

Consumption Patterns, Processing and Nutritional Value of Traditional Snack “*Mugdugu*” Consumed in Rural Areas of Burkina Faso

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Abstract: Traditional African snacks are very little known to the people. The objective of this study is to present the importance of consumption, the process and the nutritional value of a snack traditionally consumed in Burkina Faso. Consumption surveys were conducted among 250 adults in rural and urban areas Lebda and Kaya in the north center area of Burkina Faso. Production follow ups were carried out at the producers in Kaya and Lebda. Carbohydrates, lipids and proteins, iron and zinc contents were determined. *Mugdugu* is well known to the populations, 97% know it and have used it at least once. Nearly 46% and 20% of respondents in Lebda and Kaya consumed it at least once a week. The market is the main place of supply in the two localities. *Mugdugu* is consumed by all age, 1 year to more than 45 years. *Mugdugu* is based on millet (*Pennisetum glaucum*) and peanut (*Arachis hypogea*). The process is based on two essentials steps: roasting and grinding. The average contents of carbohydrates, lipids and proteins are respectively 61.78%, 21.67% and 14.45%. Those of iron and zinc are 11.97% and 3.97% respectively. The association of cereal and legume make *Mugdugu* an interesting snack of good nutritional value that must attract the attention of nutrition actors.

Keywords: Snack, Tradition, Processing, Legumes, Rural

1. Introduction

Traditional African snacks are very little known to the people. In developing countries, urban and rural markets are flooded with modern snacks such as biscuits, cakes and pastries. Snacks or between-meals snacks are important in people's diet. Snacking is extremely common among children and plays a vital role in meeting food needs [1]. According to many studies, snacks cover 21 to 25% of children's daily energy needs [2, 3]. In developing countries where basic dishes are monotonous and of poor nutritional value [4, 5], snacks are an important source of nutrients. Traditional snacks consumed in West Africa such as *masa* have low

nutritional values [6]. Most snacks have high energy value with low nutritional value, high sugar and salt contents [7, 8, 9, 10, 11, 12, 13]. The impact of snacking on people's health in many countries has been the subject of many studies. Developed countries such as France, Switzerland, England, Sweden, have introduced more options in snacking to improve the health of the people [14, 15].

A snack rich in essential nutrients based on pre-existing population preferences could contribute to improving the nutritional value of people's diets where protein and energy deficiencies are prevalent.

A good knowledge of the nutritional value of traditional snacks is an advantage to improving the nutritional condition of rural populations in developing countries.

"Mugudugu" or "djimita" in local languages of Burkina Faso is a traditionally consumed snack. It is based on millet and groundnut. This study presents the level of consumption in urban and rural areas, production processes and the nutritional value of this local snack.

2. Material and Methods

2.1. Consumer Survey

The study was conducted in the Central North region of Burkina Faso. The places concerned are Kaya and Lebda. The city of Kaya is the main city of the region. Lebda is a village located at 20 km from Kaya and belongs to the rural town of Pissila.

A total of 250 adults were surveyed on the consumption of *Mugudugu*. 135 respondents in Kaya and 115 respondents in Lebda were targeted. The adults were chosen randomly. Table 1 shows the distribution of respondents in the various study locations.

Each respondent was administered a questionnaire comprising the identity of the respondent, the level of knowledge, the source of supply, the frequency of consumption of *Mugudugu*.

2.2. Processor Survey

The processor survey consisted of figuring out the different processing steps of *mugudugu*, the raw materials and the ingredients used. This survey was conducted in Kaya and in Lebda with the *mugudugu* producers. 30 processors in Kaya and 16 in Lebda were investigated. The production units are small units on a family scale.

2.3. Sampling and Biochemical Analysis

In each location 3 samples from different units were collected and sent to the laboratory for biochemical testing. Biochemical tests were carried out on moisture, macronutrient contents according to AOAC methods [16] and iron and zinc mineral contents.

The water content was determined by differential weighing after putting the sample in an oven at 105°C. The total proteins are determined from the Kjeldah method. The identification of the fat content is made according to the Soxhlet extraction method using hexane as solvent. The ashes were determined by incineration in a muffle furnace at 550°C.

The total carbohydrate content was determined by the differential method [17].

The theoretical energy value was calculated from analytical values of total protein, fat and carbohydrates according to the Merrill and Watt method adopted by the FAO in 1970.

2.4. Statistical Analyses

Data from the consumer survey were processed on Excel. Data from biochemical testing were introduced on Excel, the

mean and standard deviation were determined.

3. Results

3.1. Consumer Survey

3.1.1. Characteristics of Respondents

Table 1 shows the characteristics of respondents. The survey interviewed 47% of women and 53% of men overall. Nearly 33% and 26% of respondents are between the ages of 18-25 and 26-35. 18% of respondents are between 36 and 45 years old and 23% are over 45 years old.

Educational attainment is low, 56% of respondents are illiterate, 24% are literate (local languages), 7% are primary, 11% are secondary and 2% are higher.

About all respondents, 97% knew *mugudugu* and had consumed it at least once. In Kaya 95% of respondents say they know *mugudugu* and 99% in Lebda. Overall, 81% of respondents believe that *mugudugu* is well known in the community, while 15% believe it is fairly well known. Only 3% say it is not known at all in the area.

Table 1. Characteristics of respondents of Kaya and Lebda.

Characteristics	respondents%
Men	53
Women	47
Age	
18-25 years	33
26-35 years	26
36-45 years	23
More than 45 years	18
Knowledge level	
Very well	44
Well	37
Fairly well	15
Never	4

3.1.2. Consumption Frequency

Figure 1 shows the frequency of *Mugudugu* consumption for all areas of the consumer survey. In Lebda, nearly 16% consumed *Mugudugu* at least once a day, 46% of respondents consumed it during the week. While in Kaya 27% consumed at least once in the month and 38% consumed at least once in a year.

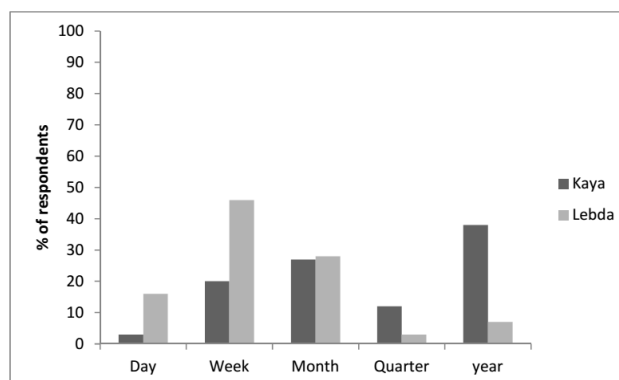


Figure 1. Frequency of *Mugudugu* consumption.

3.1.3. Supply Places

The market is the main place of sale in Kaya and Lebda respectively 78% and 97%. *Mugudugu* is also found with street vendors, in shops and at women's homes. In Kaya, 34% and 39% of the respondents are supplied respectively from street vendors and women's producers' homes. In Lebda, boutiques are a source of supply for 15% of respondents.

Table 2. Supply source of Mugudugu according to the respondents (%).

Supply place	Kaya	Lebda
Market	78	97
Street vendors	34	15

Supply place	Kaya	Lebda
Alimentations	0	0
Shops	9	15
Home of producers	39	11

3.2. Processing

The raw materials used by all female producers are millet and groundnut. The main ingredients are sugar, salt, oil and spices. The spices mentioned are pepper and ginger. The use of spices varies from one production to another with the same producer (Figure 2).

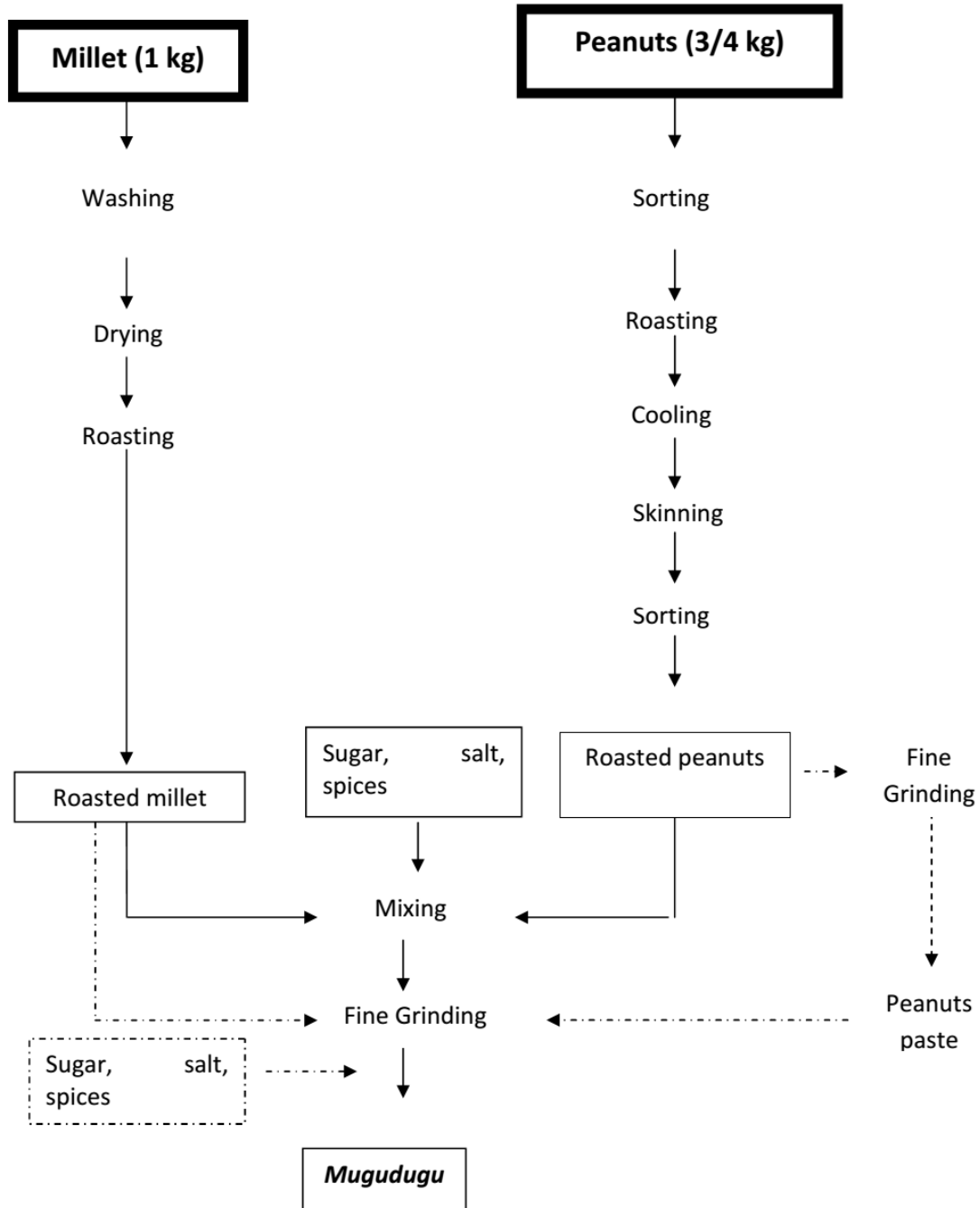


Figure 2. Diagram of production of Mugudugu.

3.2.1. Production Steps

The production of *Mugudugu* is done in three stages (Table 3). The first stage involves the processing of millet, the second stage is the processing of groundnuts, and the third stage involves mixing millet and groundnuts. The various operations of millet processing are cleaning, washing, drying, roasting and grinding. Millet was roasted by all producers while 14/30 producers in Kaya and 16/16 in Lebda ground the roasted millet. The other producers ground the millet with the mixture of groundnuts and the ingredients.

The main stages of groundnut processing are roasting and grinding. Groundnuts are roasted and ground by all producers before shredding. In Kaya 5 producers grind groundnuts in groundnut paste.

The mixture is the last stage of processing of *Mugudugu*. In Kaya and Lebda respectively 25/30 and 16/16 producers blend millet flour, roasted groundnuts and ingredients. The mixture is finely ground to give *Mugudugu*.

Table 3. Frequency of use of operations during transformation of *Mugudugu*.

Steps	Operations	Kaya (30 producers)	Lebda (16 producers)
Millet	Cleaning	1	16
	Washing	14	0
	Draining	1	0
	Drying	6	0
	Roasting	30	16
	Grinding	15	16
	Sorting/Cleaning	5	16
Peanuts	Washing	0	0
	Draining	0	0
	Drying	0	0
	Roasting	30	16
	Skinning	4	16
Mixing	Grinding	5	0
	Mixing	30	16
	Grinding	30	16

3.2.2. Main Customers

According to the response given by the processors, *Mugudugu* is consumed by both women and men (Table 4). In Lebda men consume more than women. It is consumed by all ages in Kaya and Lebda. Children are the main consumers in both areas, 98% and 83% respectively in Kaya and Lebda.

Table 4. Main customers of *Mugudugu*.

		Kaya (%)	Lebda (%)
Sex	Men	90	83
	Women	90	72
	Children (1-16 years)	98	83
Age	Young (17-45 years)	84	67
	More than 45 years	74	67

3.3. Physico-chemical Characteristics

Table 5 shows the nutritional composition of *Mugudugu*. *Mugudugu* is a low moisture product, 4.09%. It is highly energetic, 499.95 Kcal/100 g of dry product. The carbohydrate content are 61.78 g/100 g and the fat content

are 21.67 g/100 g. The protein content are 14.45 g/100 g of dry product. While the iron and zinc mineral contents are 11.97 mg/100 g and 3.97 mg / 100 g, respectively.

Table 5. biochemical composition of *Mugudugu* (100 g of dry matter).

Parameters (unity)	Contents
Humidity%	4,09 ± 0,71
Protein g/100 g	14,45 ± 0,03
Fats g/100 g	21,67 ± 2,24
Carbohydrates g/100 g	61,78 ± 0,1
Iron mg/100g	11,97 ± 0,05
Zinc mg/100g	3,97 ± 0,03
Energy (Kcal /100 g)	499,95 ± 0,07

4. Discussion

Mugudugu is a snack well known to people in Kaya and Lebda. Only 4% of respondents do not know it. It is a snack regularly consumed by all age groups, although children are the biggest consumers in both areas. Consumption is more regular in Lebda village where nearly 46% of respondents consume it once in a week. In Lebda the number of male consumers is higher than that of women. According to the outcomes of previous studies conducted in other countries such as China, Australia, the United Arab Emirates, the United States, the snacking trend is high among women [18, 19]. However, this could be explained by the low spending power of rural women in Burkina Faso.

The market is the main place of supply. The sale of *mugudugu* is done at the homes of the producers and also by street vendors.

Mugudugu is a high energy dry product, 499.5 kcal / 100g. The low moisture content makes *Mugudugu* a barely perishable product. Indeed, roasting is an essential operation during the production of *Mugudugu*. Roasting has the advantage of destroying undesirable microorganisms and inactivating enzymes. It allows a better preservation of the product. Carbohydrates and lipids account for nearly ¾ of the components. Most snacks are based on cereals, they are mainly rich in carbohydrates and fat [20; 21, 22 23]. In America, nearly 27% of children's daily energy comes from snacks. The snacks have an impact on public health (24). The addition of sugar in *mugudugu* requires special attention for its consumption. A study conducted in England showed a correlation between snacking and subcutaneous skinfold thickness in obese people [11].

The protein content of *Mugudugu* is high, 14.45 g / 100 g of dry product, compared to cereal snacks usually consumed such as biscuits and *masa*. Some authors [25] reported protein levels of 6.8% in corn biscuits. Rice snacks in Thailand have protein levels of 2.44-11.06 g/100 g [26]. The combination of millet and groundnuts makes *Mugudugu* an interesting nutritional product. The cereal and legume combination has long been advocated as an important source of energy and protein for young children [27]. Several studies have shown an improvement in protein levels by combining legumes with carbohydrate-rich foods. The addition of bean

and groundnut seeds to rice and millet improved the protein content of the products [28]. In addition to quantity, the combination of cereals and legumes improves the quality of amino acids [29]. A smart combination of cereals and legumes provides a food with high nutritional value.

However, the nutritional quality of *Mugudugu*, although interesting, could be influenced by roasting. According to many studies, roasting could lead to decomposition of proteins or cross-reactions of essential amino acids such as lysine, arginine or the Maillard reaction. Hence the need to control the time / temperature couple for a good nutritional quality of *Mugudugu*.

The iron and zinc content of *Mugudugu* is higher for the children 1 year to 3 years according to the FAO/WHO recommendations [30]. Many contaminations of iron has been observed during traditional processing [31, 32].

5. Conclusion

Mugudugu is a traditional snack which is popular with consumers in Kaya and Lebda in Burkina Faso. Since children are the main customers, special attention must be paid to the nutritional and hygienic quality of the product. A control of the time/temperature couple and the use of low-fat groundnut varieties could improve the nutritional quality of the product. *Mugudugu* could also be used as a fortification for children in rural areas.

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