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Maternal Food Habit, Nutrient Intake and Physical Activity Pattern on New Born Anthropometry of Secondary and Tertiary Health Facilities in Abeokuta Metropolis Ogun state, Nigeria

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Abstract: **The aim of this study were to assess maternal food habit, their nutrient intake and physical activity pattern on the new born anthropometry. Pregnant women (200) at the second and third trimesters attending secondary and tertiary health facilities in Abeokuta were systematically selected into the study using their booking register (N/n) irrespective of their socio-economic characteristics. Semi structured pretested questionnaire consisting of 19point questions on food habit, FAO/WHO 24hr diet and physical activity recall (in minutes) with Ainsworth physical activity compendium tracking events with meal time were administered to the respondents to assess their food habits, nutrient intake and physical activity respectively while the new born anthropometry were obtained as secondary data from delivery record. The nutrient intake and physical activity were evaluated using nutria-survey 17.0; the nutrient intake was compared with Recommended Daily Allowance (RDA) while physical activity and new born anthropometry were classified according to WHO. Result indicated that 90.9% of respondents were within 20-39years, 83.0% Yoruba tribe, 86.0% married, 50.3% had tertiary education, 32.2% were traders while 41.0%earn ₦18000-₦50000 monthly. Food habit shows that 12.5% has food taboo, 2.5% drink alcohol, 24.0% skip meals, 7.0% smoke cigarette while 25.5% purchased their meal rather than prepare it. Majority (84.4%) were physically inactive, 11.1% moderately active while only 4.5% were vigorously active. About half (48.8%) of the new born were pre-termed, 20.0% had short length, 15.6% low birth weight and 31.8% had high head circumference. There was no direct association between Physical activity and the new born anthropometry measured but there were significant association between socio-economic status and nutrient intake (p=0.007), nutrient intake (carbohydrate) and almost all the new born anthropometry (p=0.006). The carbohydrate and micronutrient intake of the respondents influenced birth outcome especially pre-termed birth. Therefore, improvement in micronutrients particularly calcium are hereby recommended to the respondents of the study.**

Keywords: **Anthropometry, Birth weight, Gestational age, Health facility, Maternal food habit, Newborn, Nutrient intake, Physical activity, Pregnant women, Pre-termed and RDA.**

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1. INTRODUCTION

Normal nutritional status generally refers to correct amount and type of nutrient taken both in quantity and in quality [1]. Pregnancy is an anabolic process and a woman's normal nutritional requirement increases during pregnancy to meet the needs of the growing fetus and the maternal tissues associated [2].

Physical activity is a global term traditionally defined as bodily movement resulting from contraction of skeletal muscle that results in an increase in energy expenditure above resting levels [3]. Physical activity level is the ratio of thermic effect energy to resting energy expenditure (or BMR) and provides an index of the average relative excess output related to intensity and duration for a 24-h period [4]. Annually, nearly 41% of all under-five death was among new born infant babies in their first 28days of life or the neonatal period and three quarters of all new born deaths occurs in the first week of life [5] and out of all the 8.2million under-five children deaths per year, about 3.3million occur during the neonatal period [6]. The majority-almost 3million of these die within one week and almost 2million on their day of delivery. An additional 3.3million are still birth. Virtually all (99%) new born deaths occur in low-and middle-income countries [5].

Low birth weight is defined as weight less than 2500g (2.5kg) taken shortly after delivery irrespective of gestational age [7]. More than 20 million infants worldwide or 15.5% of all births was born with LBW [6]. The level of LBW in developing countries (16.5%) is more than double the level in developed regions (7%). Therefore, more than 99.5% of LBW are born in developing countries [8] and contribute mainly to neonatal morbidity and mortality worldwide accounting for up to 70% of neonatal death [9].

2. METHODOLOGY

2.1 Study design

A longitudinal study was conducted among randomly sampled subjects in secondary and tertiary health facilities in Abeokuta metropolis.

2.2 Study Area

Abeokuta is the capital of Ogun State, South West Nigeria and was founded around 1830. It lies on the main railway from Lagos to Ibadan; it also has road connections to Isehin and Cotonou (Benin Republic). Abeokuta South is a local government area in Ogun State, Nigeria. The headquarters of the LGA is located at Ake, Abeokuta 7.15° N 3.35° E/7.09° N 3.21° E. It has an area of 71km² and a population of 250,278 at the 2006 census. It has 25 maternity health centers, 15 government hospitals and 30 registered private hospitals [10].

2.3 Study Population

The study population comprises of randomly selected pregnant women that were attending ante-natal clinics in both secondary and tertiary health facilities that were selected in Abeokuta South, Ogun state.

2.4 Sample Size Determination

Sample size was determined using the prevalence of Low birth weight (LBW) (The major poor pregnancy outcome) from previous study in Nigeria and was calculated using [2]**:** -$N = \frac{Z^2 p q}{d^2}$

Where: N = Minimum sample size

Z = the normal standard deviation usually set at 1.96 which correspond to 95% confidence interval

P = Observed prevalence of low birth weight (11.8%)

q = 1 –p (0.882)

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d = degree of accuracy set at (5%)

$$N = \frac{(1.96)^2 \text{ X } 0.118 \text{ X } 0.882}{(0.05)^2} = \frac{3.84 \text{ X } 0.104}{0.0025} = 159.86 \approx 200$$

2.5 Sampling Procedure

A two-stage sampling technique was used to select the pregnant women from the selected facilities. The first stage involved random selection of secondary health facilities (State Hospital Sokenu, Ijaye) out of two in Abeokuta South Local Government Area and the only tertiary health facility (Federal Medical Centre). The second stage entails systematic selection of 100 respondents each from both secondary and tertiary health facilities selected with formula N/n to determine the sampling fraction usingtheir booking register per day. Where N= Total number of women attending booking clinics on each day of sampling. n= the number of women required at that facility.

The sampling fraction was used to select study participants until the required sample per facility were reached while already selected respondents from previous visit were excluded to avoid duplication of information until the entire calculated sample size of the respondent were reached.

2.6 Exclusion Criteria.

All pregnant women attending antenatal clinic but decline consent to participate, those who will not be in the LGA at the time of their delivery, respondents from neighbouring state and LGA but attending the Ante-natal clinic of the selected LGA at the time of study and respondents at their last trimesters were also excluded from the study.

2.7 Ethical Consideration.

Ethical clearances for the use of human subject and informed consent were obtained from the ethical review board of the selected health facilities and study participants respectively while confidentiality was maintained by the researcher and the assistants.

2.8 Data collection

Semi-structured pre-tested interviewer administered questionnaire which comprises of food habit, 24hours dietary recall and adapted Ainsworth 24hours Physical activity questionnaire was used to obtain information from respondents on food habit, nutrient intake and Physical activity pattern by trained midwives and semi trained interviewers who understand and speak Yoruba and English fluently to few respondents who do not understand English but eligible to participate in the study.

2.8.1 New Born Anthropometry

Infantometer was used to measure length to nearest 0.1cm, infant weighing scale for new born weight to nearest 0.1g while measuring tape was used to obtain head circumference to nearest 0.1cm. All anthropometry measurement was classified according to WHO/UNICEF standards. Gestational age was estimated from the last menstrual period (LMP) date and was adjusted to that derived from expected delivery date (EDD) by ultrasound if the discrepancy was ≥ 7 days at 13–14 weeks, ≥ 8 days at 15–20 weeks, and ≥ 14 days at 20–24 weeks gestation, according to the method devised by Synnes and colleagues [11].

2.9 Data Analysis

Data obtained were subjected to both descriptive and inferential statistics using Statistical Package for Social Sciences (SSPS 20.0 version). Dietary intake was converted to nutrients intake and physical activity pattern was evaluated using Nutri-survey 2007 Software and compared with the Recommended Daily allowance. Anthropometric data were compared to UNICEF/WHO standards.

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3. RESULTS

3.1 Socioeconomic Characteristics of the Respondents

The socioeconomic characteristic of the respondents was depicted in Table 1 below

Table 1: Socioeconomic Characteristics of the Respondents

Variables	Frequency	Percentage
Age		
Less than 20 years	05	2.1
20-29 years	86	43.2
30-39years	95	47.7
40-49 years	10	5.0
50 years and above	04	2.0
Total	200	100
Marital status:		
Single	26	13.0
Married	172	86.0
Divorced	01	0.5
Separated	01	0.5
Total	200	100
Tribe		
Hausa	04	2.0
Igbo	20	10.0
Yoruba	168	84.0
Others	08	4.0
Total	200	100
Education		
Informal	02	1.0
Primary	27	13.8
Secondary	58	29.7
Tertiary	103	50.4
Others	10	5.1
Total	200	100
Occupation		
Full-time house wife	13	6.7
Self-employment	48	25.2
Petty trading	64	32.2
Artisan	28	14.4
Civil servant	28	14.4
Factory worker	09	2.9
Farmer	10	4.1
Total	200	100
Income		
Less than ₦18,000	52	26.0
₦18,000 - ₦50,000	82	41.0
>₦50,000 – ₦100,000	44	22.0
Above N100,000	22	11.0
Total	200	100

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3.2 Food Habit of the Respondents

Table 2 shows that 12.5% ate once/day, 21.4% did not taken in-between meals, 13.6% took alcohol in between meals, 22.0% had cultural food taboo, 7.0% Smoke cigarette while 24% skipped meals especially breakfast

Tables 2: Food Habit of the Respondents

Variables	Frequency	Percentages (%)
Frequency of eating per day		
Once	25	12.5
Twice	29	14.5
Thrice	121	60.5
Others	25	12.5
Total	200	100
In-between meals intake		
Yes	157	78.6
No	43	21.4
Total	200	100
If yes what do you take as in-between meals		
Soft drinks	28	17.6
Alcohol drinks	21	13.6
Snacks	28	17.6
Fruit and vegetables	75	47.7
Others	05	3.5
Total	157	100
Cultural food taboo		
Yes	44	22.0
No	156	78.0
Total	200	100
Smoking of cigarette		
Yes	14	7.0
No	186	93.0
Total	200	100
Alcohol consumption		
Yes	05	2.5
No	195	97.5
Total	200	100
Skipping of meals		
Yes	48	24.0
No	152	76.0
Total	200	100
Meals usually skipped		
Breakfast	12	24
Lunch	31	65.5
Dinner/Super	05	10.5
Total	48	100

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3.3 Nutrient intake of the Respondents.

Table 3 revealed that intake of all nutrient were below the RDA (Recommended dietary Allowance) for the respondents particularly 27.72% for vitamin A, 36.79% folic acid, 27.51% calcium and 46.70% iron were extremely low.

Table 3: Nutrient Intake of the Respondents.

Nutrient composition	Mean± Std. Deviation	RDA	%RDA
Calories	1382.23±1.90	2200 Kcal	62.83
Protein	45.20±2.44	71 g	63.66
Carbohydrate	171.01±11.99	175 g	97.72
Fat	36.15±2.72	56 g	64.55
Vitamin A	213.47±4.81	770 mg	27.72
Vitamin B_1	1.24±2.36	1.4mg	88.57
Vitamin B_2	1.12±1.96	1.4mg	80.0
Vitamin B_3	14.07±2.82	18mg	78.16
Folic acid	220.75±5.99	600 mg	36.79
Calcium	275.11±2.40	1000 mg	27.51
Zinc	6.63±4.94	11 mg	60.27
Iron	12.61±5.65	27 mg	46.70
Magnesium	228.03±5.34	360 mg	79.45

3.4 Physical Activity Pattern of Pregnant Women in Abeokuta Metropolis

Table 4shows that 58.5% of the respondents were extremely inactive, 25.9% were sedentary, 11.1% engaged in moderate activities as compared to 4.4% who were vigorously active.

Table 4: Physical Activity Pattern of the Respondents

Variables	Frequency	Percentage (%)
Physical activity pattern		
Extremely inactive	117	58.5
Sedentary	51.8	25.9
Moderately active	22.2	11.1
Vigorously active	09	4.5
Total	200	100

3.5 New Born Anthropometry

Table5shows that 79.2% of the newborn had normal birth weight, 2.7% were overweight, 80% of the new born had normal/optimal length, and 20% were short while none had length longer than normal when compared with the standard. More than half (59.6%) of the newborn had normal head circumference, 31.6% were above normal while 8.8 were below normal. However, gestational age of the newborn revealed that 52.1% of the new born were termed, 44.8% were preterm (premature) while few (3.1%) were post termed.

Table 5: New Born Anthropometry

Variables	Frequency	Percentage (%)
Birth Weight		
Low Birth Weight (< 2.5kg)	35	15.6
Normal Birth Weight (2.5-3.5kg)	152	79.2

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High Birth Weight (>3.5kg)	05	2.6
Total	192	100
Length		
Short New Born (<45.7cm)	38	20.0
Normal/Optimal New Born (45.7 – 60.0cm)	154	80.0
Long New Born length (>60cm)	00	00
Total	192	100
Head Circumference (HC)		
Low H.C (30 - 35cm)	17	8.8
Normal HC (>35.40cm)	114	59.6
High HC (40.1- 45.5cm)	61	31.6
Total	192	100
Gestational Age		
Preterm/Premature (≤ 37 Weeks)	86	44.8
Term (38 - 41 Weeks)	100	52.1
Post Mature (≥ 42 Weeks)	06	3.1
Total	192	100

3.6 Association between Nutrient Intake and New Born Anthropometry.

Table 6 shows that there exist positive significant association between Calorie (r = 0.181, p = 0.010) and vitamin C (r = 0.185, p = 0.009) when compared with head circumference, there was no significant association between length and nutrient intake while positive significant association exist between calorie (r = 0.560, p = 0.01), Carbohydrate (r = 0.620, p = 0.043), Magnesium (r = 0.612, p = 0.044) and birth weight. Similar positive significant association was also observed between Carbohydrate (r = 0.181, p = 0.010) and gestational age at p<0.05

Table 6: Association between Nutrient Intake and New Born Anthropometry

Nutrient intake	B.W (r)	p<0.05	G.A (r)	P<0.05	H.C(r)	p<0.05	N.L(r)	p<0.05
Calorie	0.560	0.019	-0.003	0.964	0.181*	0.010	0.066	0.536
Carbohydrate	0.620	0.043	0.142*	0.047	0.040	0.573	0.096	0.178
Protein	-0.030	0.709	-0.043	0.549	-0.018	0.798	-0.10	0.889
Fat	0.041	0.616	0.069	0.339	0.004	0.954	-0.035	0.621
Calcium	-.002	0.983	0.60	0.408	0.011	0.881	0.16	0.821
Magnesium	0.612	0.044	0.089	0.215	-0.071	0.320	0.037	0.605
Sodium	-0.029	0.724	-0.009	0.906	-0.048	0.500	-0.015	0.832
Potassium	-0.075	0.358	0.032	0.662	-0.087	0.220	-0.034	0.629
Vitamin A	-0.111	0.172	0.018	0.799	-0.010	0.889	-0.089	0.209
Vitamin C	-0.033	0.686	0.032	0.662	0.185**	0.009	0.060	0.402
Zinc	-0.076	0.350	0.006	0.932	-0.065	0.363	0.020	0.779
Iron	-0.005	0.955	0.090	0.213	0.119	0.092	0.042	0.554

*. Correlation is significant at the 0.05 level (2-tailed). BW= Birth weight, G.A= Gestational age, H.C= Head circumference

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

3.7 Association between Newborn Anthropometry and Physical Activity of Respondent

Table 7 revealed no significant association (p>0.05) between birth weight, head circumference, gestation age, chest circumference and physical activities of the respondents. Similarly, there was no significant association between nutrient intake and physical activity of the respondents

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Table 7: Association between Newborn Anthropometry and Physical Activity of Respondents

Variables	Correlation coefficient (r)	(p < 0.05)
Birth weight	0.023	0.823
Head circumference	-0.059	0.577
Gestation age	0.012	0.889
Length	-0.070	0.527

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

3.8 Association between Nutrient Intake and Physical Activities of the Respondents

Table revealed that there was no significant association between nutrient intake and physical activity of the respondents

Table 8: Association between Nutrient Intake and Physical Activities of Respondents

Nutrient intake	Correlation coefficient (r)	P< 0.05
Calorie	-0.019	0.786
Carbohydrate	-0.031	0.664
Protein	0.046	0.521
Fat	-0.043	0.548
Calcium	-0.133	0.060
Magnesium	0.058	0.416
Sodium	-0.016	0.823
Potassium	-0.061	0.391
Vitamin A	-0.020	0.781
Vitamin C	0.051	0.469
Zinc	-0.046	0.517
Iron	0.004	0.960

*. Correlation is significant at the 0.05 level (2-tailed).

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

4. DISCUSSION

Information gathered in this study based on amount of nutrient intake most especially on calories, protein, fat, magnesium, zinc, vitamin B_1, vitamin B_2, and vitamin B_3 recorded in the diets of the respondent suggest that most of them had low nutrient intake in relation to the Recommended Dietary Allowance (RDA) as percentage nutrient intake recorded in the 24 hours dietary recall of the women were below normal intake of folate, vitamin A, E, B_1, B_2, B_6, iron, calcium, phosphorus and potassium (< 75% RDA), such deviation was also reported by [12]; [13].

Finding of [14] emphasized that micronutrients are specially required in extra amounts during these physiological periods such as pregnancy cycles and that nutrients such as folic acid should be taken throughout pregnancy stage to reduce risk of congenital malformations and increases the birth weight. Although the percentage of iron, calcium and vitamin A recorded in this study were below 50%, this signifies that the respondents as well as the growing fetus investigated in this study need iron to meet the high demands of erythropoiesis (Red Blood Cell formation) and calcium during pregnancy and lactation, for proper formation of bones and teeth of the offspring, secretion of breast-milk rich in calcium and to prevent osteoporosis in the mother due to demineralization process that will be taken place in order to meet the body demand of calcium. Also vitamin A is required during lactation to improve child survival and prevent both the onset and severity of diseases like measles, respiratory infection as well as boosting the immune system of the new born [15].

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In this study, although iron was low in the nutrient intake of the respondents. This has implication of reduced hemoglobin and serum ferritin that is responsible for synthesis of blood in the body. This has adverse effect on pregnancy outcome of this study in term of birth weight and pre-termed delivery. This finding conformed to the report of [13] who also discovered low intake of iron, vitamin A, B_6, calcium, magnesium and selenium among pregnant women in eight cities of China. This iron intake deficit can be improved by iron supplementation giving to pregnant women during ante-natal and through the use of fermented and sprouted grains coupled with foods rich in vitamin C such as citrus fruits and mineral. Vitamin intake can be enhanced by folic acid and vitamin B complex supplementation and by consuming a variety of seasonal vegetables particularly green leafy vegetables, milk and fresh fruits.

Reports of this study which indicated that most of the respondents were extremely inactive in term of their physical activity levels suggests low level of involvement of the respondents in daily exercises and this on the other perspective suggest that most of the pregnant women surveyed did not have the habit of being physically active during pregnancy which has been reported to be so in many studies particularly among pregnant women. This finding is supported by [16]; [17] who assessed the barriers to physical activity during pregnancy both quantitatively and qualitatively and discovered health (i.e. tiredness, lower energy, musculoskeletal pain, fear of too early contraction etc.) and non-health related factors (motivation, environmental factors and lack of time). It may also be that the women did not receive adequate and in-depth health education and awareness of the health benefits of exercise during pregnancy therefore, pregnant women under this study need to be informed about relevance of physical activities during pregnancy as it helps reduces the risk of excessive gestational weight gain which may lead to other complications such as prolong labour [17], caesarean delivery etc. [18].

Since this study did not include pregnant women that were excluded medically from undertaking physical activity, it then implies that other reasons apart from medical reasons may likely be responsible for their physical inactivity. Within the limits of this study, the reasons for their physical inactivity may be linked with a number of clinical and socio-demographic variables such as number of children, number of miscarriage, stage of pregnancy, and occupational status, with each having a unique way of influencing the physical activity of the respondents.

There is consistent evidence that promoting physical activity in women of reproductive age may be a promising approach for the prevention of excessive weight gain, gestational diabetes mellitus and subsequent complications suffered by children born from pregnancies affected by gestational diabetes mellitus [19]; [20]; [21]. Other studies had it that women with physical inactivity are a major contributing factor to the increase in overweight or obesity [22].

In the same vain, physical inactivity has been shown to play an important role in the prevention and management of disease, reduction of maternal and fetal morbidities and production of long-term benefits for both the mother and fetus [22]. Also results of this study corroborates to the findings of [23] and [24] who claimed that despite the benefits of regular physical activity during pregnancy, report from the US National Health and Nutrition Estimation Survey of 2018 revealed that majority of pregnant women were not sufficiently physically active, tending to do less physical activities than their non-pregnant counterparts, or they reduce their physical activities during pregnancy. Other studies had it that physical activity patterns tend to decrease during pregnancy and give way to more sedentary behaviours, including watching television and reading [25]. In addition, sedentary pregnant women were at a greater risk of giving birth to low birth weight babies, than their more active counterparts [26]. Also, Low physical activity similar to that observed in this study has been reported earlier by [27].

Three-quarter of the newborn has normal birth weight and length which suggest that the inadequate level of intake recorded in maternal nutrient intake affected only few but the major macro element deficiency might have effect on the infant in the future especially of adult hood chronic diseases [28]. On the other hand, the gestational age and head circumference were a bit above average, the implication of this established that almost half of the new born were born preterm (≤37weeks of gestation) and this may be as a result of the nutrient compromise of the mothers especially carbohydrates and calorie as revealed by the association drawn between nutrient intake and the gestation age of the new born at $p<0.05$. This corroborates with the report of [29] and [28] who discovered that association between maternal dietary patterns and infant outcome that food quality was associated with birth weight and risk of small for gestational age. It may also lead to immaturity of certain vital organ in the body of the new born [30]. The importance of head circumference in the new born cannot be over emphasized. The result observed for head circumference showed that few of the new born have some of their organs not

well matured such as lung and brain, this may influence their performance and respiratory function [31] mostly when this deficit is not make-up for as will be revealed during growth monitoring process [32]. These variations recorded based on the anthropometric measurements of the neonates (newborn infants) studied suggest a variation in the ability of different anthropometric indices to identify neonates with abnormal growth in utero or accessing nutritional status at birth. This observation is similar to findings from previous studies [33]; [34]. Although, anthropometric parameter has been reported to access the nutritional status of infants however, there is no consensus on the best anthropometric indicator of abnormal intrauterine growth. Hence, a combination of at least two indicators is currently recommended [35] which is observed in this study.

Significant association was observed between nutrient intake and newborn anthropometry especially gestational age and birth weight when analyzed on a general note in terms of calorie, carbohydrate, magnesium and vitamin C, [36] and [28] also asserted similar positive influence between maternal nutrient intake and neonatal outcome. There was no significant association between nutrient intake and newborn length at $p<0.05$.

Results of this investigation which established correlation between maternal and neonatal parameters in anthropometrics and nutrient intake could be an indication that anthropometric parameters of neonate were influenced by nutrient intake of mother most especially during pregnancy phase. Results of the present investigation is in agreement with the studies of [37] and [38] who established significant positive correlation between maternal anthropometric variables with neonatal birth dimensions. Also, [39] reported significant association between neonatal outcome in relation to maternal nutrition and anthropometry of mothers.

5. CONCLUSION

The nutritional status of the respondents was on the average with respect to their nutrient intake including micronutrients most especially calcium, vitamin A and B complex, iron and foliate. However, some of the respondents skipped meals, consumed alcohol, smoke cigarette and exposed to cafeteria meals rather than prepare their meals. There were significant association between nutrient intake of the respondents and new born anthropometry while physical activity shows no influence on the newborn anthropometry.

6. RECOMMENDATION

- Nutrition counselling should focus on food rich in the identified deficient nutrient especially calcium, iron, and vitamin A in order to further improve outcome of Pregnancy in the studied areas.
- Nutrition education on importance and benefit of Physical activity during pregnancy should be fostered among pregnant women in the study area to further enhance virginal delivery.
- Suitable sporting aids, social supports and conducive environment for Physical activity should be made available in workplaces and government health facilities studied

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