Journal Homepage: -www.journalijar.com
INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)
Article DOI:10.21474/IJAR01/6335
DOI URL: http://dx.doi.org/10.21474/IJAR01/6335

RESEARCH ARTICLE

PREVALENCE OF DIETARY SUPPLEMENTS CONSUMPTION AND EXERCISE AMONG PREGNANT WOMEN IN AL MADINAH AND THEIR EFFECT ON MODE OF DELIVERY.

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Manuscript Info

Manuscript History

Received: 18 November 2017
Final Accepted: 20 December 2017
Published: January 2018

Abstract

Objective: To assess prevalence of dietary supplements consumption and exercise among pregnant women in AL Madinah and their effect on mode of delivery.

Methods: Retrospective study was conducted in AL MadinahAlmonawarah/ KSA. The study sample included 231participants who were randomly selected and covered different ages, social levels and education levels. the data was collected using electronic questionnaire, the questionnaire consisted of three sections, the first section included questions about socio-demographic characteristics, while the second section included questions to assess some potential risk factors, and third section included questions to assess the interviewee's knowledge about exercise and using supplement and herbs during pregnancy.

Results: Almost 40% of participants were aged between 19 and 29 years old, 67.3 % of participants had bachelor's degrees. 59.2 % did not do any exercise during pregnancy. Walking was the most type of exercise a female performed during pregnancy with the percentage of 83.2 %. 84.5 % of the pregnant females were taking nutritional supplements during pregnancy, 91% of them were taking iron supplements, while 93 %were taking folic acid supplements. About 21.3% of participants have been taking herbs during pregnancy, the most common type of herbs was anise by 60.3 %.

Conclusion: There was high prevalence of practice exercise among women during pregnancy in KSA, exercise reduces the need for caesarean delivery. Also, there was high prevalence of taking dietary supplement during pregnancy among Saudi women but using of dietary supplements did not affect on the type of delivery. There was low prevalence of taking herbs during pregnancy among Saudi women, and there was no effect of using herbs during pregnancy on type of delivery.

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Introduction:-

Pregnancy is the time which development of one or more embryo inside a woman. It normally lasts around Forty weeks from the last menstrual period (LMP) and ends with delivery. Women who begin their pregnancy with a healthy lifestyle (e.g. exercise, good nutrition, nonsmoking) should be encouraged to maintain those healthy habits (1).

Exercises during pregnancy:-

Physical activity, defined as any bodily movement produced by the contraction of skeletal muscles (2). Physical inactivity is the fourth risk factor for early mortality worldwide (3) .health benefits of physical activity for the pregnant woman, including prevention of obesity (4,5) , gestational diabetes (6, 7) , and preeclampsia (8, 9). Whether this is good for the fetus is unclear (10). Health authorities in the United States, Great Britain, Norway, and Denmark recommend a level of physical activity for pregnant women similar to that of the non-pregnant population (11,14). Current policy encourages physical activity during pregnancy, with UK guidelines recommending at least 30 min of moderate intensity activity at least four times a week,2–4 (15), and USA guidelines recommending 2.5 h each week (16). A systematic review associated physically demanding work with increased risk of premature birth (17), whereas a recent large cohort study showed increased risk of early spontaneous abortion with > 7 h/wk of high impact exercise (18). Potential risk factors of exercise have been listed as fetal hyperthermia with potential teratogenic effects, reduction of oxygenated blood flow (leading to fetal hypoxia) and reduction in essential substrates leading to fetal growth restriction (19). After the 13th week of pregnancy, about 1.2 extra MJ (300 kcal) per day are required to meet the metabolic needs of pregnancy (20,21). This energy requirement is increased further when daily energy expenditure is increased through exercise. In weight bearing exercise, such as walking, the energy requirement progressively increases with the increase in weight during the course of the pregnancy (22).

Nutritional supplements during pregnancy:-

The role of maternal health and nutrition has been emphasized by the recognition of the problem of low birth weight which affects some 20 million newborns annually, mainly in developing countries. This is essentially an end result of interference with fetal growth following inadequate nutrition and infections in pregnant women in these countries (23). periods of the life span include pregnancy and lactation, during which time nutrient requirements increase to support fetal and then infant growth and development (24). Its recommended intakes for 14 of the 21 essential micronutrients increase during pregnancy. These nutrients comprise 7 vitamins, 5 minerals, and Choline (25). During pregnancy the best to get vitamins and minerals from the food you eat, but same time you will need to take a supplement. Folic acid is one of important supplement for pregnancy, as it can help to prevent birth defects. Also, vitamin D for regulates the amount of calcium and phosphate in the body, which are needed to keep bones, teeth and muscles healthy. Iron, Vitamin C, Vitamin B12 and Calcium helps to keep healthy (26).

Herbs during pregnancy:-

In pregnancy, women often use herbal medicines due to the perception that these substances are more natural and therefore safer to use as compared to pharmaceutical medicines(27,28).a review of studies from the Western world, reported that the prevalence of herbal medicine use in pregnancy ranged from 1 to 60%(27).Concerns range, with some herbal medicines, from teratogenicity to an increased risk of maternal bleeding or impact on neonatal hormones due to the hormonal nature of the herbal medicine(29).In a previous study,39% of the women reporting having used herbal medicines during pregnancy had used herbal medicines that were considered possibly harmful or herbs where information about safety in pregnancy was missing (30).

physical activity and mode of delivery: -

Only three study evaluated the effect of physical activity on mode of delivery, of which tow failed to show significant differences between caesarian rates in women with and without exercise during pregnancy (**20**,31). Only one study showed an association between physical activity and mode of delivery, suggesting a considerably decrees risk of caesarian among active pregnant women(26).

Gestational diabetes mellitus (GDM) and exercise:-

Gestational diabetes mellitus (GDM) is one of the most common complications of pregnancy and is associated with a substantially elevated risk of adverse health outcomes for both mothers and offspring(28)and there is strong relation

sheep between exercise and GD. data from prospective cohorts show that physical activity before pregnancy , in early pregnancy or during pregnancy are associated with lower risk of developing GDM. [28 , 32 , 33 , 34 ,35]In another cohort study the result was Women who engage in intense physical activity before pregnancy have a 44% and 24%risk reduction for GDM and abnormal glucose tolerance, respectively [39]. The Canadian Diabetes Association (CDA) recommends that "Physical activity should be encouraged, with the frequency, type, duration, and intensity tailored to individual obstetric risk" [36]. The American Diabetes Association also suggests "Women without medical or obstetrical contraindications are encouraged to start or continue a program of moderate exercise as part of treatment for GDM" [37].

however, in A Randomized Controlled Trial There was no evidence that offering women a 12-week standard exercise program during the second half of pregnancy prevents gestational diabetes or improves insulin resistance in healthy pregnant women with normal body mass indexes [38].

Objectives:-

1. To assess the prevalence of women doing exercise during pregnancy.
2. To assess the prevalence of women consuming dietary supplement and herbs during pregnancy.
3. To identify the type and duration of exercise.
4. To identify the type of supplement and herbs.
5. To assess the effect of exercise, supplement and herbs on mode of delivery (normal vaginal delivery or cesarean)

Methodology:-

Retrospective study in AlmadinahAlmonawarah/ KSA. The study will be conducted on 231 Subjects selected randomly covering different age, social levels and education. (high school students, university students, housewives, public people, teachers, faculty members, etc). Data obtained by Using designed mannual questionnaire that was covering the following topics socio-demographic characteristics (as age, education and Social status) , assess some potential risk factors (as history of Chronic diseases, Caesarean births, Gestational Diabetes, Eclampsia). And another several questions to assess the interviewee's knowledge of exercise and using supplement and herbs during pregnancy. Data collecting period was during August 2016.

Results:-

The research was conducted on 202 pregnant females subjects in KSA,0.9 %(n=2) of the subjects aged less than 19 years old, 39.8 % (n =84) were between the ages of 19 to 29 years old, 35.5 %(n= 75) were between the ages of 30 to 40 years, 19.4 % (n= 41) ages ranged from 35 to 45 years, and 9.4 % (n=9) were females aged more than 41 years. Most of the participants were married females with the percentage of 94.8 % (n=200). Divorced females accounted for 4.3 %(n= 9) of our participants and 0.9 % (n=2) were widows. 67.3 %(n= 142) of the participant had bachelor's degrees. 0.9 %(n=2) were illiterates or able to read and write.3.8 % (n=8) had a certificate of primary education, and 22.3 %(n=47) had completed their secondary school education. Finally, 5.7 % (n= 12) had master's degrees and PhD degrees. The percentage of the chronic diseases among the participants were: 3.3 % (n= 7) had hypertension, 1.4 % (N= 3) had diabetes, 5.3 % (n= 11) had asthma, 11.8 % (n=25) had iron deficiency anemia, 2.4 % (n= 5) had urinary tract infection, 0.0% (n=0) had epilepsy, cardiac diseases and Sickle cell anemia. 72.5 % (n=153) subject had no chronic diseases, 4.3 % (9) have had other diseases. The rates of pregnancies among the participants were: 37.9 % (n=80) had been pregnant once, 33.6 %(n= 71) had been pregnant 2-3 times, 20.4 % (n=43) had been pregnant 4-5 times, and 8.1% (n=17) had been pregnant over 6 times. 88.6 % (n= 187) of the females had experienced birth and 11.4 %(n= 27) never had. 73% (n=154) had normal deliveries compared to 27 % (n=57) who have had cesarean sections. 11.4 % (n=24) of the normal deliveries had intervention (vacuum- forceps) at the time of delivery and 88.6 % (n=187) had no intervention.

7.1 %(n=15) of the females had positive history of GDM and preeclampsia during their pregnancies compared to 92.9 %(n= 196) who have not had them. Subjects were interviewed about their exercise during pregnancy and 40 .8 %(n=86) reported that they have done some type of exercise in some period during their pregnancy and 59.2 % (n=125) did not do any exercise during pregnancy. Walking was the most type of exercise a female performed during pregnancy with the percentage of 83.2 % (n=84), then Relaxing or yoga accounted to 21.8 % (n=22) followed by Aerobics, which accounted for 7.9 % (n= 8) and other type of exercises accounted for 5 % (n=5). Frequencies of exercise during pregnancy were: 38.2%(n=42) exercised once a day, 24.5 % (n=27) reported to have

exercised twice weekly, 7.3 % (n=8) have said to have exercised up to 3 or 4 times a week, 22.7 % (n=25) other. The durations of the exercises were: 28.4 %(n=29) reported to have exercised 5-10 min, 34.3 %(n=35) exercised 10-20 min, 24.5 %(n=25) for 20-30 min and 12.7 % (n=13) have exercised up to 30-40 minutes or more. 64 %(n=135) of the subjects exercised when they were not pregnant compared to 36 %(n=76) who did not. 84.5 %(n=174) of the pregnant females were taking nutritional supplements during pregnancy and 15.5 % (n=32) did not .the nutritional supplements that were taken were vitamin D 56.6 % (n=90), vitamin B12 50 % (n=72), vitamin C 43 % (n=61), iron supplements 91% (n= 159), folic acid supplements 93 % (n=172), amino acid 74.5 % (n=105), proteins 22% (n=31), fatty acid 14.5% (n=20), calcium 86.7 %(n=144). The period of time the participants reported of taking the nutritional supplements were: 22.6 %(n=44) were taking it in the first trimester of pregnancy, 13.6 %(n=24) were taking it in first &second trimester of pregnancy (first six months), 63.8 % (n= 113) were taking it in all 3 trimesters (9 months) of pregnancy. 95.7 % (n=176) of the pregnant females that were taking the nutritional supplements reported telling their doctors about them and 4.3 %(n=8) did not. 83.9%(n=177) of our subject knew the importance of folic acid supplements during pregnancy for the fetus's health, which is the prevention of congenital problems of the spinal cord (neural tube defect). 21.3%(n=45) of the subjects have been taking herbs during pregnancy compared to 78.7 %(N=166) that did not. The type of herbs the pregnant women were taking: Anise 60.3 %(n= 44), Fenugreek 28.1%(n=16), Nigella (Habit Albarakah) 37.1 % (n=23), Meramyah 25% (n=15), other 0.9% (n=12). The periods of time the participants reported of taking the herbs were: 7 % (n=4) were taking it during the First trimester (first 3 months), 28.1 %(n=16) were taking it during the First + second trimester (the first 6 months), And 64.9 %(n=37) were taking it during all 3 trimesters of pregnancy (9 months).

44.9 % (n=31) of the pregnant females reported to have told their doctors about taking the herbs. 75.8 %(n=160) were taking herbs when they were not pregnant compared to 24.2 %(n=51) that did not. The participants were interviewed about Why they were taking herbs during pregnancy and 30.9 %(n=17) answered that it's a habit in the family, 16.4 %(n=9) said that it is an advice from a mother or a relative, 49.1 %(n=27) says because they have read about its benefits, 9.1 %(n=5) said it is an advice from the doctor And 10.9 %(n=6) had other reasons.

Discussion:-

Pregnancy begins at conception with the union of a man's sperm and a woman's egg to form a single-cell embryo [(40)]. Full-term pregnancy typically lasts 38 weeks from conception or 40 weeks from the first day of a woman's last normal menstrual period.1It is known that woman's health is essential to the good health of her baby. Women who eat well and exercise regularly along with regular prenatal care are less likely to have complications during pregnancy. They are also more likely to successfully give birth to a healthy baby. So, women who begin their pregnancy with a healthy lifestyle such as; exercise, good nutrition, and nonsmoking should be encouraged to maintain those healthy habits. While those who do not have healthy lifestyles should be encouraged to view the preconception period and pregnancy as opportunities to embrace healthier routines [(1)]. This study conducted to assess the effect of exercise, supplement and herbs during pregnancy in Al-Madinah Al-Monwarah 2016. There was a low prevalence of chronic diseases among participants at this study by 28.1%. our finding closes to the results of an American study which reported that 27% of pregnant women suffered from a chronic disease [(41)]. This similarity in the results due to the convergence of life conditions and medical care between KSA and USA. The most common chronic diseases at our study was Iron deficiency with 11.90%. In recent study Prevalence of anemia (Hb<11gm/dl) on pregnant women in Pakistan was found to be 96% [(42)]. This difference prevalence of anemia between the two countries naturally because of the different economic levels and types of food between the two countries. Also, pressure was one of the common chronic diseases among our participants with 3.33%. This percentage is much lower than the rates in other countries, (17 %) in Nigeria[(43)], (17.2%)in Finland [(44)]. This difference is due to the difference in the nature of life, the level of economic, quality of food, and the pressure faced by women between Saudi Arabia and those countries. Nulliparous and grand multiparous women had been reported in previous studies to be at increased risk of hypertensive disorders of pregnancy, especially Pregnancy induced hypertension (PIH) and Pre-eclamptic toxemia (PET) [(43)]. The prevalence of smoking among women in our study was low by 2.86%. But in a study in Lebanon almost one quarter (23%) of participants reported smoking during pregnancy [(45)] . The prevalence of smoking in Lebanon is higher than in Saudi Arabia was due to a kind of fanaticism in the customs, traditions and religious restraint that prevents smoking in general and prevents the women in particular in Saudi Arabia. Regular aerobic exercise during pregnancy has been shown to improve or maintain physical fitness [(46,37)]. Although the evidence is limited, some benefit to pregnancy outcomes has been shown, and there is no evidence of harm when not contraindicated. Observational studies of women who exercise during pregnancy have shown benefits such as decreased gestational diabetes mellitus GDM [(47,48)], cesarean and operative vaginal delivery [(37,49,50)] , and postpartum recovery time [(37)] , although evidence from randomized controlled trials is limited. In those instances

where women experience low-back pain, water exercise is an excellent alternative [51] . Studies have shown that exercise during pregnancy can lower glucose levels in women with GDM [52, 53] , or help prevent preeclampsia [54] . Exercise has shown only a modest decrease in overall weight gain (1–2 kg) in normal weight, overweight, and obese women [55, 56] . 40.95% of participants at this study practice exercise during Pregnancy. In Brazil, 12.9% of women reported to engage in some type of physical activity during pregnancy [57]. in the United States, one study reported that only 15.8% of pregnant women are engaged in exercise during pregnancy at the recommended level [58]. our result higher that than the results of other studies in Brazil and United States because most of the women in the United States and Brazil are the workers and therefore do not have enough time to exercise, unlike women in Saudi Arabia. Walking was the most prevalence exercise that practiced among our participants during Pregnancy. It is considered a safe sport, could be done without the need for equipment, and does not cause tired so much. According to our results there was no effect of doing exercise at Normal delivery, but doing exercise affect at Cesarean delivery. This means doing exercise reduce the need to Cesarean delivery. This is consistent with Zeanah et al., whose reported significantly fewer cesarean sections in women who performed 40 min of moderate intensity exercise regularly during pregnancy [59], and Melzer et al., whose reported that inactive women were 3.7 times more likely to require operative delivery than active women who did at least 30 min of moderate physical activity per day [60]. But this contrary to Barakat et al., whose reported that Light-intensity resistance training that is performed over the second and third trimester of pregnancy does not affect the type of delivery [61]. It is certain that the reduction of C-sections limits the costs and complications compared with Normal delivery. Having chronic problem affected by doing exercise in our study. These results are considered logical because, Physical inactivity is a primary cause of most chronic diseases. Physical inactivity is a modifiable risk factor for cardiovascular disease and a widening variety of other chronic diseases, including diabetes mellitus, cancer (colon and breast)، obesity, hypertension, bone and joint diseases (osteoporosis and osteoarthritis)، and depression [62]. There is incontrovertible evidence that regular physical activity contributes to the primary and secondary prevention of several chronic diseases and is associated with a reduced risk of premature death [62]. Unfortunately, no mandatory system exists for reporting the harmful effects of dietary supplements. Dietary ingredients used in dietary supplements are not subject to the premarket safety evaluations required of new food ingredients, new uses of old food ingredients, or medications [63]. The most of our participants take supplements during pregnancy. Like our results a study in US reported that the majority of pregnant women in the US are using a dietary supplement at some time during their pregnancy [64]. Also in Finland [65]. Literature showed association between demographic and lifestyle factors and dietary supplement use during pregnancy [66,69]. Based on our results use of dietary supplements did not affect on the type of delivery, (Normal vaginal delivery or cesarean delivery). While other studies found that effects of vitamin D deficiency include increased risk of cesarean delivery (CD) [70,71]. Folic acid and Iron supplements were the most common dietary supplement used during pregnancy by participants at this study with 81.90% and 75.71% respectively. Because of the convincing evidence that periconceptional folic acid supplementation can decrease neural tube defects in some women, many health organizations recommend routine folic acid supplementation during pregnancy. For example, the US Centers for Disease Control and Prevention (CDC) recommends that all women of childbearing age who are capable of becoming pregnant should consume 0.4 mg/d folic acid. This recommendation has been adopted by several clinical practice associations, such as the American Academy of Pediatrics and the National Healthy Mothers, Healthy Babies Coalition [72,73]. Although multivitamin and folic acid supplementation is recommended during early pregnancy, these findings could reflect the difficulties some women encounter with tolerance of supplementation, particularly iron supplements, due to nausea and vomiting in early pregnancy [74,75]. Iron deficiency anemia is believed to be a common health problem in the Arabian Gulf [76]. Because of the recognized benefits of additional iron during pregnancy, the World Health Organization recommends daily iron supplementation (60 mg/d) for all pregnant women for 6 months or, if 6 months of treatment cannot be achieved during the pregnancy, either continuation of supplementation during the postpartum period or an increased dosage of 120 mg/d iron during pregnancy [77,78].

About 20.95% of participants at our study take herbs during pregnancy. The prevalence of herbal medicines uses among pregnant women from the Middle East varied from 22.3% to 82.3% [79]. Although the fact that knowledge of the potential side effects of many of these products is limited, particularly with respect to their use in pregnancy [80,82]. studies reported higher usage of herbs among women from rural areas that were less educated [79, 83,86]. In the current study the most common used herb was anise (20.95%). A study in Alexandria reported that aniseed was the most common herb used (40.2%) [87]. In Qatar revealed that only (1%) of pregnant women used aniseed [84]. In this there was no effect of using herbs during pregnancy on type of delivery (Normal vaginal delivery or cesarean). This is contrary to Mabina et al., whose found that Herbal medication use may lead to fetal distress, as indicated by the

high frequency of meconium-stained liquor and high caesarean section rates in this group of women presenting in labour[88].

Limitation:-

Our results are subject to certain limitations. For example, inclusion of a large number of participants was not feasible and the time for collecting the data was from one month to two so it was limited. Also, inability to obtain a detailed obstetric history to measure the effect more specifically and we did not ask about socioeconomic state of the participants .The study type maybe a cause for difficulty in recall if we did it in more than two months it will be clinical trial and that is more accurate than retrospective study .Furthermore, the rarity of study's topic in Saudi Arabia especially in ALMadinahALmonawarh made us face many barriers especially in literature review.

Conclusions:-

From this study we concluded thatthere was high prevalence of practice exercise among women during Pregnancy in KSA. Walking was the most common exercise that practiced among Saudi women during pregnancy. According to our results there was no effect of doing exercise at normal delivery, but doing exercise affect at cesarean delivery. This means exercise reduces the need for caesarean delivery. Also, doing exercise reduces having chronic diseases. There was high prevalence of taking dietary supplement during pregnancy among Saudi women, Folic acid and Iron supplements were the most common dietary supplement used during pregnancy by Saudi women. Using of dietary supplements did not affect on the type of delivery, (Normal vaginal delivery or cesarean delivery).There was low prevalence of taking herbs during pregnancy among Saudi women, the most common used herb was anise. There was no effect of using herbs during pregnancy on type of delivery (Normal vaginal delivery or cesarean).

Recommandations:-

1. Further studies about effect of exercise, supplement and herbs during pregnancy.
2. Raise awareness among women, using various ways, about the importance of exercise during pregnancy.
3. For pregnant women exercise regularly and continuity but stay away from the arduous and dangerous sports.
4. The use of dietary supplements should be with extreme caution under the supervision of a doctor, especially in pregnancy.
5. General health education for pregnant women about the benefits and harms of herbal use during pregnancy in ante-natal care especially for herbs commonly used.

Acknowledgement:-

At the outset, we would like to express our deep and sincere gratitude to the following people without whose support this research project would not have been a success. We would like to sincerely thank **Dr. JehanAlhazmi**, OB/GYN Consultant, MMCH, Madina, our supervisor and corresponding author for offering valuable advices and wise counsel, and for her availability for a genuine guidance. We also owe our gratitude to the authority of Maternity and Children Hospital in Madina for facilitating our study by providing a suitable environment and encouraging us from the beginning up to this far. We would like to sincerely thank all the data collectors who helped us in our project, namely: **Sara Ismail Alturkestany, KhadigaAbubakerAlaminElnur, RayanEid Mohammed, Amal Mohammed Alrifai,Razzan Mohammed Ghazi, DanianSoudAloufi, Khloud Mohsen Alnoom, and RazanAbdulshakourNeyaz**. We are indebted and grateful to every patient who participated in this study. Finally, we are extending our thanks to everyone who has supported us to complete the research work directly or indirectly.

Reference:-

1. American College of Obstetricians and Gynecologists. "Exercise during pregnancy and the postpartum period: ACOG technical bulletin number 189—February 1994." *International Journal of Gynecology & Obstetrics* 45.1 (1994): 65-70.
2. Thompson, W. R., N. F. Gordon, and L. S. Pescatello. "American College of Sport Medicine. ACSM's Guidelines for exercise testing and prescription. 8. painos." (2009).
3. uchholz, Susan Weber, et al. "Physical activity text messaging interventions in adults: a systematic review." *Worldviews on Evidence-Based Nursing* 10.3 (2013): 163-173.
4. Magnusson, P., et al. "Physical activity and chronic disease I. Heart disease and hypertension." *Ugeskrift for laeger* 166.17 (2004): 1543.

5. Magnusson, P., et al. "Physical activity and chronic disease III. Musculoskeletal diseases and lung diseases." *Ugeskrift for laeger* 166.17 (2004): 1552.
6. Dye, Timothy D., et al. "Physical activity, obesity, and diabetes in pregnancy." *American Journal of Epidemiology* 146.11 (1997): 961-965.
7. Solomon, Caren G., et al. "A prospective study of pregravid determinants of gestational diabetes mellitus." *Jama* 278.13 (1997): 1078-1083.
8. Marcoux, Sylvie, Jacques Brisson, and Jacqueline Fabia. "The effect of leisure time physical activity on the risk of pre-eclampsia and gestational hypertension." *Journal of Epidemiology and Community Health* 43.2 (1989): 147-152.
9. Sorensen, Tanya K., et al. "Recreational physical activity during pregnancy and risk of preeclampsia." *Hypertension* 41.6 (2003): 1273-1280.
10. Narendran, Shamanthakamani, et al. "Efficacy of yoga on pregnancy outcome." *Journal of Alternative & Complementary Medicine* 11.2 (2005): 237-244.
11. Committee on Obstetric Practice. "ACOG committee opinion. Exercise during pregnancy and the postpartum period. Number 267, January 2002. American College of Obstetricians and Gynecologists." *International journal of gynaecology and obstetrics: the official organ of the International Federation of Gynaecology and Obstetrics* 77.1 (2002): 79.
12. Denmark National Board of Health. Copenhagen, Denmark: National Board of Health; 2003. Physical activity—a handbook on prevention and treatment. (In Danish).
13. National Collaborating Centre for Women's and Children's Health. Clinical guideline. London, United Kingdom: RCOG Press; 2003. Antenatal care: routine care for the healthy pregnant woman. October 2003.
14. Håberg, Siri E., et al. "Folic acid supplements in pregnancy and early childhood respiratory health." *Archives of disease in childhood* 94.3 (2009): 180-184.
15. Damm, Peter, Bettina Breitowicz, and Hanne Hegaard. "Exercise, pregnancy, and insulin sensitivity-what is new?." *Applied Physiology, Nutrition, and Metabolism* 32.3 (2007): 537-540.
16. United States. Department of Health, and Human Services. *Two Thousand Eight Physical Activity Guidelines for Americans: Be Active, Healthy, and Happy*. Vol. 36. Government Printing Office, 2008.
17. Bonzini, Matteo, David Coggon, and Keith T. Palmer. "Risk of prematurity, low birth weight, and pre-eclampsia in relation to working hours and physical activities: a systematic review." *Occupational and Environmental Medicine*(2006).
18. Madsen, M., et al. "Leisure time physical exercise during pregnancy and the risk of miscarriage: a study within the Danish National Birth Cohort." *BJOG: An International Journal of Obstetrics &Gynaecology* 114.11 (2007): 1419-1426.
19. Wolfe, Larry A., and Gregory AL Davies. "Canadian guidelines for exercise in pregnancy." *Clinical obstetrics and gynecology* 46.2 (2003): 488-495.
20. Artal, R., and M. O'toole. "Guidelines of the American College of Obstetricians and Gynecologists for exercise during pregnancy and the postpartum period." *British journal of sports medicine* 37.1 (2003): 6-12.
21. Council, Nath Res. "Recommended dietary allowances." *Food and Nutrition Board, Commission on Life Sciences, National Research Council. Washington: National Academic* (1989).
22. Millard, Louise AC, et al. "Physical activity during pregnancy and offspring cardiovascular risk factors: findings from a prospective cohort study." *BMJ open* 3.9 (2013): e003574.
23. Metcoff, Jack, et al. "Maternal nutrition and fetal outcome1'2." (1981).
24. Picciano, Mary Frances. "Pregnancy and lactation: physiological adjustments, nutritional requirements and the role of dietary supplements." *The Journal of Nutrition* 133.6 (2003): 1997S-2002S.
25. Bailey, L. B., et al. "Present knowledge in nutrition." *Washington, DC: Internation Life Sciences Institute* (2001).
26. Cawley, S., et al. "A review of European guidelines on periconceptional folic acid supplementation." *European journal of clinical nutrition* 70.2 (2016): 143-154.
27. Hall, Helen G., Debra L. Griffiths, and Lisa G. McKenna. "The use of complementary and alternative medicine by pregnant women: a literature review." *Midwifery* 27.6 (2011): 817-824.
28. Holst, Lone, et al. "Use of herbal preparations during pregnancy: focus group discussion among expectant mothers attending a hospital antenatal clinic in Norwich, UK." *Complementary Therapies in Clinical Practice* 15.4 (2009): 225-229.
29. Mills, Edward, et al. *Herbal medicines in pregnancy and lactation: an evidence-based approach*. CRC Press, 2013.

30. Nordeng, Hedvig, and Gro C. Havnen. "Use of herbal drugs in pregnancy: a survey among 400 Norwegian women." *Pharmacoepidemiology and drug safety*13.6 (2004): 371-380.
31. Wang, Thomas W., and Barbara S. Apgar. "Exercise during pregnancy." American Family Physician 57 (1998): 1846-1859.
32. Oteng-Ntim, E., Tezcan, B., Seed, P., Poston, L., & Doyle, P. (2015). Lifestyle interventions for obese and overweight pregnant women to improve pregnancy outcome: A systematic review and meta-analysis. *The Lancet,386*. Doi:10.1016/s0140-6736(15)00899-5
33. Cavalcante, S. R., Cecatti, J. G., Pereira, R. I., Baciuk, E. P., Bernardo, A. L., &Silveira, C. (2009). Water aerobics II: Maternal body composition and perinatal outcomes after a program for low risk pregnant women. *Reproductive Health Reprod Health,6*(1). doi:10.1186/1742-4755-6-1
34. Price, B. B., Amini, S. B., &Kappeler, K. (2012). Exercise in Pregnancy. *Medicine & Science in Sports & Exercise,44*(12), 2263-2269. doi:10.1249/mss.0b013e318267ad67
35. 1. Tobias D, Zhang C, van Dam R, Bowers K, Hu F. Physical Activity Before and During Pregnancy and Risk of Gestational Diabetes Mellitus: A meta-analysis. *Diabetes Care*. 2010;34(1):223-229. doi:10.2337/dc10-1368.
36. Dodd J, Turnbull D, McPhee A et al. Antenatal lifestyle advice for women who are overweight or obese: LIMIT randomised trial. *BMJ*. 2014;348(feb10 3):g1285-g1285. doi:10.1136/bmj.g1285.
37. Smith B, Cheung N, Bauman A, Zehle K, McLean M. Postpartum Physical Activity and Related Psychosocial Factors Among Women With Recent Gestational Diabetes Mellitus. *Diabetes Care*. 2005;28(11):2650-2654. doi:10.2337/diacare.28.11.2650.
38. Dempsey J. Prospective Study of Gestational Diabetes Mellitus Risk in Relation to Maternal Recreational Physical Activity before and during Pregnancy. *American Journal of Epidemiology*. 2004;159(7):663-670. doi:10.1093/aje/kwh091.
39. A Prospective Study of Pregravid Physical Activity and Sedentary Behaviors in Relation to the Risk for Gestational Diabetes Mellitus. *Obstetrics & Gynecology*. 2006;107(6):1416. doi:10.1097/01.aog.0000209487.83544.29.
40. Carlson, Bruce M. *Human embryology and developmental biology*. Elsevier Health Sciences, 2013.
41. Chatterjee, Sharmila, Milton Kotelchuck, and UshaSambamoorthi. "Prevalence of chronic illness in pregnancy, access to care, and health care costs: Implications for interconception care." *Women's Health Issues* 18.6 (2008): S107-S116.
42. Awan, MaheMunir, Muhammad Aftab Akbar, and Misbahul Islam Khan. "A study of anemia in pregnant women of railway colony, Multan." *Pak J Med Res*43.1 (2004): 11-4.
43. Singh, Swati, et al. "Hypertensive disorders in pregnancy among pregnant women in a Nigerian Teaching Hospital." *Nigerian medical journal: journal of the Nigeria Medical Association* 55.5 (2014): 384.
44. Hartikainen, Anna-Liisa, Riitta H. Aliharmi, and Paula T. Rantakallio. "A cohort study of epidemiological associations and outcomes of pregnancies with hypertensive disorders." *Hypertension in Pregnancy* 17.1 (1998): 31-41.
45. Chaaya, M., et al. "Knowledge, attitudes, and practices of argileh (water pipe or hubble-bubble) and cigarette smoking among pregnant women in Lebanon."*Addictive behaviors* 29.9 (2004): 1821-1831.
46. de Oliveria Melo, Adriana S., et al. "Effect of a physical exercise program during pregnancy on uteroplacental and fetal blood flow and fetal growth: a randomized controlled trial." *Obstetrics & Gynecology* 120.2, Part 1 (2012): 302-310.
47. Cordero Rodriguez, Yaiza, et al. "Exercise in associated with a reduction in gestational diabetes mellitus." *Medicine & Science in Sports & Exercise.* 47.7 (2014): 1328-1333.
48. Liu, Jihong, et al. "Does physical activity during pregnancy reduce the risk of gestational diabetes among previously inactive women?." *Birth* 35.3 (2008): 188-195.
49. Barakat, Ruben, et al. "Exercise during pregnancy reduces the rate of cesarean and instrumental deliveries: results of a randomized controlled trial." *The Journal of Maternal-Fetal & Neonatal Medicine* 25.11 (2012): 2372-2376.
50. Pennick, V. E., and Gavin Young. "Interventions for preventing and treating pelvic and back pain in pregnancy." *Cochrane Database Syst Rev* 2 (2007).
51. Kihlstrand, Mari, et al. "Water-gymnastics reduced the intensity of back/low back pain in pregnant women." *ActaObstetricia et Gynecologica Scandinavica*78.3 (1999): 180-185.
52. Jovanovic-Peterson, Lois, Eric P. Durak, and Charles M. Peterson. "Randomized trial of diet versus diet plus cardiovascular conditioning on glucose levels in gestational diabetes." *American journal of obstetrics and gynecology* 161.2 (1989): 415-419.

53. García-Patterson, Apolonia, et al. "Evaluation of light exercise in the treatment of gestational diabetes." *Diabetes Care* 24.11 (2001): 2006-2007.
54. Meher, Shireen, and LeliaDuley. "Exercise or other physical activity for preventing pre-eclampsia and its complications." *The Cochrane Library* (2006).
55. Choi, JiWon, Yoshimi Fukuoka, and Ji Hyeon Lee. "The effects of physical activity and physical activity plus diet interventions on body weight in overweight or obese women who are pregnant or in postpartum: a systematic review and meta-analysis of randomized controlled trials." *Preventive medicine*56.6 (2013): 351-364.
56. Muktabhant, Benja, et al. "Diet or exercise, or both, for preventing excessive weight gain in pregnancy." *The Cochrane Library* (2015).
57. Domingues, Marlos Rodrigues, and Aluísio JD Barros. "Leisure-time physical activity during pregnancy in the 2004 Pelotas Birth Cohort Study." *Revista de Saúde Pública* 41.2 (2007): 173-180.
58. Nascimento, Simony L., Fernanda G. Surita, and José G. Cecatti. "Physical exercise during pregnancy: a systematic review." *Current Opinion in Obstetrics and Gynecology* 24.6 (2012): 387-394.
59. Zeanah, Marianne, and Sharron P. Schlosser. "Adherence to ACOG guidelines on exercise during pregnancy: effect on pregnancy outcome." *Journal of Obstetric, Gynecologic, & Neonatal Nursing* 22.4 (1993): 329-335
60. Melzer, Katarina, et al. "Effects of recommended levels of physical activity on pregnancy outcomes." *American journal of obstetrics and gynecology* 202.3 (2010): 266-e1.
61. Barakat, Ruben, et al. "Type of delivery is not affected by light resistance and toning exercise training during pregnancy: a randomized controlled trial." *American journal of obstetrics and gynecology* 201.6 (2009): 590-e1.
62. Warburton, Darren ER, Crystal Whitney Nicol, and Shannon SD Bredin. "Health benefits of physical activity: the evidence." *Canadian medical association journal* 174.6 (2006): 801-809.
63. Schweitzer, Amy. "Dietary supplements during pregnancy." *The Journal of perinatal education* 15.4 (2006): 44.
64. Branum, Amy M., Regan Bailey, and Barbara J. Singer. "Dietary supplement use and folate status during pregnancy in the United States." *The Journal of nutrition* 143.4 (2013): 486-492.
65. Aronsson, CarinAndrén, et al. "Use of dietary supplements in pregnant women in relation to sociodemographic factors–a report from The Environmental Determinants of Diabetes in the Young (TEDDY) study." *Public health nutrition*16.08 (2013): 1390-1402.
66. Haugen, Margaretha, et al. "Dietary supplements contribute substantially to the total nutrient intake in pregnant Norwegian women." *Annals of Nutrition and Metabolism* 52.4 (2008): 272-280.
67. Arkkola, Tuula, et al. "Dietary intake and use of dietary supplements in relation to demographic variables among pregnant Finnish women." *British Journal of Nutrition* 96.05 (2006): 913-920
68. Brekke, Hilde K., and Johnny Ludvigsson. "Vitamin D supplementation and diabetes-related autoimmunity in the ABIS study." *Pediatric diabetes* 8.1 (2007): 11-14.
69. Camargo, Carlos A., et al. "Maternal intake of vitamin D during pregnancy and risk of recurrent wheeze in children at 3 y of age." *The American journal of clinical nutrition* 85.3 (2007): 788-795.
70. Bodnar, Lisa M., and Hyagriv N. Simhan. "Vitamin D may be a link to black-white disparities in adverse birth outcomes." *Obstetrical & gynecological survey* 65.4 (2010): 273.
71. Del Valle, Heather B., et al., eds. *Dietary reference intakes for calcium and vitamin D*. National Academies Press, 2011.
72. Desposito, F., et al. "Folic acid for the prevention of neural tube defects." *Pediatrics* 104.2 I (1999): 325-327.
73. National Healthy Mothers Healthy Babies Coalition. Folic acid position statement. Available from: http://www.hmhb.org/ps_folicacid.html (cited 23 April 2008)
74. Nguyen, Patricia, et al. "Effect of iron content on the tolerability of prenatal multivitamins in pregnancy." *BMC pregnancy and childbirth* 8.1 (2008): 17.
75. Nguyen, Patricia, Martin Thomas, and Gideon Koren. "Predictors of prenatal multivitamin adherence in pregnant women." *The Journal of Clinical Pharmacology* 49.6 (2009): 735-742
76. Musaiger, Abdulrahman O. "The state of food and nutrition in the Arabian Gulf countries." *Nutrition in the Gulf Countries. Malnutrition and Minerals*. Karger Publishers, 1987. 105-173.
77. World Health Organization Iron and folate supplementation. Available from: http://www.who.int/making_pregnancy_safer/publications/standards1.8N.pdf (cited 23 April 2008)
78. Stoltzfus, Rebecca J., and Michele L. Dreyfuss. *Guidelines for the use of iron supplements to prevent and treat iron deficiency anemia*. Vol. 2. Washington^ eDC DC: Ilsi Press, 1998.
79. John, Lisha J., and NishaShantakumari. "Herbal medicines use during pregnancy: a review from the Middle East." *Oman medical journal* 30.4 (2015): 229.

80. Maats, F. H., and C. A. Crowther. "Patterns of vitamin, mineral and herbal supplement use prior to and during pregnancy." *Australian and New Zealand Journal of Obstetrics and Gynaecology* 42.5 (2002): 494-496.
81. Gibson, Paul S., Raymond Powrie, and Jami Star. "Herbal and alternative medicine use during pregnancy: a cross-sectional survey." *Obstetrics & Gynecology* 97.4 (2001): S44-S45.
82. Nordeng, Hedvig, and Gro C. Havnen. "Use of herbal drugs in pregnancy: a survey among 400 Norwegian women." *Pharmacoepidemiology and drug safety*13.6 (2004): 371-380.
83. Cuzzolin, Laura, et al. "Use of herbal products among 392 Italian pregnant women: focus on pregnancy outcome." *Pharmacoepidemiology and drug safety*19.11 (2010): 1151-1158.
84. Broussard, Cheryl S., et al. "Herbal use before and during pregnancy." *American journal of obstetrics and gynecology* 202.5 (2010): 443-e1.
85. , Della A., et al. "Herbal medicine use during pregnancy in a group of Australian women." *BMC pregnancy and childbirth* 6.1 (2006): 21.
86. Gharoro, E. P., and A. A. Igbafe. "Pattern of drug use amongst antenatal patients in Benin City, Nigeria." *Medical Science Monitor* 6.1 (2000): 84-87
87. Orief, Yasser Ibrahim, Nadia FouadFarghaly, and Mohamed Ibrahim Abdelaziz Ibrahim. "Use of herbal medicines among pregnant women attending family health centers in Alexandria." *Middle East Fertility Society Journal* 19.1 (2014): 42-50
88. Mabina, M. H., S. B. Pitsoe, and J. Moodley. "The effect of traditional herbal medicines on pregnancy outcome. The King Edward VIII Hospital experience." *South African medical journal= Suid-Afrikaansetydskrifvirgeneeskunde* 87.8 (1997): 1008-1010.