11. Obeid R, Holzgreve W, Pietrzik KJCD. Folate supplementation for prevention of congenital heart defects and low birth weight: An update. *Cardiovasc Diagn Ther* 2019;9(Suppl 2):S424-33.
12. Pritchard JA, Scott DE, Whalley PJ. Maternal folate deficiency and pregnancy wastage: IV. Effects of folic acid supplements, anticonvulsants, and oral contraceptives. *Am J Obstet Gynecol* 1971;109:341-6.
13. Abegaz T, Gashaw AJ. Compliance and dosage form preference in iron/folic acid supplementation in antenatal care mothers, ayder comprehensive specialized hospital, Northern Ethiopia: A cross sectional study. *Am J Basic Appl Sci* 2020;3:18.
14. AlOdan AA, Ghoraba DA. Maternal knowledge and use of folic acid among Saudi women attending antenatal care

- clinic at Security Forces Hospital, Riyadh, Saudi Arabia. *IOSR J Nurs Health Sci* 2018;7(5):11-9.
15. Dolin CD, Deierlein AL, Evans MI. Folic acid supplementation to prevent recurrent neural tube defects: 4 milligrams is too much. *Fetal Diagn Ther* 2018;44:161-5.
  16. Abd Rabou MA. Awareness of folic acid intake for prevention of neural tube defects among women in Sakaka, Saudi Arabia. *Int J Pharmacol* 2019;15:274-9.
  17. Imbard A, Benoist J-F, Blom HJ. Neural tube defects, folic acid and methylation. *Int J Environ Res Public Health* 2013;10:4352-89.
  18. Koirala S and Pokharel S. Assessing the level of knowledge in the preconceptional use of folic acid supplement among primigravida women. *Kathmandu Univ Med J (KUMJ)* 2018;16:306-10.
  19. de Guingand DL, Palmer KR, Bilardi JE, Ellery SJ. Acceptability of dietary or nutritional supplementation in pregnancy (ADONS)-Exploring the consumer's perspective on introducing creatine monohydrate as a pregnancy supplement. *Midwifery* 2020;82:102599.
  20. Tan M, Yang T, Zhu J, Li Q, Lai X, Li Y, *et al*. Maternal folic acid and micronutrient supplementation is associated with vitamin levels and symptoms in children with autism spectrum disorders. 2020;91:109-15.
  21. Bekkers MB, Elstgeest LE, Scholtens S, Haveman-Nies A, de Jongste JC, Kerkhof M, *et al*. Maternal use of folic acid supplements during pregnancy, and childhood respiratory health and atopy. *Eur Respir J* 2012;39:1468-74.
  22. Fitzsimons KJ, Modder J. Setting maternity care standards for women with obesity in pregnancy. In: *Seminars in Fetal and Neonatal Medicine*. Elsevier; 2010. p. 100-7.
  23. Nguyen HA. Undernutrition during pregnancy. Complications of pregnancy. IntechOpen, 2019. Available from: <https://www.intechopen.com/books/complications-of-pregnancy/undernutrition-during-pregnancy>.
  24. Khan IA, Kamineni V, Poornima S, Jahan P, Hasan Q, Rao P. Tumor necrosis factor alpha promoter polymorphism studies in pregnant women. *J Reprod Health Med* 2015;1:18-22.
  25. Li Z, Ye R, Zhang L, Jahan P, Hasan Q, Rao P. Folic acid supplementation during early pregnancy and the risk of gestational hypertension and preeclampsia. *Hypertension* 2013;61:873-9.
  26. Wu DY, Brat G, Milla G, Kim J. Knowledge and use of folic acid for prevention of birth defects amongst Honduran women. *Rprod Toxicol* 2007; 23:600-6.
  27. McWalter P, Al Shmassi A, Eldali A. Awareness and use of folic acid in a clinic-based Saudi pregnant population. *Saudi J Med Med Sci* 2015;3:141-5.
  28. Al-Akhfash AA, Abdulla AM, Osman AM, Abdulgafar JI, Almesned AA. Maternal knowledge and use of folic acid among Saudi females. *Saudi Med J* 2013;34:1173-8.
  29. Alreshidi FF, Almuji AS, Malak AS. Awareness of folic acid use among Saudi women attending outpatient clinics at King Fahad Medical City. *J Family Med Prim Care* 2018;7:957-62.
  30. Khan IA, Jahan P, Hasan Q, Rao P. Genetic confirmation of T2DM meta-analysis variants studied in gestational diabetes mellitus in an Indian population. *Diabetes Metab Syndr* 2019;13:688-94.
  31. Kari JA, Bardisi ES, Baitalmal RM, Ageely GA. Folic acid awareness among female college students: Neural tube defects prevention. *Saudi Med J* 2008;29:1749-51.
  32. Miranda VIA, Dal Pizzol TdS, Silveira MPT, Mengue SS, da Silveira MF, Lutz BH, *et al*. The use of folic acid, iron salts and other vitamins by pregnant women in the 2015 Pelotas birth cohort: Is there socioeconomic inequality? *BMC Public Health* 2019;19:889.
  33. Kassa ZY, Awraris T, Daba AK, Tenaw Z. Compliance with iron folic acid and associated factors among pregnant women through pill count in Hawassa city, South Ethiopia: A community based cross-sectional study. *Reprod Health* 2019;16:14.
  34. WHO. Daily Iron and Folic Acid Supplementation in Pregnant Women. Geneva: World Health Organization; 2012. p. 27.
  35. Abu-Hammad T, Dreier J, Vardy DA, Cohen AD. Physicians' knowledge and attitudes regarding periconceptional folic acid supplementation: A survey in Southern Israel. *Med Sci Monit* 2008;14:CR262-7.
  36. Ha AVV, Zhao Y, Binns CW, Pham NM, Nguyen CL, Nguyen PTH, *et al*. Low prevalence of folic acid supplementation during pregnancy: A multicenter study in Vietnam. *Nutrients* 2019;11:2347.
  37. Kim M-H, Han J-Y, Cho Y-J, Ahn HK, Kim JO, Ryu HM, *et al*. Factors associated with a positive intake of folic acid in the periconceptional period among Korean women. *Public Health Nutr* 2009;12:468-71.
  38. Yamamoto S, Wada Y. Awareness, use and information sources of folic acid supplementation to prevent neural tube defects in pregnant Japanese women. *Public Health Nutr* 2018;21:732-9.
  39. Xing X-Y, Tao F-B, Hao J-H, Huang K, Huang ZH, Zhu XM, *et al*. Periconceptional folic acid supplementation among women attending antenatal clinic in Anhui, China: Data from a population-based cohort study. *Midwifery* 2012;28:291-7.
  40. Greenberg JA, Bell SJ, Guan Y, Yu YH. Folic acid supplementation and pregnancy: More than just neural tube defect prevention. *Rev Obstet Gynecol* 2011;4:52-9.
  41. Titley CR, Dibley MJ. Factors associated with not using antenatal iron/folic acid supplements in Indonesia: The 2002/2003 and 2007 Indonesia Demographic and Health Survey. *Asia Pac J Clin Nutr* 2015;24:162-76.
  42. Timmermans S, Jaddoe VW, Hofman A, Steegers-Theunissen RP, Steegers EA. Periconception folic acid supplementation, fetal growth and the risks of low birth weight and preterm birth: The Generation R Study. *Br J Nutr* 2009;102:777-85.
  43. Agrawal S, Fledderjohann J, Vellakkal S, Stuckler D. Adequately diversified dietary intake and iron and folic acid supplementation during pregnancy is associated with reduced occurrence of symptoms suggestive of pre-eclampsia or eclampsia in Indian women. *PLoS One* 2015;10:e0119120.
  44. Nzila A, Okombo J, Molloy AM. Impact of folate supplementation on the efficacy of sulfadoxine/pyrimethamine in preventing malaria in pregnancy: The potential of 5-methyl-tetrahydrofolate. *J Antimicrob Chemother* 2013;69:323-30.
  45. Al Rakaf MS, Kurdi AM, Ammari AN, Al Hashem AM, Shoukri MM, Garne E, *et al*. Patterns of folic acid use in pregnant Saudi women and prevalence of neural tube defects—Results from a nested case-control study. *Prev Med Rep* 2015;2:572-6.
  46. Albader NA, Negm DR, El Gabry EK, El-Sayed MM, Arzoo S. Knowledge and practice of folic acid supplementation and impact of income level on awareness among women

- of child-bearing age in Saudi Arabia. Trop J Pharm Res 2019;18:1323-30.
47. AbdRabou MAJIJoP. Awareness of folic acid intake for prevention of neural tube defects among women in Sakaka, Saudi Arabia. 2019;15:274-9.
48. Ahmad B, Anam N, Khalid N, Mohsen R, Zaal L, Jadidy E, *et al.* Perceptions of women of reproductive age about vitamin and folic acid supplements during pregnancy, Taibah University, Almadinah Almunawwarah, Kingdom of Saudi Arabia. J Taibah Univ Med Sci 2013;8:199-204.
49. Al-Holy M, Eideh Aa, Epuru S, Abu-Jamous D, Ashankyty I. Awareness of folic acid intake among women in the childbearing age in hail region—Saudi Arabia. Food Nutr Sci 2013;4:49-55.