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Dietary patterns of expecting mothers and the resulting birth outcomes in Abuth Shika, Zaria

[1*]BURBA Rimamtsiwe Adi,

[2]MUSA Yusuf Hwere

[3]OYEGOKE Paul Ifeleke

[4]BULUS Rimamnungra Ibrahim

[1]Department of Home Economics, Faculty of Agriculture, Taraba State University, Jalingo-Nigeria

***Corresponding author Email**: adi.burba@tsuniversity.edu.ng / burbaadi@gmail.com

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Competing Interests.

The authors declare no competing interests.

ABSTRACT

Low birth weight (LBW) is a crucial underlying determinant and contributor to neonatal and infant mortality. The relationship between dietary patterns, of pregnant women and the birth outcomes in ABUTH Shika, Zaria was evaluated in this study. Maternal dietary pattern, anthropometric indices (weight, height, Mid Upper Arm Circumference (MUAC), and Body Mass Index (BMI)), packed cell volume were assessed. On the average, maternal dietary pattern was; cereals (27.18%), roots/tubers (26.21%), dairy products (42.50%), meat/fish/poultry (28.16%), soups/sauces (26.21%), then fruits/vegetables (31.06%) consumed at the rate of 2-4 times a week, while legumes (32%) were consumed once a week. This was achieved with the used of food frequency questionnaire (FFQ). Majority (57.3%) of the pregnant women had PCV level within the normal range, while 42.7% fell below the normal range when compared with the reference range. Correlating maternal dietary pattern and birth weight showed a significant association with birth weight. The food groups that showed significant relationship with birth weight includes cereals, roots and tubers, legumes, meat, fish and poultry. A large percentage of the biochemical parameters of the babies such as TC, TG, HDL and LDL, Glucose, Total protein and Albumin were normal, using the reference standard respectively. This study has established that dietary pattern of pregnant women is a major contributor to their birth outcome. Also, maternal weight, height and nutritional status (MUAC) had significant relationship with the birth weight of neonates of pregnant women attending ABUTH Shika, Zaria. Therefore, this study recommends urgent public health interventions that could check the incidence of low birth weight through awareness and other programs that will improve both maternal and child health.

Keywords: Dietary pattern, Anthropometric, weight, height, length, and low birth weight

1. INTRODUCTION

Pregnancy outcomes ranks among the pressing reproductive health problems in the world (Demissie and Kogi-Makau, 2017). Nutrition in pregnancy refers to the dietary planning and nutrient intake that is undertaken during pregnancy. The nutritional status of the mother at conception is a key factor for development and foetal growth, so a healthy, balanced diet is essential both before and during pregnancy (Castrogiovanni and Imbesi, 2017). Nutrient reduction, deprivation or imbalance before implantation, could result in somatic hypoevolutism at birth, alterations in endocrine and metabolic functions during postnatal life, and, often, impaired maturation of the reproductive system (Musumeci *et al.,* 2014).

Birth defects, are structural or functional abnormalities present at birth, and can result in physical and mental disabilities. They are also the leading cause of death in infants less than one year of age. While birth defects can develop at any time during pregnancy, most begin during the first trimester because it is the time when a baby's organs are formed – the most crucial part of foetal development. Neural tube defect, congenital diaphragmatic hernia, and

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and cleft palate are the most common birth defects.

Nigeria is the most populous country in Africa, with an estimated population of 193,392,517 people (NBS, 2017). The country harbors the highest population of black people in the world. Over the years, nutrition has not performed very well in Nigeria. The 2013 National Demographic Health Survey report indicates that undernutrition among women aged 15–49 years in Nigeria showed only minimal improvement over a 10-year period, with the 2003 value of 15% reducing to only 11% by 2013. Trends in overnutrition were even worse, increasing from 21% in 2003 to 25% in 2013 (Kana *et al.,* 2015). In Nigeria the neonatal mortality rate is 37 deaths per 1,000 live births, the post neonatal mortality rate is 31 deaths per 1,000 live births and the prenatal mortality rate is 41 per 1,000 pregnancies (NDHS, 2013).

The status of maternal, and foetal mortality in Nigeria may be threatening, and calls for serious attention. Some primary health care physicians, and obstetricians are not aware of the dietary, and over-the-counter medication intake practices of their patients, and thus lack the information needed to help guide them. Studies that address, and bring together the broader picture of multiple nutrient intakes or deficiencies are lacking. Health-care providers, and policy makers need information about the state of maternal and child health especially of neonates, in order to plan counseling and behavioral interventions for pregnant women on proper and adequate dietary pattern that will bring a healthy offspring.

Methods:

Sample size calculation

$$n = \frac{Z^2 p (1-p)}{d^2}$$

Where:

n: required sample size

z: standard normal distribution at 95% confidence limit=1.96

p: (7%) prevalence of Nigerian women of reproductive age in the north west region reported to be malnourished (NBS, 2014)

d: absolute desired precision of 5%

The minimum calculated sample size was 100 clients (mother-baby pairs). For more accuracy the sample size was increased to 113 clients, but 103 clients completed the study. Systematic sampling technique was used to recruit the subjects during their Anti-Natal Clinic (ANC) sessions. The inclusion criteria are strictly considered and eligible subjects were selected.

Inclusion criteria

All singleton pregnant women in their third trimester attending antenatal clinic at ABUTH that did not have medical illnesses.

Exclusion criteria

Pregnant women attending ABUTH who were sick, those at the first and second trimester and those with multiple pregnancies were excluded from the study.

Informed consent

Informed consent was sought from all pregnant women in their third trimester using a consent form.

Ethical considerations

Ethical clearance with reference number: ABUTH/HREC/TRG/39, dated 11th November 2016 was obtained from the Health Research

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Ethics committee in ABUTH Shika, Zaria.

Maternal nutritional status

Maternal anthropometry was obtained through weight, height and mid-upper arm circumference (MUAC) as described by Corgill (2003). MUAC is a measure of the sum of the muscle and subcutaneous fat in the upper arm. BMI (body mass index) is a person's weight in kilograms divided by the square of height in meters.

Neonatal nutritional status

Neonatal nutritional status through weight, head circumference and length of babies was assessed at birth, using methods as described by Fareeha *et al.,* (2014) and values were compared with WHO (2009) Z-score standard using anthro software version 14. Weight was measured using a digital weighing scale that had a pan where the babies were placed before the values were recorded to the nearest 0.01kg.

Dietary Assessment

Maternal nutritional information was collected by the use of semi-structured questionnaire. A pilot study involving about 30 subjects was done prior to the commencement of the main research to validate the materials (questionnaires). Subjects that participated in the pilot study were excluded from the study. The validated food frequency questionnaire (FFQ), was utilized in a face-to-face interview with the pregnant women. The questionnaire consisted of seven food groups adopted from Food guide pyramid (Willett, 2017). Probing questions were used to help the respondent re-member all the foods they consumed the previous day or week.

Biochemical analysis

About 2mL of neonatal cord blood was drawn by a Medical Doctor which was analyzed for blood glucose, total protein, serum albumin, and lipid profile.

Packed cell volume (Haematocrit)

Maternal blood sample was obtained after cleaning the finger with 70% alcohol and swab and subsequently pricked by a Medical Doctor. The blood collected in a sealed capillary tube was spined using micro-centrifuge (8000-Hemofas). The capillary tube was placed on the 8000-Hemofast reader to measure the packed cell volume. The values were recorded in percentages.

Serum Total Protein by Biuret method measured by absorption spectroscopy at 540 nm and serum albumin was estimated by Bromocresol Green (BCG) method with maximum absorbance at 628 nm.

Serum lipid profile determination was done using colorimeter multichannel analyzer (FKA 6062, Kensington limited United Kingdom) as described by Gohil *et al.,* (2011). Total Cholesterol, High Density lipoprotein (HDL) cholesterol, Low density lipoprotein (LDL)-cholesterol and triglycerides (absorbance at 520nm) were measured.

Where, Total Cholesterol = (VLDL-chol) + (LDL-chol) + (HDL-chol).

LDL-cholesterol was calculated from measured values of total Cholesterol, triglycerides, and HDL-cholesterol according to the relationship: (LDL-chol) = (total-chol) - (HDL-chol)(TG)/5 and (TG)/5 is an estimate of VLDL-cholesterol and all values are expressed in mmol/L (Fredrickson *et al.,* 1967).

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While, Triglycerides = Abs. of test x conc. Of std (mmol/L) Abs. of std

Statistical analysis

Data analysis was carried out using statistical package for social sciences (IBM SPSS) software version 20.0. Results are presented as mean ± SD except where otherwise stated. Z-score calculation for nutritional status was analysed using anthro software version 14. Chi-square was used to determine the relationship between dietary pattern and the birth weight. P values less than 0.05 ($p<0.05$) were taken as significant.

RESULTS

A total of 113 questionnaires were distributed and 103 were retrieved for analysis, giving a response rate of 91.2%. Sex distribution among the babies was 56 females and 47 males of which 78 of them were born through vaginal delivery while 25 by caesarean section. The age range of the participants ranged from 15 – 44 years. About 67% fell between 20- 34 making the majority of respondents. The weight ranged from 73 - 87 kg, and height difference was significant though with a smaller range (157 – 159 cm) (Table 1).

The levels of packed cell volumes of maternal blood is shown in Table 2. Majority of the women (57.3%) had normal PCV (≥33%), while 42.7% of them had their PCV levels below the normal (<33%). The pregnant women had an average PCV level of 33.27 ± 4.46.

The average dietary patterns of the pregnant women attending antenatal clinic at ABUTH Shika revealed that 39.8% of the women consumed rice 5-6 times / week, while 28.9% ate rice 2-4 times / week for the cereals group, while consumption of yam was also high (36.9%) at a frequency of 2-4 times / week followed by sweet potato (30.1%) at a frequency of once/week (Table 3). Majority of the pregnant women (42.5%) consumed dairy products 2-4 times / week. The frequency of consumption of protein sources was low.

The percentage distribution of the pregnant women according to nutritional status using MUAC is shown in Figure 1. Most of the pregnant women (85.4%) were within the normal MUAC cut off (≥23cm) while 14.6% of them were moderately malnourished (≥19cm -<23cm) and none of them were found to be severely malnourished (<19cm).

The distribution of neonates based on birth weight classification is shown in Table 4. Most of them (77.7%) weighed within the acceptable range of birth weight (2.5-3.99kg), 21.4% of them had low birth weight (<2.5kg) with the average weight of 2.28±0.12 while 1% were overweight (≥4.0kg) with an average weight of 4.05±0.00.

The levels of blood glucose, protein, and albumin of babies is shown in Table 5. Most (74.8%) of the babies were born with blood glucose levels within the normal range and with average value of 3.34±0.62. Most of the babies (81.56%) had a total protein at the normal range and with an average value of 5.87 ±0.88. Only 2.9% of the babies had albumin levels below the normal range and with the average value of 2.30 ± 0.27.

Table 1: Distribution of Weight and Height According to Age among Pregnant women Attending Antenatal Clinic at ABUTH Shika.

Age (years)	Weight (kg)	Height (cm)	Frequency	Percentage (%)
15-19	78.83±12.66[a]	158.04±9.84[a]	24	23.3
20-24	76.92±16.42[a]	158.88±9.58[a]	25	24.3
25-29	73.36±14.12[a]	157.00±6.57[a]	28	27.2
30-34	81.06±13.70[a]	158.81±8.77[a]	16	15.5
35-39	79.67±16.61[a]	157.83±7.99[a]	6	5.8
40-44	87.25±20.32[a]	159.00±3.74[a]	4	3.9
Mean ± SD	77.60±14.73[a]	158.11±8.39[a]	103	100

Values are mean ± SD, values in a column with the different superscript are considered significantly different (p<0.05)

Table 2: Maternal Packed Cell Volume among the Pregnant Women in their Third Trimester

Classification	Frequency	Percentage (%)	Mean ±SD	*Reference range (%)
Normal	59	57.3	36.27±3.21[a]	≥ 33.0
Below Normal	44	42.7	29.25±2.11[b]	<33.0
Total	103	100.0	33.27±4.46	

* Moghaddam and Radfar (2014). Means within the same column with different superscript are considered significantly different (p<0.05).

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Table 3: Dietary Patterns of the Pregnant Women Attending Antenatal Clinic at ABUTH Shika. (n=103)

Food type	Never Freq (%)	Once /month Freq (%)	Once /wk Freq (%)	2-4 times/wk Freq (%)	5-6 times/ wk Freq (%)
Cereals					
Rice	0 (0)	14 (13.6)	19 (18.5)	29 (28.9)	41 (39.8)
Maize	0 (0)	8 (7.8)	27 (26.6)	32 (31.1)	36 (35)
Sorghum	12 (11.7)	32 (31.1)	25 (24.3)	24 (23.3)	10 (9.7)
Millet	3 (2.9)	13 (12.6)	42 (40.8)	27 (26.2)	18 (17.5)
Roots and tubers					
Yam	0 (0)	15 (14.6)	29 (28.2)	38 (36.9)	21 (20.4)
Potato	0 (0)	23 (22.3)	31 (30.1)	26 (25.2)	23 (22.3)
Irish potato	1 (1)	38 (36.9)	20 (19.4)	23 (22.3)	21 (20.4)
Cassava	0 (0)	31 (30.1)	25 (24.3)	23 (22.3)	24 (23.3)
Dairy products	**0 (0)**	**9 (8.7)**	**25 (24.3)**	**44 (42.5)**	**25 (24.3)**
Meat, fish and poultry					
Beef	0 (0)	12 (11.7)	34 (33)	32 (31.1)	25 (24.3)
Lamb	4 (3.9)	27 (26)	37 (36.3)	29 (28.2)	6 (5.8)
Chicken	0 (0)	43 (41.8)	18 (17.5)	27 (26.2)	15 (14.6)
Fish	0 (0)	19 (18.4)	29 (28.2)	28 (27.2)	27 (26.2)
Egg	0 (0)	35 (33.9)	16 (15.5)	32 (31.1)	20 (19.4)
Legumes					
Ground nut	0 (0)	25 (24.3)	33 (32)	22 (21.4)	23 (22.3)
Soups and Sauces					
Sesame leaves	10 (9.7)	33 (32)	19 (18.5)	23 (22.3)	18 (17.5)
African sorrel	1 (1)	47 (45.6)	14 (13.6)	24 (23.3)	17 (16.5)
Okra	0 (0)	8 (7.8)	19 (18.5)	45 (43.7)	31 (30)
Moringa leaves	1 (1)	19 (18.5)	41 (39.8)	28 (27.2)	14 (13.6)
Pumpkin	17 (16.5)	38 (36.9)	25 (24.3)	16 (15.5)	7 (6.8)
Bitter leaf	0 (0)	21 (20.3)	38 (36.9)	27 (26.2)	17 (16.5)
Fruits and vegetables					
Sugar cane	0 (0)	16 (15.6)	33 (32)	27 (26.2)	27 (26.2)
Banana	0 (0)	38 (36.9)	16 (15.6)	26 (25.2)	23 (22.3)
Cabbage	0 (0)	28 (27.2)	22 (21.4)	42 (40.7)	11 (10.7)
Carrot	0 (0)	21 (20.3)	38 (36.9)	27 (26.2)	17 (16.5)
Coconut	0 (0)	17 (16.5)	24 (23.3)	31 (30.1)	31 (30.1)
Dates	0 (0)	21 (20.4)	17 (16.5)	43 (41.8)	22 (21.4)
Guava	0 (0)	37 (35.9)	18 (17.5)	39 (37.9)	9 (8.7)
Pineapple	0 (0)	34 (33)	25 (24.3)	27 (26.2)	17 (16.5)
Water melon	0 (0)	15 (14.5)	42 (40.8)	28 (27.2)	18 (17.5)
Baobab fruit	0 (0)	13 (12.6)	37 (35.9)	24 (23.3)	29 (28.2)
Orange	0 (0)	38 (36.9)	16 (15.6)	26 (25.2)	23 (22.3)

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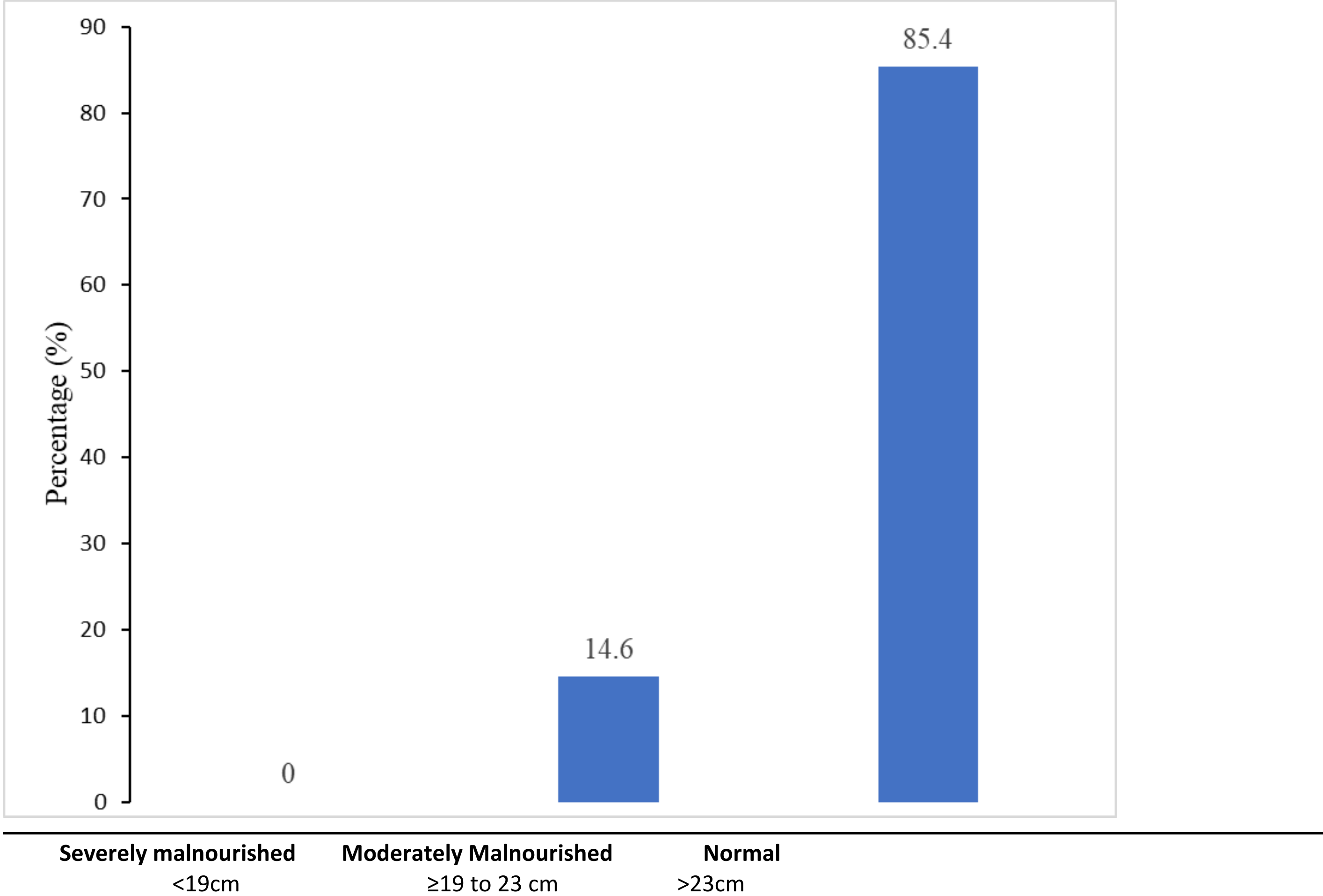

Figure 1: **Percentage Distribution of the Pregnant Women According to Nutritional Status Using MUAC**

Table 4: **Percentage Distribution of New Born Birth Weight**

Classification	Mean ± SD	Frequency	Percentage	*Reference Range
Low birth Weight	2.28±0.12	22	21.4	<2.5kg
Accepted birth weight	2.77±0.33	80	77.7	2.5-3.99kg
Overweight	4.05±0.00	1	1.0	>=4.0kg

Table 5: Levels of Blood Glucose, Protein, and Albumin of Babies

Parameter	Classification	Mean ±SD	Frequency	Percentage (%)	**Reference range
Glucose (mmol/l)	Normal	3.34±0.62	77	74.8	2.5 - 6.5
	Below normal	2.01±0.12	26	25.2	
Total Protein (g/dl)	Normal	5.87 ±0.88	84	81.56	4.4-7.6
	Below normal	3.66± 0.53	10	9.7	
	Above normal	7.98 ± 0.97	9	8.74	
Albumin (g/dl)	Normal	3.71± 0.56	100	97.1	2.9-5.5
	Below normal	2.30 ± 0.27	3	2.9	
	Above normal	0.00 ± 0.00	0	0	

*Values are Mean ± SD, n=103 (**Coté, 2013)*

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The distribution of lipid profile levels in the cord blood of babies is shown in Table 6. Most babies had their lipids within the normal ranges. All the babies had their LDL at the normal range (11-133mg/dl).

Neonatal Lipid Profile and Birth Weight. There was a significant association between neonatal Triglyceride (TG), Total cholesterol (TC), and Low-density lipoprotein (LDL) (Table 7). There was no significant relationship between High density lipoprotein (HDL) and birth weight.

Maternal Dietary Pattern and Birth Weight. There was a significant association between the frequency of consumption of cereals (x^2=89.082, p=0.000*), roots and tubers, dairy products (x^2=87.699, p=0.000*), meat, fish and poultry (x^2=70.053, p=0.000*), and legumes (x^2=74.083, p=0.000*), and birth weight (Table 8). The frequency of consumption of soups and sauces, and fruits and vegetables did not show significant association with birth weight.

Table 6: Distribution of Neonatal Lipid Profile among the Babies

n=103 Lipid	Classification	Frequency	Percentage (%)	Mean ± SD	*Reference (mg/dl)
TC	Normal	79	76.70	82.02± 19.20	40-200
	Below normal	24	23.30	38.10 ±5.40	
TG	Normal	68	66.00	46.10± 28.00	17-300
	Below normal	35	34.00	15.07±4.12	
HDL	Normal	92	89.32	28.21± 8.31	15- 75
	Below normal	11	10.67	13.34± 5.14	
LDL	Normal	103	100	55.02±4.40	11-133
	Below normal	0	0	0.00 ±0.00	

Values are mean ± SD, TC- total cholesterol, TG- triglyceride, HDL, High density lipoprotein, LDL- low density lipopro-

Table 7: The Relationship between Neonatal Lipid Profile and Birth Weight.

Variable (mg/dl), mean ±SD	LBW (n =22)	NBW (n=80)	p-value	**Reference range (mg/dl)
TG	81.10± 32.00	63.80± 14.90	0.000*	17-300
TC	84.30± 21.20	76.50±15.70	0.000*	40-200
HDL	31.50±3.10	31.90±2.30	0.530	15- 75
LDL	36.40±15.60	30.50±14.40	0.000*	11-133

LBW-low birth weight (<2.5kg); NBW- normal birth weight (2.5–3.9kg). Total Cholesterol (TC), triglycerides (TG), high density lipoprotein (HDL), low density lipoprotein (LDL). p -value <0.05 are considered significant. (** Ale-tayeb, *et al.,* 2013).

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Table 8: Relationship between Maternal Dietary Patterns and Birth Weight.

Food frequency	Underweight (< 2.5kg)	Normal (> or = 2.5kg)	Chi-square	P-value
Cereals			89.082	0.000*
Never	0 (0.0%)	7(6.8%)		
once /month	0 (0.0%)	17 (16.51%)		
once/week	0 (0.0%)	24(23.3%)		
2-4 times/week	0 (0.0%)	28(27.18%)		
5-6 times /week	23 (22.3%)	4(3.88%)		
Roots and tubers			87.699	0.000*
Never	1 (0.98%)	0 (0.0%)		
once /month	0 (0.0%)	26 (25.24%)		
once/week	0 (0.0%)	26 (25.24%)		
2-4 times/week	0 (0.0%)	27(26.21%)		
5-6 times /week	22 (21.3%)	1 (0.98%)		
Dairy products			76.863	0.000*
Never	0 (0.0%)	0 (0.0%)		
once /month	20(19.4%)	1 (0.98%)		
once/week	3 (2.9%)	22 (21.36%)		
2-4 times/week	0 (0.0 %)	32 (31.07%)		
5-6 times /week	0 (0.0%)	25 (24.3%)		
Meat, fish and poultry			70.053	0.000*
Never	3 (2.9%)	0 (0.0%)		
once /month	20 (19.4%)	7 (6.8%)		
once/week	0 (0.0%)	26 (25.24%)		
2-4 times/week	0 (0.0%)	29 (28.16%)		
5-6 times /week	0 (0.0%)	18(17.48%)		
Legumes			74.083	0.000*
Never	0 (0.0%)	0 (0.0%)		
once /month	22 (21.35%)	3 (2.9%)		
once/week	0 (0.0%)	33 (32.04%)		
2-4 times/week	1 (5.9 %)	21(20.39%)		
5-6 times /week	0 (0.0%)	23(22.33%)		
Soups and Sauces			11.529	0.099
Never	3 (29.13%)	4 (0.39%)		
once /month	14 (13.59%)	13 (12.62%)		
once/week	5 (4.85%)	21(20.39%)		
2-4 times/week	0 (0.0%)	25(24.27%)		
5-6 times /week	1 (0.98%)	17 (16.5%)		
Fruits and vegetables			4.735	0.768
Never	0 (0.0%)	0 (0.0%)		
once /month	23 (22.33%)	2 (1.94%)		
once/week	0 (0.0%)	26 (25.24%)		
2-4 times/week	0 (0.0%)	32 (31.07%)		
5-6 times /week	0 (0.0%)	20 (19.41%)		

p-value <0.05 are significantly associated with the birth outcome.

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The association between maternal anthropometric indices such as height, weight, MUAC, body mass index (BMI) and birth outcomes is shown in Table 9. The study findings showed a strong significant (p<0.05) positive relationship between the new born birth weight and maternal anthropometric indices such as MUAC (r =0.489), weight (r =0.593) and height (r =0.690). There was also a significant (p<0.05) negative correlation between the newborn head circumference and maternal anthropometric parameters such as height (r = -0.548) and MUAC (r = -0.413).

Table 9: Relationship between Maternal Anthropometric Indices and Birth Outcomes

Variables	N	Height		Weight		MUAC		BMI	
		R	p	r	P	r	p	r	P
Birth weight	103	0.690**	0.000	0.593**	0.003	0.489**	0.000	0.194*	0.050
Head circumference	103	-0.548**	0.000	-0.150	0.130	-0.413**	0.000	-0.078	0.434
Weight for height z score	103	0.028	0.780	0.084	0.401	-0.133	0.181	0.075	0.449
Length for age z score	103	-0.061	0.540	-0.023	0.815	0.029	0.769	-0.005	0.957
Weight for age z score	103	-0.021	0.825	-0.026	0.792	-0.033	0.741	-0.019	0.849

**. Correlation is significant at the 0.01 level (2-tailed).

*. Cor-

DISCUSSION

Majority (57.3%) of the women had their PCV at the normal levels (≥33). This may be due to the routine iron supplementation given to them during their antenatal visits. Less than half (42.7%) of the pregnant women had PCV levels below normal range. According to a study by Wahed *et al.* (2008), it is evident that significantly low hemoglobin percent and packed cell volume in pregnant women is due in part to dietary iron deficiency.

This study showed that all the pregnant women regardless of their nutritional status were consuming less than the recommended servings of the various food groups. Rice and maize were the most commonly consumed foods (5-6 times/week). Intake of chicken was very low, 41.8% of the pregnant women consumed it once a month. This observation is consistent with the findings that food choices are highly sensitive to price, and dietary diversity, including micronutrient and protein-rich healthy foods are the first to be dropped from the diet, because these options are usually more expensive (Bai *et al,* 2021) (Mekonnen *et al*. 2021).

Inadequate consumption of protein-rich foods constitutes a major threat to meeting the increased demand for energy and protein in the third trimester to support both the growth of the baby and the mother's own health, to prevent anemia during pregnancy and low birth weight babies. This is consistent with studies conducted by Kemunto (2013), and another by Ali *et al.,* (2014), showing only one percent of the pregnant

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women taking eggs, and organ meat.

The study also showed a significant relationship between maternal dietary pattern and birth weight. Food groups like cereals, root and tubers, dairy products, meat, fish and poultry and legumes all showed a significant relationship with birth weight. Mothers consuming cereals at a high frequency (5-6 times / week) were seen to have 22.3% incidence of low birth weight and 3.88% normal weight babies. For the protein groups (dairy products, meat fish and poultry and legumes), mothers that consumed dairy product at a high frequency (5-6 times/week) had no low-birth-weight babies but 24.3% normal weight babies. For mothers consuming meat, fish and poultry in low frequency (once / month), 19.4% of the babies were born with low birth weight while 6.8% were of normal birth weight.

Consumption of soups and sauces, fruits and vegetable did not show significant relationship with birth weight. This is in agreement with the results of a study conducted in northern Ghana by Abubakari and Jahn (2016) that women's healthy dietary pattern were found to be protective against the incidence of low birth weight babies. The study also emphasizes the need for optimal nutrition during pregnancy.

The study also showed that 25.2% of the babies had blood glucose levels below the normal range (neonatal hypoglycemia). Neonatal hypoglycemia is the most common preventable causes of brain damage if left untreated (Massachusetts Medical Society 2015).

Majority (81.56%) of the babies had their serum total protein at the normal range (4.4-7.6 g/dl) while 9.7% fell below normal range and 8.74% were above normal. Hypoproteinemia can affect the baby's immunity, growth, liver etc. This condition is quickly controlled at the onset of breastfeeding. Hyper-proteinemia on the other hand is largely asymptomatic but it indicates conditions such as dehydration, Hepatitis B, Hepatitis C, etc. Majority (97.1%) of the babies had normal albumin levels, while 2.9% was below normal level.

The Study also showed a high percentage of the babies had their lipids (TC, TG, HDL, LDL) at normal ranges. According to Kelishadi *et al.* (2005) serum lipids at young age may reflect fat disorder and risk of complication in adulthood. Measurement of serum lipoprotein in infancy could be predictive for lipoprotein disorders and cardiovascular disease in adulthood since Low birth weight is an important risk factor for cardiovascular diseases especially in low-income countries (Kelishadi *et al.,* 2005).

Conclusion

The findings of this study shows that the dietary pattern of the majority of the study population constitutes high frequency of consumption of carbohydrate food groups and low consumption of protein rich foods. Maternal dietary pattern showed a significant association with birth weight. Therefore, the study revealed a higher incidence of low birth weight than the global incidence, this calls for public health interventions to bring this ugly trend under control. Pregnant women and other care givers must be properly educated on healthy dietary patterns and food choices that will improve the birth weight of their babies.

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