Nutritional Status and Dietary Diversity among Fertility Impaired Women in Ibadan, Nigeria .

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ABSTRACT

Background: Excess weight gain and poor dietary intake pose adverse effects on health and productivity of women of reproductive age.

Objective: The study assessed association between nutritional status, dietary diversity and fertility.

Methods: Study design was cross sectional, carried out among 210 fertility-impaired women who attended gynaecological clinics of University College Hospital and Adeoyo Maternity Hospital, Ibadan, Oyo State, Nigeria. A semi-structured interviewer administered questionnaire and adapted Dietary diversity Questionnaire was developed to determine respondents' socio-demographic characteristics and dietary diversification respectively. Height (m), weight (kg) and body fat (%) were measured. Data collected were analysed by Statistical Package for Social Science (SPSS) version 21.0. Descriptive and inferential statistics were performed. Association of variables was determined by chi-square having $p<0.05$.

Results: More than half (53.3%) of respondents were within 30-39 years. Monthly average income was ₦30,000 ($187.5). Prevalence of overweight, obesity, secondary infertility, primary infertility and sexually transmitted infections (STI) was 40.5%, 32.8%, 55.5%, 44.5% and 28.5% respectively. Only 38.6% had experienced infertility beyond five years. Highly diverse diets were consumed by only 51.0% of respondents. Fruits and vegetable, organ meat, eggs, milk and milk products, meat and fish were not poorly consumed. Infertility was associated with increased Body Mass Index (p=0.042), Sexually Transmitted Infections (STI) (p=0.000), age (p=0.000), religion (p=0.020), occupation (p=0.003) and monthly income (p=0.036) were significantly associated with infertility.

Conclusion: Majority of infertile women in this study were overweight, obese, and physically inactive, experienced abdominal adiposity and secondary infertility.

Keywords: Overweight, Obesity, Diet, Infertility, Women

INTRODUCTION

Overweight and obesity are increasing at alarming rate in the world especially in Sub-Saharan African countries with resulting health conditions (1, 2, 3, 4). Currently in the world, more than 1.9 billion adults 18 years and older are overweight and over 650 million were obese (5). While in Nigeria 8.1% - 22.2% of adults are overweight and obese (6). According to the World Health Organisation, 2.8 million deaths and 35.8 million of global disability-adjusted life years (DALYs) were attributed to overweight and obesity combined (7) and the World Obesity Federation opined that if the trend of overweight/obesity continues unaddressed, 2.7 billion adults will be overweight and over 1 billion affected by obesity by 2025 (8).

Excess weight gain is diet-related resulting from excess calorie intake and low physical activity (5, 6, 9). Poor diet quality and excess energy intake can negatively affect body weight and increase burden of major chronic diseases such as cardiovascular diseases, diabetes mellitus and various types of cancer (10). However, consuming varieties of foods promotes adequate intake of macronutrient and micronutrients, nutrient adequacy and diet quality among individuals and

households (11, 12, 13, 14).

Infertility has been defined as inability of a woman to conceive after twelve or more months of attempts of natural fertilization (15). Women who experienced primary infertility have never conceived while secondary infertility means a woman had had at least one conception in the past but fails to repeat (16). According to the World Health Organization, prevalence of overweight/obesity seems higher among women than men of the same age (5), and excess weight gain poses serious burdens such as reproductive disorders, anovulation, menstrual disorders, infertility, difficulties in assisted reproduction, miscarriage and adverse pregnancy outcomes among women of reproductive age (17). The inability of a couple to conceive following 12 to 24 months of regular intercourse is known as infertility (18). Infertility is affecting 8.0-15% couples worldwide and female factors contribute 30-40% of the case (19). Up to 50-80 million of women all over the world are currently experiencing infertility and with variable instances, there is possibility of prevailing infertility to be experienced by about 50% of women of reproductive age in the world (20). Infertility is a very sensitive issue and a source of stigma in the society especially in Africa where inability to have a child is perceived as a curse (21, 22). Although prevalence of infertility varies globally there is greater proportion in Africa including Nigeria (23). This study focused on assessing nutritional status, dietary diversity and nature of fertility among fertility-impaired women attending selected hospitals in Ibadan, Oyo State, Nigeria.

MATERIALS AND METHODS

Study design
This study was a descriptive and cross-sectional study.

Study Area
The study was conducted at the gynaecological clinics of the University College Hospital and Adeoyo Maternity Hospital, Ibadan, Oyo State, Nigeria. University College Hospital, Ibadan is a teaching hospital established 1952 with the aim of training medical personnel, other healthcare professionals and to provide healthcare for the populace in Nigeria and the West African Sub-region. Adeoyo Maternity Hospital, Ibadan is a large general hospital established in 1928. It was formerly used as college hospital by the then University of Ibadan before establishment of University College Hospital, Ibadan. Adeoyo Hospital provides maternal and child healthcare services to people in Ibadan and its surrounding.

Study population
Women of reproductive age within 15-49 years who attended the infertility clinics of the University College Hospital and Adeoyo Maternity Hospital, Ibadan and gave their informed consents were randomly selected for the study.

Sample size calculation
The sample size was determined based on the formula for single population proportion.

$$N = \frac{Z^2 (p)(1-P)}{E^2}$$

Where Z is z score associated with confidence level required,
E is the required precision,
P is the occurrence rate within the population.
N is sample size.
Z score for 95% confidence level is 1.96,
P= 33%; =0.33;
1-P = 0.67; E= 0.1

$$N = \frac{(1.96)^2 (0.33)(0.67)}{(0.0651)^2}$$

$$\frac{0.84937176}{= 0.00423801}$$

$$= 200.417592 \approx 200.$$

This was rounded up to 210, to make up for natural attrition.

Data Collection Procedure
A semi-structured interviewer administered questionnaire was developed to obtain respondents' socio-demographic characteristics, lifestyle and medical history. Dietary diversity questionnaire was used to assess respondents' dietary diversification. Height (m), weight (kg) and body fat (%) were measured by stadiometer and Omron body composition monitor BF500. A non-stretchable tape rule was used to measure respondents' waist and hip circumferences (cm).

Respondents' Body Mass Index (BMI) was calculated by dividing weight (kg) by height squared (m²). Their nutritional status was defined as underweight (BMI < 18.5 kg/ m²), normal (BMI 18.5–24.9 kg/m²), overweight (BMI 25.0–29.9

kg/m^2) and obese (BMI ≥30.0 kg/m^2) (24). Waist circumference was measured to the nearest one millimetre using a non-stretchable measuring tape, with the individual standing relaxed in a single layer of clothing, at the smallest diameter between the xiphisternum and the umbilicus on normal expiration (25). The value of ≤80cm was considered as normal for women. Waist-to-hip ratio was calculated as circumference of the waist (cm) divided by the circumference of the hip (cm). Cut-off point values for abdominal obesity for women were >0.85 (26). Dietary diversity scores were categorised into low, medium and high. Score of ≤3.0 points was considered low. Score of 4.0-5.0 points was considered medium and score of ≥ 6.0 points was considered high. Fertility was categorised into two; primary infertility and Secondary infertility. Primary infertility was defined as a condition in which a woman has never being able to carry a pregnancy or giving birth to a live baby. Secondary infertility is a condition in which a woman is unable to carry a pregnancy or giving birth to a live baby after having previously at least a child.

Data Analysis
Data collected were analysed by Statistical Package for Social Science (SPSS) version 21.0 software program. Descriptive statistics employed were mean and standard deviation, range, percentages, frequencies. Cross tabulation was made to categorise the variables. Association of variables was determined by chi-sqaure. Level of significance was placed at p<0.05.

RESULTS
Socio-demographic characteristics of the respondents
Socio-demographic characteristics of the respondents are presented in Table 1. Mean age of the respondents was 33.2±5.8 years. More than half (53.3%) of them were within 30-39

Table 1. Socio-demographic characteristics and infertility of respondents

| Variable	Infertility			X^2	p-Value
	Primary F (%)	Secondary F (%)	Total F (%)		
Age (years)					
Mean±SD			33.2±5.2		
20-29	41 (50.6)	20 (15.5)	61 (29.0)	33.459	0.000*
30-39	35 (43.2)	77 (59.7)	112 (53.3)		
40-49	5 (6.2)	32 (24.8)	37 (17.6)		
Religion					
Christianity	30 (37.0)	69 (53.5)	99 (47.1)	5.404	0.020*
Islam	51 (63.0)	60 (46.5)	111 (52.9)		
Education					
Tertiary	29 (35.8)	55 (42.6)	84 (40.0)	4.717	0.318
Secondary	38 (46.9)	50 (38.8)	88 (41.9)		
Primary	11 (13.6)	15 (11.6)	26 (12.4)		
Informal	3 (3.7)	4 (3.1)	7 (3.3)		
No formal	0 (0.0)	5 (3.9)	5 (2.4)		
Primary Occupation					
Civil servant	13 (16.0)	36 (27.9)	49 (23.3)	16.018	0.003*
Private Comp worker	9 (11.1)	26 (20.2)	35 (16.7)		
Farming	1 (1.2)	7 (5.4)	8 (3.8)		
Trading	40 (49.4)	49 (38.0)	89 (42.4)		
Artisan	18 (22.2)	11 (8.5)	29 (13.8)		
Monthly Income					
≥50,000	6 (7.4)	23 (17.8)	29 (13.8)	10.305	0.036*
40,000-49,999	3 (3.7)	11 (8.5)	14 (6.7)		
30,000-39,999	19 (23.5)	17 (13.2)	36 (17.1)		
20,000-29,999	21 (25.9)	39 (30.2)	60 (28.6)		
10,000-19,999	32 (39.5)	39 (30.2)	71 (33.8)		
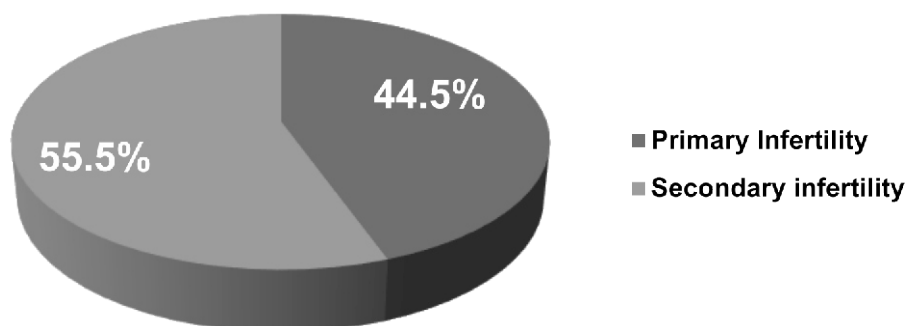
Figure 1. Categories of Infertility among Respondents

years and 52.9% were Christians. With regards to the educational status, most (81.9%) of respondents had either secondary or tertiary education. Large proportion (42.4%) of respondents were petty traders while 3.8%, 23.3% and 30.5% were farmers, civil servants, artisans or business women respectively. The average income in a month was less than ₦30,000 ($187.5) per month.

Figure 1 shows the categories of infertility among the respondents. It was observed that more than half (55.5%) of the respondents had secondary infertility while those who experienced primary

infertility were 44.5%. Age (p=0.000), religion (p=0.020), occupation (p=0.003) and monthly income (p=0.036) of the respondents were significantly associated to infertility experienced by respondents.

Medical history, lifestyle characteristics and infertility among respondents
Information on medical history, lifestyle and infertility among respondents was presented on table 2. More than (61.4%) of respondents had been experiencing infertility less than five years and 38.5% had experienced infertility for 5 years and above. Only 28.5% of respondents had

Table 2. Medical history, lifestyle characteristics and infertility of respondents

Variable	Infertility		Total	X²	p-Value
	Primary F (%)	Secondary F (%)	F(%)		
Duration of infertility					
≤4 years	56 (69.1)	73 (56.6)	129 (61.4)	3.335	0.189
5-9 years	16 (19.8)	37 (28.7)	53 (25.2)		
≥ 10 years	9 (11.1)	19 (14.7)	28 (13.3)		
Presence of STI's					
Never	45 (55.4)	105 (81.4)	150 (71.4)	16.596	0.000*
Former	23 (28.4)	17 (13.2)	40 (19.0)		
Currently	13 (16.0)	7 (5.4)	20 (9.5)		
Smoking status					
Never	79 (97.5)	123 (95.3)	202 (96.2)	1.350	0.509
Former	2 (2.5)	4 (3.1)	6 (2.9)		
Currently	0 (0.0)	2 (1.6)	2 (1.0)		
Intake of alcohol					
Never	70 (86.4)	111 (86.0)	181 (86.2)	0.291	0.865
Former	9 (11.1)	16 (12.4)	25 (11.9)		
Currently	2 (2.5)	2 (1.6)	4 (1.9)		
Frequency of exercise					
None	55 (67.9)	72 (55.8)	127 (60.0)	3.402	0.182
< 7hours	22 (27.2)	51 (39.5)	73 (34.8)		
7 hours	4 (4.9)	6 (4.7)	10 (4.8)		

Table 3: Anthropometric indices and infertility of respondents

Variable	Infertility		Total	X²	p-Value
	Primary F (%)	Secondary F (%)	F (%)		
Waist circumference					
Normal (< 80.0)	35 (43.2)	53 (41.1)	88 (41.9)	0.092	0.761
Abdominal obesity (≥ 80.0)	46 (56.8)	76 (58.9)	122 (58.1)		
Waist-hip-ratio					
Normal	33 (40.7)	62 (48.1)	95 (45.2)	1.077	0.299
Abdominal obesity	48 (59.3)	67 (51.9)	115 (54.8)		
Body mass index					
Underweight	5 (6.2)	5 (3.9)	10 (4.8)	11.545	0.042*
Normal	14 (17.3)	32 (24.8)	46 (21.9)		
Overweight	34 (42.0)	51 (39.5)	85 (40.5)		
Obese (Class I)	15 (18.5)	22 (17.1)	37 (17.6)		
Obese (Class II)	5 (6.2)	17 (13.2)	22 (10.4)		
Obese (Class III)	8 (9.8)	2 (1.5)	10 (4.8)		

suffered from Sexually Transmitted Infections (STI). Very few (3.9%) of respondents had smoked before. Only 13.8% had consumed alcohol on a regular basis. More than (60%) of respondents did not engage in physical exercise. Only 34.8% of respondents engaged in physical exercise for less than 7hours in a week and 4.8% had physical exercise for 7 hours and above in a week. Sexually Transmitted Infections experienced by respondents were significantly associated to infertility (p=0.000) (Table 2).

Nutritional Status and Infertility of Respondents

More than half of the respondents had waist circumference (58.1%) and waits-hip ratio (54.8%) beyond normal range. Body Mass Index shows that 40.5% were overweight and 32.8% were obese. Body Mass Index of respondents was significantly associated to infertility (p=0.042)

(Table 3).

Dietary diversity score of respondents

Frequency of foods consumed by respondents is presented in table 4. Cereals were starchy staples. Dark green leafy vegetables (62.9%), vitamin A rich vegetables and fruits (92.4%); legumes, nuts and seeds (66.2%); meat and fish (98.6%) were regularly consumed. Only fruits and other vegetables (77.6%), organ meat (93.3%), eggs (71.0%), milk and milk products (68.6%) were poorly consumed. Table 5 shows result of dietary diversity score and infertility among respondents. Only half (51.0%) of them consumed highly diverse diets. One third (33.3%) had medium dietary diversity score while 15.7% had low dietary diverse score. There is no significant association between dietary diversity and infertility among the respondents.

Table 4. Frequency of foods consumed by respondents

Variable	YES N (%)	NO N (%)
Starchy staples	210 (100.0)	0 (0.0)
Dark green leafy vegetables	132 (62.9)	78 (37.1)
Vitamin A rich vegetables and fruits	194 (92.4)	16 (7.6)
Other vegetables and Fruits	47 (22.4)	163 (77.6)
Organ meat (Iron rich)	14 (6.7)*	196 (93.3)
Meat and Fish	207 (98.6)	3 (1.4)
Eggs	61 (29.0)	149 (71.0)
Legumes nuts and seeds	139 (66.2)	71 (33.8)
Milk and milk products	66 (31.4)	144 (68.6)

Table 5. Dietary Diversity Score and Infertility among respondents

Variable Dietary Diversity	Infertility Primary N (%)	Secondary N (%)	Total N (%)	X²	P-value
Low (≤3.0)	12 (14.8)	21 (16.3)	33 (15.7)	0.246	0.884
Medium (4.0-5.0)	26 (32.1)	44 (34.1)	70 (33.3)		
High (≥6.0)	43 (53.1)	64 (49.6)	107 (51.0)		
Total	**81 (100.0)**	**129 (100.0)**	**210 (100.0)**		

DISCUSSION

Prevalence of primary and secondary infertility in this study is 44.5% and 55.5% respectively. The rate of primary infertility in this study is lower than 67.37% primary infertility reported in cross sectional study conducted by Benksim (27) among infertile women in Morocco.

Prevalence of secondary infertility in this study is closed to 58.9% which Odunvbun (18) reported among infertile women in Delta State, Nigeria, but lower than the rates of 67.2% and 73.2% in North-West and South-West Nigeria; and 71.6% in Northern-Ghana respectively (27-29). Previous studies had found secondary infertility to be more prevalent in Africa (18, 20, 23) and this was attributed to high cases of genital tract infection which is the observed commonest cause of secondary infertility among African couples (18, 31). This study also affirms significant association between presence of sexually transmitted infections and infertility among fertility impaired women in Ibadan

The mean age of the women in this study is 33.2±5.2 years. This is similar to 33.8±5.2 years and 34.0±6.0 years reported by Adegboda & Akindele (31) and Odunvbun (18) in their studies conducted in Lagos and Delta States among women of reproductive age respectively. However, the mean age is higher than the 31.0±8.8 years and 27.5±9.2 years in studies conducted in India (32). The observed variations in the mean age among the married women can be attributed to different cultural backgrounds which influence age at which women are married in different ethnic groups and countries. In this study, age was observed to be significantly associated with infertility and more than half of the infertility impaired women are within the age of 30-39 years. This corroborates the observation of Balasch & Gratacos (33) who said that fertility with respect to the quality of oocytes begins to decline for women of reproductive age from mid-thirties with a 12% chance of ovarian reserve at thirties with a 12% chance of ovarian reserve at

30's and a 3% ovarian reserve chance at 40's

There was no significant association between religion and infertility (p>0.05) in this study. This supports the observation of Greil (34) on the effects of religion on infertility help-seeking among infertile women in United States of America. It was observed that religiosity is indirectly associated with infertility through belief in the importance of motherhood which is associated with increased likelihood of help-seeking related medical service. Religiosity was associated with greater ethical concern about infertility treatment which is associated with decreased likelihood of the help-seeking.

Majority of women in this study had either secondary or tertiary education, were mainly civil servants and business women, 42.4% were traders having majority receiving at least 20,000 naira monthly. This indicates that the socio-economic status of women is at medium level. However, the monthly income is significantly associated with infertility. Stephen & Chandra (35) reported that the socio-economic status influences service seeking among fertility-impaired women and older women with high education and higher income seek for medical care and generally had access to assisted reproductive technology which puts them in better position in addressing reproductive health concerns than less educated women and those of low income.

Most participants in this study had experienced infertility for 4 years on the average. This duration of infertility is similar to the experience of infertile women at Calabar, Nigeria (36), but it is lower than 5 years observed in Delta State, Nigeria (17). In respect to relationship of lifestyle habits and infertility in this study, cigarette smoking and alcohol intake have no significant association with infertility. Majority of the women did not regularly engage in physical exercise. Green (37) also observed no significant association was found between vigorous exercise for an average

of less than one hour a day for weight reduction among fertility impaired women. However, a combination of reduced intake of calorie diet, fat and refined carbohydrate as well as increased aerobic exercise has been recommended to improve fertility among women and men who are overweight and obese (38). Moderate consumption of alcohol can be a contributing factor to hormonally associated fertility disorder i.e. decreased fecund ability (39 and 40) and modifying such factor and smoking through cognitive behaviour therapy may improve fertility (41). Smoking can increase the risk of infertility by causing long delay in conception and total infertility in some women. Although, other confounding factors such as age, alcohol/coffee consumption, oral contraceptives, frequency of intercourse may distort the association (42).

Nutritional status as estimated by Body Mass Index (BMI) is a major health parameter. Of the 87 risk factors evaluated by the Global Burden of Diseases, Injuries, Risk factors study in 2019, increased BMI beyond normal range had the greatest relative increase in exposure to health complications since 1990-2019 and was listed as the top five risk factors of attributable deaths and Disability Adjusted Life Years (DALYs) (43) Accordance to Greil (44), overweight and obese fertility-impaired women had reduced fertility treatment, higher cost of treatment and increased risk of pregnancy complication when compared to fertility-impaired women with ideal body weight.

Greater proportion (73.3%) of fertility impaired women in this study was overweight and obese. A significant association was observed between increased BMI and infertility. This supports what Sudha (45) observed among women in Tirupati where there was significant association between increased BMI above 30kg/m^2 and infertility, and less productivity among obese individuals. Other reports also highlighted increased reproductive challenges with overweight and obese women are at high risk of anovulatory infertility, poor responsiveness to fertility medications and increased risk of miscarriage both spontaneously and after fertility treatment (46-48).

Goon (49) indicated that high- energy, high-fat dietary pattern combined with low physical activity level predispose to high abdominal obesity among women with infertility challenge. Chavarro added that high intake of fat and dairy food increase the risk of anovulatory infertility (50). In this study, major source of staple consumed were roots and tubers (yam, potato and sweet potato); Cereals (rice, maize and maize

products); protein (legume, fish and beef) but foods such as eggs, organ meats, fruits, vegetables and dairy food products which have been affirmed to be rich in micronutrients such as iron, folic acids and calcium among other nutrients were less consumed by the women in this study. Previous studies have established significant roles of adequate intake of micronutrients in promoting women's reproductive health (51-52). Majority of the overweight and obese women had high dietary diversity indicating that the quality of the women diet was good. However, no significant association was observed between their dietary diversity and infertility (p>0.05).

CONCLUSION

Most of the infertile women in this study were overweight and obese. They are suffering from abdominal adiposity and secondary infertility is more prevalent among them. They are not physically active and they are anemic. Nutritional status, age, religion, occupation, income and presence of sexually transmitted infections are associated with infertility among the infertile women in this study.

RECOMMENDATION

Infertile women need to be educated on the need for weight control, physical activity and intake of quality diet. Intake of iron supplements should be advocated among them. The husbands of the infertile women should also be examined on sexually transmitted infections to ensure holistic prognosis against infertility in the country.

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