Comparison of Nutritional Profile of Pregnant and Non-Pregnant Women Attending Antenatal Clinic of Asokoro General Hospital, Abuja

Abstract

Background: Poor nutrition, overweight and obesity are an important risk of birth defects. This study was conducted to compare the nutritional profiles of pregnant and non-pregnant women in Abuja, Nigeria.

Method: The study was a cross-sectional study conducted in Asokoro General Hospital Abuja among 118 pregnant and 58 non-pregnant women aged 18–40 years from July-September 2019. Iintravenous blood (4ml) was collected from each participant into a BD-EDTA vacutainer tubes and 5ml into serum separator tubes. Blood samples were analysed using standard procedures. Data were analysed using IBM-SPSS version 25.0. Descriptive statistics and analysis of Variance (ANOVA) were used to compare the association between variables with $p<0.05$ considered significant.

Results: Mean BMI (Kg/m^2) of non-pregnant women (25.82±4.12) was significantly lower than pregnant women in the first (30.14±6.22), second (29.77±4.03) and third trimesters (29.63±4.54), ($P<0.05$). Iron (µmol/l) level of control subjects (12.09±3.69) was significantly lower than the second trimester (13.65±2.82) pregnant women ($P<0.05$). The protein level (µmoll/l) in the non-pregnant women (72.09±3.38) was significantly higher than in pregnant women at the first (69.45±4.50), second (63.79±3.48) and third trimester (67.96±4.01) ($P>0.05$). The difference between zinc levels in non-pregnant women (20.49±2.11) and pregnant women at second (21.79±1.57) and third trimesters (21.94±1.49) was significant ($P<0.05$). Transferrin levels in the non-pregnant women (16.25±2.11) was lower than that of pregnant women.

Conclusion: Some nutritional contents of the women were adequate while some were either inadequate or reduced. A balanced diet is recommended for pregnant women to enable them to attain balanced nutritional profiles.

Keywords: Nutrition, Body Mass Index, Pregnant women, iron deficiency

Introduction

Nutrition, which is food consumption, is described in regards to the dietary requirements of the body. A nutritious diet and a daily exercise schedule are good for health and the body, particularly while in the pregnancy (WHO, 2018). A poor diet can lead to decreased immunity, a reduced ability to adapt to illness, lower physical and mental ability, and weakened ability to function (WHO, 2018). Studies now indicate that a woman's eating patterns before conception, as well as when pregnant can significantly affect both mother and child (Caut et al., 2020; H. S. Lee, 2015; Savard et al., 2020).

During pregnancy, it is highly crucial to get a balanced diet with foods like fish and nuts to ensure optimal foetal development and both mothers and baby's wellbeing (Liu et al., 2015). A good diet in the first 1000 days can be very crucial for the growth and development of a child and efficiency during early adulthood (Victora et al., 2008). As one of the most important problems in all of the women's wellbeing, fulfilling dietary requirements during pregnancy (nutritional needs) is widely researched. Studies have shown that pregnant women generally pay more attention to their nutritional intake than their non-pregnant counterparts (Beulen et al., 2020; Kobati, 2012; Onur, 2017). Also, in developed countries, nutritional consumption among pregnant women is considerably better than among women in developing countries (Ademuyiwa et al., 2020; Lee et al., 2013; Liu et al., 2015; Lundqvist et al., 2014).

A poor diet can lead to adverse health effects during pregnancy such as anaemia, macrosomia, premature delivery, and stillbirth (WHO, 2016). Diet associated illnesses like overweight, metabolic disorders, and hypertension; and widespread systemic chronic diseases like heart attacks, diabetes, and osteoporosis (Meija & Rezeberga, 2017). Poor dietary will cause wasting like kwashiorkor in acute cases and stunting in chronic cases of malnutrition (Lewis, 2014).

Methodology

Study location

The study was conducted in Asokoro General Hospital Abuja among pregnant and non-pregnant women aged 18 – 40 years from July to September 2018. Abuja is ranked 4th among the top Nigerian cities with the highest population with an estimated population of 3,292,995 in 2020 (PopultationStat, 2021).

Study design and population

The study is a cross-sectional, observational study and the study population comprised pregnant women aged 18 – 40 years attending Antenatal Clinic (ANC) of Asokoro General Hospital, FCT, Abuja.

The sample size was determined using the Statistical formula:

$$n = \frac{Z^2\ p\ q}{d^2}$$ As described by Armitage and Berry, (1987).

Where: n= Sample Size; p = Literature prevalence rate of attribute in proportion =13%=0.13.

e= Error margin accepted =5%=0.05.

$$n = \frac{1.96^2 \times 0.13(1-0.13)}{0.05^2} = 174$$

The minimum sample size was calculated as 174 though the study comprised 176 participants (118 pregnant and 58 non-pregnant women).

Ethical issues:

Before the study was conducted, ethical approval was obtained from the ethical committee of FCT Human Research Ethical Committee (HREC), Abuja with approval number FHREC/2019/01/56/20-15-19. Inclusion criteria include pregnant women aged 18 to 40 years who gave their consents to participate in the study and while exclusion criteria include those who did not consent, not within age 18 to 40 years and those that were sick.

Sample collection

Four millimetres (4ml) of intravenous blood was collected from each study participant into a BD EDTA vacutainer tubes and 5ml into serum separator tubes. All blood samples were labelled with only three-digit numbers.

Sample Processing

After collection, all specimens were processed within 6 hours of collection using good laboratory practices and strict safety precautions in Defence Reference Laboratory: Iron was assayed by Colorimetric method with chromazurol. The assay was carried out on Selectra Pro S machine using Giesse Diagnostics kit, made in Italy. Serum Ferritin was measured using a human ferritin enzyme immunoassay method by Walters et al. (1973). The kit was intermedial, Italy. The ferritin quantitative test was based on a solid phase enzyme-linked immunosorbent assay (ELISA). The assay was carried out on an ELISA machine (ELx405 and ELx808, Bio Tek, USA). Protein was determined using the Biuret colourimetry method by Vassault et al. (1986). It was assayed using Selectra Pro S automated chemistry analyser, manufactured by Vital Scientific, Netherlands. Using Giessen Diagnostic kit made in Italy. Albumin was determined using Bromo Cresol Green (BCG) colourimetry method by Westgard & Poquette (1972). It was assayed using Selectra Pro S automated chemistry analyser, manufactured by Vital Scientific, Netherlands. Test procedures were carried out in accordance with the manufacturer's instruction.

Statistical Analysis:

All statistical analyses were carried out using Statistical Package for Social Sciences (SPSS) for windows version 25.0. Descriptive statistics which include mean, standard deviation, and percentages were computed for the measurement of results obtained. Analysis of Variance (ANOVA) was used to compare the association between variables. Associations with $p<0.05$ were considered significant.

Results

Demographic Characteristics of the Study Population

Table 1 shows the demographic characteristics of the study population. A total of 176 participants were recruited for this study, One hundred and eighteen 118 (67.0%) pregnant women 58 (33.0%) controls. The mean age was 28.75±5.2 with more than half (52.9%) within age 20 – 29 years, 42.5% were within age 30 – 39 years and almost half (45.5%) had 0-1 parity.

Table 1: Demographic Characteristics of The Study Population

Participant	No	Percentage
Pregnant Women	118	67.0
Non-Pregnant Women	58	33.0
Total	**176**	**100**
Trimesters		
First Trimesters	22	18.6
Second Trimester	52	44.1
Third Trimester	44	37.3
Total	**118**	**100**
Ages (Years)		
<20	4	2.3
20-29	93	52.9
30-39	75	42.5
>40	4	2.3
Total	**176**	**100**
Parity		
0-1	81	45.5
2	34	19.3

3	27	16.3
4	24	14.6
5	5	3.8
6	1	0.5
Total	**172**	**100**

BMI and some Nutritional profiles of pregnant women and their control counterparts in the studied population

Table 2 shows that Body Mass Index (BMI in Kg/m^2) of non-pregnant women (25.82±4.12) were significantly lower than those of pregnant women at the first trimester (30.14±6.22), second trimester (29.77±4.03) and third trimesters (29.63±4.54), (P<0.05). The difference between the BMI of pregnant women at first, second and third trimesters is not significant (P>0.05). For Iron (µmol/l), the difference between control subjects (12.09±3.69) and the pregnant women at the second trimester (13.65±2.82) was significant (P<0.05). The iron level of the pregnant women at the second trimester was raised after the first trimester and fell in the third trimester but the differences were not significant (P>0.05). The ferritin level (ng/ml) in pregnant women was highest at the first trimester (38.50±25.79) and decreases as the pregnancy progresses. The ferritin level at first trimester (38.50±25.79) was significantly higher than the second trimester (24.19±18.17) and third trimester (24.25±21.80) (P<0.05). The difference between the UIBC in µmol/l of the control subjects (65.55±16.79) was significantly higher than that of the pregnant women at the second trimester (51.86±11.96) and third trimesters (53.47±14.29) (P<0.05) but the difference between UIBC of the pregnant women at the first, second and third trimesters were not significance (P>0.05). The total iron-binding capacity (TIBC) (µmol/l) of the non-pregnant women (77.71±19.86) was significantly higher than the TIBC of pregnant women at the second trimester (63.89±13.72) and third trimester (62.30±13.05) (P<0.05) but not significant (P>0.05) with the pregnant women at the first trimester (71.71±11.97). The protein level (µmoll/l) in the non-pregnant women (72.09±3.38) was significantly higher than that of pregnant women at the first trimesters (69.45±4.50), second trimesters (63.79±3.48) and third trimester (67.96±4.01) (P>0.05). Albumin level (µmol/l) in the non-pregnant women (41.86±2.23) was significantly higher (P<0.05) than those of the pregnant women at first trimester (38.79±2.55), second trimester (35.86±1.68), and third trimester (35.15±1.65). Likewise, the difference between the albumin level in the first trimester (38.79±2.55), the second trimester (35.86±1.68) and third trimester

(35.15±1.65) were significantly lower than the control (41.86±2.23) (P<0.05). However, the difference between the second and third trimester was not significant (P>0.05). The Zinc (µmol/l) levels of non-pregnant women (20.49±2.11) were lower than that of the pregnant women, although the difference between the non-pregnant women and the pregnant women at the first trimester (20.61±4.06) was not statistically significant (P>0.05). The difference between zinc levels in non-pregnant women (20.49±2.11) and pregnant women at second trimester (21.79±1.57) and third trimester (21.94±1.49) was significant (P<0.05). Zinc levels in pregnant women increases as the pregnancy increases as second and third trimesters were significantly higher than the first trimester but this was not statistically significant (P<0.05). Transferrin levels in percentages, in the non-pregnant women (16.25±2.11), is lower than that of pregnant women. The difference between transferrin levels at all stages of pregnancy was not significant (P>0.05).

Table 3: BMI and some Nutritional profiles of pregnant women and their control counterparts in the studied population

Variable	Non-Pregnant Women (n=58)	First Trimester (n=22)	Second Trimester (n=52)	Third Trimester (n=44)	F-value	P-Value
BMI(Kg/m^2)	25.82±4.12[a]	30.14±6.22[a]	29.77±4.03[a]	29.63±4.54 [a]	10.09	0.0001[*]
Iron(µmol/l)	12.09±3.69 [a]	13.01±3.05	13.92±3.46 [a]	13.65±2.82	3.206	0.0246*
Ferritin(ng/ml)	32.93±29.05	38.50±25.79[b]	24.19±18.17[b]	24.25±21.80[b]	2.928	0.0352*
UIBC(µmol/l)	65.55±16.79 [a]	59.41±11.10	51.86±11.96 [a]	53.47±14.29 [a]	10.23	0.0001*
TIBC(µmol/l)	77.71±19.86	71.71±11.97	63.89±13.72	62.30±13.05	10.66	0.0001*
Protein(µmol/l)	72.09±3.38	69.45±4.50	63.79±3.48	67.96±4.01	12.22	0.0001*
Albumin(µmol/l)	41.86±2.23 [a]	38.79±2.55 [a]	35.86±1.68 [a]	[b]35.15±1.65 [ab]	[b]123.80	0.0001*
Zinc(µmol/l)	20.49±2.11[ab]	20.61±4.06[b]	21.79±1.57 [ab]	21.94±1.49 [ab]	5.468	0.0010*
Transferin(%)	16.25±6.83	17.20±6.83	18.19±7.47	17.17±7.81	0.6500	0.5840

Key:*Statistically significant difference between pregnant and non-pregnant women at P≤0.05; a= significant between non-pregnant, pregnant women and at different trimesters at P≤0.05; b=significant between 1st and other trimesters at P≤0.05; BMI= Body Mass Index, UIBC-Unsaturated Iron Binding Capacity, TIBC-Total Iron Binding Capacity.

Discussion

Pregnancy is a complex physiological process with many physiological changes as seen in some haematological parameters, BMI and some nutritional status. This study compared the nutritional profile and the BMI of pregnant and non-pregnant women attending antenatal clinic of Asokoro general hospital, Abuja, Nigeria. The study found that the mean BMI of the pregnant women was significantly higher than that of pregnant women. The BMI of pregnant women in this study was raised in the first trimester and slightly declined in the second and third trimesters. The finding shows that the majority of the women were either overweight or obese, especially in the first trimester. This is an issue of concern and requires interventions as studies have revealed that obesity (MBI>30) and maternal overweight (BMI-25 – 29.9) are risk factors of birth defects (Glinoer, 2006; Yazdani et al., 2012). A study conducted by Centres for Disease Control and Prevention (CDC) revealed that the risk of birth defect is higher among women who were overweight during pregnancy and the risk is tripled if the women were obese before conception (CDC, 2019).

Mean iron level of pregnant women in this study was significantly higher than non-pregnant women, regardless of the trimester but significantly higher in the second trimester than the control. On the other hand, the ferritin level of non-pregnant women was significantly higher than that of pregnant women in the second and third trimesters. However, ferritin level was very high in the first trimester (38.50±25.79) and drastically dropped in the second and third trimesters. Unsaturated Iron Binding Capacity (UIBC) and Total Iron Binding Capacity (TIBC) were significantly higher in non-pregnant women as compared to pregnant women. This decrease persisted as the trimesters increased. Higher levels of iron recorded in this study is an indication of sufficient intake of certain group of food such as dietary iron commonly found in vegetables (Caut et al., 2020) and this should be sustained. This finding is different from what was obtained in some previous studies which reported inadequate iron intake among pregnant women (Gao et al., 2013; Okubo et al., 2011). Higher iron levels reported among pregnant women in this study might be due to a higher level of awareness for pregnant women at antenatal clinics. Studies have suggested that women must maintain normal plasma ferritin level before conception and during pregnancy (Meija & Rezeberga, 2017; Serbesa & Iffa, 2018). In addition to low haemoglobin, low serum ferritin (<30 mg/L) has been considered a sign of iron deficiency anaemia (Serbesa & Iffa, 2018), which implies that the majority of second and third trimesters pregnant women in this study were anaemic since their ferritin levels were less than 25 mg/L. It is, therefore, necessary for pregnant women to eat foods such as cereal, lean meats, nuts, beans, lentils, vegetables, etc on regular basis to boost their nutritional profiles.

Mean protein level of non-pregnant women was significantly higher than pregnant women ($p<0.001$) and the minimum was observed in the second trimester. Similar to protein levels, albumin level dropped significantly in pregnancy and persisted till the third trimester as compared to non-pregnant women. Unlike the lower protein level seen in pregnant women in this study, a similar study conducted in Rivers State, Nigeria found a significantly higher protein in pregnant women as compared to non-pregnant women (Ibeh et al., 2006). However, this study reported a similar trend of decline in protein level with an increase in gestation periods. Another study conducted in Turkey found a similar result that protein level was in pregnant women as compared to non-pregnant women (Onur, 2017). Studies have associated failure to meet the required protein level as the body undergoes metabolic changes during pregnancy results in maternal weight loss and anaemia (Elango & Ball, 2016; Onur, 2017). The finding of this study showed the need for regular intake of protein-rich foods such as meat, fish and eggs in pregnancy since pregnant women need additional protein (Verbeke & De Bourdeaudhuij, 2007).

Zinc and transferrin increased as the trimesters increased compared to non-pregnant women though the rate of increase in transferrin was not statistically significant. The zinc level obtained in both pregnant and non-pregnant women in this study was higher than the recommended daily allowance of 11 mg/day and increased from 20.49 ± 2.11 in non-pregnant women to 21.94 ± 1.49 in the third trimester. Studies have emphasized the importance of zinc during pregnancy for the role of immune system development and foetal organ formation (Glinoer, 2006; Meija & Rezeberga, 2017; Savard et al., 2020).

Conclusion

This study found that the majority of pregnant women in Abuja, Nigeria was either overweight or obese. Some nutritional contents (iron, zinc and transferrin) of the women were adequate while some were either inadequate or reduced (protein, Unsaturated Iron Binding Capacity, Total Iron Binding Capacity, and albumin). Balanced diet is recommended for pregnant women to enable them attain balanced nutritional profiles.

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