

## Evaluation of the processing characteristics of *Vigna subterranea* coffee in the Ndjamena city, Chad

Maoudombaye Théophile \*

Department of Life and Earth Sciences, Faculty of Exact and Applied Sciences, University of Moundou, B p. 206, Chad.

World Journal of Advanced Research and Reviews, 2024, 24(03), 054–062

Publication history: Received on 16 October 2024; revised on 25 November 2024; accepted on 28 November 2024

Article DOI: <https://doi.org/10.30574/wjarr.2024.24.3.3594>

### Abstract

An evaluative study was carried out on the processing characteristics of *Vigna subterranea* seeds in the city of N'Djamena, the capital of Chad. A survey of women coffee growers enabled us to define the artisanal processes used to produce this coffee. The survey revealed that the ages of the women processors ranged from 20 to 56, with 8% of women aged 20 to 30, 50% of women aged 30 to 40 and 42% of women aged 40 to 56. Women's experience in coffee production varies from around 1 to 10 years, with 13.33% of women having one year's experience, 30% two years, 23.33% 3 years, 6.66% 4 years, 20% 5 years, 3.33% 6 years and 3.33% 10 years. With regard to potato pea seeds processed into coffee, all women (100%) claim to have used seeds from Bousso in their processing, those processing seeds from Djawala represent 86.67% and those using seeds from Sarh represent 60%. 17% of coffee is stored in bottles and 83% in plastic. The sale of *Vigna subterranea* coffee gives women producers an average profit of around 8,083 FCFA per month. The minimum and maximum profits from the activity are 4,000 FCFA and 10,000 FCFA per month respectively. Given the average profit from other processing activities, which is higher than the average profit from processing potato pea seeds into coffee (8,083 FCFA), the activity of processing potato pea seeds into coffee would be less profitable and therefore not the main activity of these women. However, this activity reinforces the profitability of the women processors and consequently their economy.

**Keywords:** Processing characteristics; Coffee; *Vigna subterranean*; Ndjamena

### 1. Introduction

Voandzou seeds (*Vigna subterranea*), like those of other legumes, can be eaten in a variety of ways. They can be eaten fresh, dried or cooked. The addition of legumes to local dishes helps to balance the daily diet of populations, thus reducing the protein deficiencies so common in sub-Saharan Africa [1]. They can also be used to fortify protein-poor conventional flours [2]. Consumption of voandzou seeds contributes to improving the quality of the diet as a protein supplement, and can help maintain the body in good health thanks to its antioxidant properties [3].

Legume seeds are an excellent source of raw material for coffee substitutes. The development of beverages offering an alternative to coffee has been driven by the search for foods that add nutrients to the daily diet, are beneficial to health and can be consumed by everyone without restriction [4]. These substitutes produce a black beverage that has the appearance of coffee but none of the properties of coffee, and whose basic coffee-making process is based essentially on roasting, which determines the quality of the final product. The process of roasting beans into coffee substitutes can be both artisanal and industrial ([4] ; [5]). As a result, the legume seeds used in this transformation are those of beans (in 1772), Genet à balais, chickpeas and lupins (in 1800), astragalus (in 1826), carobs, cowpeas, peanuts, soybeans, bentamoré, broad beans and fava beans (in 1842), etc. [6]. Soy coffee is well known and fairly widespread. Ground pea coffee, on the other hand, is new and little known to the public. The aim of this study is to evaluate artisanal processes for transforming *Vigna subterranea* seeds into coffee.

\* Corresponding author: Maoudombaye Théophile

## 2. Materials and methods

### 2.1. Presentation of the study area

Chad is one of the world's most continental countries, and also one of Africa's largest inland states. It is a transition country between the Saharan and Sudanian zones. It is bordered to the north by Libya, to the south by the Central African Republic, to the east by Sudan (Sudan and South Sudan) and to the west by Niger, Nigeria and Cameroon. It covers an area of 1,284,000 km<sup>2</sup> and is the 5<sup>th</sup> largest country on the African continent. It lies between 7° and 24° North latitude and between 14° and 24° East longitude. It stretches 1,700 km from north to south and 1,000 km from east to west [7].

Chad's climate is based on two air masses: the harmattan and the monsoon. The intertropical front moves between the two, an important factor in the alternation of the dry season (6 to 7 months) and the rainy season (3 to 4 months), and in the determination of rainfall, which is generally low and unstable. The thermal regime is marked by a relatively cold period from December to February (11° - 22 °C) and a hot period from March to June (39 - 45 °C) [7].

The capital of Chad is the city of N'Djamena, located between 12°06' N and 12°07' N, and between 15°03''E and 15°04' E, with an area of 395 km<sup>2</sup> (fig. 1). It is located in west-central Chad, at the confluence of the Chari and Logone rivers. Its population is estimated at 1092066 [8]. Two bridges link N'Djamena to the left bank of the Chari. N'Djamena enjoys a Sahelian climate [9]. The rainy season begins in earnest in June and ends in October, with July and August enjoying good rainfall, averaging 144 mm and 175 mm/year respectively. The average temperature is around 28 °C. N'Djamena is relatively hot, with maximum temperatures reaching 45 °C in the shade in some years [9]. The administrative and political capital, N'Djamena is the country's most cosmopolitan city. Commerce remains the dominant activity, employing 37.1% of the population [10].

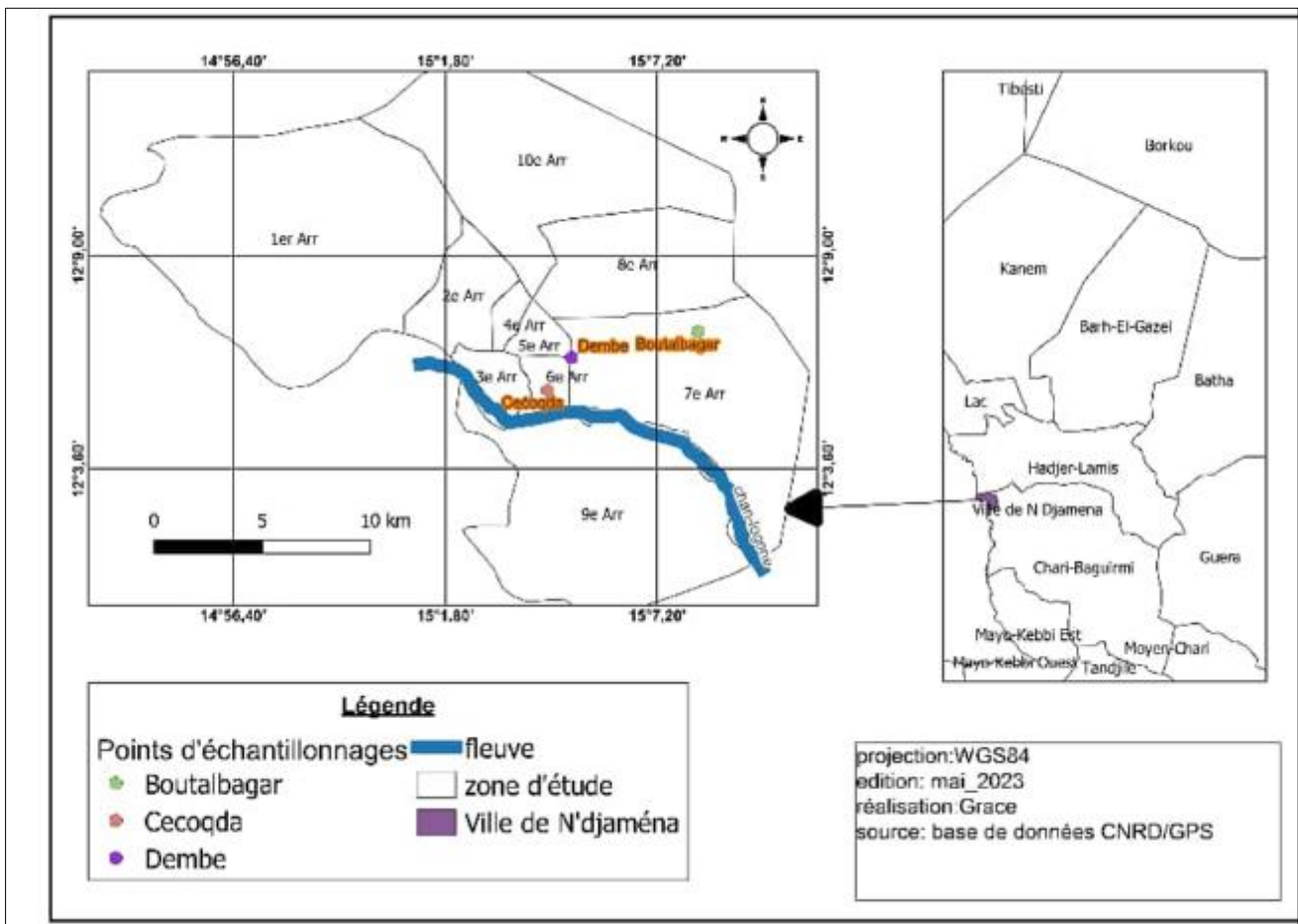
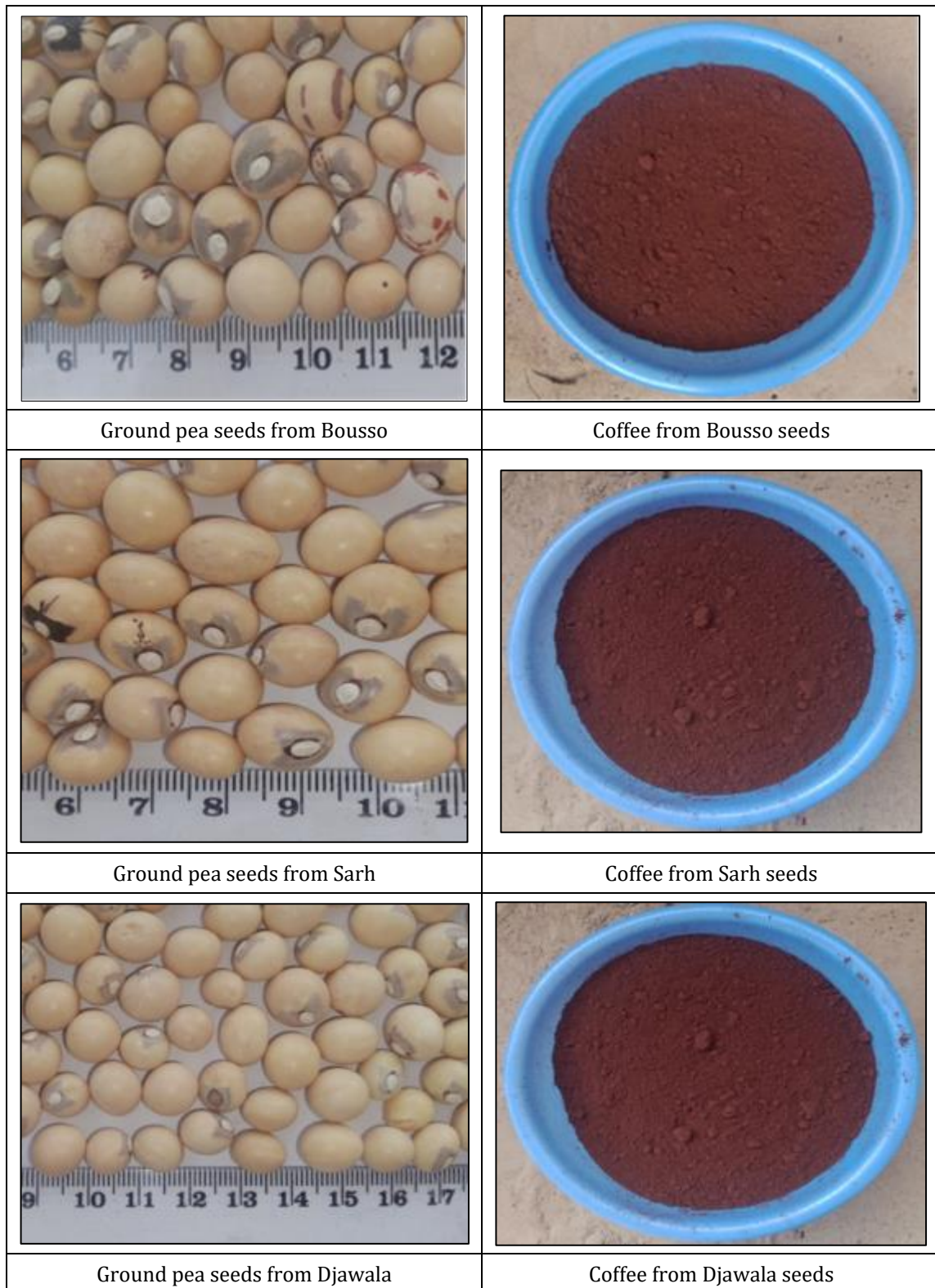


Figure 1 Map of the study area

## 2.2. Biological material

The biological material for the study consisted of the seeds of three varieties of ground pea from Sarh, Djawala and Bousso, and their coffees, produced by craftsmen and sold by women in various markets in the city of N'Djamena.



**Figure 2** Biological material

## 2.3. Methods

### 2.3.1. Assessing the processing characteristics of ground pea coffees in N'Djamena city

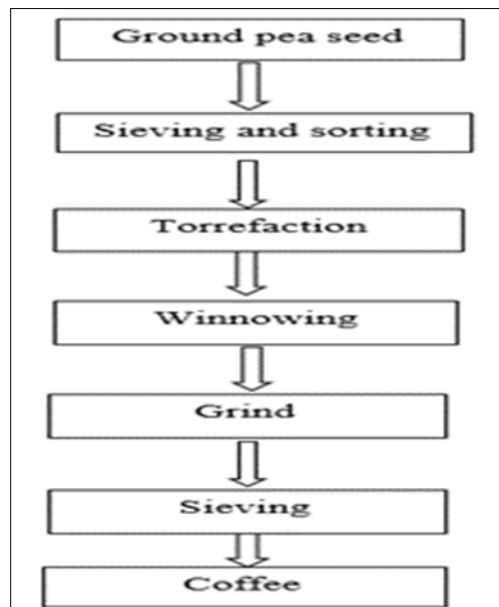
To establish the processing characteristics of coffees in the study area, a field survey sheet was drawn up, which made it possible to determine :

- Varieties of potato pea seeds used in the locality and their origin;
- Quantities of seeds processed into coffee, processing methods and frequencies;
- Coffee yields obtained per quantity of ground pea seeds;
- Methods of storing the coffees produced;
- The ages of women processors and their experience in the trade;
- Profits made by women processors, by frequency of processing, by month;
- Difficulties encountered (in obtaining seeds, processing, preserving and selling coffees).

### 2.3.2. Artisanal processing of groundnut coffee in the town of N'Djamena

Artisanal processing of ground pea coffee takes place in several stages (fig. 4). The beans are sifted and trilled by hand to remove impurities of all kinds and any misshapen seeds. The sorted seeds are then roasted over low heat in a metal pan, in which they are stirred continuously for around an hour.

Roasting allows the development of the final color and the production of volatile compounds such as ketones and aldehydes responsible for aroma and flavor [5]. The roasted beans are winnowed, ground and sieved, and the brown powder obtained is the final product (coffee).



**Figure 3** Digramme of artisanal processing of groundnut coffee substitute

## 3. Results and discussion

### 3.1. Target population for the field survey

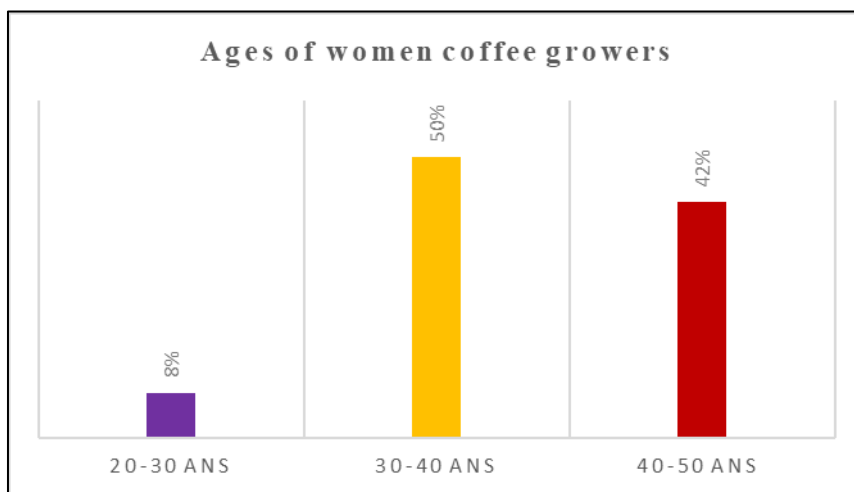
The target population for the field survey on the evaluation of the processing characteristics of potato pea seeds into coffee consisted solely of processors aged 20 and over who were willing to take part.

For this survey, we opted for non-probability sampling, as there was no secondary data available to form a sampling frame. In addition, it was not easy to locate the people carrying out this activity in local markets. To meet all these challenges, the exponential snowball method was used. This involves identifying one or more people who meet the inclusion criteria for the study. These people then help to find others who meet the inclusion criteria. Using this method, 30 women involved in the processing of ground peas into coffee were identified for this survey.

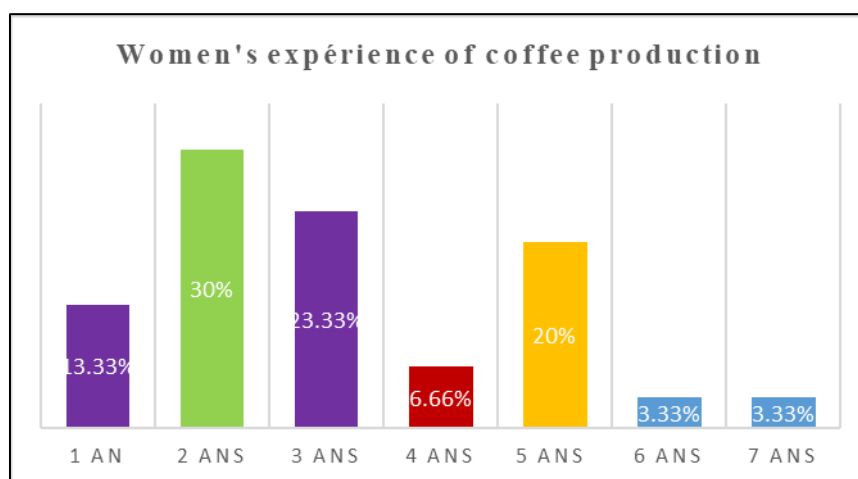
### 3.2. Profile of women processing ground pea seeds into coffee

The activity of processing ground pea seeds into coffee is carried out mainly by women. The age of women processors ranges from 20 to 56, with 8% of women aged 20 to 30, 50% of women aged 30 to 40 and 42% of women aged 40 to 56. Experience in the trade varies from around 1 to 10 years, with 13.33% of women having one year's experience, 30% two years, 23.33% 3 years, 6.66% 4 years, 20% 5 years, 3.33% 6 years and 3.33% 10 years.

These results corroborate those of [11] on the processing of roasted potato pea seeds, those of [12] on the production of artisanal flours and those of [13] on the processing of cowpea seeds into fritters and patties, who mentioned that these processing activities are carried out exclusively by women. The processing of potato pea seeds into coffee is a recent activity, as experience in this trade is 10 years, whereas it is 15 years in the production of artisanal flours [12].



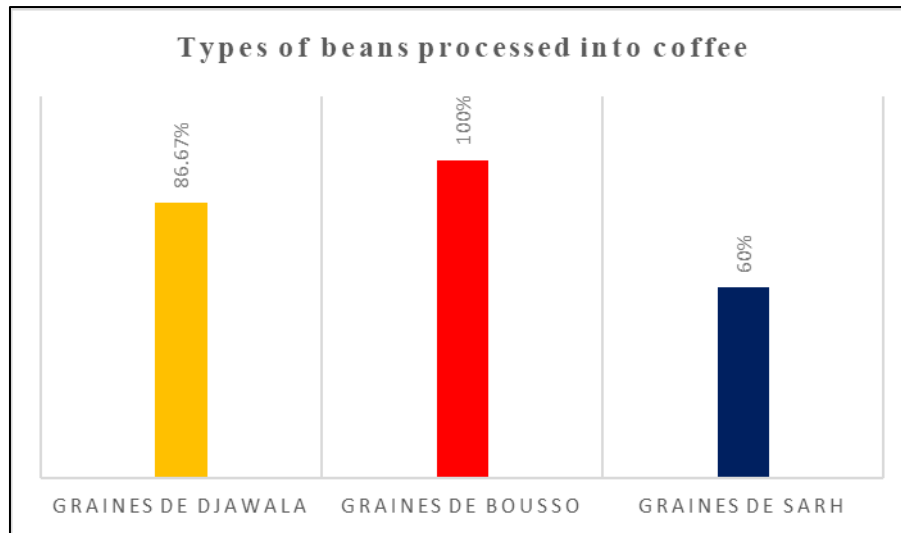
**Figure 4** Age of women who process potato pea seeds into coffee



**Figure 5** Experiences of women transforming potato pea seeds into coffee

### 3.3. Types of ground pea seeds used in coffee processing

The ground pea seeds used in coffee processing are those from Djawala, Bousso and Sarh. The rates of use of ground pea seeds in coffee processing vary according to the women processors: all women (100%) claim to have used seeds from Bousso in their processing, 86.67% of women use seeds from Djawala and 60% from Sarh.



**Figure 6** Types of ground pea seeds used in coffee processing

### 3.4. Frequency of transformation of ground pea seeds into coffee

Analysis of Table 1 shows that only 17% of women transformatrices produce coffee in a regular time interval of once a week (weekly), 25% produce in the interval of one to two weeks, 18% produce in the interval of one month and 40% produce beyond one month.

Work carried out by [12] on the frequency of artisanal processing of flour and the frequency of processing of potato pea seeds into coffee shows that the processing of potato pea seeds into coffee is slower than that of flour, as 100% of these women produce flour per week, whereas only 17% of women produce coffee per week. This frequency of production can be explained by the low selling power of coffee and the supply of raw material.

**Table 1** Frequency of processing potato pea seeds into coffee

Transformation frequencies	Percentage of women interviewed
Every week	17%
One to two weeks	25%
per month	18%
More than a month	40%

### 3.5. Quantity and yield of ground pea seeds processed into coffee

Table 2 shows that the quantities of potato pea seeds processed into coffee vary from 2.5 kg to 12.5 kg. The average quantity processed is 3.12 kg. The processing method used is exclusively roasting on a metal plate.

Coffee yields obtained from ground pea seeds vary from 3.75 kg (min) to 15 kg (max) (Table 2). The average coffee yield obtained was 5.57 kg, corresponding to 3.12 kg of processed ground pea seeds.

**Table 2** Quantities of ground pea seeds processed into coffee

Variables	Average	Standard deviatio	Min	Max
Quantity of seeds processed	3,12 kg	2,4 kg	2,5 kg	12,5 kg
Coffee obtained	5,57 kg	2,74 kg	3,75 kg	15 kg

### 3.6. Coffee storage methods

The most common methods of storage are in bottles and in plastic (figure 2). The most common method is storage in plastic, used by 83% of women producers. The ways in which coffee is stored in plastic corroborate the findings of [12] on the storage of artisanal flour in plastic, which reported the use of this method by 85.71% of women producers of artisanal flour.

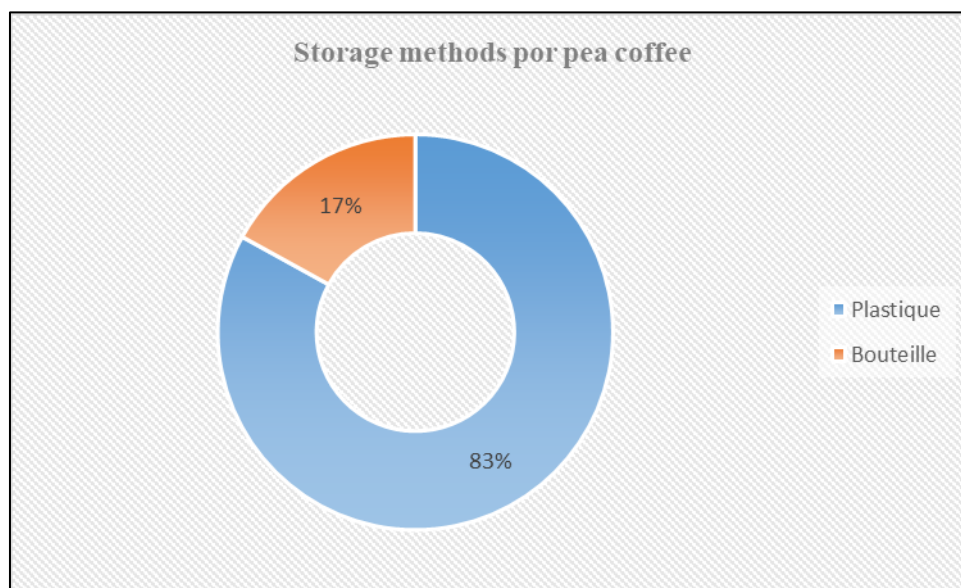


Figure 7 Modes de conservation des cafés

### 3.7. Benefits derived by women from processing potato pea seeds into coffee.

Of the 30 women who took part in the survey, only 12 have a clear idea of the benefits they derive from the activity of processing pea seeds into coffee. The other women have no clear idea of the profits they make from this activity. The average profit from coffee sales is 8,083 FCFA per month. The minimum and maximum profits from coffee production are 4,000 FCFA and 10,000 FCFA per month respectively.

As for other processing activities, half of the 30 women interviewed said they made a profit from other processing activities. On the other hand, the other half said they had no clear idea of the profits made from these activities.

The average profit from other processing activities is 8,876 FCFA per month. The minimum and maximum profits are 3,000 FCFA and 45,000 FCFA per month respectively. Given the average profit from other processing activities, which is higher than the average profit from processing potato pea seeds into coffee (8,083 FCFA), and the number of women who know the profits made per month from other activities, the activity of processing potato pea seeds into coffee would be less profitable and therefore not the main activity of these women. Profits from the sale of ground pea coffee are low compared with the sale of raw ground pea seeds, for which the average profit obtained is 38,556 FCFA per month [11].

Table 3 Profits from processing activities

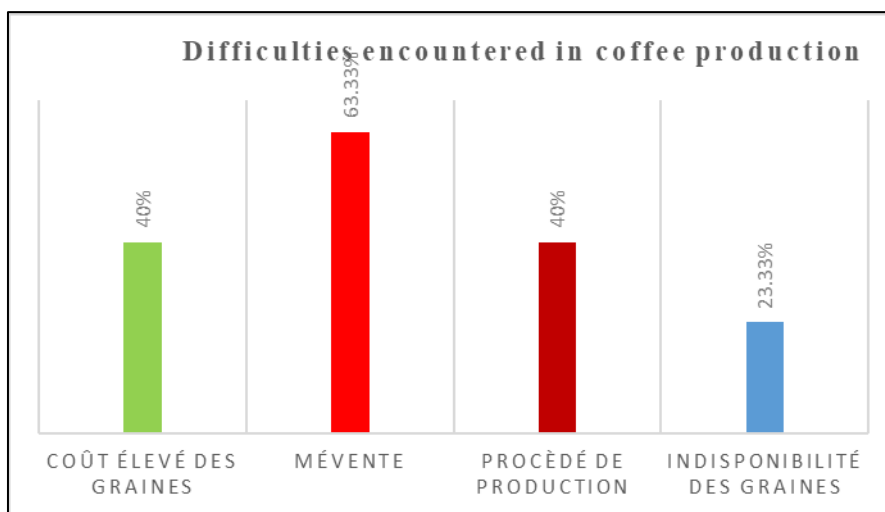
Variable	Obs	Moyenne	Ecart-type	Min	Max
Coffee benefits	12	8,083	1,831	4,000	1,0000
Benefits from other activities	17	27,733	8,875	3,000	45,000

### 3.8. Difficulties encountered in processing potato pea seeds into coffee

The main difficulties encountered by women in the processing of potato pea seeds into coffee are the high cost of the seed (40%), the unavailability of seeds at certain times of the year (23.33%), the lack of sales of the finished product (63.33%) and the duration of the production process (40%). Most of the women cited poor sales as the main difficulty, due to the population's unfamiliarity with the product.

The difficulties encountered in the transformation of ground pea seeds into coffee corroborate those encountered by [11] in the activity of roasting ground pea seeds, who mentioned as difficulties the high cost of the seeds, the poor sales of the finished product, the arduousness of the transformation processes and the supply of seeds.

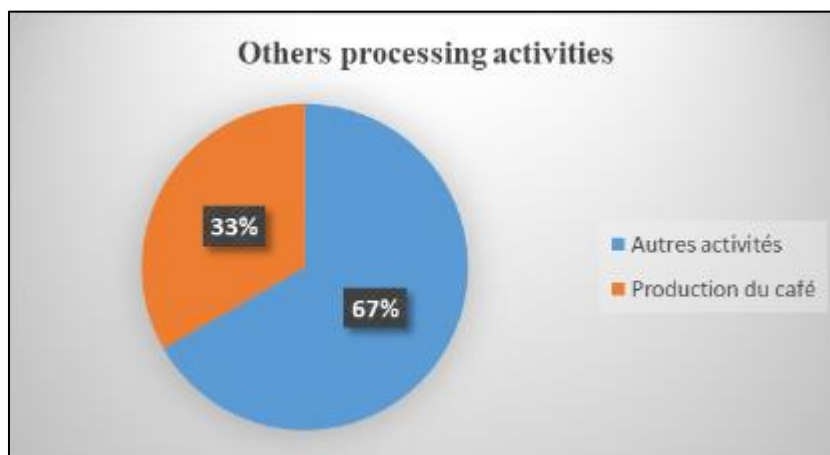
### 3.8.1. Difficulties encountered in coffee production



**Figure 8** Difficulties encountered in processing ground pea seeds into coffee

### 3.9. Other processing activities

Processing potato pea seeds into coffee is not the only activity of the women interviewed. In fact, a large proportion (66.67%) engage in other artisanal processing activities, such as potato snacks, potato flour and boiling potato beans. The remaining 33.33% of women process only potato beans into coffee.



**Figure 9** Other processing activities of the women interviewed

## 4. Conclusion

Processing potato pea seeds into coffee is a predominantly female activity. The frequency with which ground pea seeds are processed into coffee varies from one woman to another: 17% of women processors produce coffee at a regular interval of once a week (weekly), 25% produce between one and two weeks, 18% produce within a month and 40% produce more than a month. The quantities of potato pea seeds processed into coffee vary from 2.5 kg to 12.5 kg, with an average processed quantity of 3.12 kg. Coffee yields obtained from ground pea seeds vary from 3.75 kg (min) to 15 kg (max), with an average coffee yield of 5.57 kg corresponding to 3.12 kg of processed ground pea seeds. The main difficulties encountered by women in transforming potato pea seeds into coffee are the high cost of the seed (40%), the unavailability of seeds during certain periods of the year (23.33%), the poor sales of the finished product (63.33%) and



the harshness of the production process (40%). Despite all these difficulties, coffee made from ground pea seeds can be a sweet beverage for consumers and a source of income for women producers.

---

## Compliance with ethical standards

### *Acknowledgments*

The author expresses his sincere thanks to Professor MAHAMAT SEID Ali and Madame NDIMANODJI Grâce for actively contributing to data collection and processing.

### *Disclosure of conflict of interest*

There are no conflicts of interest, because as far as my two collaborators are concerned, Djéguédem Honneur was my Master's student who helped me with the collection and laboratory analyses, and Mahamat Seid Ali is a collaborator who supervised my research.

### *Statement of informed consent*

Informed consent was obtained from all individual participants included in the study.

---

## References

- [1] Ndiang Z., Bell J. M., Missouf A. D., Fokam P. E., Amougou A., 2012. Study of the morphological variability of some varieties of voandzou [*Vigna subterranea* (L.) Verdc] in Cameroon. *Journal of Applied Biosciences* 60: 4410- 4420.
- [2] Adebisi G. A., Olagunju E. O., 2011. Nutritional potential of the seed of fluted pumpkin *Telfairia occidentalis*. *Journal of New Trends Sciences Technology*, 1 : 7-18.
- [3] Mbaigaou A., Héma A., Ouédraogo M., Pale E., Naitormbaide M., Mahamout Y., Nacro M., 2013. Comparative study of polyphenol and total antioxidant contents of seed extracts from 44 varieties of voandzou (*Vigna subterranea* (L) verdcourt is the name of the author who described the *vigna subterranea*). *International Journal of Biological and Chemical Sciences* 7 (2): 861-871.
- [4] Amparo E. V. A., 2013. Obtaining a coffee substitute from broad bean and beans .Thèse doctorat .78 p.
- [5] María C., Otálora R., Yeffers R. C., 2010. Preparation of a coffee substitute (*Coffea arabica* L.) based on soybean (*Glycine max* L.). *Venezuelan Journal of Food Science and Technology*,1 (2) : 141-156.
- [6] Auguste C., 1941. Two leguminous plants grown in a number of Basse-Normandie farmers' gardens for the preparation of fake coffee. *Journal of traditional agriculture and applied botany*.123-127 p.
- [7] Anonyme., 2018. Environmental and social impact study. 94 p.
- [8] INSEED, 2021. General census of population and housing. Overall results.87 p.
- [9] Gouataine S.R., 2022. Climatic variability and pathological risks in the 9th district of N'djamena (Chad).. *Revue Espace, Territoires, Sociétés et Santé*, 5 (9) : 33-42.
- [10] Issa Y., Mopate L. Y., Louassouabo C., Ayssiwade S. B., Missoho A., 2012. Out-of-home consumption of traditional chicken in the city of Ndjamen. *Revue scientifique du Tchad*, 11 : 42- 52.
- [11] Charlie M., Niang A. B., 2018. Presentation of the results of the study of the voandzou (*vigna subterranea*) value chain in the Segou and Sikasso regions. 39 p.
- [12] Fabienne Anne-Julie A.N., Florent K.N., Clémentine A.K., Corinne T., Didier M., 2023. Practice of production, preparation and storage of artisanal infant flours in Ivory Coast. *Journal of biosciences*, 183 : 19212-19232.
- [13] Mamadou S., Veronique T., Melinda s., 2021. The development potential of cowpeas beyond their seeds in local markets in Mali. 38 p.