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.

Received 26 May, 2020; Accepted 6 August, 2021

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. Tel: +26774781763.

Author(s) agree that this article remain permanently open access under the terms of the Creative Commons Attribution License 4.0 International License.
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° S) and Longitude of 27.5 (27.4556° E) with a land area of 5,120 km² 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 Kgotta (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 Kgotta 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 rothwe 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) |
|---------------------------|-------------------|-----------------|--------------------------|
| **Legumes and nuts**      |                   |                 |                          |
| Ditloo                    | Bambara groundnut | *Vigna Subterranea (L.) Verdc* | Wet/Dry                 |
| Dinawa                    | Cowpea            | *Arachis hypogaea (L.)* | Wet/Dry                 |
| Manoko                    | Groundnut         | *Vigna unguiculata (L.) Walp* | Wet/Dry                 |
| Lethodi                   | Mung bean         | *Vigna radiate var.radiata (L) R. Wilczek* | Wet/Dry |
| Dibonkisi                 | Tepary bean       | *Phaseolus acutifolius (A. Gray)* | Wet/Dry |
| **Vegetables**            |                   |                 |                          |
| Dipotata                  | Sweet potatoes    | *Ipomoea batatas* | Wet/Dry                 |
| Morogo wa dinawa          | Cow pea leaves    | *Vigna inunguiculata* | Wet/Dry                 |
| Thepe                     | Amaranth          | *Amaranthus hybridus L. subsp. cruentus (L), Cucurbita spp.* | Wet/Dry |
| Morogo wa lephutshe       | Pumpkin leaves    | *Cleome gynandra L.* | Wet/Dry                 |
| Rothwe                    | Spider plant      | *corchorus ollitorius* | Wet/Dry                 |
| Delele                    | Bush okra         | *Lagenaria siceraria* | Wet/Dry |
| **Fruits**                |                   |                 |                          |
| Lekgomane                 | Bottle gourd      | *Citrus lanatus var. lanatus* | Wet                     |
| Lerotse                   | Wild melon        | *Citrus lanatus* | Wet/Dry                 |
| Legapu                    | Watermelon        | *Cucurbita maxima* | Wet                     |
| Lephutshe                 | Pumpkin           | *Lycopersicon hirsutum* | Wet/Dry |
| Tamati                    | Wild tomatoes     |                 |                          |
| **Grains**                |                   |                 |                          |
| Mabele                    | Sorghum           | *Sorghum bicolor (L) Moench* | Dry                     |
| Mmidi                     | Maize             | *Zea mays*      | Wet/Dry                 |
| lebelelebele              | Millet            | *Pennisetum glaucum* | 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; Amarteifio and Moholo, 2008). In addition, legumes contain proteins (Kouris-Blazo and Belski, 2016), complex carbohydrates, minerals and vitamins, polsaturated 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
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 motor 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 grounding 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 (Kimiwyw 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; Guerrera 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 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, rothe | 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        | Beef, chevron, and milk                   | Meat slicing, fermentation of milk (madilila)                        |
| products             |                                           |                                                                      |
Table 3. Nutritional composition of some traditional leafy vegetables identified per mg/100 g.

| Composition     | Amaranth | Cleome gynandra | Vigna unguiculata | Cucurbita maxima |
|-----------------|----------|-----------------|-------------------|-----------------|
| 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               | -               |
| ß-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 kcal  | 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), Mpokokwane (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 weaners 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 INTEREST

The authors have not declared any conflict of interests.

REFERENCES

Afolabi IS (2014). Moisture migration and bulk nutrients interaction in a drying food system: A review. Food and Nutrition Sciences 5:692-714.

Amarowicz R, Pegg RB (2008). Legumes as source of natural antioxidants. European Journal of Lipid Science and Technology 110(1):865-878.

Amartefio JO, Moholo D (1998). The chemical composition of four legumes consumed in Botswana. Journal of Food Composition and Analysis 11(4):329-332.

Bernstein MA, Tucker KL, Ryan ND, O'Neill EF, Clements KM, Nelson ME, Evans WJ, Fiatore SMA (2002). Higher dietary variety is associated with better nutritional status in frail elderly people. Journal of the American Dietetic Association 102(8):1096-1104. DOI: 10.1016/s0002-8223(02)90246-4

Black RE, Allen LH, Bhutta ZA, Caulfield LE, De Onis M, Ezzati M, Mathers C, Rivera J, Maternal and Child Undernutrition Study Group (2008). Maternal and child undernutrition: global and regional exposures and health consequences. Lancet 371(9608):243-260. DOI: 10.1016/S0140-6736(07)61690-9

Çakir Ö, Ucarlı C, ağatay Tarhan A, PEKMEZ M, Turgut-Kara E (2019). Nutritional and health benefits of legumes and their distinctive genomic properties. Food Science and Technology 39(1):1-12. DOI:10.1590/fst.42117

Chaves-Lopez C, Serio A, Grande-Tovar CD, Cuervo-Mulet R, Delgado-Ospina J, Paparella A (2014). Traditional fermented foods and beverages from a microbiological and nutritional perspective: The Colombian Heritage. Comprehensive Reviews in Food Science and Food Safety 13:1031-1048. DOI: 10.1111/1541-4337.12098

Chelule P, Chihope CN (2014). Feeding practices among the child care givers of 5-year-old children attended to for acute malnutrition at Nyangabgwe Hospital, Botswana. PULA: Botswana Journal of African Studies 28(1):13-27.

Dewey KG (2013). The challenges of meeting nutrients need of infants and young children during the period of complementary feeding: an evolutionary perspective. Journal of Nutrition 143(12):2050-2054.

Effuebo JE (2009). Promoting utilization of indigenous vegetables for improved nutrition in the Philippines. First international conference on indigenous vegetables and legumes, RWC Auditorium, pp. 12-15 December.

Faber M Oelofse A, van Jaarsveld PJ, Wenhoid FAM, Jansen van Rensburg WS (2010). African leafy vegetables consumed by households in the Limpopo and KwaZulu-Natal provinces in South Africa. South African Journal of Clinical Nutrition 23(1):30-38.

Fentahun M, Hager H (2009). Exploiting the locally available resources for food and nutritional security enhancement: wild fruits diversity, potential state of exploitation in the Amhara region of Ethiopia. Food security: the science, sociology and economics of food production and access to food. The International Society for Plant Pathology 2(1):207-219.

Flight I, Clifton P (2006). Cereal grains and legumes in the prevention of coronary heart disease and stroke; a review. European Journal of Clinical Nutrition 60(10):1145-59.

Flyman M, Afolayan A (2006). The suitability of wild vegetables for alleviating human dietary deficiencies. South African Journal of Botany 72(4):492-497.

Gajera RR, Joshi DC, Ravani A (2017). Processing potential of bottle gourd (L. siceraria) Fruits: An overview. International Journal of Herbal Medicine 5(4):106-109.

Ghosh-Jerath S, Singh A, Magsumbol MS, Kamboj P, Goldberg G (2016). Exploring the potential of indigenous foods to address hidden hunger: nutritive value of indigenous foods of Santhal tribal community of Jharkhand, India. Journal of Hunger Environmental Nutrition 11(4):548-568.

Gibson RS (2007). The role of diet- and host-related factors in nutrient bioavailability and thus in nutrient-based dietary requirement estimates. Food and Nutrition Bulletin 28(1):77S-100S. DOI: 10.1177/15648265070281S108.

Global Nutrition Report (2020). The burden of malnutrition at a glance; Botswana. https://globalnutritionreport.org/resources/nutrition-profiles/africa/southern-africa/botswana/.

Guerrera P, Savo V (2013). Perceived health properties of wild and cultivated food plants, local and popular traditions of Italy: A review. Journal of Ethnopharmacology 146(3):659-680.

Hou A, Chen P, Shi A, Zhang B, Wang YJ (2009). Sugar variation in soy beans seed assessed with rapid extraction and quantification method. International Journal of Agronomy 2009:1-8.

Kimiwye J, Waudo J, Mbithe D, Maudu P (2007). Utilization and medicinal value of indigenous leafy vegetables consumed in urban and peri-urban Nairobi. African Journal of Food Agriculture Nutrition and Development 7(4):1684-5374.

Kruger J, Mngwaketse T, Faber M, van der Hoeven M, Smuts CM (2015). Potential contribution of African green leafy vegetables and maize porridge composite meals to iron and zinc nutrition. Nutrition 31:1117-1123. DOI: 10.1016/j.nut.2015.04.010

Kruger M, Sayed N, Langenhoven M, Holi G (2008). Composition of south African foods. Vegetables and fruits. Supplement to the MRC food composition Table 1991. Medical Research Council, Tygerberg 160 p.

Lee S, Choi Y, Jeong HS, Lee J, Sung J (2018). Effect of different cooking methods on the content of vitamins and true retention in selected vegetables. Food Science Biotechnology 27(2):333-342. DOI:10.1007/s10068-017-0281-1

Leemrijse PW, Mojenemawal GM, Madeisa ME, Mmlototsi RM, Rampart M (2011). Potential of traditional food plants in rural household food security in Botswana. Journal of Horticulture and Forestry 3(6):171-177.

Liu RH (2004). Potential synergy of phytochemicals in cancer prevention: Mechanism of action. Journal of Nutrition 134(12):3479S-3485S.

Manama M, Kana-Sop MM, Nolla NP, Tetanye-Ekoe GI (2014). Feeding practices, food and nutrition insecurity of infants and their mothers in Bangang rural community, Cameroon. Journal of Nutrition and Food Science 4(2):2-6. DOI.org/10.4172/2155-9600.1000264

Matenge S, Lj, Apau S, Tapera R (2017). Nutritional and phytochemical content of indigenous leafy vegetables consumed in Botswana. Frontiers in Food and Nutrition Research 3(1):1-7.

Matenge STP (2020). Phytochemical Profiles and Antioxidant Activity of Legumes Consumed in Botswana. Journal of Food and Nutrition Sciences 8(4):103-107. DOI: 10.11648/j.fnns.20200804.15.

Michaelsen KF, Clements KM, Nelson ME, Evans WJ, Fiatarone SMA (2008). Perceived health properties of wild and cultivated food plants, local and popular traditions of Italy. A review. Journal of Ethnopharmacology 146(3):659-680.

Muhanje G, Roothaert RL, Webo C, Stanley M (2011). African leafy vegetables consumed by households in the Limpopo and KwaZulu-Natal provinces in South Africa. South African Journal of Clinical Nutrition 23(1):30-38.

Musinguzi E, Kikafunda JK, Kiremire BT (2006). Utilization of indigenous food plants in Uganda: a case study of South-western
Uganda. African Journal of Food, Agriculture, Nutrition and Development 6(2):1-12.

Mwema CM, Mutai BK, Lagat JK, Kibet LK, Maina MC (2012). Contribution of selected indigenous fruits on household income and food security in Mwingi, Kenya. Current Research Journal of Social Sciences 4(6):425-430.

Neumark-Sztainer D, Story M, Perry C, Casey MA (2009). Factors influencing food choices of adolescents: Findings from focus-group discussions with adolescents. Journal of American Dietetic Association 99(8):929-937.

Nguni D, Mwila G (2007). Opportunities for increased production, utilization, and income generation from African leafy vegetables in Zambia. African Journal of Food Agriculture Nutrition and Development 7(4):39-48.

Nnyepi M, Harari N, Ntshebe O (2010). Complementary feeding: A sore spot in the nutritional status and survival of children in Botswana. The United Nations Children’s Fund (UNICEF), Botswana.

Odhav B, Beekrum S, Akula US, Bajnath H (2007). Preliminary assessment of nutritional value of traditional leafy vegetables in KwaZulu-Natal, South Africa. Journal of Food Composition and Analysis 20(5):430-435.

Ohiekpohai O (2003). Promoting the nutritional goodness of traditional food products. Pakistan Journal of Nutrition 2(4):267-270.

Olatona FA, Adenihun JO, Aderibigbe SA, Adeniyi OF (2017).Use of variety/diversity scores for diet quality measurement: relation with nutritional status of women in a rural area in Burkina Faso. European Journal of Clinical Nutrition 59(5):703-716.

Savy M, Martin-Prével Y, Traissac P, Eymard-Duvernay S, Delpeuch F (2006). Dietary diversity scores and nutritional status of women change during the seasonal food shortage in rural Burkina Faso. Journal of Nutrition 136(10):2625-2632.

Solomon M, Prisca N (2012). Nutritive value of Lepidoptera litoralia (edible caterpillar) found in Jos Nigeria: implication for food security and poverty alleviation. African Journal of Food, Agriculture, Nutrition and Development 12(6).

Teucher B, Olivares M, Cori H (2004). Enhancers of iron absorption: ascobic acid and other organic acids. International Journal for Vitamin and Nutrition Research 74(6):403-419. DOI: 10.1024/0300-9831.74.6.403

Thamburaj S, Singh N (2005). Cucurbitaceous vegetables. Textbook of Vegetables: Tuber Crops and Spices, ICAR Publication, New Delhi. pp. 271-274.

UNICEF (2011). http://www.unicef.org/botswana/BCO__Annual_Report_2011.pdf. Date accessed 16-2-2016.

United Nations Children’s Fund (UNICEF) (2009). State of the World’s Children 2009, New York: UNICEF.

Venn BJ, Perry T, Green C, Skeaff M, Atken W, Moore NJ, Mann, JI, Wallace AJ, Monro J, Bradshaw A, Brown RC, Skidmore PML, Doel K, O’Brien K, Frampton C, Williams S (2010). The effect of increasing consumption of pulses and wholegrains in obese people: a randomized controlled trial. Journal of the American College of Nutrition 29(4):365-372.

Wen TN, Prasad KN, Yang B, Ismail A (2010). Bioactive substance contents and antioxidant capacity of raw and blanched vegetables. Innovative Food Science and Emerging Technologies 11:464-469.

World Health Organization (WHO) (2001). Guiding Principles for Complementary Feeding of the Breastfed Child. Geneva: WHO Press.

World Health Organization (WHO/UNICEF) (2003). Global strategy for infant and young child feeding. Geneva.

World Health Organization (WHO) (2017). Guidance on ending the inappropriate promotion of foods for infants and young children. Implementation manual. https://apps.who.int/iris/bitstream/handle/10665/260137/9789241513470-eng.pdf.