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Technical Sheet of Characteristics of Porridge Made from Millet, Maize and Cashew Almond

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ABSTRACT

From millet, maize and cashew flour porridges for children's complementary foods can be made. The millet and maize flours used are obtained after crushing fermented and germinated grains, and cashew flours after crushing dried almonds. Formulations at precise proportions of these three different flours are made and 100 g of each formulated flour is cooked in 750 mL of water. The resulting porridges (FMaC0. FMaC20. FMaC22.5, FMaC25, FMiC0, FMiC20, FMiC22.5 and FMiC25) have an appreciated sensory profile (appearance, consistency, colour, aroma, taste, overall acceptability and ph) and a satisfactory biochemical composition (ash between 1.16 and 1.88 g/100 g, protein between 8.26 and 11.37 g/100 g, fat between 2.39 and 13.93 g/100 g, energy value between 387.83 and 440.85 kcal/100 g). This makes these porridges a real source of nutrients for children.

Keywords: Porridge, Complement foods, Cashew kernel and Millet and Maize.

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INTRODUCTION

In Côte d'Ivoire, supplement feeds are often composed of porridges prepared from cereal and tuber flours. These porridges are generally thick in consistency and often difficult for the child to swallow. In these cases, mothers are forced to add water to the formula to make the porridges more liquid. According to Elenga et al. (2009), this strategy reduces the dry matter content and energy density of the porridges. By consuming these low energy density porridges, the child is exposed to a calorie and protein deficiency. The strategies adopted to eradicate child malnutrition in this type of situation consist in the search for new plant resources, rich in protein and micronutrients for the formulation of infant meals (Soro et al., 2014). Cashew kernels. rich in protein, fat, iron and zinc (Adouko et al., 2016) could also be used in the formulation of complementary foods. The incorporation of cashew flour into infant nutrition in Côte d'Ivoire, more specifically in disadvantaged regions, could ensure food security for children under 5 years of age. The purpose of this work was to present a method for the preparation of cashew kernel porridge and to determine its physicochemical composition and sensory characteristics.

MATERIALS AND METHODS

Biological Material

Cashew (*Anacardium occidentale L.*) Plate 1, maize (*Zea maize*) Plate 2 and millet (*Pennisetum glaucum*) Plate 3 are the biological material used to prepare the porridges. Maize and millet were purchased at the Forum market in Adjamé (Abidjan, Côte d'Ivoire). Cashew nuts were

Plate 1. Cashew nut

Plate 2. Maize granule

Plate 3. Millet granule.

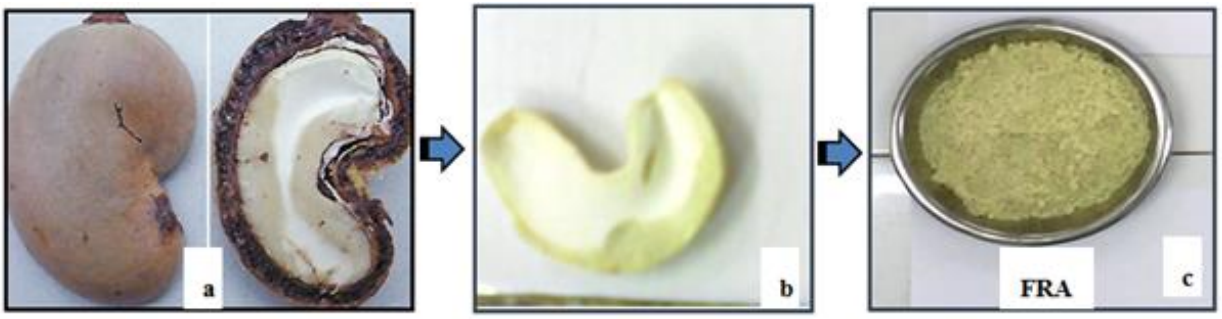

Plate 4. From nuts to cashew flour. **Plate 4a.** Cashew nuts **Plate 4b.** Cashew kernel **Plate 4c.** Cashew flour.

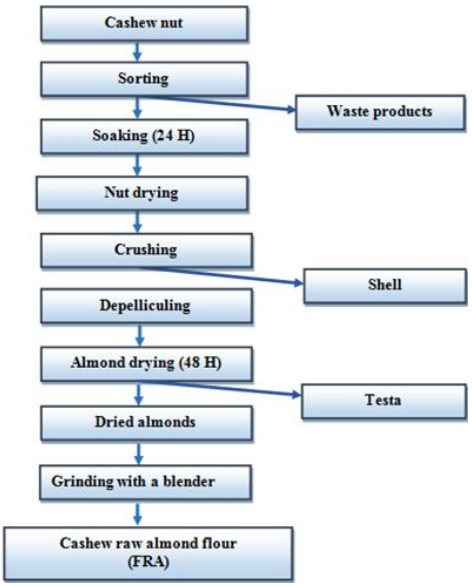

Figure 1. Cashew flour production diagram.

harvested from fields owned by local producers in Tabagne in the Gontougo region of northern and eastern Côte d'Ivoire.

Methods of Operation

For the preparation of the porridge, fermented millet flour, sprouted millet, fermented corn and sprouted corn were produced. Combinations of these flours with cashew flour (formulations) were performed and then the various formulated flours were prepared at low heat.

Production of Flours

Production of Cashew Flour

To obtain the cashew flours, the nuts were de-skinned (Plate 4) and then crushed according to the diagram below (Figure 1).

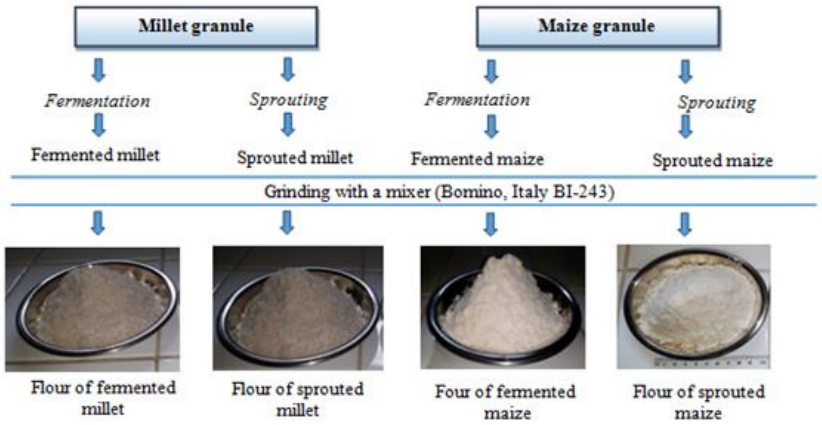

Figure 2. Millet and maize flours production diagram.

Plate 5a. Fermentation of maize (1) and millet (2).

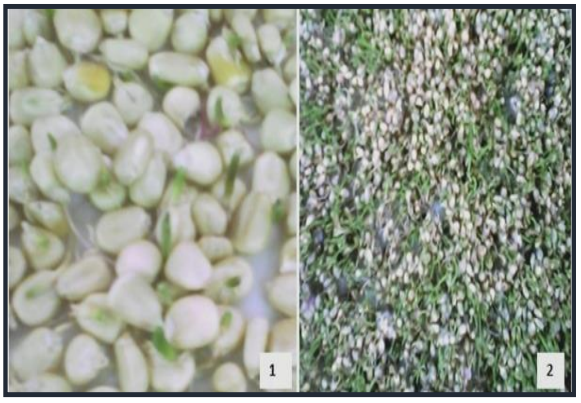

Plate 5b. Sprouting of maize (1) and millet (2).

Table 1. Flour formulation for the preparation of porridges.

Flours Formulated	Flours Millet Sprouted (%)	Flours of Millet Fermented (%)	Flours of Maize Sprouted (%)	Flours Of Fermented (%)	Flours of Cajou (%)
FMaC0	-	-	10	90	0
FMaC20	-	-	10	70	20
FMaC22.5	-	-	10	67.5	22.5
FMaC25	-	-	10	65	25
FMiC0	10	90	-	-	0
FMiC20	10	70	-	-	20
FMiC22.5	10	67.5	-	-	22.5
FMiC25	10	65	-	-	25

FMaC0: Flour consisting of 10% sprouted maize flour, 90% fermented maize flour and 0% cashew flour; FMaC20: Flour consisting of 10% sprouted maize flour, 70% fermented maize flour and 20% cashew flour; FMaC22.5: Flour consisting of 10% sprouted maize flour, 67.5% fermented maize flour and 22.5% cashew flour; FMaC25: Flour consisting of 10% sprouted maize flour, 65% fermented maize flour and 25% cashew flour; FMiC0: Flour consisting of 10% sprouted millet flour, 90% fermented millet flour; FMiC20: Flour consisting of 10% sprouted millet flour, 70% fermented millet flour and 20% cashew flour; FMaC22.5: Flour consisting of 10% sprouted millet flour, 67.5% fermented millet flour and 22.5% cashew flour; FMiC25: Flour consisting of 10% sprouted millet flour, 65% fermented millet flour and 25% cashew flour. Flour not used to make up the formulated flour.

Maize Flour and Millet Production

Figure 2 shows how maize and milet flour can be produced. Maize (2 Kg) and millet (2 Kg) grains were fermented separately in water (3L/Kg) without adding ferment in the pots for 48 h (Plate 5a). Other grains (2 Kg each) were sprouted on a white cotton cloth support, protected from the sun and regularly watered. The germination time was 5 days (Plate 5b).

Flour Formulation

The flours used to prepare the porridges are compound flours, consisting either of maize and cashew flours (

Plate 6. Cooking of the porridges.

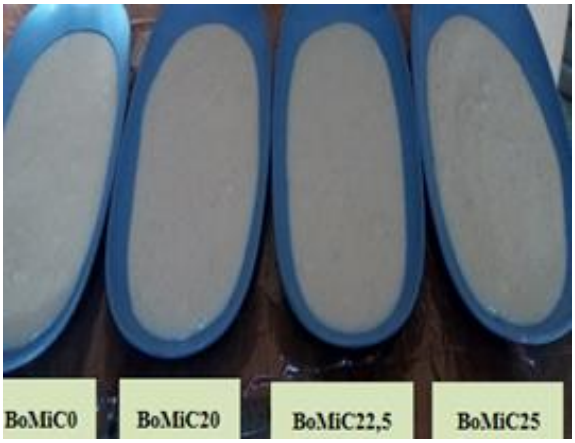

Plate 7. Millet and cashew flour porridges.

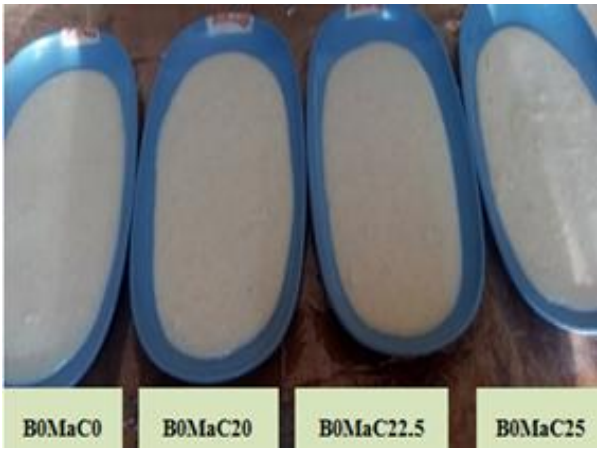

Plate 8. Maize and cashew flour porridges.

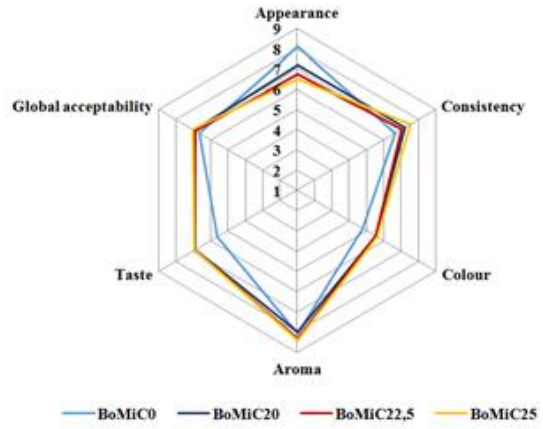

Figure 3. Sensory profile of the porridges of millet and cashew.

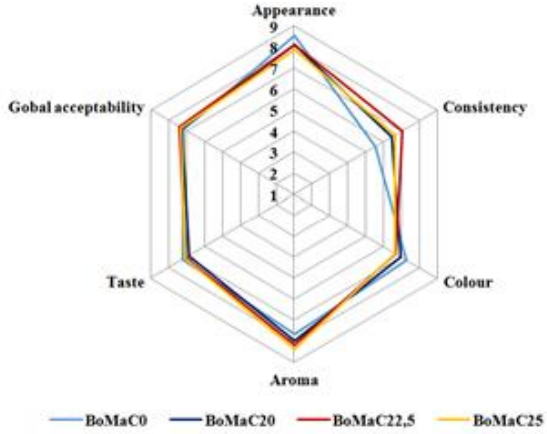

Figure 4. Sensory profile of the porridges of maize and cashew.

Table 2. Physico-chemical characteristics of compound flour for the preparation of porridge.

Flours Compound	Ashes (%)	Protein (%)	Fat (%)	Energy value (kcal)
FMiC0	1.33 ± 0.2^{a}	9.16± 0.15^{a}	2.39± 0.01^{a}	387.83± 0.3^{a}
FMiC20	1.61 ± 0.17^{b}	10.67 ± 0.01^{b}	10.99± 0.31^{b}	425.99± 0.4^{b}
FMiC22.5	1.63 ± 0.29^{b}	10.85 ± 0.02^{c}	11.02± 0.45^{c}	424.74± 0.3^{b}
FMiC25	1.88 ± 0.64^{c}	11.37 ± 0.02^{d}	11.89± 0.62^{d}	428.05± 0.1^{c}
FMaC0	1.16 ± 0.1^{a}	8.26± 0.11^{a}	4.39± 0.06^{a}	399.95± 0.2^{a}
FMaC20	1.41 ± 0.01^{b}	9.6± 0.02^{b}	12.71± 0.49^{b}	434.11± 0.01^{b}
FMaC22.5	1.43 ± 0.1^{b}	10.33± 0.07^{c}	12.89± 1.15^{b}	435.89± 0.31^{c}
FMaC25	1.46 ± 0.01^{c}	10.78± 0.06^{d}	13.93± 1.07^{c}	440.85± 0.42^{d}

The values are the means ± standard deviations of three measurements (n = 3). The same letter in the same line indicates that there is no significant difference at the 5% threshold between the samples for the parameter concerned.

FMaC0, FMaC20, FMaC22.5 and FMaC25) or millet and cashew flours (FMiC0, FMiC20, FMiC22.5 and FMiC25). These compound flours are obtained from simple flours sprouted millet, fermented millet, sprouted maize, fermented maize and cashew) in the proportions indicated in Table 1.

Cooking of the Porridges

A quantity of 100 g of the flours previously formulated was cooked with a total of 750 ml of tap water. The flour was first diluted in 250 ml of water and then the mixture was transferred to 500 ml of boiling water while

homogenizing regularly to avoid the formation of lumps. Cooking lasted 15 to 20 min over low heat.
Table sugar was added after cooking (6g/100g of porridge) to give a good taste (Plate 6).

RESULTS AND DISCUSSION

Sensory Profile of the Porridges

The various porridges obtained (Plate 7 and 8) were submitted to a panel of trained tasters. Panelists appreciate the appearance, consistency, colour, aroma, taste and judged these porridges satisfactory, as indicated by the sensory profiles (Figure 3 and 4). The sensory characteristics of these porridges are similar to those obtained for energy high-density weaning porridges made from cassava (Giarmachi et al., 1995). The good sensory profile of these porridges could be attributed to the biological treatments (fermentation and sprouting) applied to millet (Raimbault, 1995) and maize grains and to the composition of cashew raw almond flour, Millet, maize and cashew porridges have properties that can, therefore, encourage children to consume more.

Biochemical Composition of The Flours Used to Prepare the Porridges

In addition to the good sensory profile, these porridges have a satisfactory Physico-chemical composition for children (Borderon et al., 2014). The flours used to prepare these porridges have an ash, protein, fat and energy content of between 1.16 and 1.88 g/100g, 8.26 and 11.37 g/100g, 2.39 and 13.93g/100g, 387.83 and 440.85 kcal/100g, respectively (Table 2). This biochemical composition is in accordance with the recommendations of Codex (2006). These porridges could be used in households. especially in rural areas, to reduce the rate of food insecurity.

CONCLUSION

Cashew, maize and millet porridges have a good sensory profile for children and good nutritional composition. The use of accessible ingredients makes it easy to use regardless of the region of residence and the household's standard of living. This could effectively contribute to food security for the poorest households.

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