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Original Article

Dietary behaviour, food and nutrient intake of women do not change during pregnancy in Southern Ethiopia

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Abstract

Although pregnant women are required to increase food and nutrient intake to accommodate for the increased nutritional demands, information on dietary behaviour and nutrient intake is limited. This study aimed to identify the adequacy and differences in intake between pregnant and non-pregnant women in a rural community of Butajira district, Southern Ethiopia. Simple random sampling was used to recruit 159 pregnant and 164 non-pregnant women. An interactive multiple pass 24-h recall survey was used to evaluate the food and nutrient intake of the study participants. Except for iron, vitamin A and C, intakes of macro and micronutrient were below the recommendations. Almost all study participants were deficient in energy, protein, calcium, folate and niacin intakes. There was no significant difference in the mean dietary intake of all nutrients between pregnant and non-pregnant women ($p > 0.05$). The prevalence of inadequacy was comparable between pregnant and non-pregnant women in all of the nutrient intakes except for Zn, where the prevalence of inadequacy was much higher among the pregnant women. Nearly all (99.0%) of the pregnant women were deficient in niacin, folate and calcium. Although all pregnant women considered it important to increase food intake during pregnancy, only a quarter of women reported to do so. In conclusion, pregnant women in the rural community of Butajira district do not make significant dietary intake adjustments to account for increased nutrient needs during pregnancy. In food insecure areas, such as ours, nutritional counselling complemented with supplementary feeding programmes could be key to ensure adequate dietary intake.

Keywords: dietary behaviour, food and nutrient intakes, pregnancy, Ethiopia.

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Introduction

Nutritional status before and during pregnancy is an important factor for optimal pregnancy outcomes (Nichols-Richardson 2011; Roth 2011; Ramakrishnan *et al.* 2012). Pregnant women are vulnerable to nutritional inadequacy because of the increasing demand for energy and macro and micronutrients (Picciano 2003; Roth 2011). Household food security, maternal and child care practice and healthy environment and access to health care service are part of the underlying determinants of maternal and child nutritional status (Vorster 2009; UNICEF 2016). Among other factors, nutritional insults to the mother and fetus would result in a higher risk for intrauterine growth disturbance and metabolic alterations, low birth weight, preterm delivery, stillbirth, perinatal mortality, neural tube defects, impaired physical and mental development in children and other potential health risks for the mother and baby (Martorell *et al.* 1998; Abu-Saad & Fraser 2010).

The prevalence of low birth weight is estimated to be 15% worldwide and as high as 30% in many developing countries (WHO 2014). In Ethiopia, based on the 5% of deliveries, which occurred at health facilities, the prevalence of low birth weight was reported to be 17% (Central Statistical Agency 2012). In the Northern Ethiopia, the prevalence of low birth weight is estimated to be 14.6% (Gebremedhin *et al.* 2015). Limited weight gain before and during pregnancy is the most significant predictor of low birth weight, and intrauterine growth retardation (FAO/WHO/UNU 2004; Frederick *et al.* 2008).

The World Bank estimated the impact of poor maternal and child nutrition to reduce the economic output of countries by 2–3% annually (World Bank 2010).

Diets in sub-Saharan Africa are primarily plant-based with limited diversity. Because of the different bioactive anti-nutrient factors like phytates, oxalates and the forms of the nutrients in plant-based diets, the bioavailability of nutrients like zinc (Zn) and iron (Fe) has been shown to be low. Studies from Ethiopia in subsistence farming communities have shown significant gaps in the macro and micronutrient intakes (Abebe *et al.* 2008). Studies from other parts of Africa have shown similar scenarios regarding the macro and micro nutrient intakes of women during and before pregnancy (Oguntona & Akinyele 2002; Huybregts *et al.* 2009). Pregnant women from Kenya were also found to rely on diets poor in quality and diversity (Kamau-Mbuthia & Elmadfa 2007).

Information on the dietary intake of pregnant women is critical for appropriate planning and interventions that can effectively improve nutritional status of mothers and infants (Bhutta *et al.* 2008; WHO 2013; Haider & Bhutta 2015). In Ethiopia, studies on nutrient intake of pregnant women are needed to guide interventions and design new approaches that are best suited to scale-up efforts to improve maternal and child health. The objective of this paper is to identify differences in food and nutrient intakes between pregnant and non-pregnant women in a rural community in Ethiopia and to analyse the adequacy of the diet during pregnancy in this population.

Materials and methods

Study area and period

This study was conducted in a subsistence farming community of Butajira district southern Ethiopia from 2 July to 30 August 2013.

Sample size and sampling procedure

A total of 169 pregnant and 169 non-pregnant women were recruited for this study and 159 pregnant and 164 non-pregnant women agreed to participate. Four of the pregnant women gave birth during the time of visit for data collection, the other three of the pregnant women were reported to be at health care settings because of medical case and the rest three were not willing to completely respond to the questionnaire. Data could not be obtained from five of non-pregnant women as they had temporarily relocated to some other areas. The sample size for this study was calculated based on the following assumptions: detecting a daily mean energy intake difference of 1.1 MJ between pregnant and non-pregnant women, a power of 80% and 95% confidence level. The 1.1 MJ is an additional average mean energy intake that is needed for a pregnant women to account for increased energy need because of pregnancy.

Simple random sampling was used to select study participants. As the state of pregnancy varies in any community as some become pregnant and others who were pregnant become non pregnant after delivery, a list of pregnant women from the district for this study was prepared as a sampling frame. Health extension workers who were in charge of providing primary health care service in house to house basis in their respective kebeles prepared a list of 530 pregnant women based on reported pregnancy from the study sites, and this list was used to randomly select 169 pregnant women. Non-pregnant women were sampled from the Butajira rural health programme dataset. This dataset contains all the households with the demographic characteristics of the population of the district. The Butajira Rural Health Program is a health and demographic surveillance system with a continuous registration of vital and migratory events among 10 selected villages. The ethical clearance for this study was

Key message

- The nutrient intake and consumption of fruits, vegetables and animal source foods of the pregnant women was below what is recommended.
- There were no harmful traditional practices hindering the pregnant women from consuming any of the available foods.
- There was no difference in the food and nutrient intake between pregnant and non-pregnant women.

obtained from the Southern Nations, Nationalities and Peoples' Region research office.

Assessment of dietary intakes and socio-demographic characteristics

The questionnaire used in this study was pretested before it was used in the main study. The women involved in the pilot study were not part of the main study. The socio-demographic data was collected through interviews that took place at the homes of the participants. The dietary intake data was collected using multiple-pass interactive 24-h recall interviews with women in their own homes (Gibson & Ferguson 2008). A modified Helen Keller food frequency questionnaire which was used previously in Ethiopia also was used to assess the usual dietary habits of the study participants (Kassu *et al.* 2012). To estimate portion size, each of the respondents was requested to take an amount equivalent to the actual portion size consumed using a spoon. The food was put in calibrated utensils, weighed and converted to grams of food consumed. A second 24-h recall was repeated in a 20% randomly selected sub-sample and used to adjust for the day-to-day variation in nutrient intakes of study participants. The days selected for the second recall were different from the days of the week that was used for the first recall. Data collection sessions were arranged on dates with no special occasion like holidays or fasting days. The Ethiopian food composition table was used to calculate nutrient content (Ethiopian Health and Nutrition Research Institute 1998). The food composition table of Uganda was used for those foods not available in the Ethiopian table. Data were analysed and converted into the amount of energy and nutrient intake per individual per day.

Using closed ended questions, we assessed the dietary behaviour of pregnant women using an interviewer administered survey. The survey assessed cultural and traditional beliefs reported to affect food intake of pregnant women in Ethiopia and other countries (Hutter 1996). The regularity of food intake, avoidance of certain food items just because of pregnancy, deliberate reduction of food intake in fear of difficulties in delivery of a big baby, adjustment to food intake during pregnancy to account for increased food and nutrient needs of pregnancy and the belief on improving food intake during pregnancy were used as indicators to assess the dietary behaviour of the study participants.

The energy requirement of the non-pregnant women was calculated from the estimated mean basal metabolic rate (BMR) for the group multiplied by the average physical activity level for active to moderately active activity level. The BMR was predicted from age- and sex-specific equations based on the mean body weight for rural subsistence farming women (WHO 1985). For the pregnant women, the energy requirement was adjusted by adding an average additional energy requirement of 1.1 MJ on the requirements of the non-pregnant women assuming an average gestational weight gain of 12 kg. A value for habitual physical activity level (mid-point of the moderately active lifestyle) was used for this group of women from rural communities, as recommended by FAO and WHO (FAO/WHO/UNU 2004). The calculated energy intake was adjusted for digestibility by 0.95, and protein intake was adjusted for digestibility and amino acid score by 0.68 to account for quality of plant-based protein sources (WHO 1985). Household food intake was qualitatively captured through asking about the consumption of 12 food groups, including meat, fish, vegetables, fruits, eggs, potatoes and other roots/tubers, milk and milk products, beans, cereals/breads, oil, fat or butter, sugar or honey, as well as other types of foods such as coffee and tea in the 24 h preceding the survey. We grouped foods according to the Food and Nutrition Technical Assistance III Project (Swindale & Bilinisk 2006).

Statistical analysis

Data was entered in EpiData and exported to Stata 11.0 (StataCorp, College Station, TX) for analysis. A Shapiro–Wilk test was used to check for normality of the data. Results were expressed as median and the 5th and 95th percentile for the nutrient intakes because of their non-normal distribution. A Wilcoxon rank sum test was used to examine mean differences in the usual food and nutrient intakes of the study groups. A chi square test (X^2) was used to check difference among categorical variables. Spearman rank correlation was used to investigate linear relationships between energy intake and socio-demographic characteristics. All tests were two sided, and statistical significance was considered at a level of $p < 0.05$. To assess the usual nutrient

intakes and prevalence of inadequate intakes, the first day 24-h dietary intake was adjusted for the day-to-day variation within the same individuals by using the second day repeated intake from 66 subjects by using the Intake Monitoring Assessment and Planning Program software (Iowa State University 1995–2015). The estimates of the prevalence of inadequate intakes for nutrients were calculated using the estimated average requirement cut point method and the usual intake distributions from intake monitoring, assessment and planning programme (IMAPP). The estimated average requirement (EAR) cutoffs for the nutrients were adapted from those proposed by the Institute of Medicine (Institute of Medicine 2001) and FAO/WHO report (WHO 1985; FAO/WHO 2001). The estimated energy requirement was adapted from the report on human energy requirements by FAO/WHO/UNU (FAO/WHO/UNU 2004).

Results

Socio-demographic characteristics

A total of 323 study participants (response rate of 95.6%) were involved in this study. Of these women, 159 or 49.2% were pregnant. The study participants had a mean age of 29.8 (SD = 5.3) years. Most (76.5%) of the study participants were Muslim, and 68.1% were from the Gurage ethnic group. Half of the studied households had a family size greater than or equal to 4. One hundred and ninety four (60.1%) of the study participants had no formal education and only 26(8%) of the sampled population had high school and above education. About two-thirds of the sampled population had no relevant means to acquire information from mass media at home and had a monthly income of less than or equal to 500 ETB (Table 1). About half (48.4%) of the pregnant women were in their third trimester of pregnancy.

Food consumption and dietary behaviour

The pregnant study participants were questioned if they have made any dietary adjustments during their pregnancy. Almost all pregnant study participants reported that there should be dietary improvement during pregnancy. Out of the total pregnant women, however, 42.8% reported reduction in food intake while 32% made no dietary changes. The reported increased dietary intake from almost half of the study participants who reported increased dietary intake during pregnancy was because of the increased availability of food. The main reported reason for reduction of food intake was food shortage. The other reported reasons for reduction of food intake by the pregnant women were physical discomfort and unattractive monotonous diets with limited variety. Almost all pregnant mothers were convinced of the importance of improving dietary intake during pregnancy. The study participants did not report avoidance of any specific kind of food because of pregnancy or any other traditional beliefs. There was no specific time reported for meal within a day, and

Table 1. Socio-demographic characteristics of the study population in the rural population of Butajira district, Southern Ethiopia

Variables	Total ($n = 323$)	Pregnant women ($n = 159$)	Non-pregnant women ($n = 164$)	*P*-value
Age [mean(SD)]	29.8(5.3)	29.1(5.2)	30.4(5.4)	0.02
Education				0.15
No schooling	194(60.1)	89(56)	105(64.0)	
1–8 grades	103(31.9)	56(35.1)	47(28.7)	
≥9 grades	26(8.0)	14(8.8)	12(7.3)	
Family size				0.11
1–2 individuals	71(22.0)	42(26.4)	29(17.7)	
3–4 individuals	89(27.5)	42(26.4)	47(28.6)	
>4 individuals	163(50.5)	75(47.2)	88(53.7)	
Income				0.39
≤500 ETB*	220(68.1)	113(71.1)	107(65.2)	
501–1500ETB*	73(22.6)	32(20.1)	41(25.0)	
≥1501ETB*	30(9.3)	14(8.8)	16(9.8)	
TV#/Radio				0.95
Yes	115(35.6)	54(34.0)	61(37.2)	
No	208(64.4)	105(66.0)	103(62.8)	
Religion				0.10
Muslim	247(76.5)	115(72.3)	132(80.5)	
Orthodox	53(16.4)	29(18.2)	24(14.6)	
Protestant	23(7.1)	15(9.5)	8(4.9)	
Ethnicity				0.31
Gurage	220(68.1)	113(71.0)	107(65.2)	
Mareko	79(24.5)	34(21.4)	45(27.4)	
Other	24(7.4)	12(7.6)	12(7.4)	

ETB*, Ethiopian birr; TV#, Television.

food was consumed anytime convenient for the study participants more specifically when they get home. Generally, the dietary behaviour of the study participants was similar regardless of the pregnancy status (Table 2).

The mean number of food groups consumed by the two study groups was comparable. The pregnant mothers had a mean of 3.7 food groups consumed while this was 3.4 for non-pregnant mothers. Egg and meat were consumed by only 2.2% of the study population, and similarly, fruit was consumed by 3.4% of the total study population. Apart from dairy and eggs, intake of the different food groups was comparable in pregnant and non-pregnant women. The pregnant women had a higher consumption of dairy products and eggs compared to the non-pregnant participants (Table 3).

Nutrient intake

The median energy intake was comparable between pregnant and non-pregnant women (Table 4). Similar findings were observed for protein intake. The analysis of the nutrient intake for those who had reported increased food intake during pregnancy showed for many of the women that the intake for energy and other nutrients was inadequate. The prevalence of inadequate protein intake was 93.7% in non-pregnant and 98.8% in pregnant women. Our study participants were comparable in all of the nutrient intakes except for Zn intake where the prevalence of inadequacy was much higher in pregnant women. The study groups had adequate overall intakes for carbohydrates, iron, vitamin A and riboflavin in reference to the EAR (Table 4). Almost all participants were deficient in energy, protein, calcium, folate and niacin intakes. The comparison of median nutrient intake between our study groups showed no statistically significant difference in the mean intake of all nutrients between the pregnant and non-pregnant women (Table 4). In general, energy from fat was in line with the recommendations. Energy intake was positively correlated with income ($p < 0.001$) and educational status ($p = 0.01$) in the study population (Table 5).

Discussion

In low and middle-income countries, dietary intake among women is affected by different cultural habits or coping practices during food insecurity. To assess the nutritional implications of these practices, we compared the difference in dietary practice between

Table 2. Dietary behaviour and reason for change of food intake among pregnant women of the rural community of Butajira, Southern Ethiopia

Variables	Total ($n = 159$)	Planned pregnancy		*P*-value
		Yes *n* (%)	No *n* (%)	
Food intake	159	109	50	0.91
Increased	40(25.2)	29(26.6)	11(22.0)	
Decreased	68(42.8)	50(45.9)	18(36.0)	
No change	51(32.0)	30(27.5)	21(42.0)	
Reasons for decreasing food intake	68	50	18	0.12
Food shortage	41(60.3)	28(56.0)	13(72.2)	
Fear of big baby	2(3.0)	2(4.0)	0	
Physical discomfort	25(36.7)	20(40.0)	5(27.8)	
Improving diet	159	109	50	0.94
Necessary	156(98.1)	107(98.2)	49(98.0)	
Not necessary	3(1.9)	2(1.8)	1(2.0)	
Avoidance of food	159	109	50	0.38
Yes	32(20.1)	24(22.0)	8(16.0)	
No	127(79.9)	85(78.0)	42(84.0)	
Regularity of meal time	159	85	74	0.66
Regular	4(2.5)	2(2.4)	2(2.7)	
Irregular	155(97.5)	83(97.6)	72(97.3)	

Table 3. Proportions of pregnant (P) and non-pregnant (NP) women that consumed food groups and their median intake in Butajira district, Southern Ethiopia

	Consumption *n* (%)			Median intake in grams		
Food groups	NP (*N* = 164)	P (*N* = 159)	*P*-value	NP (*N* = 164)	P (*N* = 159)	*P*-value
Cereals	157(95.7)	153(96.2)	0.82	217.9	182.1	0.23
Vegetables	161(98.2)	156(98.1)	0.96	89.8	89.9	0.84
Legumes	58(35.4)	69(43.4)	0.14	0	0	0.11
Fruits	8(4.9)	10(6.3)	0.45	0	0	0.32
Roots and tubers	41(25)	32(20.1)	0.29	0	0	0.38
Meat/poultry/fish	2(1.2)	5(3.1)	0.24	0	0	0.23
Dairy products	13(7.9)	25(15.7)	0.03	0	0	0.02
Eggs	0(0.0)	7(4.4)	0.01	0	0	0.01
Oils	129(78.7)	128(80.5)	0.68	35.8	35.8	0.67

pregnant and non-pregnant women in a sample from Ethiopia. The median energy and most of the nutrient intake was low for both pregnant and non-pregnant women and the energy and also other nutrient intake of pregnant women did not differ from that of the non-pregnant women. This is despite the fact that 42.8% of pregnant women reported reduction of food intake for which the main reason was reported to be food shortage. The explanation for this discrepancy may be that the study participants might have reported reduced food intake expecting some sort of support from food relief programmes or any other. Several studies in rural areas of developing countries report similar scenarios regarding low energy intake (Kamau-Mbuthia & Elmadfa 2007; Abebe *et al.* 2008; Huybregts *et al.* 2009).

The deficiency state for energy and other nutrients even in pregnant women who claimed improved food intake during the pregnancy may be indicative of the precarious food insecurity situation of the population

Table 4. Comparison of median nutrient intake between pregnant and non-pregnant rural women of Butajira district, Southern Ethiopia

	Non pregnant *N* = 164			Pregnant *N* = 159			
Variables	Median	(p5, p95)	Prevalence of inadequacy	Median	(p5, p95)	Prevalence of inadequacy	*P* value
Energy (kcal)	1547.5	(1150.0, 1995.0)	[#]	1583.2	(1263.0, 1952.0)	[#]	0.54
Protein (g)	22.7	(13.5, 39.5)	93.7	24.5	(15.6, 40.7)	98.8	0.11
Fat (g)	51.9	(40.4, 63.8)	[¶]	65.3	(45.5, 78.0)	[¶]	0.28
Carbohydrate (g)	254.9	(158.5, 400.0)	0.1	245.8	(159.0, 385.7)	0.0	0.81
Calcium (mg)	302.6	(128.9, 640.0)	99.0	343.2	(127.5, 718.0)	98.1	0.23
Phosphorus (mg)	1001.8	(640.6, 1463.0)	2.4	1027.1	(649.9, 1620.0)	0.0	0.28
Iron (mg)	36.0	(15.8, 81.8)	1.2	39.6	(23.7, 66.4)	2.5	0.61
Zinc (mg)	7.4	(3.8, 16.0)	45.2	8.3	(4.7, 15.2)	83.6	0.30
Thiamine (mg)	0.6	(0.2, 1.6)	73.4	0.8	(0.4, 1.3)	93.0	0.19
Riboflavin (mg)	2.2	(1.4, 3.4)	0.3	2.4	(1.5, 3.8)	1.0	0.48
Niacin (mg)	6.5	(4.8, 8.6)	100	6.7	(4.4, 10.2)	99.8	0.11
Folate (μg)	141.5	(88.1, 204.6)	100	152.7	(87.3, 235.2)	100	0.10
Vitamin A (μg)	2037.9	(1307.0, 2813.0)	0.0	2056.2	(646.4, 3548.0)	3.5	0.07
Vitamin C (mg)	83.7	(25.3, 140.3)	25.0	81.4	(21.5, 146.2)	38.3	0.73

[¶]Prevalence of inadequate intake for total fat was not calculated because there was no EAR value set for total fat intake. [#]The prevalence of inadequate intake for energy as well was not calculated for the group as the energy requirement depends on individual BMR and activity level.

Table 5. Correlation between energy intake and the socio-demographic characteristics for women of the rural community of Butajira district Southern Ethiopia

Variables	*r*	*P*-value
Educational status	0.22	0.01
Income	0.29	<0.001
Family size	−0.09	0.10
Pregnancy	0.02	0.54
Marital status	0.06	0.25

r: Spearman rank correlation coefficient.

groups. Although Hutter (1996) mentioned Ethiopia to be one of the countries where pregnant mothers reduce food intake during pregnancy, we found no cultural taboos or traditional practices, which compelled the pregnant mothers at our study site to avoid or reduce intake of certain food groups. Reports from other countries, however, showed deliberate reduction in dietary intakes or avoidance of certain food groups or types by pregnant women as pregnancy proceeded to later stages (Hutter 1996; Huybregts *et al*. 2009; Zhang *et al*. 2010). These differences might result from the wide spread efforts applied by the government of Ethiopia to tackle harmful traditional practices using health extension workers. These workers go house to house providing health information, especially information related to maternal and child health, at the study site and elsewhere in the country.

Only 2.2% of the study participants consumed eggs and meat and 3.4% consumed fruits. For these three food groups, the median grams consumed were nil in both pregnant and non-pregnant women. Similar findings were reported from Burkina Faso where more than 75% of the study participants failed to consume egg and dairy products but who had higher meat consumption (Huybregts *et al*. 2009). Also dietary intakes of pregnant women from Kenya were reported to be of poor dietary quality with low animal source foods and high maize intakes (Kamau-Mbuthia & Elmadfa 2007). Studies from rural Bangladesh and northern Ethiopia reported similar findings in non-pregnant women (Arsenault *et al*. 2013; Haileslassie *et al*. 2013).

The dietary intake of our study population was monotonous and primarily composed of bread baked from maize flour or fermented false banana 'Kocho' and boiled kale. Availability of a limited number of food items was among the major reported reasons for reduction of food intake in pregnant women. This may be true in light of the physiological changes that occur during pregnancy, which may result in aversion to a certain food items which may only be available at home for consumption (Tayie *et al*. 2000). A study from southern Ethiopia in pregnant women from subsistence farming communities reported similar dietary trends as our study (Abebe *et al*. 2008). Studies from rural Kenya and Bangladesh also demonstrated the dietary quality of women to be poor and very low in animal source foods (Kamau-Mbuthia & Elmadfa 2007; Arsenault *et al*. 2013).

There was adequate median intake of total fat by the study participants. Fat contributed the recommended share of kilocalories in the total energy intake. Palm oil and other types of inexpensive oils are widely available and used for cooking. The percentage of energy from protein was below the recommendation may be because of the limited intake of animal source foods by the study participants.

Calcium intake was among the highest nutritional inadequacies reported at the study site both in pregnant and non-pregnant women, which is consistent with the low consumption of milk and other dairy products in our population. Several studies reported deficient intakes for calcium from similar diets (Oguntona & Akinyele 2002; Abebe *et al*. 2008; Huybregts *et al*. 2009). Iron intake was somewhat better even though the study population had low consumption of animal source foods. The widely prevalent consumption of kale and of teff, which is an Ethiopian traditional grain, rich in iron might have contributed to higher iron intake. A study from Sidama, Southern Ethiopia reported the study population to have adequate intakes for iron compared to other nutrients of concern (Abebe *et al*. 2008). Also other reports have suggested that iron intakes are not a major limitation for the Ethiopian population (Gebre-Medhin *et al*. 1976; Niguse *et al*. 2013).

Like most other nutrients assessed, low Zn intake was detected both in pregnant and non-pregnant women. The zinc deficiency in pregnant women was more severe than in non-pregnant women. This may be because pregnant women did not improve their

dietary intakes after becoming pregnant, and the increased requirement for the nutrient makes them more deficient compared to the non-pregnant group. Prevalence of inadequate zinc intake was 83.6% in pregnant women, despite the fact that dietary zinc was somewhat better compared to intakes reported from Nigeria and Sidama, southern Ethiopia (Oguntona & Akinyele 2002; Abebe *et al*. 2008).

All of our study participants were deficient in dietary folic acid intakes, and none of our study participants were taking nutritional supplements. Diets of women from developing countries are commonly deficient for this nutrient posing risk for sequelae associated with the deficiency of the nutrient (Kamau-Mbuthia & Elmadfa 2007; Huybregts *et al*. 2009; Arsenault *et al*. 2013). A study from Bangladesh on children and adult women reported low food intake and limited dietary diversity to be the reasons for the micronutrient deficiencies including folate (Arsenault *et al*. 2013).

Almost all of our study participants had adequate intakes for Vitamin A in reference to the EAR. As our study population had generally poor consumption of most vegetables and fruits that are rich in vitamin A, Ethiopian kale which is a source of both vitamin A and C, and which was widely consumed by our study population, was primarily responsible for the adequate intake of this nutrient. The vitamin C intake of our study population was much better than that reported by Abebe *et al*. (2008) in pregnant women of Sidama and by Kassu *et al*. (2012) in non-pregnant women from Northern Ethiopia. This difference might be because of the traditionally consumed false banana or 'kocho', which is quite low in this vitamin, for the case of Sidama community in Southern Ethiopia and to the westernized dietary patterns followed by the urban dwellers of relatively affluent families in Gondar town Northern Ethiopia as reported by the researchers (Abebe *et al*. 2008; Kassu *et al*. 2012).

The income and educational status were positively associated with energy intake in our study population. These findings were supported by a study from rural Nepal and from African countries, which reported food and nutrient intake to be affected by poor socioeconomic status and by low literacy level of women (Papadopol *et al*. 2005; Christiana *et al*. 2006; Kassu *et al*. 2012). In contrast to these findings, pregnant women from lower socioeconomic status who were given nutrition counselling increased food intake during pregnancy. Nutrition counselling given to women during pregnancy had a higher influence for dietary improvement than the educational status of the mother (Bhat *et al*. 2002). WHO also stresses that individualized nutrition counselling is an effective strategy to improve dietary intakes of pregnant women regardless of socioeconomic status (WHO 2013).

The local government bodies and NGOs working in the areas of maternal and child health should focus on food-based interventions in the study area. Because evidence suggests that nutrition education and counselling are most likely to show greatest benefit in low- and middle-income countries when provided along with nutrition support, targeted supplementary feeding programmes for pregnant mothers along with nutrition counselling have to be considered for the food insecure households. The district agriculture and rural development office of Butajira should focus on initiating and supporting horticulture farming and small animal rearing to diversify the dietary intakes of the study area to address the overall general nutritional needs of women of the reproductive age group. As incorporation of insects to the food recipe may increase the nutrient content of food, designing intervention strategies to test acceptability for adoption of insects into the food basket is important. Promotion of small animal rearing for household consumption may also bring significant improvement in the food and nutrient composition of the study area.

Reporting the prevalence of risk of inadequacy of nutrient intakes based on usual nutrient intake distribution is one of the strong points of the study. Second, the use of the probabilistic sampling technique enables inferring the result to the general population. Complementing data from 24-h recall with data from food frequency could be taken as the third strong point. Some potential limitations of the study are that the food composition table of Ethiopia is limited and the use of food composition data for some food items from Uganda might have added to the variation of nutrient intake. The use of 24-hour recall to estimate the general nutrient intake of the study population might have under estimated food and nutrient intakes because of recall bias and portion size estimation. Repeating the

24-h recall only on 20% of the total sample might have introduced some error in the estimation of the day to day variation of nutrient intakes of the sampled population.

In conclusion, energy and nutrient intake of both pregnant and non-pregnant women were below the EAR for their respective categories for most of the nutrients. There was no difference in the food and nutrient intakes between pregnant and non-pregnant women of the study population, and pregnant mothers made no changes in their dietary patterns because of pregnancy. However, almost all pregnant study participants believed that there should be dietary improvement during pregnancy.

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Conflict of interest

The authors declare that they have no conflict of interest.

Authors' contribution

TTA, SDH and SHG were involved in designing the study, drafting the manuscript, reviewing and approving it for submission. CL is involved in drafting the manuscript, reviewing and approving it for submission for publication.

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