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Original Research Article

ASSOCIATION OF MATERNAL SOCIODEMOGRAPHIC CHARACTERISTICS AND PREPREGNANCY BIOMETRIC INDICES WITH BIRTH WEIGHT OUTCOME AMONG GHANAIAN WOMEN IN THE KUMASI METROPOLIS

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ABSTRACT

Background: Maternal sociodemographic characteristics affect birth weight, an important predictor of neonatal morbidity and mortality. Maternal lipid levels during pregnancy have been linked to abnormal birth weight. Notwithstanding, there is lack of data on the maternal sociodemographic characteristics and early maternal lipid levels on birth weight outcomes in Ghana. This study therefore sought to determine the relationship between maternal sociodemographic characteristics,early maternal lipid levels and birth weight outcome among Ghanaian women in the Kumasi Metropolis of Ghana.

Methods: Maternal lipid levelswere assessed in the first trimester from 246 pregnant women attending AntenatalClinic in the Kumasi Metropolis, Ghana, between January 2014 and October 2016. Maternal sociodemographic informationwas collected through standard medical record forms at first antenatal visit. Pregnancy was tracked till delivery and birth weight measured.

Results: The mean maternal age was 27.42±6.10 years and that of parity was 2.57±1.42. Mean gestational age was 36.60±2.46 weeks. The proportion of study participants decreased from those whose highest education was JHS, no formal education, SHS, primary and then university. The means of maternal pre-pregnancy systolic and diastolic blood pressures were 118.81±25.15mmHg and 75.04±14.02mmHg respectively. Both total cholesterol and triglycerides had their respective means and ranges of 4.02±0.09mmol/L and 1.47±0.05 mmol/L.

Conclusion: The birth weight of neonates of mothers with no formal education was significantly higher compared to mothers with formal education at <95th percentile of pre-pregnancy maternal triglycerides. Mean neonatal birth weight of the Akan mothers was significantly lower than that of the Northernersbut higher than their Fante counterparts at <95th percentile of pre-pregnancy maternal total cholesterol level.

KEY WORDS: Maternal Sociodemographic, Maternal Lipid Levels, Birth Weight, Neonatal Morbidity and Mortality, Abnormal Birth Weight.

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INTRODUCTION

There is paucity of information on maternal sociodemographic parameters affecting pregnancy. However, few studies available have shown association between maternal socio demographic characteristics and increased risk of adverse pregnancy outcomessuch as preterm birth, low birth weight and foetal growth restriction [1]. These characteristics include age of the mother, parity, education, occupation,

religion, marital status, ethnicity, family size and income levels [2]. Identification of these factors of adverse pregnancy outcome is important because it permits the identification of pregnant women at risk [3]. The age range perceived appropriate to conceive with insignificant obstetric complications is 20-35 years[2].

Postnatal mortality is found to be highest in 20-35 year old mothers[4].Several studies have associated advanced maternal age with pregnancy complications [5-8]. Maternal parity isalso found to relate with pregnancy wastages. With wastage decreasing from 2-4 pregnancies but rises with the 5th birth and above[4].

Marital status is recognized to pose high risk to maternal and neonatal health outcomes[9]. Single pregnant women face a lot of socioeconomic challenges including poor mental health and psychosocial stress, stigmatization, discrimination, job loss and violence, contributing to low patronage at free prenatal care services offered by government institutions.Poor and delayed prenatal care are associated with poor neonatal outcomes[10-13].

Mothers who work as labourers during gestation are said to be at 7.14 times risk of delivering low birth weight babies relative to their counterparts in the service class [14].

A study in the US observed lower odds of low birth weight among neonates of unmarried urban mothers who at least involved themselves in religious service once a week, but not in neonates of unmarried urban mothers not involved in religious attendance [15].

The connection between religion and health of the individual is more observable in the African settings, where sickness and deathare attributed to spiritual powers. The potential factors explaining maternal religious involvement and birth weight of neonates are speculated to include the mental and behavioural health of mothers[15, 16].

Minority racial populations in advanced countries have been found to exhibit increased adverse pregnancy outcome. A comparative study among African, US born black women and US born white women in Illinois reported lower risk of African born black women delivering low birth weight neonates than US born white women [17].

A study observed that, African-Caribbean, Moroccan and Ghanaian women showed statistically significant low levels of total cholesterol relative to the Dutch women while Ghanaian women had lower levels of triglycerides as compared with the other countries[18]. Maternal ethnicity offers possible explanations to variations in gestation and neonatal mortality across ethnic groups. This observation is assumed to result from differences in socioeconomic, behavioural and physiological characteristics [19].

Pregnant women having increased circulating physiological lipids obtains sufficient energy to provide for herself and the foetusas well as maintain steady metabolic rate [20]. The circulating lipid concentrations of non-pregnant women is recommended to be lower than 5mmol/L for total cholesterol, 3mmol/L for LDL-C, 2mmol/L for triglycerides and above 1mmol/L for HDL-C. However, these values naturally rise during pregnancy [21]. Several studiesrecommended values during early and mid-gestation of TC, TG and LDL-C to be < 95th percentile while HDL-C should be > 5th percentile[22-24]. Maternal cholesterol and triglyceride levels in early pregnancy are crucial in determining the health status of both the foetus and the placenta[18].Triglyceride of 300 mg/L and above corresponded with increased birth weight of 3.5 to 4.0 kg[25]. In addition to glucose, triglycerides probably serve as source of fuel for foetalgrowth [21]. HDL-C is known to significantly affect total cholesterol balance.Decreased maternal HDL-C concentration results in the extra-embryonic tissues undertaking compensatory mechanisms to ensure adequate circulating lipid uptake for foetal growth [26].Apart from its importance in the transport of cholesterol and maintaining circulating lipid balance, HDL-C exhibits antioxidant, anti-inflammatory and anti-thrombotic characteristics [27, 28].

Ghana as a lower middle income country needs more cost effective scientific approaches in improving the health of the populace especially in the area of maternal and child health. Notwithstanding, many studies in Ghana have related maternal sociodemographic and biometric indices with maternal cardiovascular

diseases, obesity and hypertensive disorders [29, 30], with little or no information available on maternal sociodemographic and pre pregnancy biometric indices with neonatal birth weight.

This study therefore was conducted to examine relationship between maternal socio demo graphic characteristics and prepregnancy biometric indices with birth weight outcome in the Kumasi Metropolis of Ghana.

MATERIALS AND METHODS

Study Design and Population: An analytical descriptive cross sectional study was conducted at the Victory Maternity Home and Clinic in the Kumasi Metropolis between January 2014 and October 2018. A total of 246 pregnant womenattending antenatal care services for the first timewith informed consentwere enrolled.

Inclusion and Exclusion criteria: Included in this study were mothers who consented to participate in the study, had singleton live birth, without pregnancy or delivery complications, whose socio-demographic records as well as blood samples were collected for lipid profile analysis. Pregnant women who did not consent to participate in the study, gave multiple births, lost their babiesor had pregnancy or delivery complications were excluded.

Maternal Sociodemographic Variables and Neonatal birth Weight: Maternal sociodemographic information including age, parity, education, religion, ethnicity, occupation and marital status were collected through the "Road to Good Health" card established by Ministry of Health and Ghana Health Service[31]and completed at the Victory Maternity Home and Clinic at first antenatal visit. Neonatal birth weight was weighed using electronic balance. The recommended early and middle pregnancy levels (< 95th percentile of TC, TG and LDL and <5th percentile of HDL)[22].

Sampling and Biochemical Analysis: Blood samples were collected in the morning after an overnight fast (at least 12 hours) into a 3.5ml vacutainer (BD Plymouth, SST II Advance Tubes, UK) and transported to the Wenchi Methodist Hospital Laboratory for the serum preparation and analysis. Serum was stored at -80^{o}C after centrifugation at 2000rpm for 5 minutes until assayed. Fasting Total Cholesterol (TC), Triglyceride (TG) and HDL-C were measured on Automated Chemistry Analyzer (Flexor junior, Vital Scientific N.V., Netherland) with reagents from ELITech Group company, (SEPPIM S.A.S., France). LDL-Cwas calculated using the Friedewald equation,LDL-C (mmol/l) = [TC(mmol/l) – (TG (mmol/L)/2.2 + HDL (mmol/L)incorporated into the auto-analyzer.

Statistical analysis: Statistical analysis was performed using Graph Pad Prism Version 6. The differences in means between maternal sociodemographicand biometric indices were compared using One-Way ANOVAat significant level of $p < 0.05$.

RESULTS

The mean maternal age was 27.42 ± 6.10 years (15-43 years) and that of parity was 2.57± 1.42 (1-8) births. Mean gestational age was 36.60± 2.46 weeks (28-50 weeks). Table 1 shows the sociodemographic characteristics of study participants (N = 246).

Table 1: Maternal Sociodemographic Characteristics

Characteristics	Percentage
Education	
None	21.4
Primary	13
Junior High School	43.9
Senior High School	17.3
Tertiary	4.3
Occupation	
None	4.3
Farmer	1.4
Hairdresser	7.9
Housewife	10
Seamstress	7
Student	3.8
Teacher	3.8
Trader	59.6
Others	2.2
Religion	
Christian	71.8
Muslim	28.2
Marital status	
Married	86.2
Single	13.8
Ethnicity	
Akan	50.7
Brong	1.1
Ewe	5.1
Fante	8.1
Northerner	35

Results of the maternal biometric parameters are summarized in Table 2.

Table 2: Descriptive Statistics of Maternal Biometric Parameters.

Variables	Mean	SD	Range
SBP (mmHg)	118.81	25.15	90 – 250
DBP (mmHg)	75.04	14.02	50 – 120
TC (mmol/L)	4.02	0.09	1.40 - 9.15
TG (mmol/L)	1.47	0.05	0.38 - 6.92
HDL-C (mmol/L)	1.11	0.47	0.05 - 2.98
LDL-C (mmol/L)	2.24	0.83	0.36 - 5.68

SD – Standard Deviation, SE – Standard Error, SBP – Systolic Blood Pressure, DBP – Diastolic Blood Pressure, TC – Total Cholesterol, TG – Triglycerides, HDL – High Density Lipoprotein. LDL – Low Density Lipoprotein

Table 3: Summary of Comparison between Maternal Sociodemographic Characteristics and Biometric Indicesusing one-way ANOVA.

Sociodemographic	SP (mmHg)		DP (mmHg)		TC (mmol/l)		TG (mmol/l)		HDL (mmol/l)		LDL(mmol/l)	
	Mean ± SD	P Value	Mean ± SD	P Value	Mean ± SD	P Value	Mean ± SD	P Value	Mean ± SD	P Value	Mean ± SD	P Value
Education												
No formal education	116.90 ± 24.11	0.35	74.18 ± 14.52	0.368	3.95 ± 1.05	0.0001**	1.57 ± 0.83	0.292	1.20 ± 0.50	0.301	2.14 ± 0.88	0.243
Primary	124.70 ± 36.55		78.33 ± 12.21		4.13 ± 1.37		1.29 ± 0.51		1.20 ± 0.49		2.35 ± 0.89	
JHS	118.10 ± 20.39		74.71 ± 14.36		4.04 ± 1.03		1.46 ± 0.67		1.12 ± 0.48		2.27 ± 0.72	
SHS	120.10 ± 28.52		75.44 ± 13.71		4.09 ± 1.07		1.46 ± 0.67		1.10 ± 0.39		2.32 ± 0.94	
Tertiary	112.30 ± 15.53		71.19 ± 13.95		3.41 ± 0.95		1.84 ± 1.82		0.83 ± 0.47		1.74 ± 0.88	
Ethnicity												
Akans	117.40 ± 22.11	0.477	74.46 ± 13.31	0.522	4.07 ± 1.14	0.348	1.52 ± 0.85	0.083	1.09 ± 0.47	0.65	2.28 ± 0.89	0.0220*
Fantes	114.90 ± 23.16		72.07 ± 15.99		4.19 ± 0.70		1.17 ± 0.48		1.25 ± 0.38		2.46 ± 0.60	
Northerners	122.00 ± 29.85		76.58 ± 14.46		3.98 ± 1.08		1.44 ± 0.63		1.09 ± 0.46		2.24 ± 0.77	
Ewes	117.00 ± 21.87		75.05 ± 14.11		3.53 ± 1.30		1.90 ± 0.94		1.12 ± 0.66		1.54 ± 0.77	
Brongs	120.80 ± 21.65		74.75 ± 17.42		3.16 ± 0.35		1.145 ± 0.28		1.18 ± 0.34		1.46 ± 0.14	
Occupation												
Unemployed	133.40 ± 43.87	0.052	77.19 ± 15.29	0.132	3.84 ± 1.10	0.734	1.47 ± 0.81	0.729	0.99 ± 0.40	0.34	2.15 ± 0.86	0.694
Farmers	103.30 ± 15.28		66.67 ± 5.77		4.00 ± 0.96		1.43 ± 1.56		1.45 ± 0.24		1.90 ± 0.53	
Traders	117.00 ± 24.24		73.69 ± 12.96		4.10 ± 1.15		1.44 ± 0.62		1.13 ± 0.50		2.33 ± 0.86	
Housewives	129.50 ± 35.16		77.92 ± 15 77		3.77 ± 1.10		1.43 ± 0.77		0.99 ± 0.41		2.10 ± 0.86	
Hairdressers	119.50 ± 30.57		72.86 ± 14.54		3.81 ± 1.06		1.62 ± 0.85		1.02 ± 0.43		2.07 ± 0.89	
Dress makers	114.70 ± 24.12		68.42 ± 13.85		4.15 ± 1.06		1.48 ± 0.68		1.20 ± 0.32		2.78 ± 0.75	
Teachers	103.80 ± 9.16		65.00 ± 10.69		3.56 ± 0.83		1.22 ± 0.28		0.95 ± 0.45		1.96 ± 0.37	
Students	120.90 ± 31.45		76.36 ± 18.59		4.08 ± 0.67		1.89 ± 1.84		1.25 ± 0.53		2.01 ± 0.62	
Others	116.30 ± 9.16		78.75 ± 6.41		4.02 ± 1.08		1.48 ± 0.62		1.18 ± 0.42		2.16 ± 1.01	

SP = Systolic Blood Pressure, DP = Diastolic Blood Pressure, TC = Total Cholesterol, TG = Triglycerides, HDL = High Density Lipoproteins, LDL = Low Density Lipoprotein, $^{*}p < 0.05$, $^{**}p<0.001$

Table 4: Describes the comparison of neonatal birth weight at <95th percentile of TC, TG and LDL-C and >5th percentile of HDL-C prepregnancy maternal lipid levels with respecttomaternal education.

<95th BW	AKANS	NORTHERNERS	FANTES	p-value
BWTC	3.10 ± 0.47	3.25 ± 0.52	2.97 ± 0.45	0.022
BWTG	3.10 ± 0.47	3.25 ± 0.52	2.97 ± 0.44	0.025
BWLDL	3.10 ± 0.48	3.25 ± 0.52	2.97 ± 0.45	0.023
>5th BW				
BWHDL	3.10 ± 0.48	3.23 ± 0.50	2.92 ± 0.38	0.018

Table 5: Summary of Comparison of neonatal birth weight at <95th and >5th Percentiles of prepregnancy maternal lipid levels and maternal education levels.

<95th BW	NON	PRI	JHS	SHS	TER	p-Value
BWTC	3.20 ± 0.51	3.14 ± 0.41	3.15 ± 0.50	3.15 ± 0.55	2.85 ±0.39	403
BWTG	3.21 ± 0.51	3.13 ± 0.41	3.15 ± 0.50	3.14 ± 0.54	2.83 ± 0.41	0.021
BWLDL-C	3.19 ± 0.50	3.10 ± 0.36	3.15 ± 0.50	3.15 ± 0.54	2.78 ± 0.46	0.404
>5th BW						
BWHDL-C	3.27 ± 0.48	3.20 ± 0.51	3.12 ± 0.52	3.08 ± 0.47	2.99 ± 0.40	0.326

<95th = less than 95th percentile, >5th greater than 5th percentile, BW = neonatal birth weight, NON = mother with no formal education, PRI = Primary School JHS = Junior High school, SHS -= Senior High School, TER = Tertiary education, TC = total cholesterol, TG = triglyceride, LDL = low density lipoprotein, HDL = high density lipoprotein, S = Statistically significant, NS = Not statistically significant.

It was observed that, mothers who did not have any formal education gave birth to neonates with significantly high birth weight than those who had attained formal education at <95th percentile of TG prepregnancy maternal lipid level. However, the differences recorded for neonatal birth weight at <95th percentiles of TC, LDL-C and >5th percentile of HDL-C were not statistically significant.

Neonatal birth weight at < 95th percentiles of TC, TG and LDL-C and > 5th percentile of HDL-C were compared between theAkans, Northerners and Fantes. The differences in birth weight at <95th percentilewere statistically significant as shown in Table 5.

DISCUSSION

Maternal sociodemographic characteristics are known to forecast valuable information concerning pregnancy outcomes. Therefore, early identification of anomalies of maternal sociodemographic factors could provide i nexpensive amenable solutions in the prevention of adverse pregnancy outcomes[2, 3].

The present study recorded mean maternal age of 27.42 ± 6.10 years, while parity was 2.57± 1.42. These findings aresimilar to the 27.71±5.95years and 2.68 ± 1.71 observed for maternal age and parity respectively in a previous study at the same facility [32]. They are also similar to the maternal age of 28.0 ± 5.2 yearsand parity of 2.0 ± 1.4 results observed among the control population in a study on the lipid profile and high maternal BMI in the Cape Coast Metropolis[33]. Another study conducted in North-West of Nigeria recorded a mean maternal age of 28.2 ± 5.7years and parity of 3.0 ± 2.0 [34]. A Sri Lanka based study recorded mean maternal age of 28.2 ± 5.5 years and parity of 2.0 ± 1.2 [35]. The relatedness in these results could be an indication of a common social factor that regulates child bearing age and parity such as not giving birth at teen age in order to gain the respect of society. The mean maternal age in this study could also place the participants within the range of ideal childbearing age [2]. It could also indicate that, majority of the women were not much concerned about pursuing higher education [7, 8, 36].

It has been found adverse effects of maternal age below 20 years and above 35 years[37, 38].

The mean parity of the present study showed that, majority of the mothers were expecting their third neonates. This might place the mothers in the state of low risk of adverse pregnancy outcome. Primparous mothers have high risk of delivering low weighted neonates [38-40]. This is because, the first pregnancy places huge constraint on the uterus resulting in uterine adaptation through expression of genes from the placenta. This leads to efficient blood supply and hence adequate nutrient supply so that the mother can provide efficient support for her subsequent pregnancies [39]. This theory may be ideal for the second to fourth order pregnancies. However, the fifth order and above have been found to be associated with a number of adverse effects including abortion [4].

The percentage distributions observed in the present study as regards education levels were differentfrom results of similar study conducted among Ogu Speaking people of Badagry Area of Lagos State in Nigeria which found that 35 % of the respondents had primary school education, 41.7% of the population had secondary school education, 16.7% had tertiary education, while 6.7% had no formal education [41].

Another study in the Aminu Kano Teaching Hospital in the North – West Nigeria also found that, 49.5% had tertiary education, 42% had secondary education, 4.5% had primary education, 2% had Qua'ranic education and 1% had no formal of education [34].

The differences observed in education levels of these studies could result from variations in socio-political and educational systems. Maternal educational level is an important determinant of social class in Ghana and elsewhere because improved literacy is believed to lead to healthy life style practices including proper health-seeking behaviour.

Low level of maternal education contributes to poor understanding of nutrition and feeding practices [2].

This is also supported by the Demographic Health Survey findings from three African countries, namely Tanzania, Malawi and Zimbabwe which suggested that, maternal education level impact significantly on pregnancy

outcome as education enlight ensmothers[42]. It has been reported that, mothers with high level of education are likely not to deliver low birth weight babies [43].

Religion is known to have protective effects on maternal health and survival as certain religious beliefs offers motivations to desist from unhealthy practices including smoking, substance abuse and drinking. Existingevidence suggests that, health outcome derived from religious involvement could be transferred from mother to child [15]. In this present study, the religious affiliation of the participants was found to belong to two major religions namely Christianity (71.8%) and Islamic (28.2%). A study in Badagry Area of Lagos State in Nigeria also observed 63.2% Christian, 19.3% Islam and 17.5% other religions [41]. These observations presuppose that, Christians and Moslems dominated in both studies under comparison. Some of the religious believes could be beneficial to the pregnant women whereas others might endanger the lives of both the mother and her foetus. Religious believes for centuries have been more observable in the African settings where diseases and deaths are attributed to supernatural powers. Study of the US Fragile Family and Child Wellbeing data found that, low birth weight among neonates whose mothers involved themselves in religious service at least once a week had lower odds ratio than neonates with mothers who did not involve themselves in religious service at all[15]. The impact of maternal religious involvement has been observed through fate and healthy mental status and behaviour. Healthy mental state leads to good social and psychological practices that result in high optimism and sense of meaning and purpose to reduce depression, anxiety and fear. Religion is also known to play supportive and social community to promote healthy pregnancy outcome [16, 44].

Clearly, differences exist in maternal characteristics among ethnic groups. This probably could result from cultural and traditional practices observed in across ethnic groups. The ethnic groupings according to this study were Akans, Brongs, Ewes, Fantes and Northerners. The observation is not surprising as over half of the study population were Akans. Kumasi is the seat of all Akan speaking people in Ghana. The other observation where Northerners formed the second highest population confirmed the location of Kumasi as situated between the regions up north and the rich south of Ghana and therefore attracts a lot of migrants from the northern parts of Ghana. Kumasi also is the largest commercial capital of Ghana and attracts different tribes from various parts of the country [45]. Also, infrastructural development gap and provision of social amenities between the southern and northern Ghana probably explains the observed pattern [46].

The type of occupation during pregnancy is critical in determining the outcome. The study population was found to belong to different occupational backgrounds.Although, other studies conducted elsewhere did not specifically categorize the occupation levels as was done in this study, the findings are closely related. One such study was conducted among 120 pregnant women in Badagry Area in Lagos State, wherein 31.7% were Civil servants, 53.3% were into business and 15% were artisans [41]. Some studies also recorded 27.5% employed against 72.5% unemployed while 30.6% employed versus 69.4% unemployed [11, 34]. The 59.6% of the study population engaged in trading was an indication of economic viability of the Kumasi city with few people involved in farming. The nature of trading activities in Kumasi though seem economically good, it poses threat to the pregnant women in that long hours of standing, lifting and carrying heavy loads as tight business schedules have been found to associate with poor perinatal outcomes including preterm delivery and low birth weight [47].

The social, traditional and psychological premium on marriage may have perinatal consequences onboth the mother and the neonate. The observation of current study is in line with studies in Montreal, Canada which recorded a higher percentage (61%) of married and a lower percentage (39%) of unmarried women[9]. Likewise, a study in Brazil found77. 4% married and 22.6% unmarried among the study participants but contradicts with a study on Malaysian women which found 51.8% unmarried and 48.2% married[11, 48]. This could suggest cross cultural variations in attaching

importance to marriage before birth. It has been reported that, unmarried status exerts psychosocial stress which influences the pregnancy through physiological alterations in neuroendocrine activities of the expectant mother [9]. It is suggested that, unmarried status serves as a surrogate marker for other potential harmful practices such as discontinuous antenatal care services, smoking and drinking that endanger the lives of the foetus and the mother [48]

Maternal Biometric Indices: In the present study, the observed mean values of maternal biometric indiceswere higher than observed in some studies[49]. Mean values of all the biometric parameters, except triglycerides observed in the present study were lower than studiesconductedamongGhanaian population which associated maternal biometric indices with conditions other than pregnancy. For example, reported mean systolic and diastolic blood pressures of 132.5 ± 1.19 mmHg and 86.3 ± 0.73 mmHg, TC of 4.40 ± 0.05 mmol/l, TG of 1.20 ± 0.03 mmol/l, HDL of 1.34 ± 0.02 mmol/l and LDL of 2.51 ± 0.05 mmol/l have been observed in premenopausal and postmenopausal Ghanaian women with metabolic syndrome[50]. Also, in studying the metabolic syndrome among sportsmen and women in the Kumasi Metropolis, mean SBP(132.20 ± 1.71 mmHg) and DBP(79.18 ± 1.10 mmHg), TC(4.77 ± 0.09 mmol/l), TG(0.98 ± 0.04 mmol/l), HDL (1.79 ± 0.07 mmol/l) and LDL(2.62 ± 0.10 mmol/l) were observed [51]. The differences in mean values of the biometric parameters of the present studyand other studies especially those conducted in Ghanaian could be due to differences in attributes such as metabolic syndrome and menopausal ages not considered in this study[50, 51].

Maternal Sociodemographic and Biometric indices with Neonatal birth weight: No significant association existed between SBP and DBP at various levels of maternal education. Similarly, no association was found between maternal TG and the categories of education. The same observations were made for HDL and LDL. However, statistically significant association was observed between the levels of maternal education and the total cholesterol. It was realized that total cholesterol levels were high among mothers who attained primary, junior and senior high education, but was low for the "no formal education" and tertiary categories.This could be explained in terms of positions of these categories on the socioeconomic ladder where the "no formal education" mothers may engage in manual livelihood businesses which indirectly improves physical activity and in turn cut down certain negative effects of low education on cholesterol biomarkers. The highly educated probably are mindful of dietary pattern that might influence their cholesterol levels[52]. Also, with the exception of LDL, the various ethnic groups did not show significant association with the biometric indices. The study did not observe significant differences in the means of SBP and DBP, TC, TG, HDL and LDL in relation to maternal occupation.

This observation contradictsa study which reported that women with low education exhibited trend towards high lipid profile in comparison with their colleagues with high education levels, although the authors reported no statistical significance difference[53].

During pregnancy, most of maternal physiological processes are increasingly influenced by the activities of placental hormones particularly in the third trimester[54]. However, the finding in this current study could be explained in terms of linkage of education with the health of the individual. Evidence suggests that, highly educated individual is enlightened and practises healthy behaviour, enjoys better employment and income and also aware of prevailing social and psychosocial factors [55].

Pregnant women withoutformal education showed statistically significant differences in the mean values of the birth weight than those who attained formal education at <95th percentile of prepregnancy maternal triglyceride level. However, the differences recorded for neonatal birth weight at <95th percentile of TC, LDL-C and >5th percentile of HDL-C were not statistically significant.It has been reported that,TG probably serves as alternative source of energy for the growth of the developing foetus[21]. The present finding shows that, mothers with no formal education delivered neonates with high birth weight.This finding is contrary to a study by Balihallimath et al. (2015) which reported that,

birth weight increased with increasing number of years of education. The inconsistency between the finding of this present study and those reporting positive relation of birth weight with number of years of schooling could arise from differences in economic status of the study areas.

The birth weight differences observed in the current study among the three predominant ethnic groups were significant at various levels of <95th percentile TC, TG, and LDL and >5th percentile of HDL.Generally, differences in ethnic lipid profiles have been well reported with most findings attributing the differences to genetics, changes in oestrogen levels and lifestyle factors [56, 57].People from Northern Ghana are known to be physically active than their Akancounterpartsprobably as a result of culture, farming, lifestyle etc.[58]. The Akans are more prone to western lifestyle, which could contribute to the observed differences in birth weight. This is also supportedby two separate studies conducted in Kumasi and Northern Ghana with the former reportingabnormal mean values of serum lipids inthe study participants while the findings fromthe latter study indicatedhealthier lipid profile levelsamong the study participants [29, 30]. It is well established that. Ghanaian women have low levels of total cholesterol and triglycerides [18] and this could have affected the lipid profile during gestation leading to the observed differences in birth weight.

CONCLUSION

There was a relationship between maternal level of education and total cholesterol levels. Also, significant relationship between maternal ethnicity and LDL levels was observed. The birth weight of neonates of mothers with no formal education was significantly higher comparable to mothers with formal education. Differences in neonatal birth weight of the Akans, Northerners, and Fanteswere significant.

Conflicts of Interests: **None**

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