



# **Popularization of Traditional Processing of Cowpea into Couscous (Beroua) in the West (Dogondoutchi) and Mid-South (Maradi and Zinder) of Niger**

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## **Authors' contributions**

*This work was carried out in collaboration among all authors. Author IA designed the study, wrote the protocol, and coordinate the wrote up of the whole manuscript. Authors OSS and MEG managed the analyses of the study and manuscript correction. Authors AAS and MAH managed the literature searches wrote the first draft of the manuscript. All authors read and approved the final manuscript.*

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## **ABSTRACT**

In Niger, there is a rich diversity of food processing sits from cowpea (*Vigna unguiculata*). Like most processed products, beroua or cowpea couscous is produced using artisanal processes. It is originated from the people of Arawa (Dogondoutchi). This transformation spread to the Maradi and Zinder regions, where studies have shown variability in the processing of cowpea grains into beroua. This study aimed to describe local knowledge around the different processes of processing cowpea into beroua through important areas of cowpea agricultural production in Niger, notably Dosso, Maradi and Zinder. The results show that beroua has been known for several years by local populations, its production and consumption are based on traditional knowledge and know-

how. Cultural and technical exchanges between peoples transformed the beroua popular quickly. The beroua, through marketing and various exhibitions, has contributed to the popularization of Niger's traditional dishes both at national and international level.

*Keywords: Cowpea; processing; local know-how; beroua.*

## 1. INTRODUCTION

Cowpea (*Vigna unguiculata*) called cornilla, cowpea or black-eyed cowpea is a plant species commonly used in Africa. It is highly nutritional, contributes to the food security of the African people in general and to develop livestock farming in particular. Cowpea is a very old legume whose origin varies according to the literature. Although, widespread throughout the tropics, nowadays West Africa seems to be the main origin of this species [1,2,3] representing nearly two thirds of world production particularly in Niger, Nigeria, Mali but also a little in East Africa, Ethiopia, Tanzania and Uganda [4].

According to the National Catalog of Plant Species and Varieties (CNEV) of Niger in 1994 [5], there are 16 varieties of cowpea frequently exploited in Niger and whose seeds are white or red in color. These are IT 89KD374-57; IT 90K372-1-2; IT 96D610; IT 97K499-38; IT 97K499-35; IT 98K205-8; IT 99K-573-1-1; K VX 30-309-6G; TN 121-80; TN 256-87; TN 27-80; TN 28-87; TN3-78; TN5-78; TN 88-63 and HTR. Generally, in cowpea food processing, the white varieties are the most sought after, so researchers from the International Institute of Tropical Agriculture (IITA) in Kano managed to create VITA, TVX and IT lines in 1978. The IT line has several varieties including, among others, IT98K 205-8, IT 97K 499-35, IT 97K 499-38, IT 90K-372-1-2, IT89KD-374-57, IT99k-573-1- 1 each of which resists striga, drought, and gives a high seed yield [6]. In addition, the INRAN research reported by SNV in 2009, the varieties TN 121-80, IN92E-26 and K VX 30-309-6 have a production duration of 80-85 days, while TN5-78 has a 70-75 days cycle. All these varieties have very good resistance to striga, and give a good seed yield [7,8,9].

Sub-Saharan countries face critical food and nutrition problems. Among the foods likely to solve nutritional problems, cowpeas are the most important grain legume in the tropical savannah areas of Africa in general and Niger in particular. In Niger, it ranks second in terms of production and third place in rainfed crops after millet and sorghum. Cowpea production represents more than 40% of the national gross domestic product

and constitutes the main source of income for more than 80% of the mainly rural population [10]. Its use in food contributes significantly to improving household food and nutritional security. Indeed, despite its high proportion in nutritional value, cowpea is considered until recently as food for low-income households commonly known as "poor man's meat" [11]. The processing is generally done in an artisanal way. Thus, cowpea is consumed either in the form of family dishes such as "cowpea rice", cowpea puree and a good number of other recipes intended for sale; among which we can cite the donut commonly called "kossai" the dumpling called "dan Wake", the Bérroua or cowpea couscous and many others [1,12,13,14].

The production of cowpea in the Dosso region is around 200 tonnes per year (DRAD, year) and that of the bérroua of the Togon group (Dogondoutchi) in the same region was estimated at more than 50 tonnes in 2013 [8,15,16]. The purpose of this study is to list the different process know-how of cowpea into couscous (beroua) through the key areas of its production in Niger, namely the regions of Dosso, Maradi and Zinder.

## 2. MATERIALS AND METHODS

### 2.1 Materials

The technical materials used in the beroua manufacturing processes are presented in Table 1. This is based on the method used in the West (Dogondoutchi, Dosso) and in the midsouth (Maradi, Zinder) of Niger.

Depending on the locality, some women use cowpeas "big grains" from the local market [15,17]; on the other hand, they use K VX and IT90, such as this study the varieties IT90 and IT99K-573-1-1 are used by members of women groups of cowpea processing identified in Maradi and Zinder.

### 2.2 Methods

This study was carried out using a questionnaire administered to women cowpea processing groups (Focus group) from the various localities

identified, that is in the West of Niger the locality of Dogondouchi was choosing due to beroua history that said it was originated from [18,19]; and in the midsouth of Niger in the regions of Maradi and Zinder (Fig. 1).

**Table 1. Materials used in the processing of cowpea into beroua according to the methods founded in Niger**

Materiel	Usage
Van	Winnowing, sorting
Mortar and pestle	Shelling, crushing
Water (containers)	Washing
Mat, white fabric, mosquito net	Drying
Mill	Crushing, Grinding
Sieve and cup	Sieving
Calabash	Cleaning, rolling
Couscoussier	Cooking
Spatula	Crumbling
Plastique bag, sealing machine	Packaging

sites. The processing of cowpea into beroua are shown in Table 2 according to locality.

**Sorting:** Sorting as the first activity is generally done by hand, which will make it possible to obtain a clean cowpea.

**Winnowing:** It is done using a van or two calabashes, it eliminates impurities that could not be detected during sorting; during a certain stage, the grains are separated from their integuments and all other impurities;

**Soaking:** It consists of immersing the cowpea in water for one (1) to two (2) minutes, this time will allow the grains to soak water superficially and facilitate their separation with the dandruff. This step collects impurities and unfit grains for the processing which will float above the water and which are extracted by hand;

**Draining:** It consists in passing the water through a filter / strainer (cloth or any other material not allowing the passage of cowpea grains), until the last drops of water;

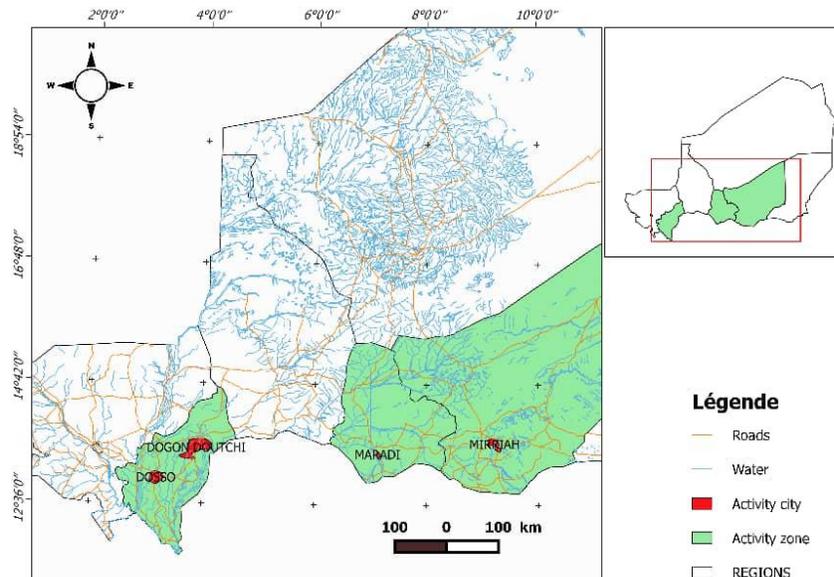
**Crushing / Pounding:** Crushing consists of putting the dried grains back into the mortar and crushing without applying force, to allow the bran to detach from the grains;

**Shelling:** It consists of crushing the cowpea in a mortar after a light humidification and it is until detachment of cowpea films;

### 3. RESULTS AND DISCUSSION

#### 3.1 Results

The survey findings made it possible to identify the different varieties of cowpea used for making beroua and to differentiate between the processes according to the localities. Also, the investigation was carried out at the processing



**Fig. 1. Map of identified beroua production activities zones in Niger. FRENCH**

**Table 2. The different unit operations for processing cowpea grains into beroua from the identified sites of its production in Niger**

Production Zones Localities Material Stapes	West		Midsouth	
	Dogondoutchi Cowpea	Dosso Cowpea	Maradi Cowpea	Mirriah (Zinder) Cowpea
1	Sorting		Sorting	Sorting
2	Winnowing		Winnowing	Winnowing
3	Soaking		Soaking	Soaking
4	Drainage		Drainage	Drainage
5	-		Crushing	Pounding
6	Dehulling		Shelling	Shelling
7	-		Winnowing	Winnowing
8	Washing		Washing	-
9	Drainage		Drainage	-
10	Drying		Drying	Drying
11	Grinding		Grinding	Grinding
12	Grinding I	Grinding II	Grinding	Grinding
13	Sieving I	Sieving II	-	-
14	Rolling		Rolling	Rolling
15	-		Pre-drying	Pre-drying
16	Cooking		Cooking	Cooking
17	-		Crushing	-
18	Drying		Drying	Drying
<b>Product</b>	Beroua		Beroua	Beroua

**Dehulling:** It is sometimes a form of hulling but practiced in a calabash containing cowpea fairly moistened by making a press / crushing movement by hand;

**Washing:** After shelling and winnowing, the cowpea is then washed. This washing removes impurities such as the integuments / dandruff;

**Drying:** It consists of dehydrating either the cowpea grains or the Bérroua preform most often in the sun, while stirring them from time to time until satisfied;

**Grinding:** This is the Grinding step to obtain a flour and broken mixture for the proper functioning of the next operation;

**Sieving:** Sieving consists in separating coarse, medium or broken flour, and fine flour.

**Sieving II:** Fine sieving: semi-coarse flour after sieving makes it possible to obtain medium broken (used later for the formation of lumps of Bérroua) and fine flour.

**Rolling:** Knead the cowpea flour and the medium break with a little solution (water + *Ceratotherca sesamoides* + natron (NaOH)) then roll up, add cowpea flour as the lumps form;

**Cooking:** Thus, the lumps obtained are steamed in a couscoussier;

**Crumbling:** During cooking, water vapor droplets are created which causes the formation of lumps of beroua. After pouring the beroua onto a clean mat, the clods are crushed manually or a valve. This action is taken when the beroua is in its hot state;

**Bérroua:** Finished product from the process (Fig. 2).

### 3.2 Discussion

Across the three identified far zones of processing cowpeas in Niger practiced by women, for whom it remains the main income-generating activity on a permanent basis. According to the benchmark study on the cowpea sector in the Zinder and Maradi regions [8], white cowpea varieties such as KBX and IT90 are much more used by processors who praise its good processability and good quality yield. According to the results of research by the National Institute of Agronomic Research of Niger (INRAN), for the preparation of a dish made from cowpea flour, often women prefer white cowpea [20]. Which fits perfectly with the choice of these two varieties used in the study carried out at Maradi. In general, the production



Fig. 2. A photo of a Dogondoutchi beroua (© SARA\_Computers, July, 2018)

methods for traditional food products are manual with materials such as mortar and calabash [17]. The beroua has been known for several years by local populations, its production and consumption are based on traditional knowledge and skills acquired from generation to generation [8,15]. What distinguishes the beroua from other local products is its popularity, its uniqueness in the culture of Niger. The cultural and technical exchanges between the people made it possible to quickly make the transformation of the beroua popular and transmitted gradually from generation to generation. The beroua through various trade exhibitions has contributed to the popularization of the traditional Nigerien dish and beroua was winner of the various price at national and international level [21].

Dehulling whether dry or wet has a negative effect on nutritional quality. Indeed, shelling leads to loss of vitamins, particularly the B group vitamins. Studies have shown a higher prevalence of vitamin B1 or Beriberi deficiency in populations with increased consumption of shelled food than in populations consuming whole cereals grains [19,22,23]. Shelling also promotes the loss of dietary fibers essential for

good intestinal transit. However, studies have shown that these losses were relatively less significant when shelling was done in the traditional way with mortar and pestle than in an industrial way [3,18,24].

Rolling is a step during which a solution is prepared, consisting of water and natron (NaOH) to which we add *Ceratotheca sesamoides*. According to the processors surveyed, the use of this solution makes it easier to form lumps and gives a good texture; that is to say, the solution acts as a binder. It should be noted that the presence of natron improves the nutritional characteristics of cowpea seeds. This is how the calcium content goes from 73.3 mg/g in cowpeas cooked in water to 256.6 mg/g in cowpeas cooked with 1% natron [15]. The rolling process began with pouring a small quantity of medium grain flour (broken) and a little of *C. sesamoides* solution into a calabash recipient (*Lagenaria siceraria*), then add a small amount of flour. Apply the contents a backward and forward movement with hand pam following the concavity of the calabash; followed by adding either flour or the *C. sesamoides* solution depending on the binding or dry appearance of the dough. Then,

repeat the same exercise until the formation of beroua granules [17].

The survey has shown that beroua is a traditional product from Niger, consumed regularly and in those days during the post-harvest period [3]. This product reflects a particular national character. It is an element that has a cultural characteristic of Dogondoutchi people. Processing techniques are passed on from generation to generation and are part of local villages folklore [15]. This product is made according to an artisanal method which was established by the people of Dogondoutchi known as Arawa in Hausa language; the practice has extended to the regions of Maradi and Zinder where studies have demonstrated the variability of the indigenous technology used to process cowpea grains into beroua.

#### 4. CONCLUSION

Cowpea processing is essentially artisanal, little work has been done to understand the nuances that exist between the processing indigenous technology depending on the localities in Niger. However, traditional, artisanal processing technology constitute a cultural asset and can serve as a basis for original work in the food science. Beroua, whatever produced by low-income people, is in fact a real means of dispersing indigenous knowledge and means of identifying their people.

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#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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