

*Full Length Research Paper*

# **Identification of traditional weaning foods and their processing methods in the Northeast District of Botswana**

**Sarah Tshepho Pona Matenge\* and Goabaone Nancy Bareetseng**

Research Department, Boitekanelo College, Tlokweng, Botswana.

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**Weaning is an important milestone in a baby's life and weaning practices are strongly associated with culture of a society. The use of traditional foods is important since they contain vital nutrients and essential vitamins important for the proper maintenance of human health, especially for children who are often vulnerable to malnutrition and diseases. The focus of this study was to identify traditional weaning foods with public health potential for complementary feeding. The study was conducted in six villages in the Northeast District of Botswana. The qualitative research comprised focus group discussions, key informants, and non-participant observation. The target population were women in childbearing age, which is between 20 and 40 years, including fathers, local chiefs, older women, and men who have been residing in the villages over a long time and are knowledgeable with the traditional foods consumed. Traditional food stuffs such as cereals, legumes, fruits and vegetables and animal and animal products were identified and perceived by the respondents to have health and nutrition benefits. Different traditional processing methods were identified. There is a need to promote the consumption of traditional foods in a bid to improve nutrition and health security in Botswana.**

**Key words:** Traditional foods, weaning foods, food processing, nutritional values, food security.

## **INTRODUCTION**

Although Botswana has made a significant effort to meet the millennium development Goal 1c (halving 1990 rates of child underweight by 2015), undernutrition and over nutrition coexist both in children and adults United Nations Children Fund (UNICEF, 2009, 2011). According to Global Nutrition Report (2020), in Botswana, the prevalence of stunting, wasting and overweight among children under five years of age was 28.9, 7.3, and 10%, respectively. The high malnutrition rates may lead to risks such as low-birth weight infants and stunted children may be at greater risk of chronic diseases such as diabetes

and heart disease than children who start out well-nourished (Black et al., 2008). These statistics demonstrates the need for concerted effort to reduce and prevent further malnutrition.

Various factors have been associated with the double burden and this includes rapid urbanization and the adoption of western diets which are high in refined carbohydrates, saturated fats, and sugars, combined with a more sedentary lifestyle (Popkin, 2002). Furthermore, an inadequate food intake and the availability of nutritionally sound complementary foods is one key cause of

\*Corresponding author. E-mail: [stpmatenge@gmail.com](mailto:stpmatenge@gmail.com). Tel: +26774781763.

malnutrition in young children especially in many resource poor settings. In most cases complementary foods fail to meet nutritional requirements of infants as they are mostly plant-based diets, low in micro-nutrient-dense animal source foods (WHO, 2001). The presence of anti-nutrients, thus limit the absorption of essential micronutrient leading to micronutrient deficiencies. Feeding especially in early years of life of the child has a lifelong effect, therefore, the inception of timely, adequate, and balanced weaning foods is detrimental in the success of combating infant and child malnutrition (Olatona et al., 2017).

This improvement on infant and young child feeding will not only increase the rate of survival of children but also promote their healthy growth and development (WHO, 2017). Moreover, factors such as lack of awareness on the part of national governments due to limited financial investment and prioritization in training health workers, protective legislation and counseling programs to improve complementary feeding practices were mentioned as problems that hinder adequate and optimal nutrition (Dewey, 2013). The knowledge of the mothers on utilization of health care, infant, and young child feeding, breastfeeding and complementary feeding practices of the care givers (Nnyepi et al., 2010; Olatona et al., 2017), food security in association with caregiver's unemployment and poor education also played a significant role (Chelule and Chihope, 2014; Mananga et al., 2014).

In Africa, traditional weaning foods are starch based (Michaelsen et al., 2017) and have been associated with nutrient deficiencies among young children. In view of this, the use of low-cost weaning foods from the locally available suitable foods has been strongly recommended as a strategy to combat malnutrition in developing countries as they are affordable and locally available and provide reliable options to families (WHO and UNICEF, 2003). Indigenous foods are easy to grow, rich in vitamins and minerals, and are loaded with phytochemicals and antioxidants (Matenge, 2020; Matenge et al., 2017; Eusebio, 2009). Therefore, indigenous foods can contribute to addressing food insecurity and poor nutrition (Mbhenyane, 2017) and may be utilized to alleviate childhood malnutrition (Roos et al., 2007). For instance, in East Africa, according to Muhanji et al. (2011) indigenous foods can play a significant role in providing food and nutrition security in both urban and rural settings. In Ethiopia, indigenous food sources have played a prominent role in rescuing lives of people during times of famine and war (Fentahun and Hager, 2009). In Kenya, in a study on contribution of selected indigenous fruits on household income and food security reported that indigenous fruits provided food for household consumption during the dry seasons (Mwema et al., 2012). In south western Uganda, Musinguzi et al. (2006) in their study also demonstrated that indigenous foods were depended on to provide food in the rural areas. Therefore, it is crucial to maintain traditional diets and food patterns in general due to their wholesomeness and nutrient density

compared to some of the processed foods (Popkin, 2014). Although many of the indigenous plant species are neglected and underutilized, the potential of utilizing foods from the wild such as indigenous vegetables, fruits, mushrooms, and bush meat could contribute to the rural household food basket in Botswana and improve nutrition and food security (Legwaila et al., 2011; Ohiokpehai, 2003).

In Botswana, few studies on infant feeding practices have been carried out and the use of indigenous foods as weaning foods has remained unsearched. The lack of information about the potential health benefits of traditional weaning foods warrants an investigation. Therefore, the current study is aimed at identifying indigenous foods with public health potential for complementary feeding and to identify food processing methods and nutritional values of identified indigenous foods with a view to promote the use of indigenous foods for complementary feeding. In this article, indigenous foods and traditional foods will be used interchangeably to describe those foods that have been part of the food system in Botswana or those that were introduced into the country for quite a long time and are now recognised as naturalised or traditional foods.

## METHODOLOGY

### Study design

This was a qualitative study. Secondary data on botanical names and nutrient and non-nutrient content was collected from the published literature.

### Study area and population

The study was conducted in four rural areas in the Northeast District of Botswana namely Makaleng, Zwenshambe, Mapoka, Moroka, and Jakalas No. 1 villages. The villages were selected randomly to ensure generalization of conclusions. The Northeast District lies between Latitude of  $-21.0$  ( $20.9031^{\circ}$  S) and Longitude of  $27.5$  ( $27.4556^{\circ}$  E) with a land area of  $5,120$  km<sup>2</sup> and has a population of 167, 500 people (Census of Botswana, 2011 Central Statistics Office of Botswana). The villages are predominately inhabited by the Bakalanga speaking people and the main economic activities are subsistence farming of maize, indigenous leafy vegetables, sorghum, millet, melons, and legumes. The study was conducted during the harvesting period between April and June 2018 to capture the diversity of foods consumed in the study areas. The Northeast district is known for it is a myriad variety of traditional foods which are culturally acceptable and form an integral part of local foods habit.

A letter of informed consent was drawn up and given to each participant and respondent. Ethical approval was obtained from the Ministry of Health and Wellness.

### Data collection methods

#### Focus group discussions

Focus groups discussions were selected to obtain data on the traditional food system and to get a deeper understanding of the interviewees' perspective associated with the research questions. One focus group discussion consisting of 8 to 10 participants was

conducted in each study area over a period of one month to solicit information on the commonly consumed foods, availability, seasonality, and their source. Traditional weaning foods, health benefits and processing and cooking methods were probed. To recruit participants, specially arranged meetings by the local leaders were held at the Kgotla (traditional village meeting place). The goal of these meetings was primarily to introduce the researcher to the communities, to inform them about the study, to elicit support and to invite participants to take part in the study. Participants were recruited based on a specific purpose rather than randomly. To realize this, purposive sampling took place in order to obtain insights into a phenomenon. Participants were selected for their specialized knowledge and unique perspective on the topic. Consequently, participants were men and women with children, and the elderly (men and women). Mothers were encouraged to participate as they are responsible for food preparation and feeding their families. Focus group discussions were held at the Kgotla as it was easily accessible to the participants. A semi structured questioning route was used in the focus groups to ensure accuracy in questions asked across groups yet allow for some flexibility in accordance with topics raised and level of participation within the groups (Neumark-Sztainer et al., 1999). During the interviews, participants were probed to elicit more information and talk with each other, drawing out common group understanding. The use of local language Setswana by the moderator maximized the group's cohesiveness and openness while maintaining cultural homogeneity and language use. Each group discussion lasted approximately 90 min. Verbal consent for the voice recording of the sessions was obtained. Participants were informed that the voice recordings will be transcribed without using their names and that the recordings will be discarded after data analysis.

#### **Key informant interviews**

Six key informants from the participating villages were recruited based on a specific purpose rather than randomly. To realize this, purposive sampling took place in order to obtain insights into a phenomenon. Key informants were selected for their specialized knowledge and unique perspective on the topic. Consequently, key informants were the old aged 60 and above who have been residing in the communities under study and are familiar with traditional foods consumed and food preparation practices. They were identified with the help of the local leaders and the community at large. They were asked to state why the foods listed from the focus group discussions were consumed. Also, the nutritional and health benefits and processing and cooking methods were probed.

#### **Identification of traditional weaning foods**

An inventory of indigenous and traditional foods was prepared from a free listing activity done during the focus groups discussions and they were classified into 6 groups namely cereals, leafy vegetables, animal foods, fruits, legumes, roots, and tubers. The foods were listed by their familiar local/English and botanical names obtained from literature search. Food availability, seasonality, processing and cooking methods, their source, and health benefits of the food were explored. From the free listing of indigenous and traditional foods, participants were further probed to identify traditional weaning foods known to the community.

The non-participant observation was used in conjunction with other methods of data collection such as surveys, group, and individual interviews to explore the social phenomena in depth and to make data more meaningful. An observation protocol for recording information (Creswell, 2009) was used and it included the following: (a) the environment such as the local vegetation, plant and animal species, soils, and crops; (b) the participants: their relationships with one another, the structures or groupings existing

among the participants and anything else worth observable was recorded in a field book.

#### **Secondary data**

Literature on nutrients composition was sourced from published literature.

#### **Data analysis**

Focus group discussion audio tapes were transcribed verbatim. The transcribed data were coded and categorised into various themes based on the information provided. The themes that emerged were type of foods, groups, season of availability, sources and uses. In addition, nutritional and health benefits were tabulated.

## **RESULTS AND DISCUSSION**

### **Identified traditional weaning foods**

Table 1 gives a summary of traditional weaning foods identified in the study areas. The list of identified traditional food from focus group discussions was compared with list obtained field survey and inventory made. The food types fell into six categories, namely, legumes and nuts, roots and tubers, grains, milk and milk products, fruits, and vegetables. The foods were listed by their familiar local/English and botanical names where available. All traditional foods mentioned by the respondents were cultivated except for leafy vegetables namely *delele* and *rotlhwe* which are harvested from the wild. According to focus group participants and key informants, sorghum, maize, and millet meal were the most frequently used in the study area. However, sorghum was used as the most basic weaning foods often fortified with milk and/or melon. All the aforementioned foods were considered nutritious by the respondents.

Although legumes are associated with indigestibility, diarrhoea, and flatulence in the early stages of weaning (Hou et al., 2009), focus group participants satisfactory used legume products for weaning. Focus group participants mentioned that they blend legumes to fortify sorghum porridge. Common legumes consumed in the study areas were varieties of cowpea, bambara groundnuts and groundnut, mung bean and tepary bean. Leafy vegetables, fruits and legumes were said to help in preventing constipation and promote good health whilst starchy foods were considered as energy giving foods. The results demonstrated the diverse food groups. Diverse food groups reflect diversified diets (Savy et al., 2005). Many studies have shown that consuming diets with diverse food groups is associated with better nutritional status (Matenge et al., 2017; Mbhenyane, 2017; Ghosh-Jerath, 2016; Kruger et al., 2015; Savy et al., 2006, 2005; Bernstein et al., 2002). The diverse food groups identified thus presents a big opportunity for the country to make use of these foods and improve the

**Table 1.** Summary of various traditional plant foods identified.

Traditional weaning foods	Food plant source	Scientific name	Seasonality* (wet or dry)
<b>Legumes and nuts</b>			
Ditloo	Bambara groundnut	<i>Vigna Subterranea (L.) Verdc</i>	Wet/Dry
Dinawa	Cowpea	<i>Arachis hypogaea (L.)</i>	Wet/Dry
Manoko	Groundnut	<i>Vigna unguiculata (L.) Walp</i>	Wet/Dry
Lethodi	Mung bean	<i>Vigna radiate var, radiata (L) R. Wilczek</i>	Wet/Dry
Dibonkisi	Tepary bean	<i>Phaseolus acutifolius (A. Gray)</i>	Wet/Dry
<b>Vegetables</b>			
Dipotata	Sweet potatoes	<i>Ipomoea batatas</i>	Wet/Dry
Morogo wa dinawa	Cow pea leaves	<i>Vigna inguiculata</i>	Wet/Dry
Thepe	Amaranth	<i>Amaranthus hybridus L. subsp. cruentus (L), Cucurbita spp.</i>	Wet/Dry
Morogo wa lephutshe	Pumpkin leaves	<i>Cleome gynandra L.</i>	Wet
Rotlhwe	Spider plant	<i>corchorus olitorius</i>	Wet/Dry
Delele	Bush okra	<i>Lagenaria siceraria</i>	Wet/Dry
<b>Fruits</b>			
Lekgomane	Bottle gourd	<i>Citrullus lanatus var. lanatus</i>	Wet
Lerotse	Wild melon	<i>Citrullus lanatus</i>	Wet/Dry
Legapu	Watermelon	<i>Cucurbita maxima</i>	Wet
Lephutshe	Pumpkin	<i>Lycopersicon hirsutum</i>	Wet/Dry
Tamati	Wild tomatoes		Wet
<b>Grains</b>			
Mabele	Sorghum	<i>Sorghum bicolor (L) Moench</i>	Dry
Mmidi	Maize	<i>Zea mays</i>	Wet/Dry
lebelebele	Millet	<i>Pennisetum glaucum</i>	Dry

\*Wet season-December to March; Dry season-April to October.

nutritional status of its population. There is evidence from studies conducted around the world that a high intake of plant foods especially legumes and leafy vegetables is linked with lower risk of cardiovascular diseases (CVD) and coronary heart disease (CHD) (Polak et al., 2015; Orlich and Fraser, 2014; Flight and Clifton, 2006; Liu, 2004), because of the unique phytochemicals and antioxidants (Matenge, 2020; Ren et al., 2012; Amarowicz and Pegg, 2008). In addition, legumes contain proteins (Kouris-Blazo and Belski, 2016), complex carbohydrates, minerals and vitamins, polysaturated fatty acids, and dietary fiber which are beneficial to health (Çakir et al., 2019; Polak et al., 2015; Amarteifio and Moholo, 1998). Regular consumption of legumes may help prevent weight gain through its lower glycemic index (Venn et al., 2010).

### Traditional preparation and processing methods

Table 2 presents various methods cited by the respondents as being used in the preparation of traditional foods for consumption in the study area. Different methods of cooking were used in the

preparation of traditional foods. However, according to the key informants all fruits were consumed raw except for bottle gourd and pumpkins which are boiled or steamed and mashed. In addition, respondents alluded that they were easy to cook, thus saving cooking time and labour. Research has shown that shorter cooking time and steaming minimize the oxidation and carotenoids and loss in cooking water (Lee et al., 2018). Bottle gourd plays an important role in providing essential nutrients. Although not much research has been conducted on the processing of bottle gourd in Africa, studies show that bottle gourd can be processed into different products such as pudding, pickles, chutney and used in soups, curries and/or simply drunk as a juice (Gajera et al., 2017; Thamburaj and Singh, 2005).

Leafy vegetables were blanched in boiling water in a three-legged pot (cast iron) and spread on a corrugated roof iron for sun-drying. There are some evidence that blanching vegetables reduce antioxidant activity (Wen et al., 2010) and vitamin C (Lee et al., 2018). Sun-drying as a method of preservation for vegetables, fruits and meat reduces moisture content (Faber et al., 2010) and thus reduction in microorganism activity. However, studies

**Table 2.** Preparation/processing methods used in the study areas.

Food category	Examples of food	Preparation/processing methods
Legumes	Jugo beans/Bambara groundnuts, groundnuts, beans	Boiling, soaking, pounding of groundnuts into powder, drying
Fruits and Vegetables	Delele, thepe, amaranth, pumpkin leaves, rothwe	Washing to remove soil, soaking, boiling, blanching, sautéing, steaming, mashing, drying
Roots and tubers	Sweet potatoes, melon, makgomane	Peeling to remove skin, Boiling, mashing, steaming
Cereals and grains	Sorghum, millet, maize	Threshing to detach grain kernel from the panicle, winnowing to separate the grain from chaff, pounding/dry milling, soaking, sorghum
Meat and meat products	Beef, chevron, and milk	Meat slicing, fermentation of milk (madila)

have identified that open sun drying exposes food to dust and insects (Afolabi, 2014) and causes inferior color, texture, and excessive loss of nutrients (Lee et al., 2018). This calls for proper training in the correct methods. Soaking of cereals such as sorghum, maize, and millet before grinding and cooking was common in the study sites. According to the participants, soaking of sorghum, millet and maize helps in the dehulling of grains and softening of legumes and therefore less cooking time. Gibson (2007) reported that soaking in water can result in passive diffusion of water-soluble vitamins, sodium, potassium, and magnesium phytate and some loss of water-soluble vitamins.

Apart from sun drying, fermentation of sorghum meal and maize was common in some study sites. The grains were ground with mortar and pestle to remove bran and to obtain a good flour. Fermentation has the potential to enhance iron and zinc absorption and hydrolyze phytate to lower inositol phosphates (Teucher et al., 2004), and improves organoleptic properties as well as the extended life shelf (Chaves-Lopez et al., 2014). In addition, studies on weaning foods have shown that fermentation increases macro nutrient digestibility and mineral bioavailability and increases the content of amino acids and other nutrients (Samtiya et al., 2020). Unfortunately, fermentation is linked with proliferation of microorganisms (yeast and molds) that can cause food safety problems (Omemu, 2011) and have significant adverse effects on the nutritive value of foods. Therefore, practical approaches to controlling safety hazards in fermented foods is an area of research interest due to the need to prevent toxicity and associated health problems caused by these microorganisms.

There was little variation in the preparation methods from place to place apart from slight modifications from time to time for quality improvement (Table 2). Recipes used in the preparation of these foods were also mentioned. Leafy vegetables were prepared either dried or fresh. Fresh leafy vegetables are boiled in just enough water with salt and oil added. Preparation of dried leafy

vegetables includes grinding and boiled in just enough water with salt and oil added. Sometimes chopped onions and tomatoes were added and cooked until the liquid runs dry. Another variation was to fry onions and tomatoes separately and add to the cooked leaves and stewed further for 10 min. Ground peanuts were often added to increase the nutritive value and taste. Most respondents reported adding bicarbonate of soda when cooking *delele* to make it cook fast and also to enhance the green colour and flavor (Nguni and Mwila, 2007). Addition of bicarbonate of soda can lead to leaching of B vitamins such as B1, B2 and niacin (Kimiye et al., 2007). Leafy vegetables are source of used as accompaniments to starchy foods such sorghum, millet and maize meal which are often prepared as stiff or soft porridge. Cereals such as maize and sorghum meal were often fortified with milk or sour milk to improve nutritional quality, and sometimes sugar added. According to the respondents, legumes were soaked overnight, and slow cooked, mashed, or served as soup. Eggs made part of the weaning foods. In most cases they were boiled and mashed. Meat from goat, cow, game, sheep, and chicken were introduced at a later stage of weaning and often served with porridge.

#### **Nutritional composition of some traditional weaning foods identified**

A review of secondary data (Table 3) indicated that traditional foods are good sources of proteins, carbohydrates, dietary fibre, minerals, and vitamins (Solomon and Prisca, 2012; Guarrera and Savo, 2013; Legwaila et al., 2011; Flyman and Afolayan, 2006; Odhav et al., 2007; Orech et al., 2007). In addition, traditional leafy vegetables are loaded with phytochemicals and antioxidants (Matenge, 2020; Matenge et al., 2017; Eusebio, 2009). There is less information about micronutrient analysis of indigenous foods in the literature. Micronutrients such as calcium, iron and magnesium have been determined for some few fruits and nuts.

**Table 3.** Nutritional composition of some traditional leafy vegetables identified per mg/100 g.

Composition	<i>Amaranth</i>	<i>Cleome gynandra</i>	<i>Vigna unguiculata</i>	<i>Cucurbita maxima</i>
Iron (mg)	8.9	6.0	3.9	15.9
Protein (g)	4.6	4.8	4.1	4.2
Moisture (%)	84.0	86.6	87.6	87.3
Kilojoule	176.4	142.8	6.8	5.0
Carbohydrates (g)	8.2	5.2	221.1	382.9
Fibre (g)	1.8	13	80.1	119.2
Ascorbic acid (mg)	64	288	2249.35	1694.55
Calcium (mg)	410	111	0.05	0.12
Phosphorus (mg)	103	-	107	-
β-carotene (mg)	5716	-	-	-
Thiamine (mg)	0.05	-	-	-
Riboflavin (mg)	0.42	-	-	-
Folate (ug)	122	-	-	-

Source: Kruger et al. (2008).

**Table 4.** Nutritional composition of some weaning foods per mg/100 g.

Food item	Cal	Carb	Prot	Fat	Fiber	Ash	Fe	Thiamin	Ca
Millet	363 kcal	67.0 g	11.8 g	4.8 g	2.3 g	2.2g	11.0 g	0.38 mg	4 mg
Amaranths spp	42 cal	8.2 g	4.6 g	-	1.8 g	-	8.9 mg	0.05 mg	410 mg
Sweet potato	110 kcal	28.0 g	1.6 g	0.2 g	4.0 g	-	2 mg	0.078 mg	33 mg
Sorghum	329 kcal	70.7 g	10.4 g	3.1 g	2.0 g	-	5.4 mg	0.38 mg	25 mg
Delele	32 kcal	29.0-62.0 g	22.5-28.0 g	1.25-1.50 g	8.5-10.0 g	9.8-18.0g	2.73 mg	0.79 mg	184 mg
Groundnuts	567 kcal	15.5%	30.0%	48.8%	3.0%	2.0%	-	-	2%
Jugo beans/Bambara groundnuts	345 kcal	57 g	19 g	6.2 g	5.2-6.4%	3.2-4.4g	12 mg	-	62 mg
Beans	320 kcal	57 g	22 g	1.5 g	8.8 g	-	8.2 g	0.63 mg	120 mg
Melon	34 kcal	8.6 g	0.84 g	0.1 g	0.9 g	-	-	0.017 mg	-
Pumpkins	26 kcal	6.50 g	1.0 g	0.1 g	0.5 g	-	0.80 g	0.50 mg	21 mg

Source: Muthoni and Nyamongo (2015), Savage and Keenan (2014), Muriuki (2015), Alegbejo (2013), Robinson and Neal (2013), Murevanhema (2013), Mpotokwane (2018), Lester (2015), Iheanacho and Udebuani (2009), Kulamarva and Raghavan (2009), Murevanhema (2013), Sharma and Rao (2013), and Singh (2016).

Therefore, there is a need for comprehensive studies.

In conclusion, in this study, an abundance of

legume, cereal, fruits and vegetable based traditional weaning foods were identified with little contribution made by animal products such as

meat and milk products (Table 4). The results of this study revealed a high variation in nutrient composition. Dishes with high and low content

of nutrients were also identified. Processing methods for traditional foods identified in this study could be explored and improved. Malnutrition in weaning children can be reduced significantly when traditional foods in Botswana system are improved using a combination of strategies including nutrition education and promotion of these foods towards sustained nutrition security. Further research needs to be undertaken with the aim of providing a more comprehensive and detailed information on traditional foods which are important for complementary feeding. Providing information on the benefits of consuming traditional foods could contribute to both food and nutrition security.

## CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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