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Assessment of Obesity Among Pregnant Women in the Volta Region of Ghana

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Abstract:

Background: Obesity remains a rising challenge in both developed and developing countries, and maternal obesity has become one of the most occurring risk factors, which can lead to gestational diabetes, pre-eclampsia and prematurity in obstetric practice for both the mother and the child.

Pregnancy is a timeline where obesity cannot be effectively worked on as the mother is more likely to live unhealthy lifestyle such as unhealthy diet, binge eating and less physical activity, which would most likely affect foetal health. This is an issue as most pregnant women in Volta Region are either overweight or obese. This research assessed the prevalence of obesity among pregnant women in the Volta Region of Ghana.

Material and Method: A full structured questionnaire was administered to 220 participants based on their knowledge of obesity and its effect on pregnancy, food choices, mealtimes and portion sizes, as well as physical activity during pregnancy. Body weight and height were measured using standardized procedures and body mass index (BMI) was calculated. Overweight and obesity were defined based on WHO criteria. Data analysis was performed using SPSS version 20.0.

Results: Based on excessive gestational weight gain, prevalence of obesity among the pregnant women was 54% (119). Majority of respondents had poor knowledge of obesity and its effect on the mother and the foetus, which represented a significant correlation ($p< 0.0001$) between their caloric intake and high gestational weight gain. Physical activity showed no significant effect ($p = 0.2$) on gestational weight gain. However, pre-pregnancy BMI of the expectant mothers was directly linked to high gestational weight gain with age being the significant risk factor ($p<0.02$) for obesity before pregnancy.

Conclusion: This research found limited awareness of excessive gestational weight gain and its health consequences among pregnant women and the unborn baby. Therefore, monitoring gestational weight gain using diverse approaches to integrate and manage the condition in routine antenatal care needs consideration.

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INTRODUCTION

In clinical practice and epidemiological research, obesity is commonly defined using the body mass index (BMI), which approximates body fat. Adults with a BMI between 25 and 29.9 kg/m² are categorized as overweight and those with BMI greater than or equal to 30 kg/m² are categorized as obese [1,4]. Obesity is a condition in which the fat stores (adiposity) are excessive for an individual's height, gender and race to an extent that produces adverse health outcomes [4]. Obesity is a major public health problem, and has been estimated globally as the fifth leading cause of mortality [1]. The World Health Organization (WHO) estimates that 1.1 billion adults living in both developed and developing countries are overweight in which 300 million are obese with a high proportion being women [2]. Overweight and obesity are due to interaction of several factors such as physical activity and diet [3].

Until recently, the United States has had the highest prevalence of obesity among the developed nations. However, increases in the prevalence of obesity and overweight have been observed throughout the world [5]. The global epidemic of non-communicable diseases (NCDs) has been linked to obesity, with the highest prevalence in high-income countries [6]. Obesity, as one of the key modifiable risk factors for NCD, has been shown not only as prevalent in high-income countries but has also displayed rising prevalence in low- and middle-income countries [6]. A survey of seven Sub-Saharan African countries showed an increase in obesity prevalence by an average of 35% in the last two decades with some estimates reaching as high as 50%. Other studies have estimated a doubling of obesity prevalence in the last 15 years, in West Africa, especially amongst women [6].

Among women of reproductive age, the prevalence of obesity was 30% in the United States and 7 to 25% in Western European countries in 2016 [7]. A joint study conducted by two universities – Kwame Nkrumah University of Science and Technology (KNUST) and the University of Western Cape in South Africa – concluded that 43% of Ghanaian adults are either overweight or obese, with the highest prevalence among women. Another study also indicated that prevalence of obesity among Ghanaian women ranges from 7.4 to 50%. Data from the 2008 Ghana Demographics and Health Survey (GDHS) suggested that 29% of pregnant women are overweight and 12% are obese. Two hospital-based surveys conducted in Ghana and Nigeria reported obesity in pregnancy to be 17.9% and 6.0% respectively [8]. In Ghana, a study conducted in Tamale reported the prevalence of central adiposity to be 31.2% among civil servants [9]. Wave 1 of women's Health study of Accra (WHSA-1) found that 62.2% of 1,237 non-pregnant women living in Accra were overweight or obese [10]. The prevalence of obesity has been reported in Ghana to be high, particularly among women who are educated, married, have children and employed [10].

Maternal obesity refers to obesity of a woman during pregnancy and it has a significant impact on the maternal metabolism and offspring development contributing to adverse outcomes [11]. Studies conducted in high income countries showed an association between maternal body mass index (BMI) and complications during pregnancy, delivery and postpartum period for both mother and offspring, including hypertensive disorders in pregnancy, gestational diabetes mellitus (GDM), caesarean delivery, postpartum hemorrhage (PPH) macrosomia, congenital abnormalities and deaths [12]. As reported by Rowlands *et al*., [13], maternal obesity and excessive weight gain in pregnancy have been linked with increased risk of pregnancy induced hypertension and consequently maternal and perinatal morbidity and mortality.

Several studies have found that children of mothers who were obese before and during pregnancy seemed to have problems such as mental and autism disorders than children of mothers with a normal weight. Additionally, children of obese mothers seemed to have developmental disorders: the odds of having autism spectrum disorder (ASD) or attention deficit hyperactivity disorder (ADHD) is increased by 36% and 62% respectively [11].

The amount of weight gained during pregnancy can affect the immediate and future health of the mother and the infant. Maternal weight gain in pregnancy can offer a good means of assessing the wellbeing of the pregnant mother and, by inference of her baby. Inadequate prenatal weight gain for the mother is a significant risk factor for intra-uterine growth restriction, pre-term delivery and low birth weight in infants [14]. Evidence supports an association between excessive gestational weight and increased birth weight and postpartum weight retention as well as between inadequate weight gain and decreased birth weight [15]. Gestational weight gain recommendations help to optimize pregnancy outcomes. The Institute of

Medicine (IOM) published the recommended weight gains by pre-pregnancy BMI which have been the standard for subsequent research. These recommendations are; for BMI < 19.8 kg/m^2 should have total weight gain of 12.5 to 18 kg; BMI of 19.8 to 26.0 kg/m^2 should have total weight gain between 11.5 to 16 kg; BMI of 26.0 to 29.0 kg/m should have total weight gain of 7.0 to 11.5kg, and for BMI > 29.0 kg/m should have total weight gain of 7.0 kg [14].

Overweight and obesity are a global health issue, recognized as the single greatest contributor to compromised health during pregnancy [16]. Although guidelines and protocols recognize hypertension and diabetes among others as independent risk factors for adverse outcome during pregnancy, they are limited in their effect of obesity during pregnancy. Several studies have reported that poor dietary choices, overeating and less physical activity all lead to obesity during pregnancy. Early take up of dietary and lifestyle interventions have the potential to reduce these risks during pregnancy [17]. Women who are overweight or obese remain at increased risk of virtually all pregnancy related complications, and the risk increases with an increase in BMI [18,19]. While some of these additional risks represent the development of pregnancy specific complications (including gestational diabetes and pre-eclampsia) [18,19], women who are overweight or obese are more likely to have pre-existing medical conditions which may be further exacerbated by the pregnancy itself. Pregnancy is a period during which obesity can be effectively confronted as the mother is more disposed to lifestyle modifications, such as unhealthy diet, binge eating and less physical activity, which would most likely affect foetal health. Obesity in pregnancy has public health implications on both the mother and fetus such as gestational diabetes, pre-eclampsia, prematurity and increased risk of caesarean delivery. In Ghana, the prevalence of obesity is increasing, which reflects on the trend globally. Locally, there are some variations as well, such as obesity in pregnancy. Investigating this is necessary due to lack of regional health data on obesity in pregnancy, which becomes difficult to get region specific interventions to address the situation. Understanding, the prevalence will also help to address the complications such as gestational diabetes, pre-eclampsia, prematurity and caesarian delivery that come with obesity in pregnancy. The findings of this study can help in allocating resources for enhanced prenatal care and nutrition counselling of pregnant women. Effective strategies to improve pregnancy and birth outcomes for women who are overweight or obese are urgently required, including greater public health efforts to address weight loss prior to conception [20]. Much work has not been carried out on obesity in pregnant women and much data on this area of research in the Volta Region are not available and therefore, the object of this study. The study would go a long way to fill a knowledge gap as well as aid in providing evidence-based public health initiatives that would improve maternal and fetal health outcomes in Ghana and beyond.

MATERIALS AND METHODS

The Ho Teaching Hospital is the only tertiary health care facility that serves as the referral centre for all other hospitals in the Volta region. It is situated in Trafalgar, a suburb of Ho. The hospital runs an ante-natal clinic to cater for the teeming needs of pregnant women not only resident in Ho but also in neighboring towns and villages. Due to this, the antenatal clinic (ANC) has a very high patronage.

All the methods employed in the study were in accordance with the relevant research guidelines and regulations.

Study Design and Sampling Technique

Cross–sectional study was used. Data was collected by use of a designed questionnaire and direct physical measurements (height and weight). The questionnaires captured data on socio-demographic characteristics (age, sex, marital and employment status), alcohol consumption, cigarette use, diet, physical activity level and knowledge on the subject. Weighing scale and stadiometer were used to measure weight and height of study participants respectively. Body mass index (kg/m^2) was calculated from values of weight and height measurements and used to determine obesity status of the participants. The population of interest in this study covered pregnant women who were attending antenatal clinic at the Ho Teaching Hospital with gestational age of 20 weeks and above. According to the Hospital records, about 505 pregnant women attend the ANC of the hospital monthly for the services that they offer. Participants were conveniently selected based on the inclusion criteria and their willingness to participate in the study. Pregnant women with gestational age below 20 were excluded because at this stage, maternal weight gain is insignificant.

Sample Size Determination

The sample size of 219 participants was determined using the Cochran's formula adjusted for smaller populations. The formula $n = \frac{z^2 xpq}{e^2}$ where n = sample size, z= z-score, p = estimated proportion of the population that has the attribute in question, q = 1-p, e = desired level of precision or margin of error. Using a z value of 1.96 (95% Confidence level), p value of 0.5, q = 0.5 and e= 0.05, an initial sample size of 384 was realized. However, the average number of pregnant women who visit the ANC monthly is 505 so the sample size was modified for a small population using the formula $n = \frac{n_0}{1 + \frac{(n_0 - 1}{N}}$ where n = final sample size, n_0 = initial sample size and N = population size. Since N= 505, the modified sample size = 219. However, for the purpose of collecting data, it was rounded off to 220, therefore 220 participants were used in the data collection.

Research Instrument

Questionnaires, weighing scales and Stadiometer were used as instruments for the data collection. The questionnaires were divided into two sets – the first part was the consent form and the second part were made up of eight sections. Section A was on the demographic data of the respondents and Section B and C elicited information on their obstetric information (trimester and parity). Section D focused on dietary food choices and caloric intake and section E was used to assess current physical activity levels of participants (type, number of times in a week and duration spent in doing the physical activity). Section F elicited information on their lifestyle (smoking and alcohol intake) and the last section was used to assess knowledge on obesity, causes and the effect on the mother and the baby. In all, twenty-four (24) items were in the questionnaire. Each class of questionnaire was preceded with a subheading to reflect the variables being tested at that section. These questionnaires included close ended questions with multiple choice answers or responses and open-ended questions. Steps were taken to avoid leading, ambiguous, double barrel, and double negation in the construction of the questionnaires. The use of jargons as well as very long questions was also avoided.

Data was collected from January 2019 to February 2019.

Anthropometric Measurements

Participants' weights were measured using a Seca 770 floor digital scale (Seca, Hamburg, Germany) which was periodically calibrated for accuracy using known weights. Participants were in minimal clothing, with shoes removed and made to stand with feet fully on the scale. Also, participants were asked to remove belts, watches and other jewelry on their wrist and items from their pockets prior to taking of measurements. It was ensured that subject's weight was evenly distributed on both feet. Subjects stood upright, hands by their sides and head levelled with eyes looking straight ahead. Weight was then recorded to the nearest 0.1 kg. Their first weight taken during their first antenatal visit was used to compute for their BMI before pregnancy, this is because the weight gain in the first trimester is not significant according to IOM gestational weight gain recommendations. The height was not measured but their previous height was taken from their maternal books. Body mass index (BMI) was calculated as weight (kg)/height (m^2). General overweight and obesity definition were based on the current WHO criteria underweight: BMI<18.5 kg/m^2, normal weight BMI 18.5-24.9 kg/m^2, overweight (pre-obese) BMI 25-29.9 kg/m^2 and obese BMI >=30 kg/m^2.

International Physical Activity Questionnaire (IPAQ) was used to measure participants physical activity level. It consisted of three questions on physical activity in a typical week. Frequencies and time duration spent on each activity was measured. A verbal self-reported 24-hour food recall and usual intake were taken to estimate the energy intake of the participants. Graduated food models were used to aid in portion size estimation. Foods obtained were analysed using Microsoft excel spreadsheet (2016). The United States Department of Agriculture (2010) tables were employed for the analysis of nutrient composition including macronutrient content of the foods.

A pilot study was conducted by interviewing and taking weight and height measurements from six pregnant women at the Ho Polyclinic before the study began. This enhanced editing of the questionnaire and prevented ambiguity to some questions and proper calibration of the weighing scale. The Principal Investigator and Research Assistants were trained prior to data collection on the use of both weighing scales and dietary intake format. Additionally, training on interview processes of subjects was carried out. Data consistency was ensured by randomly selecting and reviewing completed questionnaires and taking

anthropometric measurements of selected participants. Calibration of the weighing scale was carried out prior to the measurements. Questionnaires were coded, stored and restricted to the research team only.

Ethical clearance was sought from the University of Health and Allied Sciences Research and Ethics Committee and an official permission from the Ho Teaching Hospital was obtained before the study. The importance of the study, aims and processes as well as any possible risks involved were fully explained to the participants before obtaining their written and signed informed consent, thus participants had the right to take part in the study or not. No compensation such as money was given to participants for their involvement. Confidentiality of participants was protected and questionnaires were coded. Completed data collection tools were well-secured under lock and key.

Data Analyses

Statistical analyses were carried out using Statistical Package for the Social Sciences (SPSS version 20.0). Analyses were performed on the variables and 95% confidence level was set to test for significance. The data were first analyzed using descriptive statistics (means and standard deviations). Information from the 24-hour food recall and usual intake were converted into quantities (quantitative data) of nutrient intakes using Ghana's food composition table and analyzed using United States Department of Agriculture (USDA) nutrient database [21].

RESULTS

The data analysis and findings of this study are presented in tables and figures using frequencies and percentages. The questionnaire collected demographics, obstetrics, anthropometric, dietary, and physical activity, and knowledge on obesity, their causes and effects on the mother and baby.

The results in Figure **1** below reveal that out of the 220 respondents, forty-four percent (44%) had a normal BMI before pregnancy followed by 33% being overweight and 21% being obese whiles only 2% were underweight before pregnancy.

Figure **2** below, shows that among the 69.1% (152) respondents who performed physical activity, majority of them representing 81.57% (124) walked as a form of physical activity. This was followed by those performing house chores, also representing 13.82% (21), then 11.18% (17) and 3.94% (6) for pregnancy exercise and jogging respectively.

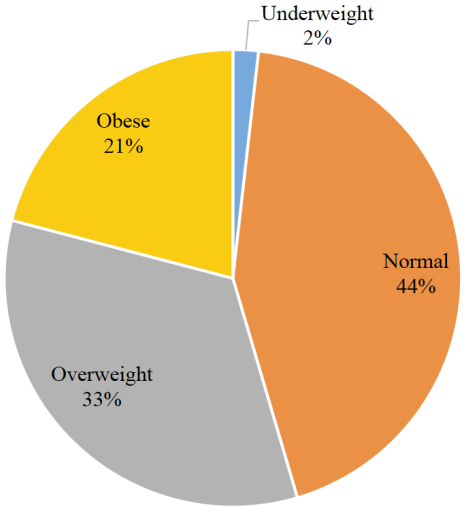

Figure 1: A pie-chart showing the BMI categories of respondents.

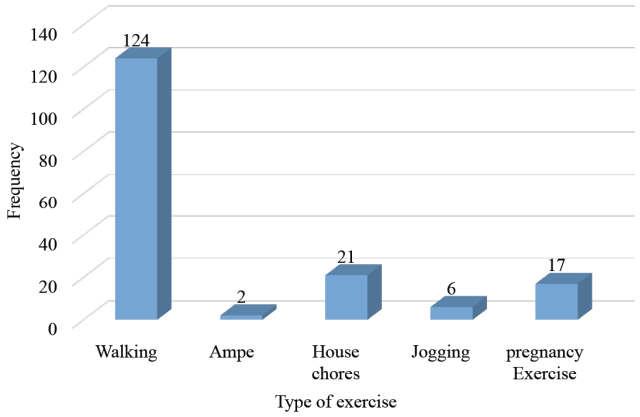

Figure 2: Physical Activity of respondents.

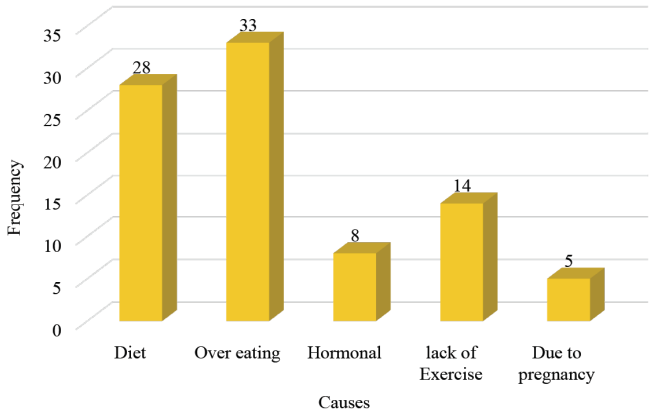

Figure 3: Causes of obesity according to respondents.

Figure **3** above, shows the causes of obesity in pregnancy based on respondent's view. Majority of

them said obesity is caused by overeating 38.37% (33), 32.5% (28) said diet whiles 16% (14) said obesity is caused by lack of physical activity. Then 9.3% (8) and 5.81% (5) said obesity is caused by hormonal and pregnancy respectively.

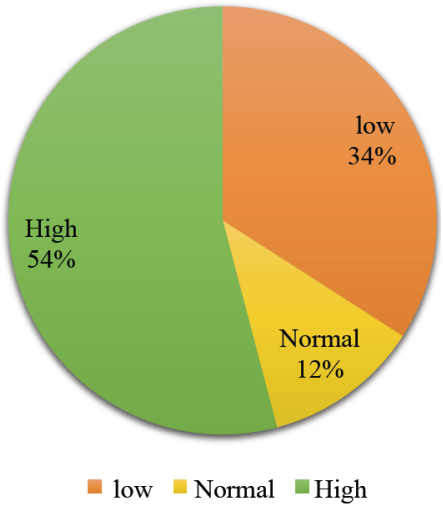

Figure 4: A pie-chart showing gestational weight gain of respondents.

As illustrated in Figure **4** above, it was revealed that out of 220 respondents, 54% (119) exceeded their gestational weight gain based on their pre-pregnancy BMI, 34% (75) of the respondents gained less and only 12% (26) of them gained the right gestational weight.

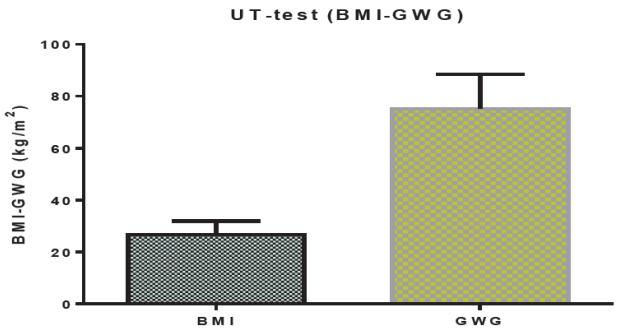

Figure 5: An unpaired T-test relationship between pre-pregnancy BMI and GWG.

Figure **5** above is an unpaired t-test that was carried out between BMI and GWG at $p< 0.05$ and the value was significant at $p< 0.0001$.

Demographic Data

The data, as presented in Table **1** below, include the demographic characteristics of the respondents based on their age, marital status, educational level, occupation, income, residence and ethnicity. Two hundred and twenty (220) consented pregnant women were enrolled in the study. More than 95% of the respondents were within the age bracket of 20 to 40 years. The age group 26-30 years recorded the modal frequency of respondents with 84 of them representing 38.2%. The age group 31-35 years recorded the second highest frequency of study participants with (71) respondents whiles the age 41-45 years recorded the least frequency of participants with (7) respondents representing 32.3% and 3.2% respectively. More than 70% of the study participants were married whiles very few 10.5% were cohabiting. Out of the total, 95 respondents representing 42.3% had obtained tertiary education whiles the least, (6) respondents had primary education and (10) respondents had no formal education representing 2.7% and 4.5% respectively. Majority of the study respondents, (105) 47.7% were non- formal workers whiles (34) representing 15.5% were unemployed. Forty-two (19.1%) respondents did not earn a salary whiles majority representing 79% (174) earned between 50 to 1000 Ghana cedis monthly. Most of the participants 62.7% (138) lived in the urban areas whilst 37.3% (82) lived in the rural areas. Majority of the participants were Ewes 85.5% (188).

Obstetrics Data

This sub-section presents data on trimester and parity of respondents.

According to Table **2**, majority of our study participants were in the third trimester of their pregnancy (60.5%).

Anthropometric Data

This sub-section presents data on respondent's pre-pregnancy BMI categories based on the WHO classification and its association with age and parity.

Table **3** below shows the associations between age groups and respondents pre-pregnancy BMI. Those within the age range of 31-35 years recorded the highest obese pre- pregnancy BMI of 43.48% (20) with a p-value of 0.002 indicating an association. This was followed by those in the range of 26-30 years with an obese pre- pregnancy BMI of 26.06% (12). Respondents within the ages of 36-40 years had an obese pre- pregnancy BMI of 8% (17.39) and those within the ages of 20-25 and 41-45 recorded the lowest obese pre- pregnancy BMI of 6.25% (3).

Table **4** below shows the linkage between parity and pre-pregnancy BMI. Respondents with two children

Table 1: Socio-Demographic Characteristics of Participants

Characteristics	Frequency (n=220)	Percentage (%)
Age groups		
20-25	33	15.0
26-30	84	38.2
31-35	71	32.3
36-40	25	11.4
41-45	7	3.2
Marital status		
Single	25	11.4
Married	172	78.2
Cohabiting	23	10.5
Educational background		
No formal	10	4.5
Primary	6	2.7
JHS	56	25.5
Secondary	53	24.1
Tertiary	95	43.2
Occupation		
Formal worker	81	36.8
Non-formal worker	105	47.7
Unemployed	34	15.5
Salary GHC		
No earnings	42	19.1
<50	14	6.4
50-100	53	24.1
101-200	36	16.4
200-500	24	10.9
500-1000	47	21.4
1001-3000	4	1.8
Residence		
Rural	82	37.3
Urban	138	62.7
Ethnicity		
Ewe	188	85.5
Akan	20	9.1
Ga-Adangbe	5	2.3
Northerner	5	2.3
Foreigners	2	1.4

Table 2: Obstetric Information of Respondents

Parameter	Frequency (n=220)	Percentage (%)
Trimester		
2nd trimester	87	39.5
3rd trimester	133	60.5
Parity		
No child	83	37.7
1 child	53	24.1
2 children	48	21.8
3 children	22	10.0
4 children	12	5.5
5 children	2	0.9

Table 3 Associations between Pre- pregnancy BMI and Age

Age groups	Underweight	Normal	Overweight	Obese	P-value
20-25	3 (75.00)	20 (20.83)	7 (9.46)	3 (6.52)	0.002
26-30	1 (25.00)	36 (37.50)	35 (47.30)	12 (26.09)	
31-35	0 (0.00)	25 (26.04)	26 (35.14)	20 (43.48)	
36-40	0 (0.00)	11(11.46)	6 (8.11)	8 (17.39)	
41-45	0 (0.00)	4 (4.17)	0 (0.00)	3 (6.52)	

Table 4: Association between Pre-Pregnancy BMI and Parity

Parity	Underweight	Normal	Overweight	Obese	P-value
No child	3 (75.00)	44 (45.83)	28 (37.84)	8 (17.39)	0.058
1 child	1(25.00)	22(22.92)	21(28.38)	9 (19.57)	
2 children	0 (0.00)	18 (18.75)	17 (22.97)	13 (28.26)	
3 children	0 (0.00)	7 (7.29)	5 (6.76)	10 (21.74)	
4 children	0 (0.00)	4 (4.17)	3 (4.05)	5 (10.87)	
5 children	0 (0.00)	1 (1.04)	0 (0.00)	1 (2.17)	

Table 5: Physical Activity of Respondents

Day/Time	<30min	30-60min	>60min	Total
1-2 days	23 (15.13)	6 (3.95)	3 (1.97)	32 (21.05)
3-4 days	18 (11.84)	15 (9.87)	5 (3.29)	38 (25.00)
5-7 days	36 (23.68)	30 (19.74)	16 (10.53)	82 (53.95)
Total	77 (50.66)	51(33.55)	24 (15.79)	152 (100.00)

recorded the highest incidence of obesity with 13% (28.26) and a p –value of 0.058, this was followed by those with one child with 9% (19.57) whilst, those with no child recorded 8% (17.39) and those with four children had 5% (10.87) and those with five children recorded the lowest of obesity before pregnancy of 1% (2.17).

Physical Activity

This sub-section presents data on the physical activity of respondents, type of activity and duration.

As illustrated in Table **5** above, out of the total respondents, 152 representing 69.1% undertook physical activity while 30.9% (68) did not do any physical activities. Among the 152 participants who engaged in physical activity, majority (82) 53.95% did it 5-7 times weekly, while the least number (32) 21.05% did it twice weekly. Likewise (38) 25% of them did it for 3-4 days a week. Again, among respondents who engaged in physical activity, majority (77), representing 50.66% did it less than 30 minutes a day. Also, 33.55% (51) of them exercised within 30-60 minutes, while just a few of them 15.79% (24) were able to exercise one hour per day.

Respondents' Knowledge on Obesity

This sub-section presents data on the knowledge respondents had on obesity and its effect on the mother and baby.

Based on Table **6** below, majority of the respondents 51% (114) did not have knowledge about obesity.. On the effect of obesity on the health of the mother, 47.7% (105) didn't know about it, 30.5% (67) knew about it, 11.4% (25) were not sure there was any effect on the mother and 10.3% (23) said no, there is no effect of obesity on the health of the mother. On the effect of obesity on the health of the baby, 52.3% of the respondent didn't have any knowledge on it, 27.3% (60) knew about it, whilst, 10.5% (23) said no there is no association between obesity and the health of the unborn baby, and 10% (22) of the respondent were not sure of the effect on the baby.

Gestational Weight Gain of Respondent

This sub-section presents data on the gestational weight gain of respondents in the various trimesters calculated based on their pre-pregnancy BMI and IOM recommendations for appropriate gestational weight gain and its association on pre-pregnancy BMI and physical activity.

Table **7** below shows the association between physical activity and gestational weight gain. Majority of the respondents, 71.43% (85), who exercise exceeded their gestational weight gain as compared to those who did not exercise, 28.57% (34).

Table 6: Knowledge of Obesity in Pregnancy

Knowledge of obesity	(n=220)	(%)
Yes	106	48.2
No	114	51.8
Health risk to mother		
Yes	67	30.5
No	23	10.5
Maybe	25	11.4
I don't know	105	47.7
Health risk to baby		
Yes	60	27.3
No	23	10.5
Maybe	22	10.0
I don't know	115	52.3

Table 7: Association between Physical Activity and GWG

Physical activity	Low	Normal	High	p-value
Yes	53(70.67)	14(53.85)	85(71.43)	0.2
No	22(29.33)	12(46.15)	34(28.57)	

Dietary Intake

This sub-section presents data on the association between respondents' caloric intake and gestational weight gain.

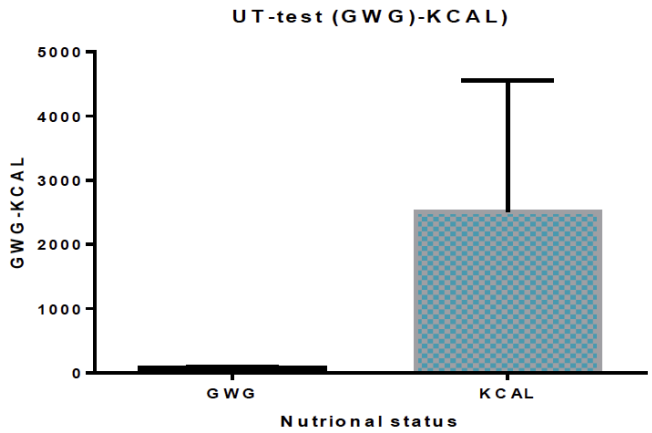

Figure 6: Association between Caloric Intake and GWG.

An unpaired t-test was carried out to determine the association between caloric intake and GWG at $p<0.05$ and the value was significant ($p< 0.0001$) as shown in Figure **6**.

DISCUSSION

A total of 220 participants were enrolled in the study. Majority of the respondents were in the age group 26 – 30 years. A plausible reason for this observation was due to the fact that women within this age bracket are highly fertile and are potential mothers [22]. Majority of the respondents were married. Most of the respondents had tertiary education and majority of the pregnant women were employed. That stands to reason that they have a source of income, thus they may not be totally dependent on their partners. Respondents in the urban areas had the highest frequency and this can be attributed to the fact that Ho Teaching Hospital is the nearest facility to them as compared to those in rural areas who come only when they have a critical condition.

Pre- Pregnancy BMI and AGE

Pregnant women within the ages 31-35 years had the highest prevalence of being significantly obese before pregnancy. For biological reasons, age could have an effect on the probability of being obese. Specifically, women may gain weight as they approach middle age, but they begin to lose weight as they enter old age, resulting in an inverted U-shape relation between weight and age [23]. This is also likely to be caused by less participation in physical activity (sedentary lifestyle) leading to high accumulation of energy than that expended resulting in putting on more weight. This increases their chance of becoming overweight and obese. These findings concur with a study done in India [24], which reported a significant association between age and risk of obesity.

Pre-Pregnancy BMI and PARITY

Women who had given birth to two children had higher probabilities of being obese, followed by those with three children and those with one, although the (p-value = 0.58 was not significant) as compared to women with no children. A prospective 25 years study on parity and body mass index concluded that childbearing is associated with permanent weight gain in some women, but the relationship differs by maternal BMI in young adulthood, number of births, race or ethnicity and the length of follow ups [25]. A woman's risk of overweight or obesity increases by 7% per child [26]. During pregnancy, women gain weight so that their babies get proper nourishment and develop normally. After giving birth, some women find it hard to lose the weight gained. They may become pregnant again with the same obese weight which can lead to higher gestational weight gain.

Physical Activity and GWG

Physical inactivity has been reported to be associated with overweight and obesity [27]. Also, physical activity has been identified as an important factor for healthy pregnancy in women of all weight ranges and also the beneficial effect of exercise during pregnancy on the maternal and neonatal health outcomes has been consistently identified [28]. This study revealed that majority of the respondents performed a physical activity in a week for a specific time or duration. However, self-reported physical activity was not associated with the high incidence of gestational weight gain among these pregnant women with a p- value of 0.2. This finding was not in line with several systematic reviews and meta-analyses done to assess the effect of antenatal exercise interventions on gestational weight gain and pregnancy outcomes. These studies showed that antenatal exercise interventions do not appear to be associated with harm and its effect on limiting gestational weight gain was moderate [29]. The results of this study can be attributed to barriers of performing physical activity during pregnancy such as

lack of time, access to child care and also concern about their safety and that of their unborn child [30]. The trimester in which the pregnant woman is in can also be a factor. This concurs with literature which indicates that pregnant women are less active than non-pregnant women with activity declining over pregnancy [31]. Thus, they are more active in their first and second trimesters than the third trimester. They perform daily activities and do not allocate proper time to exercise.

Dietary Intake and GWG

The use of fruits and vegetables, whole grains and lean meats have been reported to help in weight control programmes [32]. This may be described by the fact that fruits and vegetables do contain little energy that contributes to weight gain [33]. According to Tetens and Alinia, [33] fruits and vegetables consumption help in the control of overweight and obesity. Participants' self-reported caloric intake was found to be significantly associated with gestational weight gain ($p< 0.0001$). Majority (54%) of the respondents chose high caloric diet instead of fibrous rich diet such as whole grains, fruits and vegetables which are also a good source of minerals and vitamins. Although they are taught at antenatal clinic to eat balanced diet, they lack knowledge on how to make these choices.

Knowledge on Obesity in Pregnancy

In this study, it was observed that most respondents (52%) did not have awareness about obesity in pregnancy, its causes and effects on the mother and the unborn baby. This finding was demonstrated in a study that pregnant women have a low awareness of the perinatal complications associated with excess maternal weight [35]. Similar finding was reported by a mixed method study in an overweight and obese pregnant population to generate details about women's views of making healthy diet and lifestyle changes during pregnancy [36]. The result indicated that although many women were aware that high BMI and high GWG were associated with adverse maternal health outcomes, knowledge of neonatal outcomes was less evident. This is likely due to the fact that these pregnant women do not have much information on the subject and they are not educated at the antenatal clinic.

Body Mass Index and GWG

With respect to gestational weight gain and its relationship with pre- pregnancy BMI, this study reported a high incidence of GWG with significant association with BMI ($p<0.0001$). This finding is consistent with those reported in a study on increased maternal pre- pregnancy BMI which was associated with an increase in children's behavioral problems (OR total behavioral problems reported by mothers' pre-pregnancy obesity versus normal weight: 1.78 [95% CI 1.17 to 2.69] and reported by teachers for pre-pregnancy overweight versus normal weight: 1.32 [1.00 to 1.74]). Maternal pre- pregnancy obesity was associated with an increase in peer relationship problems reported by teachers (OR: 1.77 [1.18 to 2.64]). It was also associated with a small decrease in cognitive flexibility [11]. Conversely, other researchers have reported that even the IOM guidelines may be too restrictive for severely obese women and may be associated with increased rates of preterm births, small for gestational age infants and perinatal mortality when compared with women with a similar BMI, who gain average weight during pregnancy [37]. This result can be associated with the lack of knowledge on their basic anthropometric data (their weight, height and BMI) and lack of knowledge on the guidelines for appropriate gestational weight gain during pregnancy.

CONCLUSION

This study focuses on the intricate interactions of age, parity, and physical activity in gestational weight gain. While age-related factors increase the risk of obesity, reproductive patterns have a substantial impact on body weight. Increased number of high gestational weight denotes the prevalence of obesity or overweight among pregnant women at the antenatal clinic of the Ho Teaching Hospital. In addition, there was a significant association between caloric intake and high gestational weight gain ($p< 0.0001$). Physical activity showed no significant association on gestational weight gain. However, respondents' pre-pregnancy BMI was directly linked to high gestational weight gain with age being a significant risk factor for obesity before pregnancy ($p<0.02$). Promoting safe and practical physical exercise during pregnancy is critical for mother and newborn health. Policies should be implemented to encourage pregnant women to live healthy lives throughout their pregnancy and beyond.

ETHICAL APPROVAL AND CONSENT TO PARTICIPATE

All the necessary ethical considerations were fulfilled for this work and a certificate issued by the Institute of Health Research, University of Health and Allied

Sciences. Reference number UHAS-REC A.4 [261] 18-19.

CONSENT FOR PUBLICATION

Consent was sought from the participants

AVAILABILITY OF DATA AND MATERIALS

Additional information or data related to the study shall be made available on request.

COMPETING INTERESTS

The authors declare no competing interest from conception to finalization of the study.

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AUTHORS' CONTRIBUTIONS

G. A. Conceptualize, Investigated, Validated, provided resources, analyzed data, supervised, Writing – Editing and Review and contributed to the methods. **G. P.** Validated, Investigated, Writing – Original Drafting, and provided resources; **J. A. A.** Writing - Review and Editing, analyzed data, supervised and provided resources; **T.A:** Writing - Review and Editing, analyzed data.

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