

The Nutrition Transition and Adequacy of the Diet of Pregnant Women in Kenya

Nelia P Steyn¹, Whadi-ah Parker¹, Johanna H Nel², Ayah Rosemary³, Dorcus Mbithe⁴

¹ Centre for the Determinants of Social and Environmental Nutrition, Population Health, Health Systems and Innovation, Human Sciences Research Council, Cape Town

² Department of Logistics, University of Stellenbosch, Stellenbosch

³ Unilever, International Office

⁴ Kenyatta University, Department of Foods, Nutrition and Dietetics, Kenya

Abstract. Aims: To assess the nutritional adequacy of the diet of pregnant women in Kenya. **Methods:** A nationally representative sample of women aged ≥ 15 years (N=1061) was assessed in Kenya. A sub-sample of pregnant women (N=53) were randomly included in the group and their data is presented here. A 24-hour dietary recall was conducted with each participant and dietary diversity score (DDS), food variety score (FVS) and mean nutrient adequacy ratio (MAR) were calculated. **Results:** Mean energy, protein, fibre, calcium and zinc intakes were below the recommended allowances (RDA). Very low mean intakes were also recorded for vitamin D, niacin, folate and vitamin B6. Fat and carbohydrate intakes exceeded the RDA. **Conclusion:** The dietary pattern showed aspects of the nutrition transition, namely a high fat, low fibre, and high carbohydrate intake as well as typical aspects associated with food insecurity, namely low energy and protein intakes, and a low dietary diversity.

Key words: South Africa, Kenya, Dietary intake, Pregnancy, Dietary diversity, Nutrition transition, Obesity

1. Introduction

Kenya is a sub-Saharan country undergoing rapid urbanization. This has resulted in changes in lifestyle and diet which are frequently detrimental to the health of the population. Some of these changes include dietary ones, such as an increased intake of an energy-dense nutrient poor diet which is high in saturated fats, trans fats, sodium and added sugar while being lower in fibre and carbohydrate than the traditional staple diet [1]. A poor diet is generally also accompanied by a sedentary lifestyle with the person being inactive both at work and during leisure time [2]. In addition to the nutrition transition taking place, Kenya is still a low income country having a Human Development Index (HDI) of 0.470 [3] and a per capita dietary energy of 2089 kCal/day [4]. Stunting and underweight in children under five years is still high at 35 % and 16.5%, respectively [5]. As in other low income countries many people are also exposed to food insecurity resulting from a diet low in dietary variety and energy. This in turn leads to stunting, underweight and micronutrient deficiencies [6]. Hence, when evaluating diet in the context of the nutrition transition it is essential to determine both the quality and diversity of the diet. Pregnant women are especially vulnerable to food insecurity and the effects of a diet which is poor in diversity [7,8]. Intake of iron, folate, vitamin B12 and vitamin A are among the most important nutrients required as is a diet having sufficient energy to meet the demands of the growing foetus [8]. This paper describes these aspects in a random sample of pregnant women living in Kenya.

2. Methods

In Kenya, women aged 15 to 60 years, were randomly selected from the four primary regions- Nakuru, Kisumu, Meru, and Nairobi by the Kenya Central Bureau of Statistics (CBS). The regions were stratified according to socio-economic categories as well as urban and rural areas and the sample was drawn proportionally from these sub-regions. Fifteen households were randomly selected from each Enumerator Area by the CBS and the main female responsible for food preparation was interviewed at her home in 2005. The total sample comprised 1061 women of which 53 were pregnant (n=1061; 96% response rate). This paper describes the diet of the pregnant women; the data on non-pregnant women is published elsewhere. Dietary data were collected by means of a structured pre-coded validated 24 hour recall questionnaire. Each participant was required to report on all the foods and drinks consumed during the previous 24 hours. Probing allowed the interviewer to obtain information on forgotten foods. In order to facilitate the estimation of portion sizes, various dietary aides were used. The fieldworkers used a dietary assessment kit comprising life-size drawings and generic food models.

Repeated 24-hour recall interviews were undertaken on 10% of the total sample in order to evaluate the reliability of data collected. These repeated interviews were done by the supervisors of the teams. No one knew in advance which homes would be randomly selected for the repeated visits. Repeatability of a random 10% of the sample (n=104) found that there were no significant mean differences in energy, macro- and micronutrients ($p \geq 0.05$) (except vitamin D) evaluated between the repeated measurements, suggesting that one recall provided sufficient reliability of data intake. Each subject also completed a short frequency questionnaire which reported on foods eaten and meal pattern over the past seven days.

Signed informed consent was obtained from each participant in each country. Participants were not identified by name on the questionnaires and strict confidentiality was maintained. The Ethics Committee of the Medical Research Council and the Department of Health in Kenya approved the proposal for the study.

A dietary diversity score (DDS), food variety score (FVS) and nutrient adequacy ratio (NAR) were calculated for each subject. DDS was calculated as the number of food groups out of a total of 9 groups consumed over a period of 24 hours [27]. The groups were: (1) cereals, roots and tubers; (2) vitamin A rich vegetables and fruits; (3) non-rich vitamin A (other) vegetables; (4) non-rich vitamin A (other) fruit; (5) dairy; (6) meat, poultry and fish; (7) fats and oils; (8) legumes and nuts; and (9) eggs. The FVS was defined as the number of different food items consumed over 24-hours. The NAR was calculated for energy, protein, micronutrients (vitamins A, B6, B12, C, niacin, thiamine, riboflavin, and minerals calcium, iron and zinc). NAR was calculated as the ratio of the intake of a nutrient divided by the recommended intake for that nutrient (RNI), using WHO/FAO recommended intakes [28]. The mean adequacy ratio (MAR) was calculated as the measure of adequacy of the overall diet. $MAR = \text{sum of each NAR (truncated at 1)} / \text{number of nutrients (excluding energy and protein)}$. A MAR of 100% would indicate a perfect diet with the exact requirement met for each nutrient.

3. Results

Tables 1 and 2 provide the nutrient data of the pregnant women in the sample. Mean energy intake (6700kJ) was considerably less than the estimated average requirement (EAR-10093kJ) resulting in a NAR of 72.8%. Protein intake, which was largely plant-based, was also less than the RDA, having an NAR of 85.8%. Mean carbohydrate and fat intake intakes were greater than the RDAs. Mean fibre intake (15.8g) was less than the adequate intake [AI (28g)]. Calcium and zinc intakes were far below the RDA resulting in mean NAQs of 56.7% and 78.2%, respectively. In terms of micronutrients, vitamin A, C, and B₁₂ had NARs above the RDAs. However, mean intakes of vitamin D (32.7%), niacin (44.9%), folate (47.9%) and vitamin B₆ (52.2%) were particularly low. Linolenic and linoleic acid were both below the AIs. The MAR for the diet overall was 60%. The group had a mean FVS of 7.4 different items per day and a DDS of 4.7. A household used an average of 4 breads per week of which 3.3 were white loaves. The average household also used 1157.4 g flour per week. In terms of spreads, a household used 171.9 g margarine, 418.1 g cooking fat, and 242.3 g of oil per week. This amounted to 45.6 g margarine, 111.7 g cooking fat and 60.1 g oil per person per week, and 31 g per person per day of fats. Jam, honey, and peanut butter were also commonly consumed, and 14% used avocado as a spread.

The usual meal pattern of the women was a three meal a day pattern (83.1%), while 33.2% had one snack and 27.5% had 2 snacking periods. The majority of women (90%) indicated that they have breakfast every weekday and 97% indicated that they have breakfast every Saturday and Sunday. The most popular foods and beverages consumed at breakfast 4-7 times a week were tea with milk (77.3%), and bread (51.7%), with margarine (43.6%). About 22% had cooked porridge for breakfast. The most popular items consumed at breakfast 1-3 times a week were cooked porridge (35%), chapatis (48%), mandazi (fat cakes) (32.1%) and fried egg (31.5%). Regarding the making of flour products, 63.6% made chapattis 1-3 times a week and 20.2% make pancakes. Bread was eaten at breakfast by 88.9% of women and as a morning snack by 11.1%. The usual amount of bread eaten for breakfast was 3-4 slices and at the morning break 2 slices.

Table1. Mean energy, macronutrient and mineral intake of Kenyan pregnant women (n=53)

Women					
Nutrients	Mean	SE	95%LCI	95%UCI	RDA/AI*
Energy (kJ)	6700	254.6	6187	7213	10093-11991EAR
CHO (g)	254 (63.7%E)	13.7	226.4	281.7	175
Total protein(g)	42.9 (10.8%E)	2.7	37.5	48.3	71
Animal protein (g)	8.3	1.5	5.3	11.2	
Plant protein-(g)	20.3	1.2	17.9	22.7	
Total fat (g)	52.6 (29.7%E)	3.0	46.6	58.7	28*
MUFA (g)	15.2	1.1	13.1	17.3	
PUFA (g)	14.6	1.1	12.4	16.7	
SFA (g)	17.4	1.1	15.1	19.7	
P:S ratio	1.0	0.03	0.9	1.0	
Cholesterol-(mg)	158.5	22.9	112.4	204.7	
Added sugar (g)	29.7 (7%E)	3.8	22.1	37.4	
Fibre (g)	15.8	1.1	13.5	18.1	28*
Calcium (mg)	576.7	78.1	419.4	734.0	1000
Iron (mg)	32.8	7.3	18.1	47.6	27
Zinc (mg)	4.0	0.3	3.4	4.6	11
Mg (mg)	325.9	25.2	275.1	376.7	350
Se (ug)	23.8	3.1	17.6	30.0	60
18:3 w3 (ALA)(g)	0.3	0.04	0.2	0.4	1.4*
20:5 w3 (EPA)(g)	0.01	0.002	0.003	0.01	
22:6 w3 (DHA)(g)	0.04	0.02	0.01	0.08	
18:2 w6 (LA)(g)	8.4	1.1	6.1	10.7	13*
20:4 w6 (AA)(g)	0.04	0.01	0.01	0.06	
NAR %					
Energy	72.8	2.8	67.2	78.4	
Total protein	85.8	5.7	74.3	97.3	
Calcium	56.7	7.8	40.9	72.4	
Iron	112.5	25.0	62.1	163.0	
Zinc	78.2	6.0	66.1	90.3	
Mg	148.1	11.4	125.0	171.2	
Se	91.5	11.9	67.5	115.5	

LCI=lower confidence interval; UCI=upper confidence interval; NAR=Nutrient adequacy ratio
 CHO=carbohydrate; MUFA=monounsaturated fatty acids; PUFA=polyunsaturated fatty acids
 SFA=saturated fatty acids; SE=standard error; (ALA=alpha-linolenic acid; EPA=eicosapentanoic acid; DHA=docosahexanoic acid;
 LA=linoleic acid; AA=arachidonic acid); RDA= Recommended Dietary Allowance; AI= Adequate Intake

Predominantly white bread was eaten (> 80%). The most commonly eaten vegetables over the past week were green leafy vegetables eaten by 94.8% who consumed it more than once (89.2%). This was followed by tomatoes (94.6%), potatoes (84.1%), cabbage (82.7%) and carrots (70.5%). Beef was consumed by 75.5% more than once a week, and fish by 41.7% once a week, and by 18.8% more than once a week. Dry beans were consumed by 73.7% and more than once a week by 45.9%. Furthermore, lentils and dry peas were consumed by 16.6% more than once a week. Legumes in total made a large contribution to the diet. Maize was most commonly consumed by 91.2% and more than once by 84.1%. Rice was consumed by 85.2%, githeri (maize, tomato, and beans) by 77.2% and millet by 23.4%.

Table 2: Mean micronutrient intake, nutrient adequacy ratios and dietary diversity scores of Kenyan pregnant women (n=53)

Nutrients	Women				
	Mean	SE	95%LCI	95%UCI	RDA/AI*
Folate (ug)	191.6	14.8	161.9	221.4	600
Niacin (mg)	6.4	0.5	5.3	7.5	18
Riboflavin (mg)	0.9	0.1	0.7	1.2	1.4
Thiamine (mg)	1.0	0.1	0.9	1.1	1.4
Vitamin A (RE)	1511.9	311.5	884.5	2139.4	770
Vitamin B6 (mg)	0.7	0.1	0.5	0.8	1.9
Vitamin C (mg)	87.0	7.9	71.2	102.8	85
Vitamin B12 (ug)	3.3	2.6	1.9	8.5	2.6
Vitamin E (mg)	6.5	1.0	4.4	8.5	15
Vitamin D (ug)	1.6	0.3	1.0	2.3	5*
NAR					
Folate	47.9	3.7	40.5	55.3	
Niacin	44.9	3.9	37.0	52.9	
Riboflavin	86.7	10.7	65.2	108.3	
Thiamine	89.7	6.0	77.7	101.7	
Vitamin A	296.8	62.6	170.7	422.8	
Vitamin B6	52.2	5.7	40.7	63.7	
Vitamin C	195.8	17.5	160.4	231.1	
Vitamin B12	137.1	107.2	78.8	353.1	
Vitamin E	86.2	13.3	59.4	113.1	
Vitamin D	32.7	6.7	19.1	46.5	
MAR	59.7	1.8	56.1	63.4	
FVS	7.4	0.3	6.7	8.0	
DDS	4.7	0.2	4.3	5.0	

LCI=lower confidence interval; UCI=upper confidence interval; NAR= Nutrient adequacy ratio; MAR=Mean adequacy ratio; FVS=Food variety score; DDS=Dietary diversity score; SE=standard error; RDA= Recommended Dietary Allowance; AI= Adequate Intake

4. Discussion

This study showed that the diet of pregnant women studied was not adequate. It was low in dietary diversity, low in energy and protein and high in fat and carbohydrate. Furthermore, some nutrients such as calcium, zinc, vitamin D, niacin, folate and vitamin B6 were low enough to raise concern. Fats and oils were highly prevalent on the intake list of Kenyans, including three items (cooking fat, brick margarine, oil) appearing among the most common 10 items eaten daily. Furthermore, many food items frequently eaten were fried, e.g. pancakes, chapattis, even bananas. This explains to some degree the high intake of fat, although it still remains below the recommended percent of 30% of energy intake [2]. The high carbohydrate intake is explained by the large quantities of bread and maize consumed. Good aspects about the diet were the high intake of green leafy vegetables and legumes which contribute micronutrients and protein. The low energy intake is of greatest concern since an infant's size at birth and during the first 6 months of life are dependent on maternal size at pregnancy and weight gained during pregnancy [8]. A study in Kenya has shown that pregnant women had a decreasing energy intake during pregnancy and their weight gain was only

half the size of women in North America [8]. Considering the low mean energy intake of women in this study, this finding is not surprising.

5. Conclusions

The dietary pattern showed aspects of the nutrition transition, namely a high fat, low fibre, and high carbohydrate intake as well as typical aspects associated with food insecurity, namely low diversity, low energy, low protein and inadequate micronutrient intakes, making it unsuitable for pregnant women.

6. References

- [1] WHO. Global Strategy on Diet, Physical Activity and Health. Geneva: WHO, 2004.
- [2] WHO. *Diet, Nutrition and the Prevention of Chronic Diseases*. Geneva: WHO, 2003
- [3] FAO. *Country profiles*. On line: <http://www.fao.org/countryprofiles/index.asp?lang=en&iso3=ZAF>. Accessed 23 November, 2011
- [4] FAOSTAT. Food and Agriculture Organisation. *Food balance sheets by country*: On line: http://faostat.fao.org/app_support/SmartError.aspx?500&eid=faostat_rb_error_ea16e6bb1f6546a68f2f7804bc16c3a2 (Accessed 1 February 2012).
- [5] WHO. *Country profiles*. On line: <http://apps.who.int/ghodata/?theme=country#>. Accessed 23 March 2011.
- [6] P.M. Nyangweso, M.O. Odhiambo, P. Odunga, M. Korir, D. Otieno, M.J. Kipsat. Optimal consumption bundle for household food security in Vihiga District, Kenya. *Afri Crop Sci Conf Proc* 2009, **9**: 739-744.
- [7] C.G. Neumann, and G.G. Harrison. Onset and evolution of stunting in infants and children. Examples from the Human Nutrition Collaborative Research Support Program. Kenya and Egypt studies. *Eur J Clin Nutr*. 1994, Feb;**48** Suppl 1:S90-102.
- [8] P. Ramachandran. Maternal nutrition--effect on fetal growth and outcome of pregnancy. *Nutr Rev*. 2002, May;**60**(5 Pt 2):S26-34.