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The Alarming Results In Regard To Assessing Dietary Intake Of A Pregnant Group At Their Second And Third Trimesters.

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Abstract:
Nutrition is indispensable prior and during pregnancy to a child's healthy growth and development. Meeting nutritional needs during pregnancy has been always thought of as a major public health issue. A cross-sectional study was carried out at the Ministry of Health's (MoH) Maternal and Children Health Centers (MCHC) in Amman to assess the dietary intake in a convenient sample of 300 seemingly healthy pregnant women between 17 and 40 years-old and at ≥ 13 weeks of gestation. Maternal demographic cheracteristics, medical history, anthropometric measurements and dietary data (three days recall) were collected. The daily mean intake of carbohydrates exceeded the recommended intake in 45.3% of the pregnant women. Fiber intake was less than 28g/day in 90% of them. Total fats intake (45.6g/day) was lower than the Recommended Dietary Allowance (RDA) in 42.3% of the pregnant women. Two thirds of them consumed moderate amount of saturated fats (14.6g/day). The mean daily intake of proteins was 50.5±20.2g. More than two-thirds consumed protein less than the RDA, subsequently, intakes of all essential amino acids were below RDAs. The intake of fat soluble vitamins was lower than RDA for vitamins D, E, and K. While the intake of vitamin A was higher than RDA. The intake of minerals was lower than RDA for (calcium, fluoride, iodine, iron, zinc, and selenium), while the intakes of sodium and copper were higher. It was found that that water soluble vitamins can be more affected by demographic changes while fat soluble were less affected with some exceptions. Maternal nutrition and diets of pregnant women in this study show alarming indicators that may negatively affect the well-being of both pregnant women. The inadequacy diet intake was addressed in addition to the imbalanced with the RDA.
Keywords: pregnancy, RDA, nutrients intake, malnutrition, second half of pregnancy.

Introduction:

Throughout a human's life cycle, nutrition has a direct impact on health (Elmadfa and Meyer, 2012). However, it is well known that pregnant women are the most vulnerable group through human life cycle in terms of nutritional health (El-Qudah, 2015). Attention to the maternal diet during all trimesters of pregnancy is critical to both safeguard the health of mothers and ensure the healthy outcome (Cheng et al., 2009).Vitamins and minerals support every stage of maternal, placental and fetal interactions to promote and maintain healthy gestation (Gernand et al., 2016). Fat-soluble vitamins among blood levels are prone to increase in pregnancy; whereas water-soluble vitamins levels tend to decrease. Occasionally; prescribing multivitamin supplements during pregnancy overcomes adequacy in water-soluble vitamins levels (Brown, 2016). Supplements provided to pregnant women should

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contain the essential nutrients that most likely lacking in their diets (Arimond et al., 2018). These nutrients include the vitamins pyridoxine, B12, folic acid, D, C and the mineral elements, such as iron, iodine, zinc, copper and selenium. Nutrient amounts should not exceed tolerable upper intake levels for pregnant women (Gernand et al., 2016).

Pregnancy is associated with intense anatomical, physiological, biochemical andendocrine changes that affect many organs and systems of pregnant women (Soma-Pillay *et al.,* 2016, Yanamandra and Chandraharan, 2012). It has been found that maternal dietary intakes of protein, fat and carbohydrates in pregnancy were positively associated with child dietary intakes of these same nutrients later on (Brion*et al.,* 2010).

At the end of the first trimester the fetus weighs 30g; then the following six months of pregnancy is the maximum growth rate for the maternal plasma volume, uterine blood flow and fetal weight (Mann and Truswell, 2002). Gestational weight gain higher than the recommended ranges may have various adverse effects on the mother, such as increased risk for pregnancy induced hypertension, gestational diabetes (GDM), while lower gestational weight gain is associated with increased risk for unsuccessful breastfeeding (WHO, 2018).

Macronutrients or so-called “energy providing nutrients” are carbohydrates (CHO), proteins and fats. These nutrients are usually needed in larger quantities compared to micronutrients like vitamins and minerals (WHO, 2018). Energy requirement during pregnancy increases through pregnancy. In the first trimester, energy requirements are the same as of the non-pregnant women, however, requirement increases in the second and third trimesters by 340 kcal/ day and 450 kcal/ day, respectively. Higher intakes of the CHO subgroup glucose and lactose were found to be associated with birth weight (Sharma *et al.,* 2018).

On the other hand, protein requirement during the first trimester is the same as the requirement of non-pregnant. However, requirement increase during second and third trimesters to reach 1.1g/kg of pre-pregnancy body weight (Mahan & Raymond, 2012). The studies on amino acids have revealed an increase in requirements during later stages of pregnancy for all of the amino acids in order to accommodate the increased needs for fetal tissues synthesis, although the increases varied among the amino acids (Elango & Ball, 2016).

Therefore, this study aimed to assess and evaluate macronutrient and micronutrients consumption from foods among a group of pregnant women in Amman Governorate during the second or third trimesters, and compare the consumption macronutrients and micronutrients in a group of Jordanian pregnant women with to RDA, and finally to assess and compare macronutrient and micronutrients consumption among the underweight, normal, overweight and obese pregnant women of the study.

Methods:

Ethical approval: This study was approved by the committee of Graduated Studies faculty and Deanship of Academic Research. A written consent was obtained from all pregnant women that participated in the study. Names of the pregnant women of the sample on the consent form were not

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included in the study results or mentioned in the discussion parts of the study in order to maintain full privacy and confidentiality. The objective of the study was explained to each pregnant woman who participated before asking for consent.

Study design: A descriptive cross sectional study design was applied to a convenient sample of pregnant women attending MoH facilities for antenatal care during the period from August to October 2018.

Study participants: Study participants are selected according to the below set inclusion and exclusion criteria. Inclusion criteria are: all women visiting in MCHC living in Amman Governorate, pregnant women should be in their second or third trimester, Singleton pregnancy, Jordanian nationality and age ranges from 17- 40 years. Exclusion criteria are: women living outside Amman Governorate, pregnant women in the first trimester, women considered at a high risk of preterm delivery or fetuses with congenital anomalies, twin/multi fetal pregnancy, pregnant women with chronic diseases (eg: DM, HTN,TB, Hepatitis… etc) and Smokers.

Sample of the Study: The study was carried out in the Ministry of Health's Maternal and Child Health Center (MCHC) in Amman. Sample size was calculated using Raosoft® online sample size calculator (Raosoft, 2004); which is designed specifically for population surveys to calculate the sample size and define how many responses are required to meet the desired confidence level (usually 95%) and with an acceptable margin of error (usually 5%) while taking in consideration the population size. Population size was 1,413 and was estimated by multiplying number of marriage contracts in 2017 in Amman (28,263) with the percentage of pregnant women 5% (DOS, 2017). Up to 300 pregnant women were recruited. A total of 20 MCHCs were selected according to the highest case load and reach area from different districts in Amman. Each MCHC were visited more than once on different weekdays.

Maternal Anthropometric Measurements: Height and current body weight of the pregnant women were measured by the researcher. SECA electronic land scale (Model 876) was used to measure current weight and recorded to the nearest 0.1 kg, whereas, height was taken using measuring tape and recorded to 0.1 cm. The pre-pregnancy weight and gestational age was obtained from the women's medical files. Finally, pre-pregnancy BMI and total GWG was calculated.

Demographic and Health Data: The presence of any underlying health conditions and smoking were asked our before filling out the form. If the pregnant women were free of such conditions consent was taken for participation and a checklist of demographic characteristics.

Dietary Data Collection: Maternal dietary intake was collected using a 3-day food recall (see appendix 4). Measuring cups and food models were used to help pregnant women accurately estimate their intake of food items. The days of Eid Al Adha and Arafat Day that came across during the data collection periods were excluded as they may affect the habitual daily intake. Dietary intake from food intake was

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calculated using the food composition tables for use in the Middle East (Pellett and Shadarevian 2013) and ESHA software (Ver 10.9/2011).

Statistical Analysis: All data was collected and entered into the Statistical Program for Social Studies software (SPSS17.0.1.2008, Chicago: SPSS Inc.). Correlations, simple and multiple regression analyses were used to establish which variables have significant effects on maternal nutritional status as well as socioeconomic status. A two-tailed t-test and ANOVA was used to evaluate grouped data. The outcomes data was presented in numbers, proportions, means, and standard deviation. An alpha level of 0.05 was set to assure statistical significance.

Results:

Characteristics of the Study Sample

The study consisted of 300 pregnant women. The characteristics of the pregnant women are presented in Table (1). Pregnant women aged 17-30 years constituted the highest category (219) with a percentage of (73%) in terms of the age variable.

Pre-Pregnancy Weight and Gestational Weight Gain

The mean pre-pregnancy weight and the mean of total GWG were (64.8kg) and (4.09kg) respectively in the second trimester, while in the third trimester the mean pre-pregnancy weight was (63.57kg) and the mean of total GWG was (8.38kg) Table (2). Among the pregnant women (150) were within normal BMI (50%), on the other hand, pre-pregnancy underweight was the lowest (5%), suggesting a relatively high expectation of overweight related pregnancy complications.

Table (1): Characteristics of the Study pregnant women

Variable	**Categories**	**N**[1]	**%**[2]
Age	17-30 years	219	73
	31-40 years	81	27
Pre-pregnancy BMI[3]	Underweight	15	5
	Normal weight	150	50
	Overweight	94	31.3
	Obese	41	13.7

Table (2). Mean Pre-Pregnancy Weight and Total Gestational Weight Gain in Second and Third Trimesters

Trimester	**N**[1]	**Variable**	**Means (kg)**
2nd	173	Mean pre-pregnancy weight	64.8 ±13.3 kg
		Mean total GWG[2]	4.09 ±5.3 kg
3rd	127	Mean pre-pregnancy weight	63.5 ±12.8 kg

		Mean total GWG[2]	8.38 ±5.8 kg

1: N represented the Number of participant.

2: GWG gestational weight gain calculated as current weight – pre-pregnancy weight.

Carbohydrates and Fiber Intakes:

The intakes in term of means are compared; an adequate amount (179.3g/day±69.05) is consumed according to our study pregnant (Figure 1). There was no significant difference (*P*=0.5) between the mean intake of CHO in the second trimester (177.3g/day) and the third trimester (182.4g/day). The mean intake of fiber was 14.6g±10.6 and from the pregnant women only 4.7% (14) met the recommended intakes (28g/day). Almost half of the 300 participants (136) consumed CHO that exceeded the RDA (Figure 2), while 30.3% (91) met the RDA and 24.3% (73) consumed less. However, when

Proteins Intakes:

Protein intakes (50.5g/day) did not meet the RDA (Figure 3), in more than two third of the pregnant women (82.7%) shown in Figure 4. There was no significant difference (*P*=0.8) between the mean intakes of protein in the second trimester (50.1g/day) and the third trimester (51.1g/day). The mean intakes of all EAA were below the RDA. In addition, the majority of pregnant consumed lower than the RDAs of all the EAA (Figure 5).

Figure 1: Mean Carbohydrates and Fiber Intakes:

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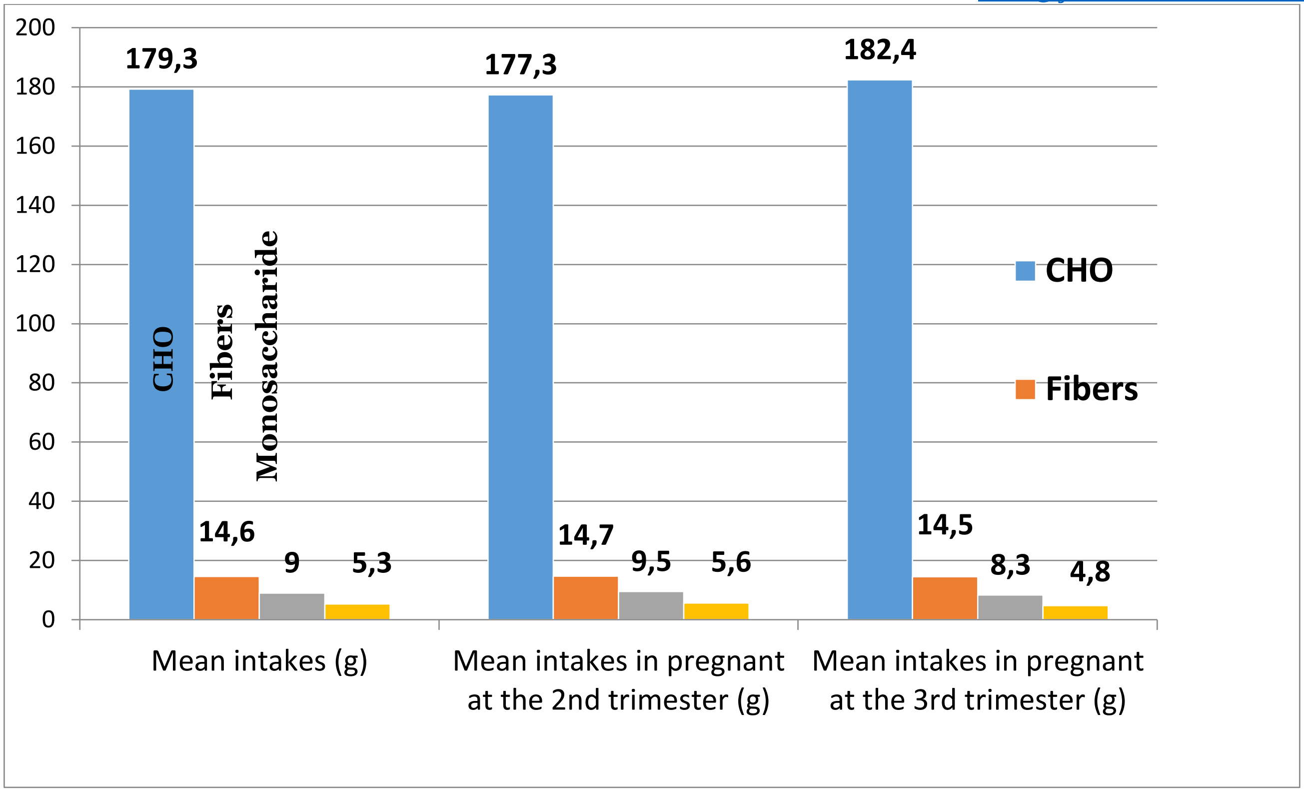
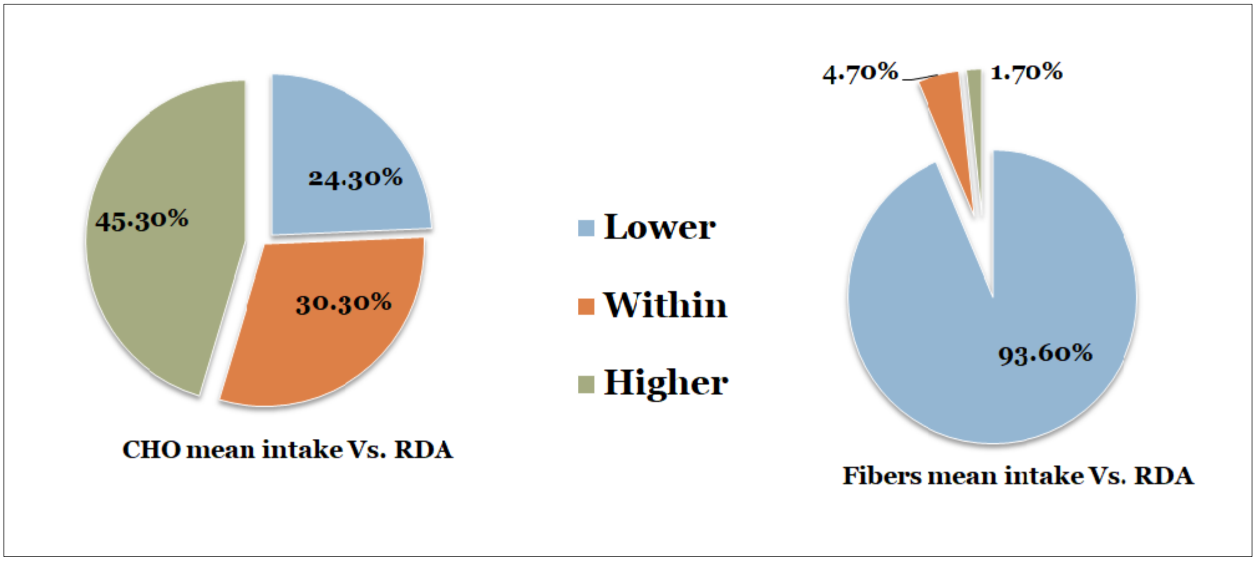


Figure 2: Mean Carbohydrates and Fiber Intakes compared to Recommended Daily Allowances:



Total Fats and Fat Components Intakes

The fats intakes RDA was met by 24.7% of the pregnant women (74) but 42.3% failed to meet the RDA and 33% exceeded the RDA. Mean intake (45.6g/day±20.6) was rational in the study (Figure 6). Fat components mean intakes were (14.6g/day±10.4) of saturated fats, (11.7g/day±8.6) of mono-unsaturated fats and (9.7/day±6.4) of poly-unsaturated fats. The mean intake of trans-fats was

(0.13g/day±0.21) which can be accepted as normal. A high percentage of the pregnant women met the recommended upper limit of saturated fats 70% (210), whereas the mean intakes of omega-3 and omega-6 in the study were below RDA (1.4g and 13g respectively). A high percentage of pregnant women did not consume adequate quantities of omega-3 98% (294) and omega-6 98.7% (296). Mean intakes of cholesterol were 206.3mg a minority of the pregnant women exceeding the recommended intake 20% (60). Inconsistency between means of intakes and percentages suggests high variation and heterogeneity in the study pregnant women (Figure 7). There was no significant difference (*P*=0.2) between the mean intakes of fats in the second trimester (44.5g/day) and the third trimester (47.1g/day) (Figure 8).

Figure 3: Mean Protein and amino acids Intakes:

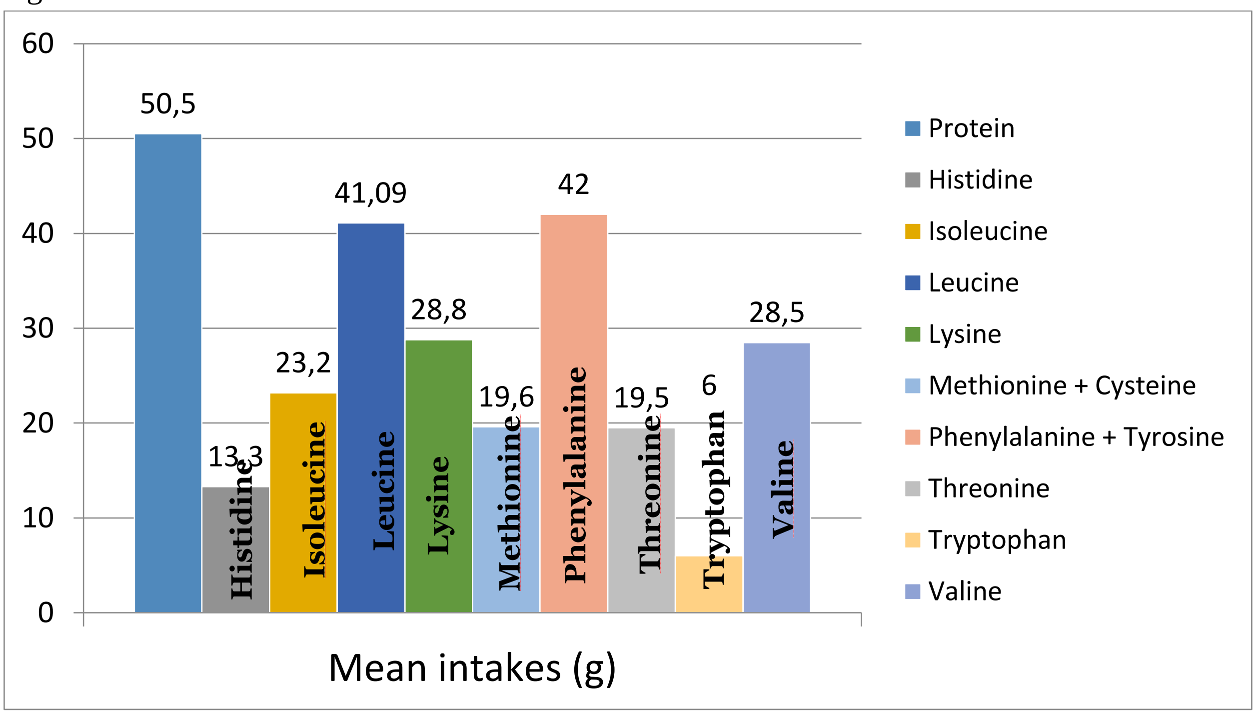


Figure 4: Mean Protein and amino acids Intakes VS Recommended Daily Allowances

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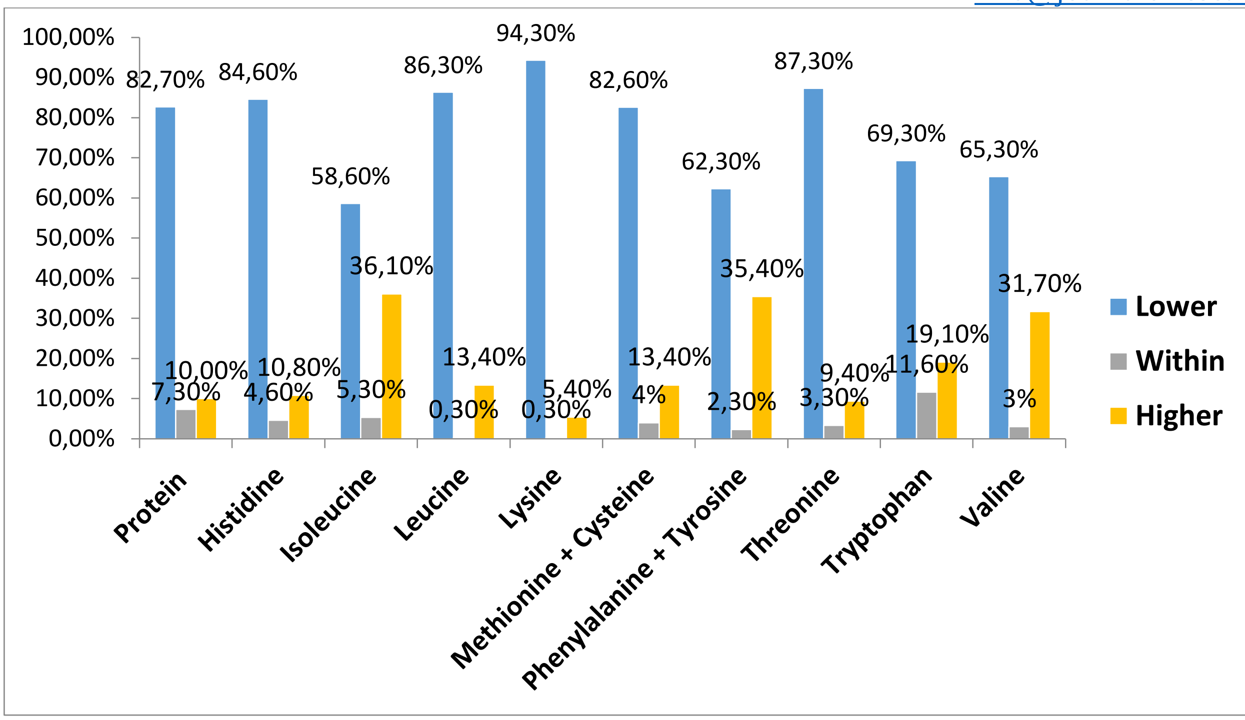

Figure 5: Mean Protein and amino acids Intakes VS Gestational trimester:

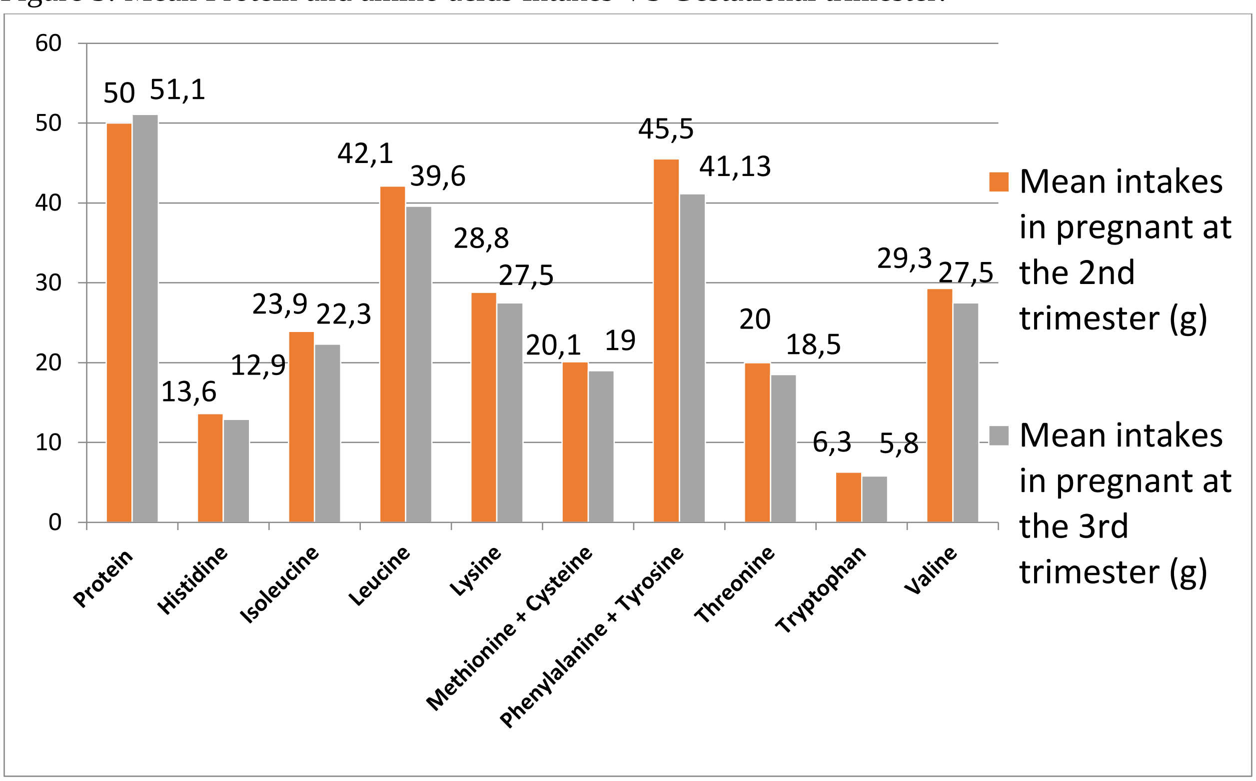

Figure 6: Mean fats and fats component Intakes:

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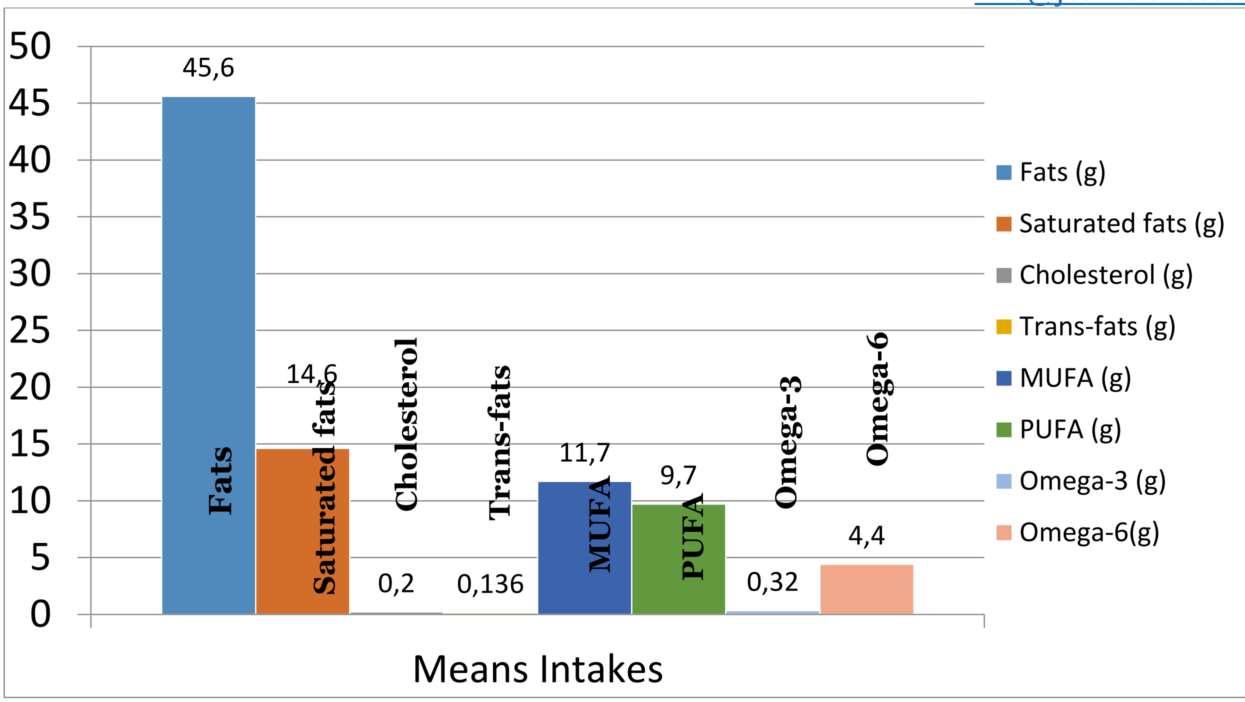

Figure 7: Mean fats and fats component Intakes VS Recommended Daily Allowances:

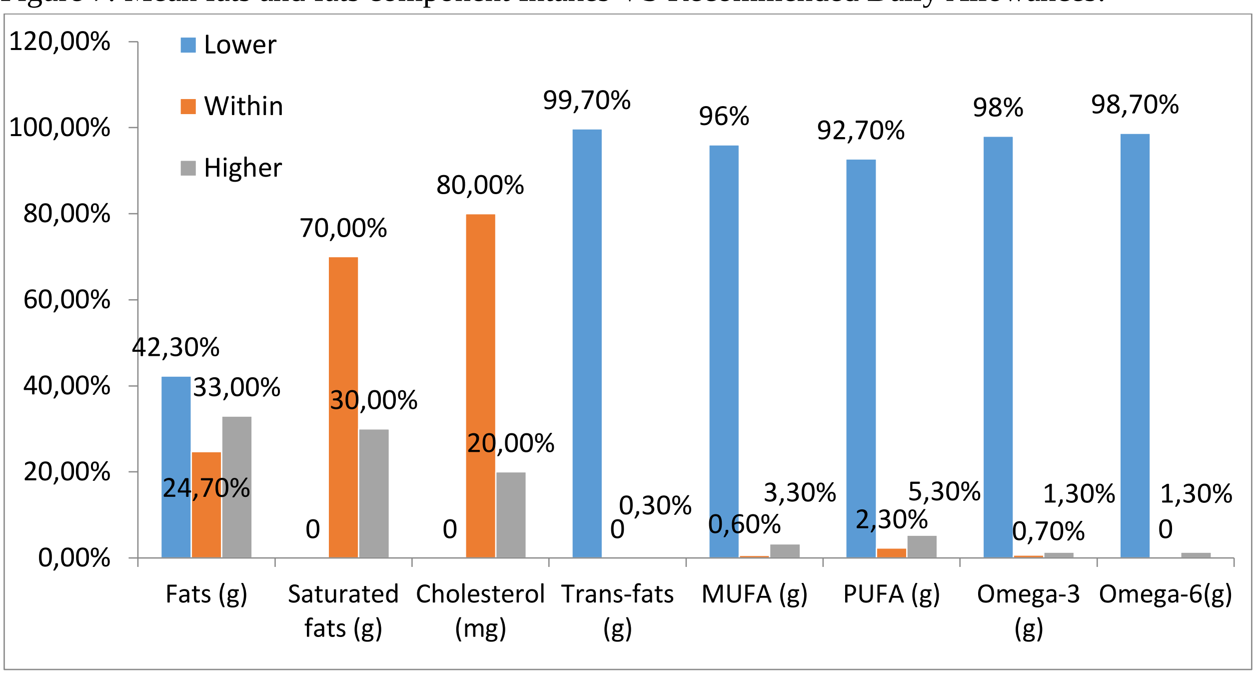

Figure 8: Mean Protein and amino acids Intakes VS Gestational trimester:

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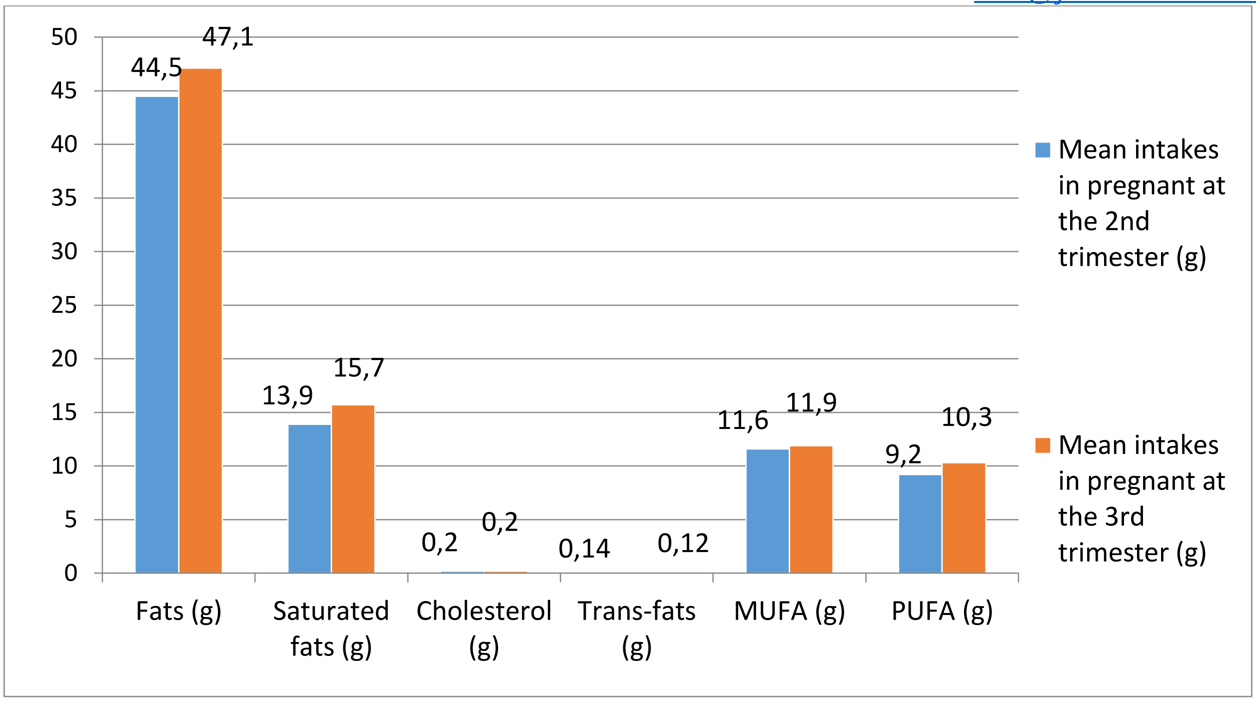

Energy and Macronutrients Correlation to Gestational Weight Gain

Energy, CHO and total fats consumption were directly related to total GWG at $P \leq 0.05$. In contrast, protein intakes were not associated with GWG. The correlation was negative between protein intakes and total GWG Table (3). Saturated fats intakes showed insignificant correlation with GWG (*r*=0.078). Interestingly, fiber intakes showed a significant positive correlation (*r*=0.048) with GWG.

Table (3): Energy and Macronutrients Correlation to Gestational Weight Gain

Macronutrients	Pearson Correlation (*r*)
Energy (kcal)	**0.144***
CHO (g)	**0.135***
Fibers (g)	**0.048***
Protein (g)	-0.028
Fats (g)	**0.140***
Saturated fats (g)	0.078

- Significant correlation.

Micronutrients intakes

Vitamins:

The mean intake of most vitamins was below the DRI. However, the mean intake of B12 was within the range of the RDA (Figure 9 & 10). The intakes of fat soluble vitamins was lower than RDA for vitamin D and K (100 %, 97.7%) respectively, while the intake of vitamin A was higher than the RDA

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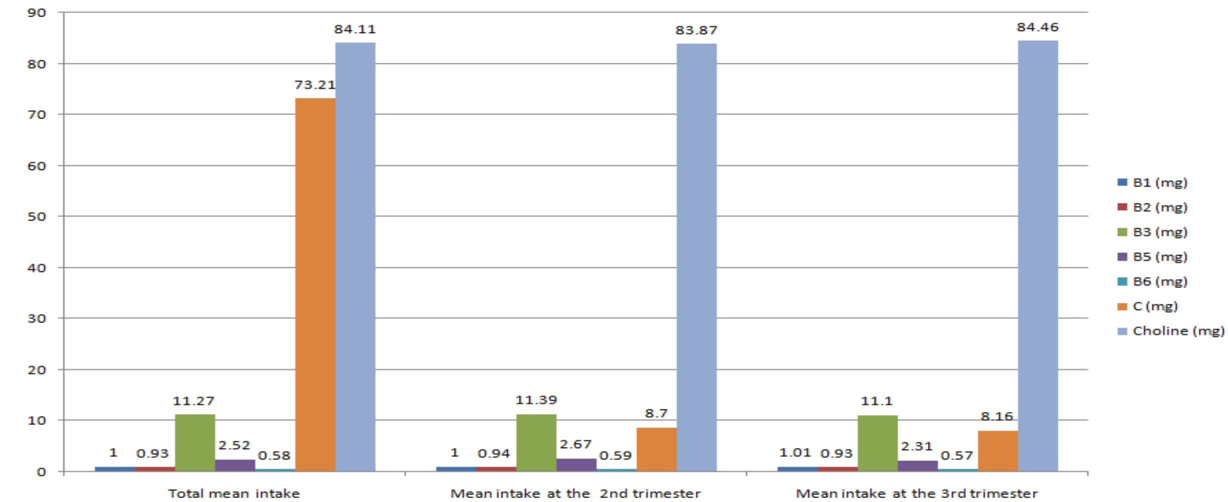
(93.7%) as shown in figure (Figure 11, 12 & 13). Intakes of water soluble vitamins, fat soluble vitamins showed no significant difference between second and third trimesters (p values > 0.05)

Figure 9: Mean **Water Soluble Vitamins:** Intakes and Recommended Daily Allowances:



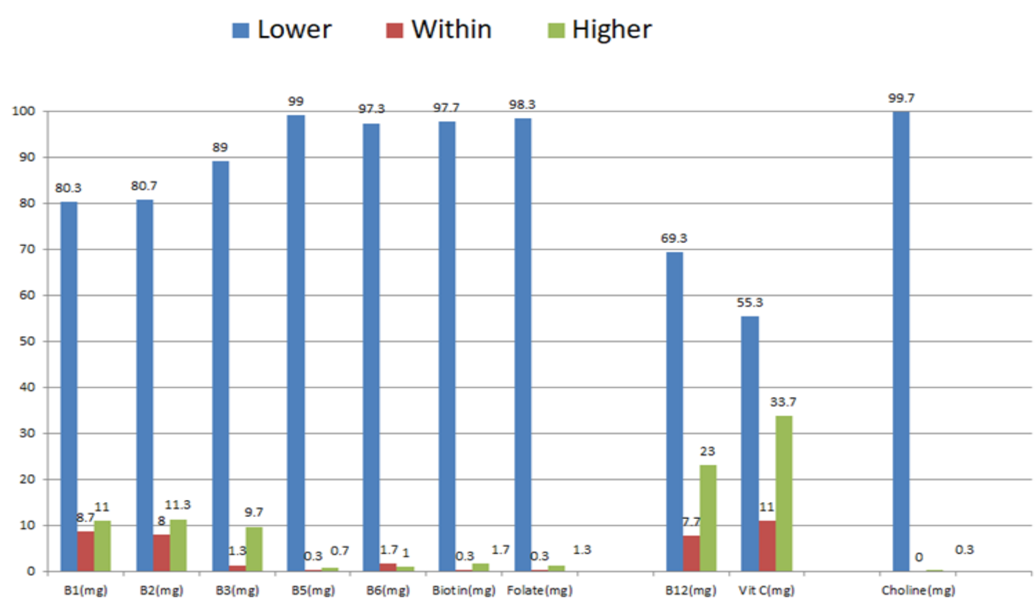


Figure 10: Mean **Water Soluble Vitamins:** Intakes and Recommended Daily Allowances:

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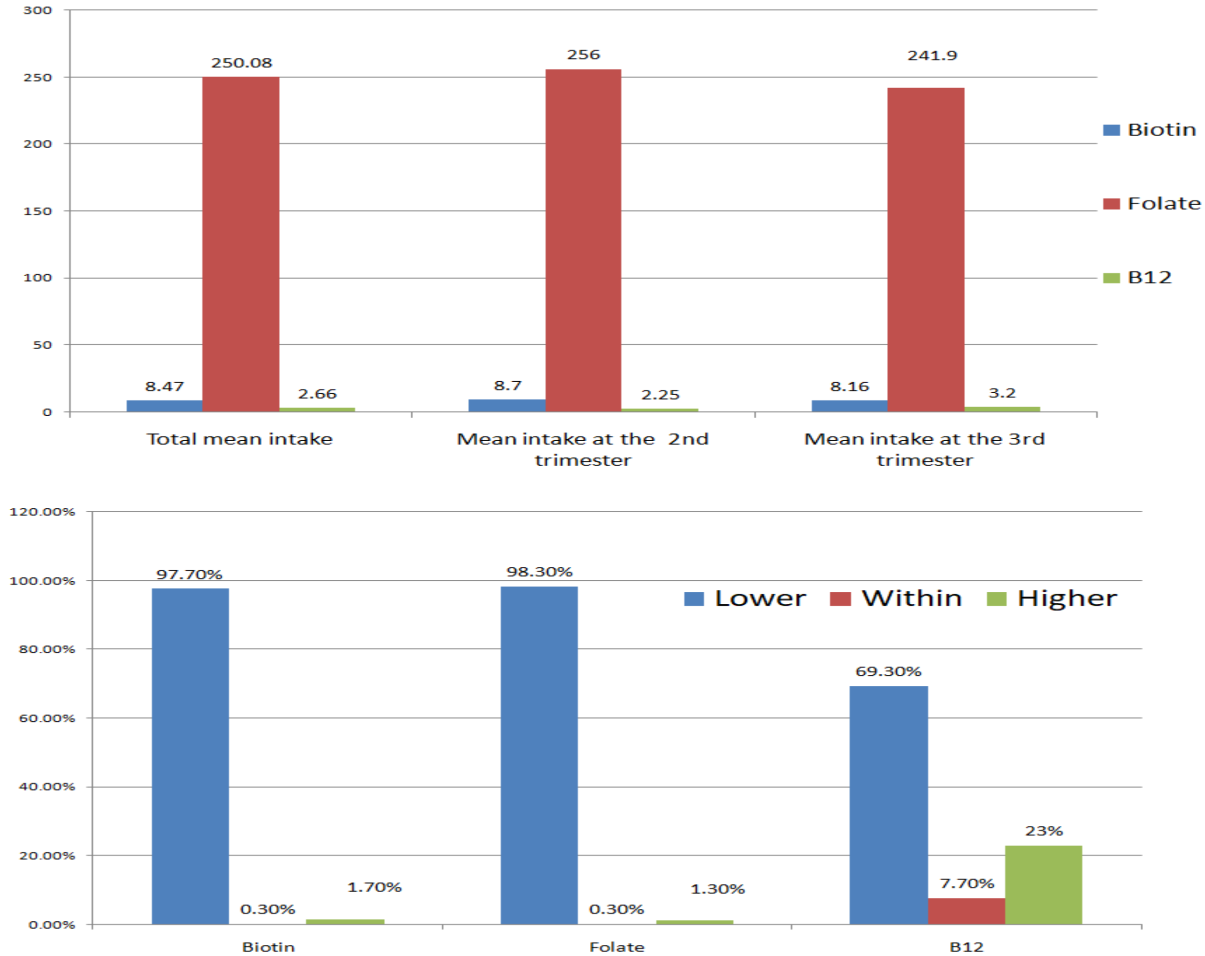

Figure 11: Mean **Vitamin A:** Intakes and Recommended Daily Allowance:

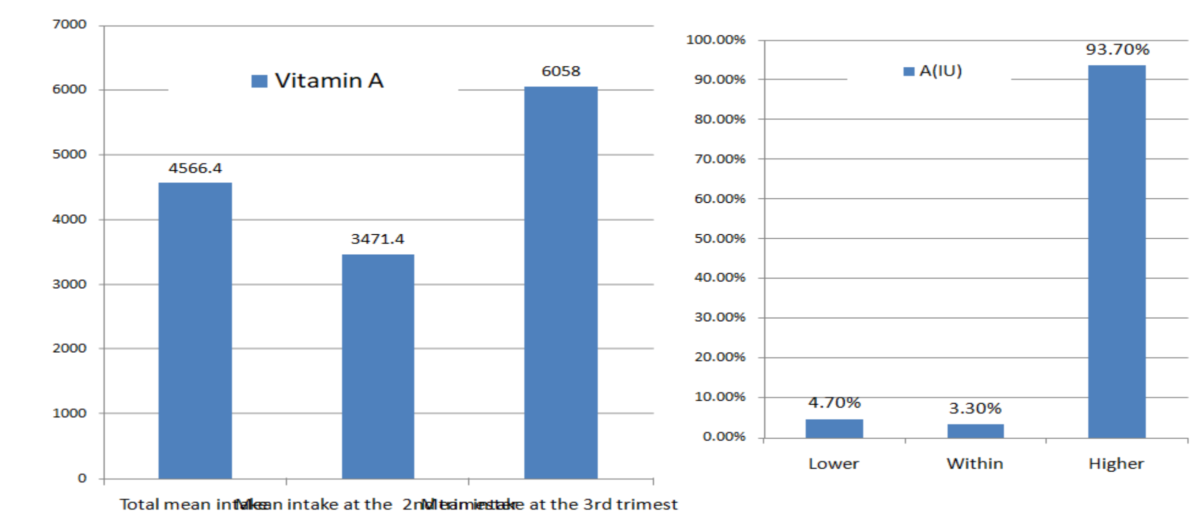

Figure 12: Mean **Vitamins D & K:** Intakes and Recommended Daily Allowances:

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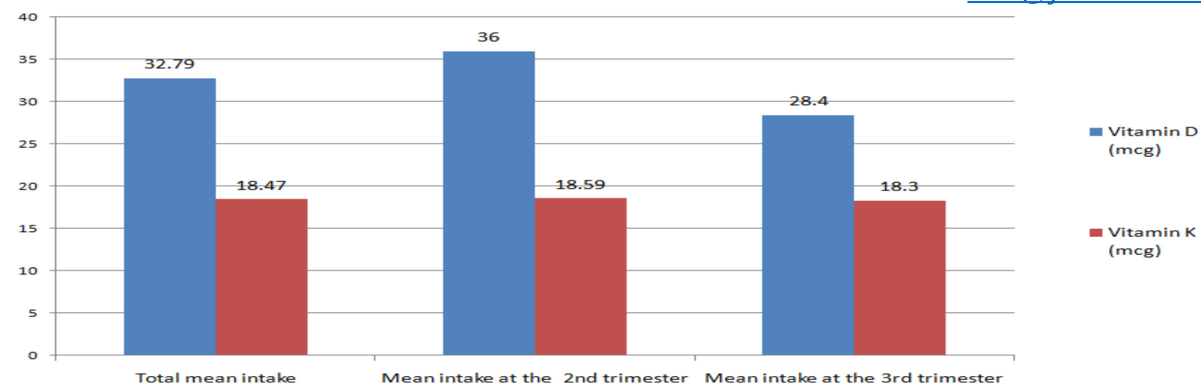


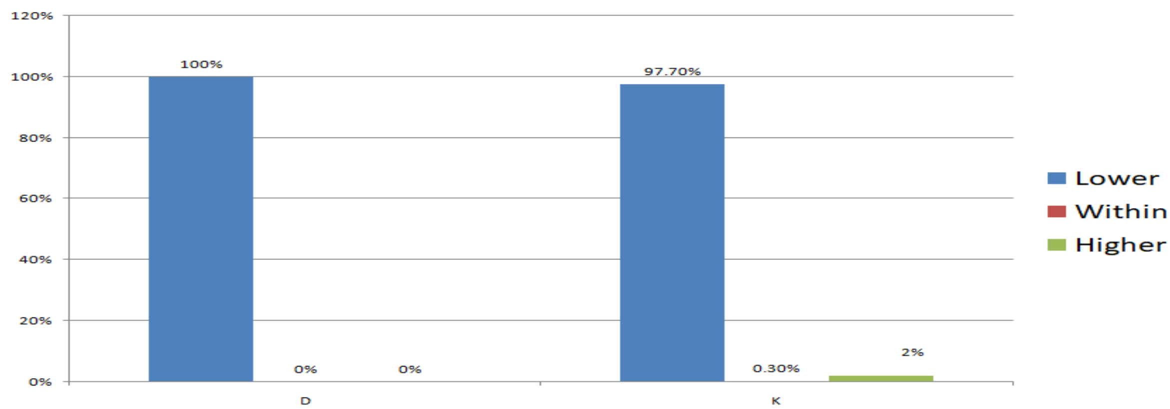
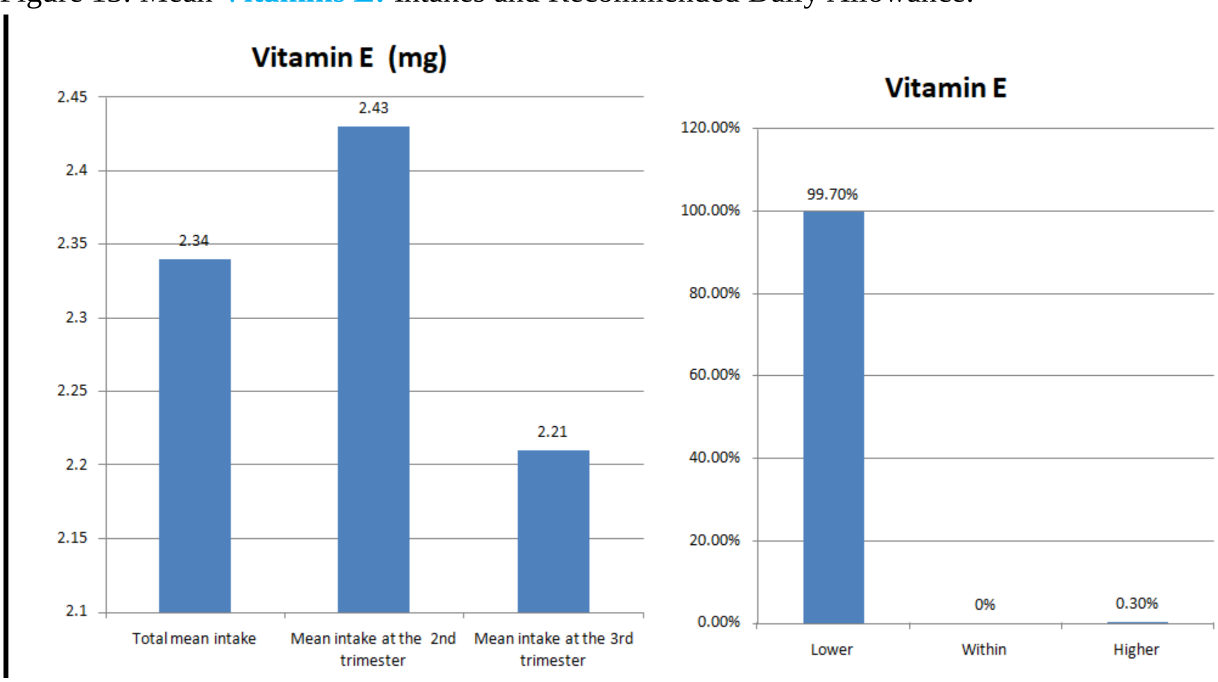


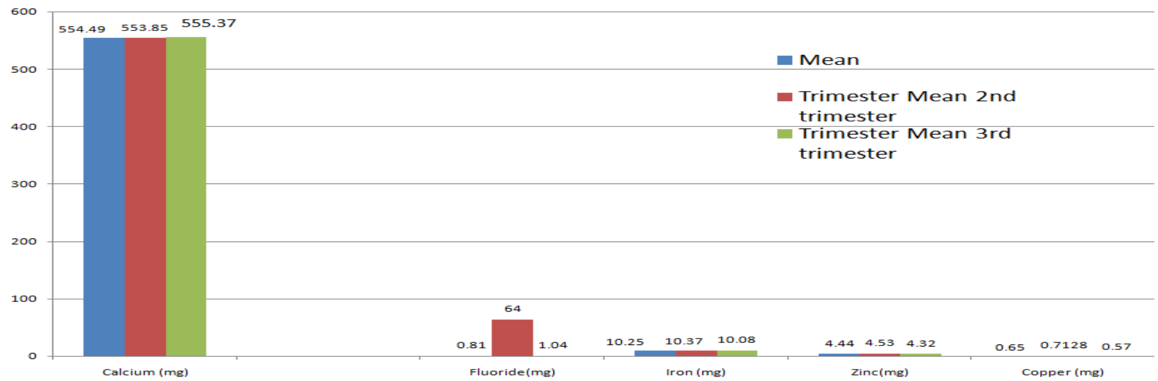
Figure 13: Mean **Vitamins E:** Intakes and Recommended Daily Allowance:



Minerals:

The intakes of major and trace minerals were lower than RDA for calcium, fluoride, iodine, iron, zinc and selenium. While the intakes of Cupper and sodium were higher than RDA as shown in Figures 14, 15 & 16.

Figure 14: Mean **Minerals** Intakes and Recommended Daily Allowances:



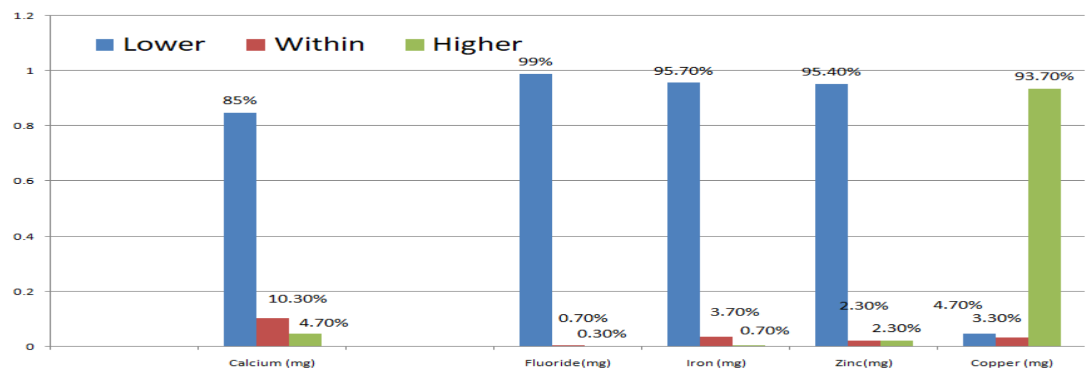


Figure 15: Mean **Sodium** Intakes and Recommended Daily Allowances:

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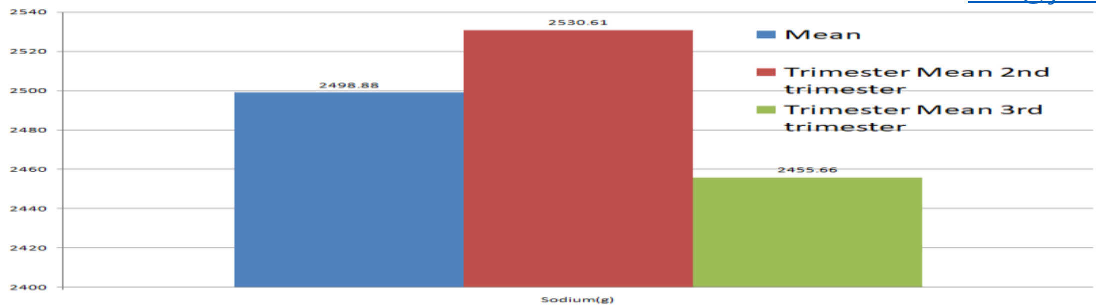


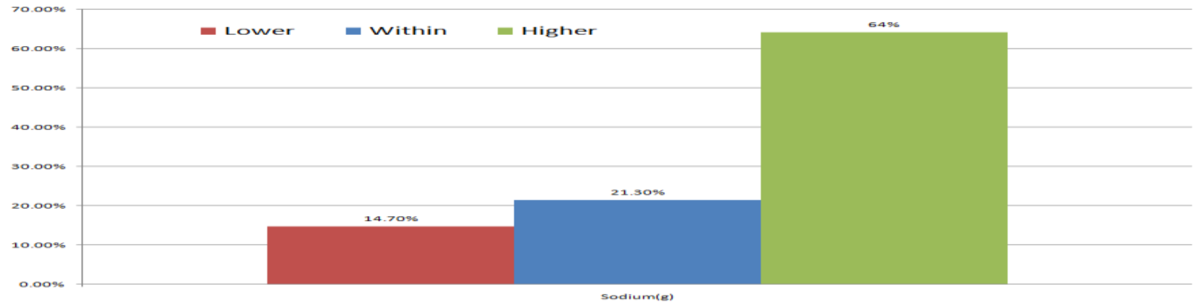
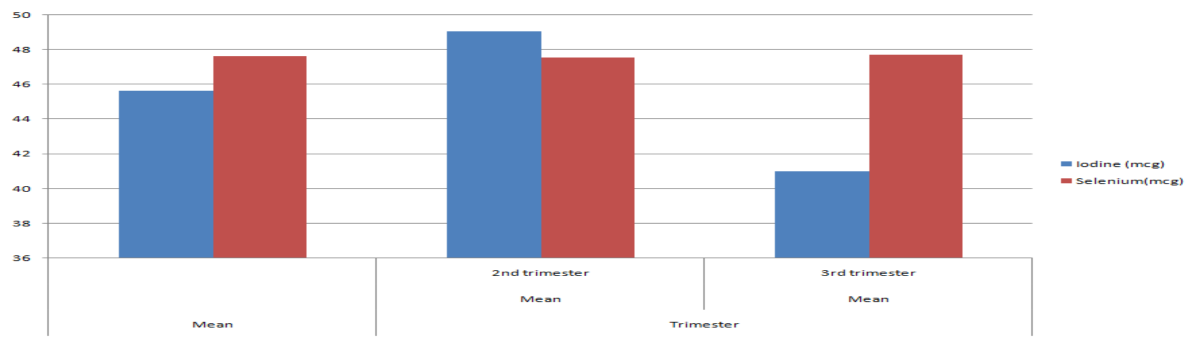
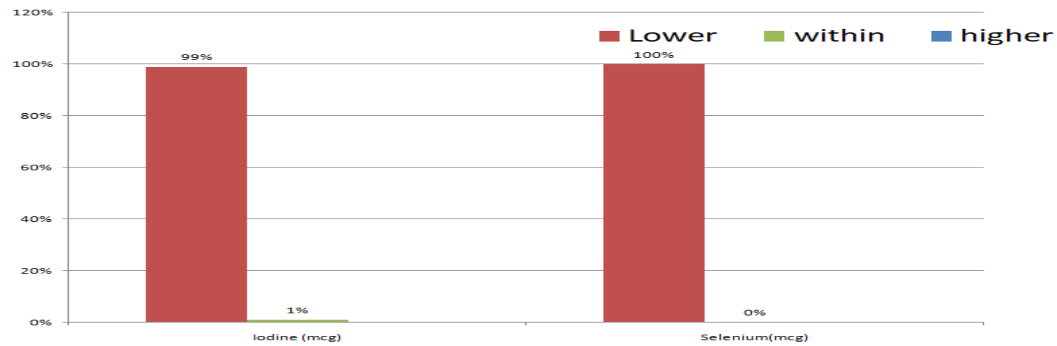
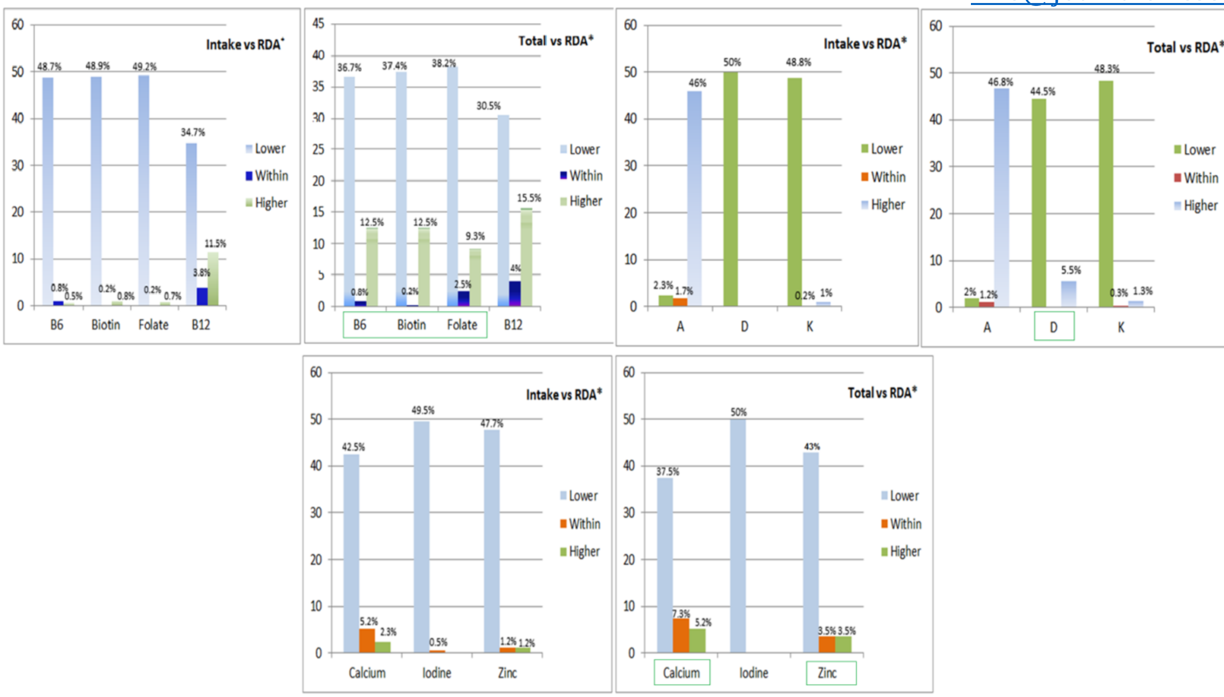


Figure 16: Mean **Iodine and Selenium** Intakes and Recommended Daily Allowances:







Macronutrients Intakes Break Down According to Body Mass Index:

Relations of energy and macronutrients intakes with BMI were assessed in the study (Figure 17). From the results, a significant inverse relation (*P*=0.01*)* was noticed between the reported energy intake and BMI. Higher intakes of energy were reported in lower BMI categories. The same case goes with the CHO and proteins intakes (*P*=0.02) and (*P*=0.01) also. However, no association between fiber intakes and BMI were detected. Intakes of total fats, saturated fats, MUFA and PUFA were reported in higher level within the lower categories of BMI. However, this incident was significant in total fats intakes only.

Figure 17: **Macronutrients Intakes Break Down According to Body Mass Index:**

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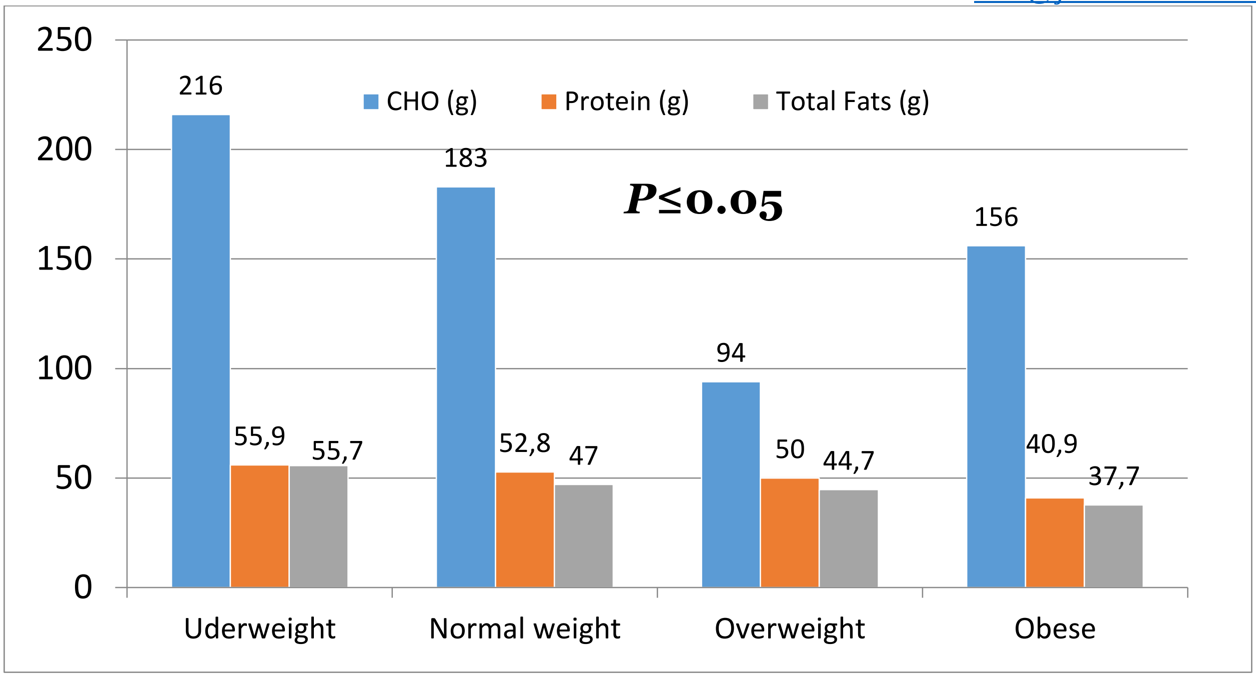

Discussion:

This study assessed dietary intakes intake among a group of pregnant women from food and supplements during second and third trimesters and examining efficacy of micronutrient supplementation in improving micronutrients intake. To the best of the researcher's knowledge, very limited studies have been conducted to assess the nutritional status among pregnant women in Amman since 1993 (Shalbak, 1993).

Mean intakes of CHO were in agreement with the recommended intakes whereas fiber intakes were lower in more than 90% of the pregnant women. Proteins mean intakes were low (50.5 g) in the majority of the pregnant women which can be multi-factorial. High intakes of simple sugar may lead to loss of appetite (Anderson and Woodend, 2003) and resorting to consume the more available and ready to consume CHO sources rather than preparing a better choice of foods.Aversion away from meat source was common in the pregnant woman of this study as many of them stated that they do not consume meat sources. Since the requirements of EAA were set according to the grams of proteins needed, this study indicated low EAA intakes among pregnant women in Amman. Knowing the risk, low animal protein food items among the pregnant women's diet might contribute in lowering the intakes of total fats and saturated fat; mean intakes of the total fats and saturated fats were within recommended intakes. In addition, about 80% of the pregnant women consumed moderate amounts of cholesterol (200 mg), consequently, lowering risk of adiposity in infants, formation of atherosclerosis (Olmos *et al.*, 2018) and metabolic disease in later life according to the results of a study by Shapiro *et al.*, (2017). However, low intakes of omega-3 and omega-6were major characteristics of pregnant women in our study. The researcher suggests that the reasons are due to poor choices of fats sources

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(low food availability and the expensive price of food rich in omega-3 and omega-6or ignorance of the role of omega-3 and omega-6 in fetal development.The intakes of the pregnant women were lower than RDA in all vitamins and minerals, with some exceptions. Noticeably, vitamin A consumption was significantly higher than RDA while fortunately vitamin B12 intakes were adequate due to consumption of organ meat source such as liver, brain, heart and kidney; beef liver contains 24612 IU of vitamin A and 90.05μ g of B12 per 100 g (USDA, 2016). It was noticed that pregnant women in our study had many brand forms for multivitamins as supplement; however, some of these brands were not considered suitable for pregnant use, noting that it's not advised to have supplements of vitamins (A, E and K) during pregnancy (van den Broek et al, 2002; Rumbold et al, 2015). In addition, sodium and copper intakes were also significantly higher than the RDA due to excessive intake of processed food, junk food and bread (Al-Wa'l and Takruri, 2016).

Demographic characteristics of the pregnant women had an effect on energy and macronutrient intakes. CHO, proteins, total fats especially saturated fats intakes were affected by educational level and place of living in Amman. Generally, it was obvious that higher intakes were among pregnant women with higher education and also among pregnant women living in west of Amman. It may be explained by the fact that these categories are affected highly by what is known as a civilized culture and fast foods with high energy density food rich in saturated fats and simple sugars. On the other hand, household monthly income played a role in affecting maternal diet. Higher intakes of total fats, saturated fats and protein intakes were seen among higher monthly income households though it was insignificant. Economic constraints may have led to inability to afford a diversity of food choices; consequently, lowering the dietary intakes of foods such as meat, poultry and fish. Demographic characteristics of the sample had also an effect on intakes of micronutrients. Intakes of B2, B6, B12, Biotin, and iron were affected by educational level. Generally it was obvious that higher intakes were consumed among more educated pregnant women which may be explained by the fact that these categories are affected highly by a more civilized culture (Bärebring et al., 2018). In addition, the intake of vitamin B6 and iron, among other nutrients, were significantly affected by monthly income. Pregnant women with low monthly income had lower B6 and iron intakes when compared with pregnant women higher monthly income.

Intake of the vitamins (B1, B2, B3, B6, D and folate) and the minerals (calcium, iodine, selenium, iron, sodium and zinc) were different according to pregnant women living in different districts in Amman. Those intakes were higher among west Amman due to the fact that they have higher income and can afford to buy different types of high quality food, high consumption of meat products, better knowledge for nutritional requirements and self-care. In addition, according to food groups there were lower intakes of grains, vegetables, fruits, milk, meats and beans compered to recommended values.

Women employment may play a major factor in determining the quantity and quality of food intake, there was a significant relationship between the intakes of choline, selenium and fluoride with employment. Our study showed that the non-employed pregnant women may have had more time to prepare meals and consume higher quantities of choline and selenium, while as employed women who might have less time to take care of their quality of food could depend on fast food consume due to lack of time to prepare homemade meals, which could result with lower amounts of choline and selenium. In addition, fluoride was found to be higher in employed pregnant women, potentially due to consuming higher quantities of coffee and tea during working hours.

When discussing the pre-pregnancy BMI in pregnancy, reporting of intakes showed a trend among the pregnant women whose pre-pregnancy BMI were either low or high. The underweight prior to pregnancy reported higher intakes of macronutrients whereas obese pregnant women prior to pregnancy reported lower intakes. Hence, this raises the question of overestimation and underestimation of intakes caused by fear of being judged for low or high intakes, additionally, the panic of gaining extra weight during pregnancy in overweight and obese pregnant women. Moran *et al.*, (2018) found a significant relation between prevalence of underreporting intakes in overweight/obese pregnant women; it was noticed that overweight and obese pregnant women tends to more under-report food intake than normal weight pregnant women.

Energy and macronutrients intakes between the second and third trimesters showed no significant differences. Lack of knowledge of the nutritional needs and requirements through pregnancy, unawareness of the risks associated with suboptimal nutrition andpoor economic status may have contributed to the negligence of maternal diets, leading to a possible threat of not accommodating the nutrients needs for fetal development and irreversible complications on pregnant women and outcome. Gestational weight gain among the pregnant women was affected significantly by energy, CHO and total fats intakes. A result that agrees with majority of researches (Jebeile, *et al*.,2016) that controlling intakes of energy and macronutrients (recognized as the “energy yielding nutrients”) sustain an optimal GWG. Olafsdottir*et al.*, (2006) investigated dietary factors related to the risk suboptimal or excessive GWG, excessive GWG was among pregnant women who consumed higher energy, CHO, fats and proteins whereas, pregnant who gained suboptimal weight had their energy intakes decreased as pregnancy progressed.

Supplementation is important among pregnant women to recover low micronutrients intake from food. Our study showed that the consumption of micronutrients from food and supplement was relatively low among pregnant women, during second and third trimesters due to the aforementioned factors. It was found that depending on supplement to increase micronutrients intake was not effective because the intake from food was less than recommended even when supplement were used. Hence, such result indicates that effect of the well-being of pregnant women and infants negatively.

Conclusion:

From the collected data and information, we can conclude that the maternal diet in Amman can be considered inadequate and imbalanced, a matter that may impose a danger on the pregnant women. There is more risk of protein-energy malnutrition and fetal growth retardation, which increase the risks of maternal and fetal mortality and morbidity. Mean intakes of CHO intake were relatively high among the majority of the pregnant women whereas fiber intakes were low in more than 90% showing

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hints in probability of chronic and metabolic diseases development in pregnant women and their outcomes. Fortunately, reasonable intakes of total fats and saturated fat ease concerns raised regarding high fats intakes complications such as GM and long term metabolic disease for mother and child including hypertension, obesity and diabetes. However inadequate intakes of omega-3 and omega-6 in the study may affect the neurological and retinal development of the fetus. Micronutrients intake were relatively low among the pregnant woman during second and third trimesters; except for vitamin A and sodium that were found relatively high, while vitamin B12 intakes were found to be adequate. Hence, prenatal care that helps women to identify high micronutrients foods is important for the health of the women and the newborns. The study found that nutritional intake is consistently inadequate, and therefore, activating the role of a nutritionist in the MCHC is important in order to counsel pregnant women to improve nutritional intake. An observation that highlights the importance of nutritional awareness and conducting an active nutrition and health education offices especially in locations characterized with meager income, education and knowledge levels.

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