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## Low macronutrients intake and associated factors among Maasai women of reproductive age in Ngorongoro Conservation Area, Tanzania

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### Abstract

**Background:** It was previously reported that the prevalence of oral thrush among Maasai women of reproductive age was disproportionately high in the absence of established predisposing factors, such as HIV/AIDS, syphilis, diabetes and anaemia. This study investigated whether incidence of oral thrush was due to low serum micronutrients levels. Results showed that all study participants were deficient in Vitamins A and C; some had insufficient levels of Vitamin D. We set out to understand the normal dietary intake of Maasai women of reproductive age and their traditions associated with food intake. Our aim was to review the types of foods and amounts consumed in relation to potentials for oral thrush occurrence.

**Methods:** Interviews were conducted using a structured questionnaire; the information collected included data on age, parity, pregnancy status, weight, height, frequently eaten foods, number of meals, and food restrictions. Clinicians also examined participants for presence/absence of oral thrush lesions. A twenty four hour dietary recall was conducted, focusing on macro and micro nutrient content of the food consumed using the Tanzania Food Composition Table and computed with Excel™ 2007 software.

**Results:** The twenty four hour dietary recall assessment revealed that the most frequently eaten food (71%) was thin porridge made from maize flour. Carbohydrates contributed the most energy (approximately 80%), followed by fats (12%), and protein (8%). Student's t-test showed no significant difference in dietary intake of carbohydrates and protein between women with and without oral thrush (with  $p>0.05$ ). However, all groups showed low intake of protein, carbohydrates, fats and micronutrients such as vitamins A, C, B12, folate, and iron.

**Conclusions:** There is a need of intervening in this community through nutrition education and advocacy among health workers who are expected to spread the knowledge to the community. These findings are important in addressing the type of food aid directed to this community, which should include protein sources like beans.

**Keywords:** Maasai Women, Dietary intake, Ngorongoro Conservation Area, Oral thrush

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## Introduction

The prevalence of oral thrush, which was previously reported to be 32%, among Maasai women of reproductive age is a matter of concern because it may interfere with food intake and fetal development during pregnancy (Martin *et al.*, 2014a). In a previous investigation, the predisposing factors to oral thrush were investigated including pregnancy, HIV/AIDS, syphilis, diabetes, and anaemia but were not significantly correlated with oral thrush in this population (Martin *et al.*, 2014a). A study of serum micronutrients levels was conducted to further explain why oral thrush prevalence is high in the absence of immune compromising conditions. Results showed that study participants had low serum levels of Vitamin A and C, as well a twenty four hour dietary recall showed low intake of foods rich in vitamins A, C, B12, folate, and iron (Martin *et al.*, 2014b). This study was done to test the hypothesis that daily food intake of Maasai women of reproductive age is below the recommended levels.

The Maasai have traditionally lived as pastoralists surviving on their cattle. For a number of years, the Government of Tanzania has prohibited subsistence farming in conservation areas, including Ngorongoro Conservation Area Authority (NCAA). The Office of the Prime Minister committed to provide free food to the Maasai community living in the NCAA instead lieu of

allowing them to cultivate in the area (Nkwame, 2013). However, it has been reported that the relief food promised was still in silos because the Maasai could not afford buying the maize at a subsidized price (Mushi, 2013). Cattle are the pivotal livelihoods resource for Maasai, and traditionally Maasai consume blood and milk of cows rather than their meat (Goodman, 2002).

In every society there are multiple factors that influence what people select to meet their food needs. These factors depend on social, cultural, and environmental influences. Social and cultural influences, such as gender based food distribution and rituals, determine the pattern of food available across social groupings. Environmental influences, such as climate changes, determine the diversity of the foods available being it animals or plant species used as foods (Kuhnlein and Receveur, 1996). Due to evolving lifestyle and these influences, the Maasai depend more on maize than meat and dairy products to meet their daily nutrients needs (Brady *et al.*, 2008).

Maasai are strong adherents to their culture and traditions, which makes a consideration of their food consumption patterns important. However, there are many challenges to obtaining dietary intake data as these methods are resource intensive and require sophisticated analytical methods. For this reason, even nationally collected data like the Tanzania Demographic and Health Survey does not include quantitative data on dietary assessment (Arimond *et al.*, 2010; Ruel *et al.*, 2010). Without data on dietary intake, it is difficult to design, implement, and evaluate programs to tackle diet related problems in the community. In this study, a twenty four hours dietary recall method was used, as it is one of the most widely used approaches due to its practicability (Olinto *et al.*, 1995).

In this study, the intention was to understand the normal dietary intake of Maasai women of reproductive age including insights into their traditions associated with food intake. The rationale was to consider the types and quantities of foods in relation to oral thrush occurrence.

## **Materials and Methods**

### **Study Area and Design**

This study was conducted in the Ngorongoro Conservation Area (NCA) which is located west of Arusha in the Crater Highlands area of Tanzania. Ngorongoro District has a population of 174,278 (82,610 males; 91,668 females) with approximately 46,750 women of reproductive age (Martin, *et al.*, 2014: Vol 2(12)

(National Bureau of Statistics, 2012). The majority of Maasai live in the rural area as pastoralists with primary dependence on their cattle for their livelihoods (Coast, 2002).

This was a cross sectional study among Maasai women of reproductive age (15-49 years). Data was collected in November 2013 involving Maasai women living in one of three villages in the NCA, specifically Olbalbal, Alelilayi and Misigiyo.

### **Sample Size and Sampling**

The sample size was calculated using the formula  $n = \frac{Z^2 P (1-p)}{d^2}$  where p= anticipated proportion of population with oral thrush (32%); d = Absolute precision (5%); (Confidence interval) I =90% and Z=1.96. The sample size obtained was 334. The same formula was also used by a study in South India (Reshmi *et al.*, 2012).

A convenience sampling technique was used in which a recruitment call was made through the word of mouth. The call was made between 7-8 pm by a person appointed by the village leader using a loud speaker and repeated for two consecutive days. Participants were asked to gather at the Village Office/school on a given day. The women who showed up and agreed to participate in the study were enrolled as participants. A total of 210 women consented to participation in the study and answered the questionnaire interviews. About half (n=107) were included in dietary studies using the twenty four hour dietary recall.

### **Oral Thrush Examination**

Oral thrush was examined by an Assistant Medical Officer who used a clinical torch to observe the oral cavity. If an individual had oral thrush, a swab of the infected area was taken. Swabs were preserved in a media till further analysis. Oral thrush was scored using a 0 to 4 scale as described by Wright *et al.*, (2009). Those with confirmed oral thrush were given Nystatin tablets, dosage depended on the severity of the condition. Full methodology and results of this portion of the study are reported in a previous publication (Martin, Buza, and Petrucka, 2014a)

### **Data Collection**

#### *Interviews*

A structured interview questionnaire was used to collect information from participating women. Some of the information collected included data on age, parity, pregnancy status, weight, height,

frequently eaten foods, number of meals, prohibited or restricted foods, and reasons for their restrictions.

### *Twenty Four Hour Dietary Recall*

This data was collected from 107 women (50% of the study population). Twenty four hour dietary recall was done according to the method described by Thompson and Byers(1994). Two Maasai men and a woman (nurse) who speaks Kimasai were trained on how to conduct a 24 hour dietary recall. Food like porridge and tea were estimated using Maasai measurements namely 'laibooda', 'majeshi' and 'ndisa' denoting litre, half litre and quarter litre, respectively. Other foods were estimated using plates.

### **Data Analysis**

Data were analyzed using Predictive Analytical Software™ (PASW) Version 20.0. Descriptive statistics (i.e. frequency) were used to summarize the data and Student's t-test was used to compare means of different groups.

### **Ethics**

Ethical approval was sought and obtained from the National Institute for Medical Research (NIMR) Tanzania, Certificate Number NIMR/HQ/R.8a/Vol.IX/1474. Permission to conduct the study was also sought and received from Tanzania Wildlife Research Institute (TAWIRI) and from the respective villages/wards governments. All study participants provided a written informed consent.

### **Results**

#### **i) Basic characteristics**

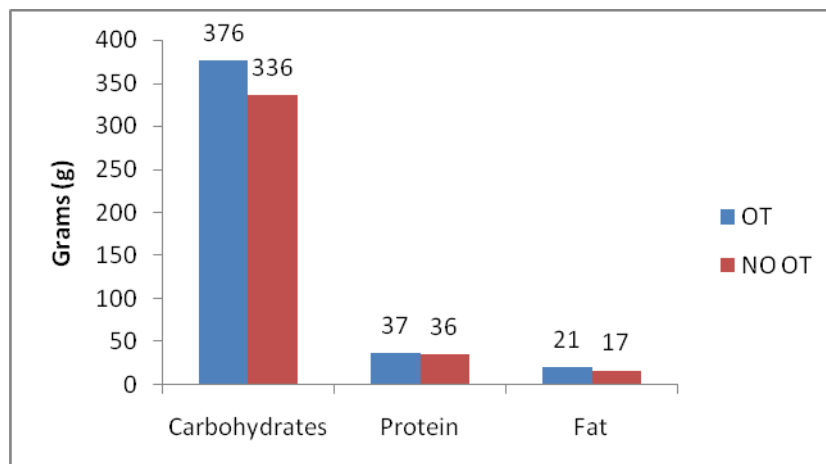
The number of women who participated in dietary studies was 51% (n=107) of the total number of participants. The sample had the same characteristics as the general population studied (Table 1).

**Table 1: Demographics of reproductive age women participants**

Descriptive	
Total number of subjects	210
Married	89%
Pastoralists	99.5%
Education: No formal education	68%
Primary	28%
Secondary	4%
Partner's education: No formal education	66%
Primary	29%
Secondary	3%
Collage	2%
Breastfeeding: Yes	61%
No	39%

**ii) Dietary intake of participants with and without OT**

Generally Maasai women had low intake of carbohydrates, protein, and fat per day compared to the recommended daily intake regardless of their oral thrush status. There were no statistically significant ( $p=0.569$ ) differences between women with ( $n=28$ ) and without oral thrush ( $n=79$ ) in the amount of carbohydrates, protein, and fat intake per day (see Figure 1).



**Figure 1: Dietary intake of Participants with or without Oral Thrush.**

iii) Dietary sources and frequency of meals

The majority of women consumed a very repetitive diet constituted mainly of maize. Very few had access to other foods that would provide them with protein and other nutrients (see Figure 2).

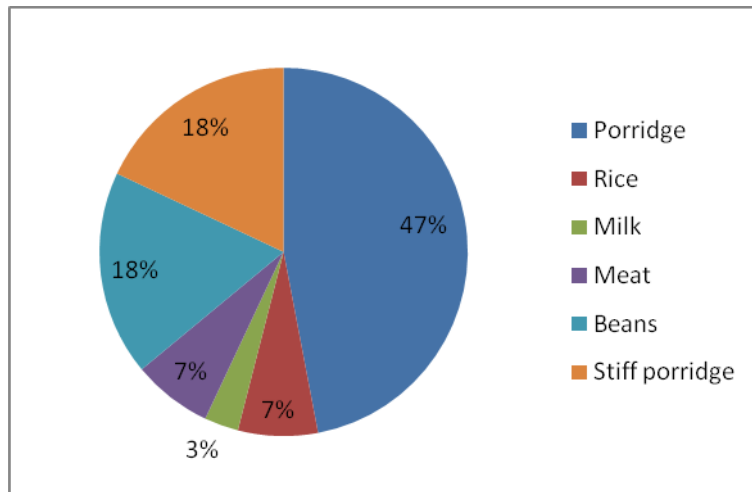


Figure 2: Frequency of foods consumed by select Maasai women.

Among Maasai pregnant women, it is common to be limited to one or two meals per day (see Figure 3). Very few women had access to more than two meals daily, which is related to cultural reasons, traditions, and socioeconomic status.

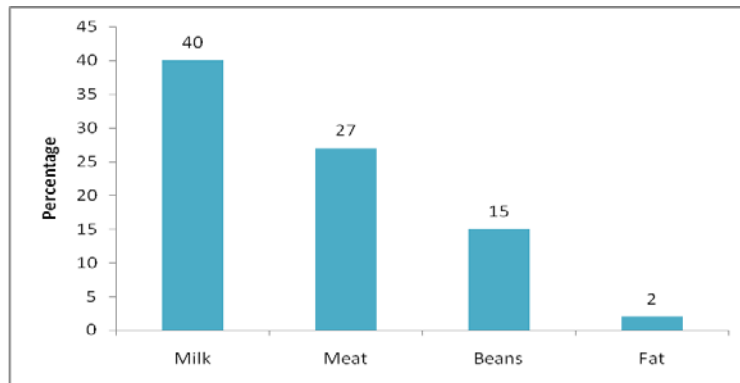


Figure 3: Number of meals consumed daily during pregnancy.



**iv) Cultural practices with regard to food consumed during pregnancy**

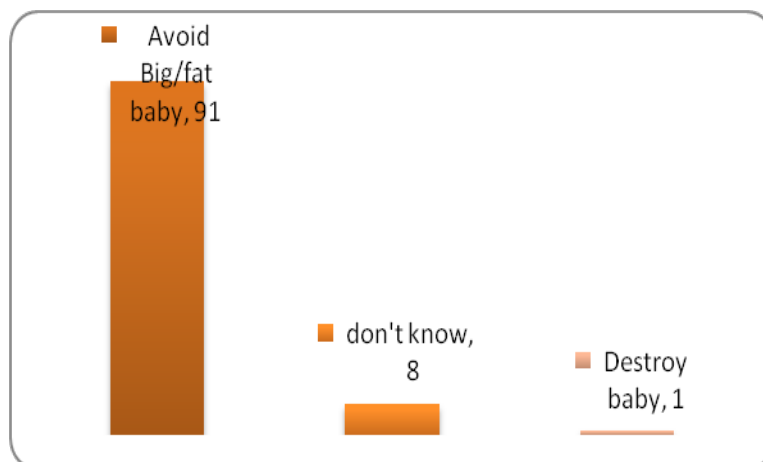
Figure 4 and 5 below show the percentage of women reporting on foods not allowed during pregnancy and the reasons for their restriction. Results show that pregnant Maasai women are not allowed to eat foods that are rich in protein (such as milk, meat, and beans), with nearly 90% providing the rationale that this rationing will reduce the size of the neonate thereby easing delivery.



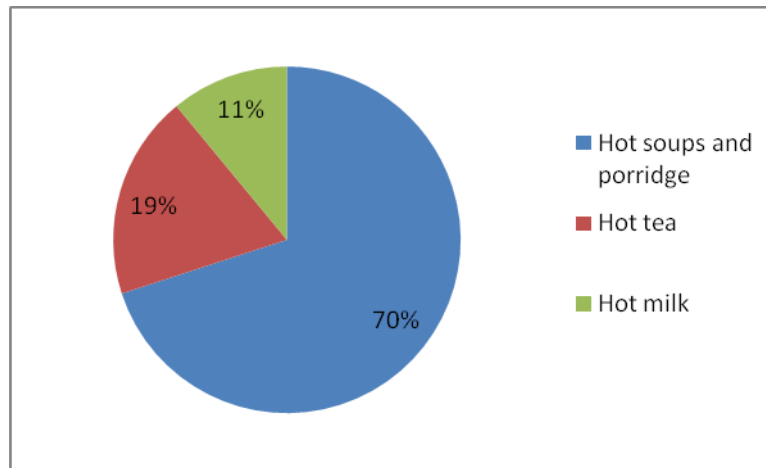
**Figure 4: Participant reported food restrictions during pregnancy.**

**i) Cultural practices with regard to food consumed after delivery**

After delivery about 70% (see Figure 6) of Maasai women reported they are encouraged to eat watery foods/lactogogus foods like hot soups and porridge which stimulates milk flow.



**Figure 5: Rationales for food restriction during pregnancy amongst Maasai.**



**Figure 6: Foods given to Maasai woman after delivery.**

## Discussion

Since oral thrush is an opportunistic infection, a balanced diet is assumed necessary to avert this condition by providing the necessary nutrients. However, our findings indicated that there is no statistically significant difference in total energy related to carbohydrate, protein and fat intake among Maasai women with or without oral thrush. This finding would seem counter-intuitive to expectations. In the past, Maasai had sufficient supplies of milk and meat but, of recent, excessive drought has caused starvation in their flocks and lowered production of milk (Brady *et al.*, 2008). This study showed that participants' diets consisted primarily of cereal rather than meat and milk. In this regard, dependency on animal product has shifted to dependency on maize which is provided as food aid from the Government of Tanzania. The resort to using maize is unfavorable because maize meal is bulky and low in nutrient density (Yeudall *et al.*, 2005).

This study showed that that Maasai women have no access to other sources of nutrients. Very few reported consuming protein rich foods like meat, milk and beans. The reason for this poor intake could be associated with the enactment of the *Ngorongoro Act of 1975* which prohibited Maasai from cultivating in the conservation area (Goodman, 2002). In light of the unbalanced food aid basket, denial to subsistence farming is potentially detrimental to this vulnerable

community especially women and children. Traditionally, Maasai women have many roles such as to build houses, milk cows, graze, and collect firewood and water. Maasai women are at liberty to use money from the sale of milk to buy other food items, however, milk production has dwindled due to drought and significantly impacted on this income source.

Poor diet diversification (see Figure 2) and inadequate intake of macronutrients in this community may be the possible predisposing factor to opportunistic infections such as oral thrush. This observation is consistent with results from other studies considering pregnant and lactating women in developing countries. It is reported that, in most developing countries, women of reproductive age suffer from micronutrients deficiency due to inadequate intake of fruits, vegetables, and animal products (West, 2002; Huffman *et al.*, 1999)

Another reason for the observed low intake of food may related to the timeframe of this dietary assessment which was done in November which is a dry season in this community. This is a time of food and milk scarcity due to lack of enough pastures.

A previous dietary survey among Maasai pastoralists in Tanzania and Kenya showed the main items of diet were white maize, rice, beans, tea, and milk (McCormick and Elmore-Meegan, 1992); however, this study included men and women. In this study, the Maasai traditional diet of milk and meat was shown as being replaced with a high percentage of cereals. It is noted that this trend has potential implication in terms of obesity, and non-communicable disease (i.e., diabetes).

Reduction in the number of meals and restriction of certain foods like milk, meat, beans, and fat is common amongst Maasai pregnant women. The main reason given for the restriction of some foods is to avoid a large birth weight infant and reduction of birth complications. This finding mirrored Brady *et al.*'s (2008) reporting that due to the fear of birth complications associated with overweight babies, it is a practice within the Maasai tribe to provide half a ration serving to pregnant women in the second trimester stage (4 to 6 months) and, in addition, these women are made to vomit, using oil extracted from sheep meat. Another study reported that the Maasai believe that excess weight gain of either the mother or the foetus will make the birth process difficult and dangerous (Mpoke *et al.*, 1993). All these practices may cause stress, negative energy balance, and/or deficiency of essential nutrients to pregnant (and post-partum) women potentially resulting in increased susceptibility to infections such as oral thrush.

In conclusion, participating Maasai women of reproductive age had low energy, carbohydrate, fat and protein intake compared to the Tanzanian standard intake recommendations. There is a need of intervening in this community through nutrition education and advocacy. One potential approach might be to apply the Social and Behavior Change Communication (SBCC) tool to promote health outcomes in the Maasai community. In addition, a reconsideration of the relief food policy for the Maasai community is recommended. In this relief food adjustment to include a protein source like beans and this should be affordable.

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