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A prospective cohort assessment of maternal physical activity in Migori County

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Abstract

Maternal nutrition is critical for both mother and child as it lays fundamental foundation for the successful outcome of pregnancy. Nutrition of pregnant women is critical for it contributes immensely to the outcome of pregnancy. Kenya's high rates of undernutrition among women of reproductive age are due to sub-optimal feeding practices, heavy workload, among others among pregnant women leading to preterm births, low birth weight, high mortality and morbidity, impaired growth, and increased risks during childbirth for both mother and child. This study assessed physical activity and determined their relationships before and after a counselling intervention among pregnant women. A prospective cohort study design was used and simple random sampling was used to obtain a sample of 150 pregnant women from three sub-county hospitals purposively selected for study. Pregnant women of GA ≤26 were recruited and enrolled into Nutrition Counselling intervention study. Data was International Physical Activity Questionnaire, biochemical. Data was collected at baseline and after intervention for each woman and data was analyzed by IPAQ scoring protocol and SPSS and t-tests were used to test for differences between means. There were slight reductions in physical activity factors and increased time for rest was observed after intervention although there were no significant reductions in activity levels at $p \leq 0.05$. The finding is important to central and local governments, civil society, intergovernmental agencies, research groups, business enterprises and community under study. The study fills the knowledge gap and therefore contributes to the advancement of knowledge. This study finding contributes to the advancement of knowledge and is also important to the Government, Non-governmental organizations, Research and Business bodies and Community under study.

Keywords: Pregnant Women; Physical Activity Levels; Nutrition Counselling

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1. Introduction

Approximately 200 million women become pregnant each year in developing countries and many of these women suffer from ongoing nutritional deficiencies Many women in developing countries and other parts of the world get pregnant every year but many of them experience persistent nutrient deficiencies therefore many enter pregnancy at sub-optimal weight (Leslie, 2000; Ruel, 2013; Merkel, 2016). According to FAO (2012) and Merkel (2016) a large number of women in many parts of the world enter pregnancy at sub-optimal weight. In many parts of developing countries women are responsible for performing a large portion of unpaid domestic work much of which is difficult physical labour. In sub-Saharan Africa women contribute 60-80% of agricultural labour to produce food for sale and household consumption many women in several parts of the world enter pregnancy when under weight and in many parts of developing countries women perform heavy physical work. Women contribute a large proportion of agricultural labour in Sub-Saharan Africa (Ransom and Elder, 2013). Low income women from developing countries must often continue a strenuous work pattern until shortly before delivery. This makes them engage in high levels of activity throughout pregnancy. This energy expenditure increases the amount of energy needed from their diet. Women of low Socio-economic status in developing countries often continue to engage in strenuous physical work until shortly before delivery. This leads to increased energy expenditure which increases the amount of energy needed from their diet.

There is evidence to suggest that other maternal characteristics may also affect pregnancy outcomes. Among these, the effect of strenuous maternal work on pregnancy outcomes constitutes a priority for investigation especially in developing countries where high proportion of women bear heavy physical work either inside or outside the home (Odiwuor et al., Kimiywe et al., 2013). Strenuous work may precipitate an early delivery and gestational age is recognized as a major determinant of birth weight (Nutrition Division (GOK), 2012).

Increased maternal requirements for physical activity combined with low micronutrient and energy intake may also reduce the supply of nutrients to the foetus. For pregnant women increased calorie requirements for physical activity coupled with deficient energy and micronutrient intake may also reduce the supply of nutrients to the unborn. The definitive negative outcome of poor nutrition, strenuous work is reflected in the high prevalence of maternal and infant mortality and poor pregnancy outcomes in developing countries.

2. Methods

The study sought to determine physical activity levels before and after a nutrition counselling schedule. The study area was Migori County Kenya. Prospective cohort design was adopted for the study. Cohorts of pregnant women were selected based on gestation age. These were enrolled into the nutrition counselling programme and each followed prospectively for between four to seven months after baseline information was obtained. All Pregnant women up to 26 weeks gestation were recruited for the study. One hundred and

fifty women who met the selection criteria were randomly selected in three health facilities purposively selected as centres for the study. The study included women with a documented medical history, but the diagnosis not listed in the exclusion criteria, those who resided in the county for more than 6 months and those who gave consent to participate in the study. The study excluded women pregnant with multiples, women with diabetes or hypertension prior to pregnancy and women who were bedridden.

2.1. Procedures

Research Assistants who also included health workers in the hospitals were trained on data collection techniques and on delivery of the content of the nutrition counselling resources. The Health workers underwent a second training session on the Nutrition flip chart on the content and on how to deliver the content to the pregnant women during ANC visits. The objectives of the training were to harmonize questionnaire content, to review effective adult teaching techniques and to familiarize researchers with counseling materials. After the training Researcher and Assistants proceeded to the various health facilities for sample selection and recruitment. The pregnant women were selected by simple random sampling as they received ANC services. Upon recruitment, baseline data was collected after which the counselling resources were issued to each subject with instructions on how to undertake the counselling process. Data collection was hospital based. A total of 150 pregnant women were selected for study. Each participant was given a code and their names recorded against the codes to ease follow up. After the study the names were discarded and only the codes were used for data entry and analysis.

7 Day International Physical Activity Questionnaire (IPAQ) was used to collect physical activity data. IPAQ was used to investigate physical activity which consisted of timing, duration of work, number of hours and days worked per week, time taken to travel to and from work, vigorous activities, moderate intensity activities and leisure time activities. A review of physical activity studies found that questionnaires were the most widely used instruments reinforcing them as the most feasible option for measuring physical activity in epidemiological studies (Sclusssel et al., 2008). Subjects were issued with IPAQ forms which they were to carry home and record information on physical activity done every day between waking up and going to bed for 7 days. Those unable to fill in were instructed to use a member of the family who was able to read and write. The subjects were instructed to return the filled IPAQ forms during the next ANC visit. Physical activity data was collected at baseline and at the end of the intervention. During the ANC visit before the last appointment subjects were issued with IPAQ forms again which they were instructed to fill in as they did during baseline for 7 days and were asked to return them during the last regular appointment at ANC. The physical activity data was categorized into three domains namely vigorous intensity, moderate intensity and walking.

The counselling resources that were used were a brochure with a title of “Sound Nutrition Benefits You and Your Baby” that contained information about best nutrition practices, encouraging weight gain and reduction in physical activity and general care in pregnancy and a counselling chart that contained information on the suitable foods and best practices during all the months of pregnancy which included reduction in physical activity. Through contact with the counselling materials, women were expected to have

learnt and practised behaviours that would reduce their physical activity. For the pregnant women. Duration of intervention was determined by the gestation age at recruitment and this ranged from four to seven months depending on the gestation age of every subject at recruitment. Data of pregnant women who underwent the exposure with counselling resources for a minimum of four months qualified for analysis.

Physical Activity data were analysed according to IPAQ Scoring Protocol. The volume of activity was obtained by computing each type of activity, classified as total physical activity level, vigorous intensity, moderate intensity and walking by its energy requirements referred to as METS (multiples of the resting metabolic rate) to produce a score expressed as MET-minutes per week: Met level x minutes of activity x events per week. MET levels are expressed as;

- Vigorous = 8.0 METs
- Moderate = 4.0 METs
- Walking = 3.3 METs

The total physical activity MET-minutes/week was computed as the sum of vigorous, moderate and walking MET-minutes/week scores i.e. Total MET-min/week = (Walk METs*min*days) + (Mod METs*min*days) + (Vig METs*min*days). The IPAQ Scoring Protocol proposed three levels of physical activity which were used to categorize the subjects, Inactive, Minimally active and HEPA- active (IPAQ Research Committee, 2004). The physical activity data scored for each subject was entered into excel spreadsheet and later transferred to SPSS. Frequencies and descriptive statistics were used as appropriate. T-tests and Analysis of variance were used to test for relationships among physical activity levels, Statistical significance was taken at $P < 0.05$.

A research permit was obtained from National Commission for Science, Technology and Innovation (NACOSTI). Permission to carry out research was sought from the Migori County Commissioner, County Director of Health and County Director of Education. Project administration was sought from the Medical Officers in Charge at all the selected health facilities. Participation in the study was purely voluntary and informed consent was obtained from the pregnant women who were then recruited into the NCI study. Data confidentiality was also maintained. Approval to carry out research was given by National Commission for Science, Technology and Innovation and clearance was sought from County Commissioner, County Directors of Health and Education and Medical Officers in Charge at the selected Health facilities. Informed consent was obtained and participation was purely voluntary. Data confidentiality was obtained through coding.

3. Results

At baseline, the total mean met-minute for the women was 3362.54±351.35 met-minutes/week while the median was 3474 met-minutes/week. Vigorous activities that were done by the women were computed to a mean of 1787.81±315.90 met-minutes/week and a median of 1920 met-minutes /week. The mean met-minutes for moderate activities was 916.89±85.67 and median was 960 met-minutes/week. Met-minute per week for walking was 657.94±140.14. The mean daily hours spent on activity was 12.21±2.27 and median hours was 13 per day (Table 1 & 3).

After the intervention a repeat of physical activity data collection found the women to have a total mean met-minute per week of 3143.24±462.1, vigorous intensity activities of 1550.52±835.87 met-minute per week, moderate intensity activities 931.01±63.17 met-minute per week, walking 661.78±616.38 met-minute per week, sitting weekday 129.77±62 minutes, sitting weekend 205.61±76.51 minutes and mean daily hours to be 11.33 hours ±1.35. Paired t-test was used to test for the differences in the means of the physical activity factors at baseline and after the intervention (Table 1) found no significant differences for all the factors at $p \leq 0.05$ (Table 1).

Under physical activity factors above or below median, for vigorous intensity activities 75 % were below median. For moderate intensity activities, 35.3 % of women were below median. For walking category 70.7 % were below median. For those who spent time sitting on weekends 31 % were below median and on weekdays 44 % were below median (Table 3).

Table 1. Mean physical activity levels at baseline and post intervention

FACTOR	BASELINE POSTINTERVENTION					
	Mean	**Std. Dev**	**Mean**	**Std. Dev**	**t**	**sig**
MET-minutes/ week	3362.64	351.35	3143.24	462.10	-.386	.000
Vigorous IA	1787.81	315.90	1550.52	835.87	-.379	.000
Moderate IA	916.89	85.671	931.01	63.17	.119	.000
Walking	657.94	140.13	661.78	616.38	.103	.000
Sitting Weekend	187.72	59.96	205.61	76.15	.227	.281
Sitting Weekday	110.67	45.75	129.77	62.0	.202	.000
Daily Hours	12.21	2.27	11.33	1.35	-.381	.003

**IA – Intensity Activities*
p≤.05

Table 2. Median Physical activity factors of pregnant women at baseline and post intervention

Factor	Median	
	Baseline	**post intervention**
MET-minutes/ week	3474	3095
Vigorous IA	1920	1789
Moderate IA	960	960
Walking	660	650
Sitting Weekend	180	130
Sitting Weekday	120	300
Daily Hours	13	11.30

Figure 1 indicates categorical scores of physical activity levels of pregnant women. At baseline as well as post intervention most of the women (80.1 % and 66.1 % respectively) were HEPA active while those who

were minimally active at post intervention increased. None of the pregnant women were in the inactive category.

Table 3. Physical Activity categories of above and below median (N=116)

PA Categories	Frequency	< Median (Percentage)	Frequency	≥ Median (Percentage)
MET-minutes	87	75	29	25.0
Vigorous intensity Activities	41	35.3	75	64.7
Moderate intensity Activities	28	24.1	88	75.9
Walking	82	70.7	34	29.3
Sitting Weekdays	36	44	65	56 .0
Sitting weekend	36	31. 0	80	69. 0
Daily Hours	49	42.2	67	57.8

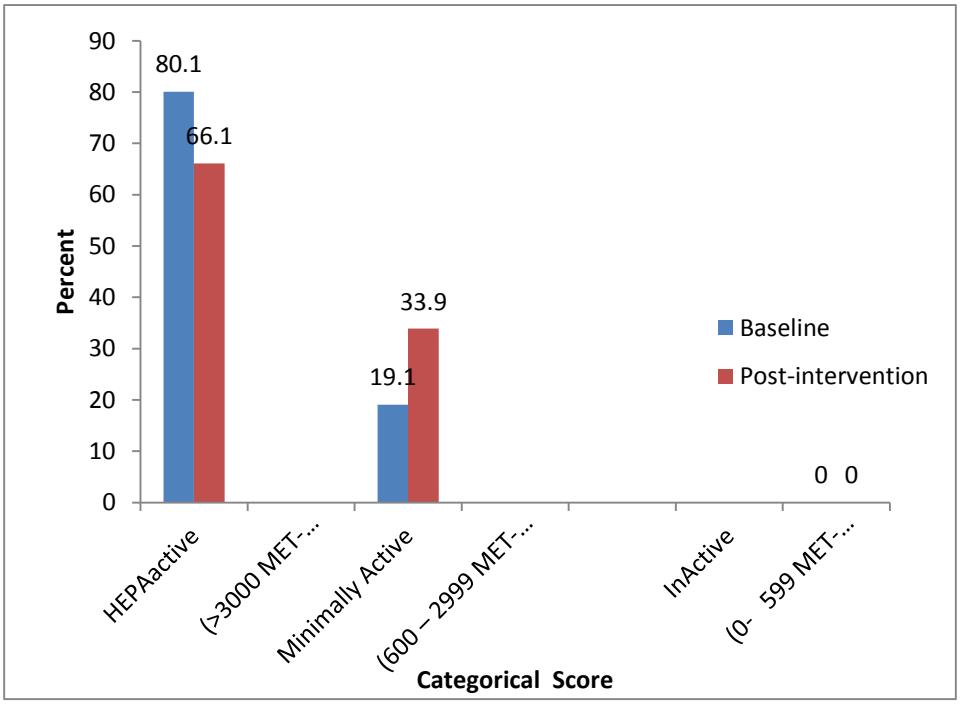

Figure 1. Categorical physical activity levels of pregnant women

4. Discussion

The entire physical activity factors median reduced except for sitting over the week days that increased. There were slight reductions in the means of total met-minutes/week, vigorous intensity activity and daily hours after the intervention. However moderate intensity activities increased suggesting that while the

women reduced their vigorous intensity activities, they increased their moderate intensity activities in order to make up for the physical work requirements. Many of them did not have domestic help.

According to Puja et al. (2017), many women in rural areas carry out heavy activities in their households, in agricultural activities and in their reproductive roles. All women do their household activities alone or with the help of family members however they reduce their farm activities and involve themselves more in household work. They found 48 % of women to have been involved mostly in moderate intensity activities and only 34.7 % to have been involved mostly in vigorous activities.

This pattern is consistent with the finding from this study. Walking and sitting on both week day and weekend increased as well. There were no significant differences in the means of the physical activity factors at baseline and after the intervention (Table 1). This implies that the physical activity at baseline was similar to that after intervention indicating that women did not have a significant reduction in their workloads during their pregnancies during the study. A study in Buchi Nigeria found that 80 % of pregnant women continued to do heavy work even in the last trimester and in Cross River about half of the pregnant women continued with their heavy workloads (NIPS, 2013). Dwarkanath et al. (2007) state that physical activity is an important factor during the antenatal period since women have variable physical activities at work outside the home as well as domestic chores in the home. They found that physical activity in the first trimester of pregnancy is an important factor in determining birth weight in Indian babies.

The term birth category spent fewer hours (11.63 Hours/day) than the preterm category (12.23 hours/day) on activity daily, implying that they may have had more rest. This is confirmed by the finding that term birth category spent slightly more hours on rest on both weekdays (112.23 minutes/week) and weekends (191.38 minutes/week) than the preterm category. The median activity factors were also higher for preterm category except for sitting on weekdays and weekends where the median figures were the same. However, the women did not reduce their activity levels much.

A study on influence on maternal physical activity on infant's body composition (Bisson et al., 2016) found that in women performing ≥90 minutes per day of vigorous intensity physical activity was associated with a significant decrease in birth weight compared with no vigorous physical activity. A study on physical Activity and pregnancy outcomes (Ahlborg, 1995) also found that strenuous work had a negative effect on gestation age, birth weight and spontaneous abortion. These findings support the hypothesis that high physical activity can be a risk factor for poor pregnancy outcome.

Most women had lower total met-minutes weekly compared to those who had higher total met-minutes than the median. There were more women who had higher vigorous intensity activity levels as well as moderate intensity activity levels weekly than those who were below the median for each category. The values indicate that more women had high levels of vigorous as well as moderate intensity activities than the median. More women had lower walking levels than median compared to those who were above the median. Ahlborg (1995) states that long hours of walking seem to increase the risk of preterm delivery. It is therefore imperative that pregnant women reduce hours spent on walking. More women walking less in this study group is important for their positive pregnancy outcomes.

For all categories of sitting and the hours spent daily on activity, more of the women had levels above median showing that the amounts were high for most women. In the community where the study took place subsistence farming is the main economic activity and women engage in labour during pregnancy with only small inter-individual variation of physical work as shown by Figure 1 where most women are hepa-active (≥ 3000 met-minute/week). This finding is consistent with those obtained by a similar study in the same region on physical activity that found pregnant women to be involved in vigorous activity throughout their pregnancy (Odiwuor et al., 2013). Most of the women were Hepa active at both baseline and post-intervention with slight reductions in high activity levels and slight increase in sufficient activity at post-intervention (Figure 1). Minimally active category is more than the minimum level of activity recommended for adults in current public health recommendations. Hepa active category exceeds the minimum public health physical activity recommendations although there is no consensus on the exact amount of activity for maximal benefit (IPAQ Research Committee, 2004). Women attain numerous benefits from physical activity. During pregnancy however due to physical changes that occur during pregnancy and also due to inadequate energy intake among women in developing countries special precautions are needed. WHO guidelines recommend that adults should engage in at least 150 minutes of moderate intensity activity throughout the week or 75 minutes of vigorous intensity activity or equivalent combination of the two (Evenson et al., 2014). Most Country guidelines support moderate intensity physical activity during pregnancy. Reductions in Vigorous intensity activity and increase in moderate intensity activity may be beneficial to this sample under study although the time they engage in activity in a day (12.21 and 11.33 hours at baseline and post-intervention respectively) is way above the recommendations.

The women in this study need to reduce their activity levels because this is one way of improving their nutritional status and thereby increasing birth weight and gestation age. Mostly in pregnancy, reducing activity levels can help meet energy needs. A study in Ethiopia showed that pregnant women who engaged in low levels of activity gained more weight and gave birth to infants with higher birth weights than those who engaged in heavy activities even though they all had similar intakes of energy (Linkage, 2001). The findings from this study that found women to reduce vigorous intensity physical activity but increase moderate intensity physical activity in late pregnancy is consistent with a study on influence of maternal physical activity on infant's body composition by Bisson et al. (2016) that found 48.1 % of women to be engaged in vigorous physical activity at 17 weeks gestation and only 17.6 % doing so at 36 weeks gestation.

In this study the women did not reduce their activity levels even after counselling. Factors beyond the women may have compelled them to continue with their heavy physical activity such as unavailability of domestic help and low income levels that may not have guaranteed the women money to hire domestic help. Other strategies may therefore be required to help the pregnant women reduce their physical activity levels. Evidence is sufficient to warrant the maximum protection of pregnant women to heavy physical work according to Occupational Med (2006). Ahlborg (1995) also emphasizes that heavy work duties should be avoided and enough rest periods ensured especially in late pregnancy.

National Academy of Sciences (IMNRCNA, 2009) states that unlike food intake which is usually underreported, physical activity tends to be overestimated and activities of one kind may cause a reduction in activities of another. Therefore there is a chance that findings from this study may have been

overestimated and that levels of activity may actually be lower than obtained. It is important to note however that in such poor economic settings the women must usually continue with heavy activity given the lifestyles imposed on them by their socioeconomic conditions.

5. Conclusion

There was a slight reduction in women's total activity level per week and vigorous intensity activities but an increase in moderate intensity activities as well as rest after counselling. Total daily hours on activity also reduced. However there were no significant reductions in physical activity levels. Strategies that address other risks to adequate nutrition such as heavy physical work that can help the pregnant women to overcome social, environmental and economic constraints should be introduced such as efforts to ensure economic empowerment to ensure the women have adequate incomes to access more food and acquire domestic support are needed.

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