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Research Article

Nutritional and Health Risk of Women of Childbearing Age in Urban Ghana

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Abstract

Background: The ongoing changes in dietary and lifestyle habits parallel the increase in non-communicable diseases and the accompanying poor pregnancy outcome in developing countries.

Objective: This pilot study examined the nutritional and health indicators of women of childbearing age in Accra, Ghana.

Methods: This was a cross-sectional study of 75 childbearing-age women. Non-pregnant females between the ages 30-50 years with no known history of chronic disease were recruited. Data was collected using structured questionnaires, anthropometric measurements and health indicators via biomarkers such as blood pressure, fasting blood glucose and blood lipids. Descriptive analysis was used to summarize and describe the data. SPSS was used for data analysis. The criterion for statistical significance was set as $p<0.05$.

Results: Of the 75 women who participated, 76% had birthed at least one child. Median age was 37 years, 56% were college graduates, and almost half were considered middle-income earners. The mean BMI was 29.13 kgm2 with about 43% of the participants being obese. Average percent body fat was 42%. Although participant blood pressure, blood triglycerides and total LDL cholesterol levels did not differ by weight status, normal weight women tended to have slightly higher levels of HDL cholesterol ($p<0.05$). Mean fasting blood glucose level was within the normal range with no significant differences by weight status.

Conclusion: Majority of the participants were either overweight or obese with excess percent body fat. There is therefore a need for a study with larger sample size and potentially prospective in nature to examine the association between lifestyle behaviors, dietary practices and health outcomes. Such information will be vital in the prevention of obesity and its associated co-morbidities amongst women of childbearing age in countries going through nutrition transition.

Keywords: Blood Glucose; Blood Lipid; Ghana; Nutrition Transition; Obesity; Western Lifestyle

Introduction

Global economic development has brought about many changes in the way of life. Within the developing world, people are leaving their rural dwellings in search of economic opportunities in urban and more industrialized areas. Within these urban areas, Westernization is commonplace, influencing the dietary habits and lifestyle indicative of Nutrition Transition. The "Nutrition Transition", as it is aptly referred, describes the predictable changes to lifestyle and diet that come along with population shifts towards Westernization. The western diet- known for its refined carbohydrates, increased animal products, high fat, sugar, and the sedentary lifestyle that usually accompanies it has a profound impact on nutrition and health status of a population [1-3]. Within the developing world, it is the middle- and higher- income earners who are more likely to have access to the Western diet and lifestyle, both seen as symbol of status. Further, due to physical and cultural considerations in the developing world, particularly in sub-Saharan Africa, women are more likely to be obese than men.

In the past, communicable diseases were of paramount concern in the developing world. Today, a shift is occurring towards non-communicable diseases such as hypertension, cardiovascular disease, diabetes and obesity [4,5]. The increase of non-communicable diseases is especially alarming as they appear to most affect urban women of child-bearing age [5,6]. Maternal obesity related issues include increased risk of gestational diabetes, preterm birth, higher infant mortality and obesity of the child with age [1].

While the nutrition transition is a known phenomenon reported worldwide, it is the developing world that currently faces the greatest challenges [5]. Research has shown that typical body composition and fat patterning in people from the Middle East, Asia, Latin America and Africa are conducive to health risks at BMIs lower than what is typically considered overweight [1]. Because of those risks, it is paramount to public health that more effort is invested in the study of the Nutrition Transition and understanding its effect on the health of the population. Rapidly urbanizing developing nations can learn from the impact to other countries and gain insight for development of best practices. This is particularly true in Africa. It has been projected that by 2050, the majority of the continent (56%) will be urban [7].

Of particular interest is the Republic of Ghana. Like many nations in Africa, Ghana is currently undergoing its own shift to urbanization. According to the United Nations, Ghana's urban areas increased from 15% in 1950 to 53% in 2014 [7]. By 2030, urbanization is expected to be 65% [8]. The Nutrition Transition has already had an impact on public health within Ghana. The middle to upper class within Ghana continue to make the shift with increased consumption of processed food (high in fat, sodium, added sugar and limited fiber) and decreased physical activity [9]. These changes have brought about an increase in Non-Communicable Diseases (NCDs). By 2030, NCDs are forecasted to be the most common cause of death in Sub-saharan Africa [10]. Public health records have shown prevalence of hypertension within Ghana has increased from 60,000 in 1990 to about 700,000 in 2010 alone [11].

Women's health issues have also been affected. Thirty percent of Ghanaian women of childbearing-age (aged 15-49) were reported overweight or obese in 2008 with urban women being twice as likely to be overweight or obese compared to their rural counterparts [12]. Ghana is ranked as one of the countries with the highest preterm birthrate, with about 14% infants born prematurely [13]. Given the known health issues regarding women of childbearing age, the goal of this study was to assess and describe the nutrition and health situation of Ghanaian women of childbearing age, particularly those in the urban area of Accra. Specifically, we examined various biomarkers related to cardiovascular health (example. blood lipid levels, blood pressure and fasting blood sugar) in relation to weight status of women of childbearing age in an urban environment.

Methodology

Study Design and Population

This was a cross-sectional study conducted in Accra, Ghana with women of childbearing age. A total of 75 women who were found to be eligible were recruited to participate in the study. Participants were recruited from the University of Ghana and surrounding communities. Participants were included in the study if they reported as not being pregnant, 30-50 years old, no history of chronic disease, not taking any medication known to influence body weight, not making conscious effort to either lose or gain weight in the last 3 months and self-identified as Ghanaian.

Participants were taken through the consenting process where the study protocol was explained to them. They were given opportunity to ask questions regarding the study protocol. It was only after their questions or concerns were answered/clarified and they expressed interest to continue were they made to sign the informed consent form. Data collection commenced only after participant had signed the consent form. The Human Subject Institutional Review Board of the University of Georgia (protocol number STUDY00003837) approved the study. The approved protocol from the University of Georgia was subsequently reviewed and approved by the Ethics Committee of the School of Applied and Basic Sciences of the University of Ghana.

Data collection

Anthropometric Measures: A pretested questionnaire was used to capture the data. Anthropometric measurement: body weight, height, hip and waist circumference, were taken in duplicates by following standard protocol. Body weight was measured to the nearest 0.01 kg using the SECA 769 weighing scale. Height (using SECA 220 stadiometer), hip and waist circumferences were measured to the nearest 0.1 cm. Waist and hip circumferences were measured using an inextensible tape. BMI as an anthropometric indicator was calculated by dividing weight (in kilograms) by the height (in meters) squared. BMI was classified as normal weight (BMI = 18.5-24.9 kg/m^2), overweight (BMI = 25.0-29.9 kg/m^2), and obese (BMI ≥ 30.0 kg/m^2). Waist to hip ratio was calculated by dividing the waist circumference by the hip circumference. Percent Body fat (%BF) was measured by Bioelectrical Impedance Analysis (BIA), using a commercially available body composition monitor (Omron BF-508) and following the measurement protocol stated in the manufacturer's manual. Body fat was classified as normal (%BF = 15-22 versus 18-32), overweight (%BF = 22 versus 32), and obese (%BF = 25 versus 35) for men and women respectively [14,15].

Blood Pressure Measurement: Blood Pressure (BP) was taken using an electronic sphygmomanometer (BP785N, Omron 10 Series® BP monitor) after participant had been seated in a comfortable and restful position for at least 10 minutes. The cuff was wrapped around the mid-upper arm of the left hand of the participant. Protocol for BP measurement was followed as stated in the manufacturer's manual. Blood pressure was classified as normal (systolic: less than 120 mmHg; diastolic: less than 80 mmHg), prehypertension (systolic: 120-139 mmHg; diastolic: 80-90 mmHg), and hypertension (systolic: ≥ 140 mmHg; diastolic ≥ 90 mmHg).

Biomarker Measurement: Following an overnight fast, blood sample was collected from participants as stated in the CardioChek HemoCue Glucose 201+ user guides. To assess blood lipid panel, participant's forefinger was prepared by wiping the tip with alcohol pad to sterilize the area and allowed to dry. The sterilized area of the forefinger was subsequently pricked with a lancet and 35-40 µL of blood collected with disposable sterile capillary pipette. The collected blood in the disposable capillary pipette was subsequently transferred onto the test strip blood application window of the lipid panel strip while it was firmly inserted into the CardioCheck PA analyzer. The test lasted between 1.5 and 2 minutes with the results displayed automatically on the analyzer window. Fasting blood glucose concentration was measured using HemoCue Glucose 201+. A drop of blood was collected from the pricked finger described above into a microcuvette and inserted into the HemoCue Glucose 201+ analyzer for blood glucose measurement. The measured fasting blood glucose, Total Cholesterol (TC), Low-Density Lipoprotein (LDL), High Density Lipoprotein (HDL) and triglyceride levels were later classified. Fasting blood glucose was classified as normal (FBG < 100 mg/dL), prediabetes (FBG: 100-125 mg/dL), and diabetes (FBG ≥ 126 mg/dL). Total cholesterol was classified as desirable less than 5.2 mmol/L, intermediate or borderline high as 5.2-6.2 mmol/L and high as greater than 6.2 mmol/L. Total LDL cholesterol was classified as optimal below 2.6 mmol/L, near optimal as 2.6-3.3 mmol/L, borderline high as 3.4-4.1 mmol/L, high as 4.1-4.9 mmol/L and very high as greater than 4.9 mmol/L. Total HDL cholesterol was classified as poor below 1.0 mmol/L, moderate/better as 1.0-1.5 mmol/L and high/best as greater than 1.5 mmol/L. For Triglyceride levels we classified desirable as less than 1.7 mmol/L and borderline high as greater or equal to 1.7 mmol/L.

Statistical Analysis

Statistical Package for Social Sciences (SPSS) version 23 for Windows was used for data entry and analysis. Continuous variables were summarized into means and standard deviation. Categorical variables were summarized into frequencies and percentages. Student's unpaired, two-sided t-test was used to compare means between groups while Pearson Chi-squared test was used to compare categorical variables. All differences were considered statistically significant at P-value < 0.05.

Results

Characteristics of Participants

A total of 75 females between the ages of 30-50 years participated in this study. The mean age was 37.52±5.09 (range: 30-49) years. Majority 53 (70.7%) were < 40 years, lived with spouse 43 (57.3%), had children 57 (76.0%), had a household annual income 36(48%) >GH₵ 6000, were college graduates or higher 40 (53%) and were not self-employed 70 (93.3%). The prevalence of overweight and obesity was 42.6% and 26.7%, respectively (Table 1).

Variable	n	%
Age (years)		
<40	53	70.7
≥40	22	29.3
Household Income		
<₵2,000	17	22.7
₵2,000-₵3,999	12	16
₵4,000-₵5,999	10	13.3
≥₵6,000	36	48
Highest level of education categorized		
Senior High School or Less	20	26.7
Some College or Technical/Vocational	15	20
College Graduate or higher	40	53.3
Are you currently working?		
Working at a job, self employed	5	6.7
Working at a job, not self employed	70	93.3
Partner or spouse you live with		
Yes	43	57.3
No	32	42.7
BMI Categories		
Normal Weight	23	30.7
Overweight	20	26.7
Obese	32	42.6
Do you have children?		
Yes	57	76
No	18	24

Table 1: Characteristics of participants (N=75).

Anthropometric Measurement

The mean height, weight, hip and waist circumference of the study participants were 160.04±6.11 cm, 73.78±1.60kg, 107.03±12.36 cm and 93.60±14.35 cm respectively. The mean BMI and waist to hip ratio was 28.85±5.78 kg/m² and 0.87±0.06, respectively (Table 2). Mean of all anthropometric measures were significant (P<0.05) across the BMI groups. Most participants across the BMI categories (52.2% normal weight, 80.0% overweight and 100.0% obese) significantly had excess body fat (P= <0.0001) (Table 3).

Variable	BMI categories				P-value
	Total N=75	Normal weight n=23	Overweight n=20	Obese n=32	
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	
Age (years)	37.52±5.09	37.65±5.23	35.25±2.85	38.84±5.68	0.044
Anthropometric measures					
Weight (kg)	73.79±14.86	60.07±6.02	71.53±6.07	85.06±14.30	<0.0001
Height (cm)	160.04±6.11	161.70±5.50	161.46±6.20	157.97±6.04	0.037
BMI (kg/m²)	28.85±5.78	22.95±1.70	27.42±1.45	34.00±4.68	<0.0001
Waist Circumference (cm)	93.61±14.35	81.68±5.57	91.79±4.84	103.31±5.83	<0.0001
Hip Circumference (cm)	107.03±12.36	98.93±5.18	105.57±3.79	113.78±15.49	<0.0001
Waist to hip ratio	0.87±0.06	0.83±0.05	0.87±0.04	0.91±0.06	<0.0001
Percent body fat (%)	41.75±6.86	34.80±3.71	40.32±3.68	47.63±4.64	<0.0001
Blood Pressure Measurement					
Systolic blood pressure (mmHg)	119.93±16.73	116.91±15.62	119.95±21.03	116.91±15.62	0.533
Diastolic blood pressure (mmHg)	82.81±12.23	79.65±8.458	83.65±15.44	84.56±12.22	0.324
Biomarker Measurement					
Fasting blood glucose (mg/dL)	92.21±10.13	90.39±9.17	94.60±6.33	92.03±12.43	0.399
Total cholesterol (mmol/L)	4.60±1.07	4.48±0.92	4.40±0.99	4.81±1.21	0.34
Total LDL cholesterol (mmol/L)	2.84±0.99	2.57±0.81	2.72±0.80	3.11±1.16	0.108
Total HDL cholesterol (mmol/L)	1.32±0.40	1.48±0.35	1.25±0.43	1.24±0.38	0.053
Triglyceride level (mmol/L)	0.96±0.27	0.94±0.28	0.93±0.27	0.99±0.27	0.765

Table 2: Distribution of risk factors by participants BMI (N= 75).

Variable	BMI categories			P-value
	Normal weight n=23	Overweight n=-20	Obese n= 32	
Waist-to-hip ratio				0.003
Low risk	9 (39.1)	1 (5.0)	4 (12.5)	
Moderate risk	7 (30.4)	5 (25.0)	3 (9.4)	
High risk	7 (30.4)	14 (70.0)	25 (78.1)	
Waist circumference				
Reduced risk	7 (30.4)	0 (0.0)	1 (3.1)	<0.0001

Increased risk	12 (52.2)	4 (20.0)	1 (3.1)	
Greatly increased risk	4 (17.4)	16 (80.0)	30 (93.8)	
Percent body fat				
Normal	5 (21.7)	0 ((0.0)	0 (0.0)	<0.0001
Moderate	6 (26.1)	4 (20.0)	0 (0.0)	
Excess	12 (52.2)	16 (80.0)	32 (100)	
Systolic blood pressure				0.966
Normal	20 (87.0)	17 (85.0)	28 (87.5)	
hypertensive	3 (13.0)	3 (15.0)	4 (12.5)	
Diastolic blood pressure				0.61
Normal	19 (82.6)	16 (80.0)	23 (71.9)	
Hypertensive	4 (17.4)	4 (20.0)	9 (28.1)	
Fasting blood glucose				0.611
Normal	18 (78.3)	15 (75.0)	27 (84.4)	
Prediabetes	5 (21.7)	5 (25.0)	4 (12.5)	
Diabetes	0 (0.0)	0 (0.0)	1 (3.1)	
Total cholesterol				
Desirable	17 (73.9)	14 (70.0)	22 (68.8)	
Intermediate	5 (21.7)	6 (30.0)	5 (15.6)	
high	1 (4.3)	0 (0.0)	5 (15.6)	
Total LDL cholesterol				0.217
Optimal	14 (60.9)	8 (40.0)	12 (37.5)	
Near optimal	4 (17.4)	8 (40.0)	10 (31.3)	
Borderline high	5 (21.7)	4 (20.0)	5 (15.6)	
High	0 (0.0)	0 (0.0)	3 (9.4)	
Very high	0 (0.0)	0 (0.0)	2 (6.3)	
Total HDL cholesterol				0.049
High risk	3 (13.0)	8 (40.0)	11 (34.4)	
Average risk	8 (34.8)	8 (40.0)	15 (46.9)	
Low risk	12 (52.2)	4 (20.0)	6 (18.8)	
Triglyceride level				0.584
Normal	23 (100.0)	19 (95.0)	31 (96.9)	
Borderline high	0 (0.0)	1 (5.0)	1 (3.1)	

Footnote: Number in parenthesis is percentage

Table 3: Distribution of risk factor categories by participants BMI.

Blood Pressure Measurement

There were no statistically significant differences in mean blood pressure across the BMI categories (P= 0.53). Majority of participants had a normal systolic and diastolic blood pressure across BMI categories (systolic: normal weight= 87.0%, overweight= 85.0%, obese= 87.5%; diastolic: normal weight=82.6%, overweight=80.0%, obese= 71.9%) but was not significant (P=0.966 and P= 0.610 respectively) (Table 3).

Biomarker Measurement

The mean fasting blood glucose (92.21±10.31) mg/dl was in the normal range. The mean total cholesterol (4.60 ±1.07) mmol/L was in the desirable range. The mean LDL cholesterol (2.84±0.99) mmol/L was near-optimal and the mean triglyceride level (096±0.27) mmol/L was in the normal range.

Association Between Weight Status and Health Indicators

While 70.0% of overweight and 78.1% obese participants had significantly higher risk for cardiovascular diseases according to the estimated waist-to-hip ratio, 39.1% of normal weight participants had a lower risk (P=0.003) (Table 3). According to waist circumference and percent body fat measurements, overweight and obese participants were at increased risk for cardiovascular diseases compared to their normal weight counterparts (P = <0.0001). There were no significant differences in the mean values of the biomarker measurements assessed (P>0.05) across the BMI categories (Table 2). Majority of the study participants across the BMI categories (78.3% of normal weight, 75.0% of overweight and 84.4% of obese) had a normal fasting blood glucose level (Table 3). From the lipid panel test, only total HDL cholesterol showed a weak significant association (P=0.049) with normal weight women having slightly higher levels compared to their overweight and obese counterparts (Table 3).

Discussion

The ongoing nutrition transition across low and middle-income countries has led to an increase in obesity and associated morbidities, particularly among women of childbearing age. The impact is greater in urban areas with the adoption of Western food habits and lifestyle and cultural perception of weight compared to rural settings. This study examined the potential influence of the nutrition transition on the nutrition and health of women of childbearing age in Accra, Ghana. Over half of the participants had at least some college education and were either overweight or obese. Average blood pressure was within the normal range but tended to increase with increasing age. The mean fasting blood glucose level was within the normal range regardless of weight status. Overall, there was no significant differences in blood lipid levels by weight status except for HDL cholesterol which tended to be slightly higher among women of normal weight.

The prevalence of obesity was higher among older participants who also had greater adiposity assessed via waist-to-hip ratio and percent body fat. Our findings show all participants had an above optimal distribution of abdominal fat with the average waist-to-hip ratio being greater than 0.8 which is consistent with findings from the Women's Health Survey of Accra [16]. The observed obesity prevalence is also higher than reported by Kodaman and colleagues [6] in their study conducted in Accra, Ghana even though their participants were older than participants in the current study. The high prevalence of obesity and excess body fat observed in the current study are of public health importance and has implications on the course of pregnancy and pregnancy outcome. Because of the strong association between maternal obesity and pregnancy complication such as gestational diabetes, pre-eclampsia, gestational hypertension and the potential for induced labor as well as delivery of macrosomic baby [15,17], it is important for women of childbearing age to maintain healthy weight.

Although most participants had excess body fat they had a normal systolic and diastolic blood pressure. This observation is contradictory to previous studies that have reported association between obesity, excess body fat and measured blood pressure [16]. This observation could be attributed to the active lifestyle of Ghanaian women. Mean fasting blood glucose level was within the normal range and did not differ significantly by weight status. Our findings are in line with that of a larger population-based study conducted within urban Ghana among females [6]. Even though Kodaman and colleagues [6] reported the prevalence of diabetes in urban Ghana to be similar to that of the developed world, we only observed a prevalence of diabetes to be 1.3% among participants in the current study. The differences in the prevalence of diabetes could be due to the small sample size and age in the current study compared to the study by Kodaman, et al. [6] Regardless, the impact of diabetes on parturition for mother and child are well known and require urgent attention within the healthcare system.

Dyslipidemia is a major risk factor for coronary heart disease [18]. A closer examination of our results reveal obese women were likely to have dyslipidemia. There were no significant differences in the mean levels of the different blood lipids by weight status except for HDL cholesterol which tended to be slightly higher among normal weight women. This observation could be due to the active lifestyle (although not assessed in the current study) of Ghanaian women. Our findings, though not statistically significant, corroborate those of previous studies [19,20]. This study has a number of limitations that should be considered when interpreting the findings. This was a cross-sectional study with convenience sample of only 75 women of childbearing age. The data are descriptive in nature and therefore limits the generalizability of the findings.

Conclusions

Based on the results from this study, more public health measures aimed at understanding the impact of the ongoing Nutrition Transition should be directed to the prevention of obesity and its associated co-morbidities amongst women of child bearing age to ensure a healthy population. Future studies using larger sample size should focus on the general lifestyle including physical activity of these women to gain holistic picture of the impact of the ongoing Nutrition Transition to guide public health interventions.

Declaration

Ethics Approval and Consent to Participants

The study was conducted according to the guidelines laid down in the Declaration of Helsinki. The protocol was reviewed and approval by the Human Subjects Institutional Review Board of the University of Georgia (protocol number STUDY00003837). Informed written consent was obtained from participants before being enrolled to participate in the study.

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Conflicts of interest

The authors declare no competing interests.

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Authors Contribution

AKA and MSA conceptualized and designed the study. MSA and RA acquired the data. AKA, MSA and RA analyzed and interpreted the data. RA, AP and EJ drafted the manuscript and critically revised it for intellectual content with input from AKA and MSA. All authors read and approved the final manuscript.

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