



## RESEARCH PAPER

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## Organoleptic and sensory profiles of three infant porridges developed with roasting, malting and fermentation process

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### Abstract

In free living conditions, 30 mothers of infant aged 6 to 23 months of southern Benin, were given successively three experimental infant porridges in order to determine their organoleptic and sensory profiles. These porridges were prepared with roasting, fermentation and germination process. Two high energy density porridges (malted porridge Fg3 and fermented porridge F3) and low energy density porridge (G1) were composed of maize and "Mawè" a fermented maize dough, sorghum, soybean, baobab pulp and sucrose. The organoleptic profile of these porridges was evaluated on a 5-point tasting scale. F3 was high appreciated (82.8%) compared Fg3 (82.4%) and G1 (60.8%). On based of sensory descriptors, F3 and Fg3 porridges has presented respectively the high percent (98%) of taste and odour descriptors (90%). Fg3 was highly fluid (83.30%). The mothers had very appreciated fermented F3 porridge (56.66%). Sensory profile of Fg3 porridge was chestnut colour, a sweet savour and highly fluidity. A sensory profile descriptor of F3 porridge was chestnut colour, a sweet and fermented savour and good savour higher than those of Fg3.

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## Introduction

From about 6 months of age, exclusive breastfeeding cannot provide all the energy and the nutrients necessary to meet infants' nutritional needs. Consequently, consumption of other foods is necessary to complement breast milk (WHO/UNICEF, 2012). These two forms of feeding as breastfeeding and complementary feeding must be continuous until at 2 years around. This is between 6 to 24 months old, that the time when malnutrition starts in many infants caused by the knowledges on inadequate complementary foods and inappropriate young child complementary feeding practices (Bournez *et al.*, 2019). Even though the consumption of adequate complementary foods is necessary after 6 months, these products seem to be directly or indirectly linked with some forms of malnutrition (Kouton *et al.*, 2017). Infant energy and nutrient intake are influenced by factors related to the food, to the child and to the caregivers (Brown *et al.*, 2017).

It's recognized that the organoleptic characteristics of complementary food affect the infant's amounts intake (Brown *et al.*, 2017). So, their acceptability depends in major of adequation of their characteristic, sensory and cultural preference by consumers precisely the mothers of infant in complementary feeding. Among the factors, the taste and flavour of complementary food higher influence their energy and nutrient intake (Brugaillères *et al.*, 2019).

Indeed, this is around 6 months that the differentiation of taste and the mastication function appear in the infant (Brugaillères *et al.*, 2019). Many researchers have showed that the organoleptic factors of complementary foods increase the infant's energy and nutrient intake (Brown, 2017; Ventura *et al.*, 2017; Brugaillères *et al.*, 2019).

In Benin, as in most West African countries, complementary feeding practices are not optimal (Kouton *et al.*, 2017). Children received generally the maize porridge without sucrose or the mixing of maize and sorghum porridge. These complementary foods are not diversified and have a low energy and nutrient density (Atègbo, 1993; Kouton *et al.*, 2017).

Preliminary studies carried out in Benin (Kouton *et al.*, 2017), showed that infant energy and nutrient intakes from porridges were very low due both to insufficient energy and nutrient density and the low amount of porridge consumed. Porridge is slightly enriched with protein materials and daily distribution frequency is low (Kouton *et al.*, 2017). Nutritional and energy qualities of complementary foods must be improved (Kouton *et al.*, 2017). Consequently, their organoleptic characteristics must be also improved (Kouton *et al.*, 2017).

This is context explain in Benin, the highest prevalence of malnutrition was observed in the age group 6-23 months and 32% of stunting (EDSB, 2018). The inadequate complementary foods and inappropriate complementary feeding practices decrease the amounts porridge consumed and appetite of infant, and decrease consequently an infant's nutrient intake (Cristina *et al.*, 2017). Naturally, during the consumption of their porridges, the infant's comportment was disagreeable with crying and refusal that reduce also a consumed amount of porridge (Brugaillères *et al.*, 2018). Nutritionally adequate complementary feeding is of high priority in developing countries for ending with malnutrition (Kouassi *et al.*, 2015; Songré-Ouattara *et al.*, 2016).

It's then necessary that the infants increase their intake for a successful infant's thousand first days (Kouton *et al.*, 2017). In order to reach goals, it's important to develop the process and formulation for the improvement the organoleptic characteristics of infant porridge such as taste, flavour and viscosity. In this context, this study determined the organoleptic and sensory profiles of three porridges based on maize, a fermented maize dough as "Mawè", sorghum and soybeans prepared with roasting, fermentation and germination process in rural area of Southern Benin.

## Material and methods

### Raw material

Raw material is consisted of two cereals such as: maize (*Zea mays*), red sorghum (*Sorghum bicolor*), and soybean (*Glycine max*; yellow grains). Soybean, red sorghum, and maize grains, the sucrose and

baobab pulp (*Adansonia digitata*) were obtained from local market located in southern Benin. A maize dough fermented “Mawè” was used for the preparation of fermented infant flour. “Mawè” production diagram was described by Hounhouigan *et al.*, (1993). Fermented and malted infant flours have been formulated respectively by method of Brou (2000) and Traoré *et al.* (2004). The infant flours were described by Kouton *et al.* (2017).

#### Mothers-infant

Thirty mother-infant from a rural area of Adja-Ouèrè (South-Benin) were enrolled in the study. To be eligible, mothers of infant aged 6 to 23-month-old (fifteen infants aged of 6 to 11 months and fifteen aged of 12 to 23 months) at the beginning of the study, have a weight-for-length Z score  $>-3$  and no particular health problems, have no apparent handicap, be breastfed, and be a regular consumer of porridge.

#### Porridges

Three experimental porridges were tested. A low energy density porridge (G1) for simulate the porridge usually prepared by mothers and two high energy density porridges were tested. The mean dry matter content of G1 (95% roasted maize flour and 5% of sugar) was 15%, equivalent to 60 Kcal. The malted porridge (Fg3), with a high energy density, had a dry matter content of 31.25%, equivalent to 125 Kcal/100 g and the fermented porridge (F3), with a dry matter content of 30%, equivalent to 120 Kcal/100g. The composition of each of flours is as followed (Table 1). The mixture optimizations and fortified were performed for the infant flours using computer program (optimize mixture design) through Minitab 14 software application by FAO and WHO Commission (2009) recommendations for infant complementary food for older infants and young children.

**Table 1.** Composition of 100g of Flours: Quantity of ingredient (g/100g).

Infant flours	Roasted maize flour	Germinated maize flour	Germinated sorghum flour	“Mawè” flour	Roasted sorghum flour	Roasted soybeans flour	Sucrose	Baobab pulp
G1	95	-	-	-	-	-	5	-
Fg3	-	30	25	-	-	25	15	5
F3	-	4	-	30	21	25	15	5

G1: low energy density porridge, Fg3: high energy density malted porridge and F3: high energy density fermented porridge.

#### Procedure

Each mother was given the three experimental porridges. Each porridge was given by day for a period of 3 days, at the usual porridges feeding time (12PM). Each was given the three experimental porridges. Porridges were prepared at home by field workers in a standard way. The quantity of water necessary to prepare the porridge, were weighed and added to pre-weighed flour. Porridges were cooked for 5min. The porridges have been coded and presented at mothers with a bowl and spoon. After the tasting, mothers have rinsed their mouth and coached the compartment of favourite porridge.

The appreciation of mother was noticed on a tasting scale at 5 point. The score was of 1 (disagreeable) to 5 (agreeable) and have been affected at different descriptors of tasting scale. The method which consisted to determine the organoleptic and sensory

profiles descriptors of each porridge. The note has been attributed at each descriptor.

#### Data analysis

Data were analysed with the SPSS system. The data were evaluated by analysis of variance (ANOVA) procedures in Statistica 7.1 were used to perform descriptive analysis and compare the means of triplicate measurements of parameters. Let's notify that the means were considered to be significantly different when  $p < 0.05$ . The least significant difference test was used to separate the means when the difference was significant.

#### Ethical considerations

Local health authorities were informed about the study. A consent form was presented and explained to parents (father and mother) in their local language in order to have their verbal and written consent.

Mothers gave also their consent to participate in tasting and determination of organoleptic and sensory profiles of infant porridges.

## Result and discussion

### Organoleptic profiles of three infant porridges

The mothers' appreciation (n=30) of sensory parameters of three porridges on a scale score of 1 to 5 has permit to calculate the means percent of each sensory descriptors to determine their organoleptic profiling (Table 2). On based a mean percent of sensory descriptors, the fermented porridge (F3) has presented the higher percent (98%) of taste descriptors and contrary a malted porridge has presented the higher percent respectively for odour (90%) and fluidity (83.30%) descriptors. Fermented porridge was higher appreciated by mothers with a higher appreciation global score of 82.8% compared to global score 82.4% and 60.8% respectively of malted (Fg3) and low energy density (G1) porridges. The fermented porridge (F3) has presented the higher

percent of taste descriptors. This higher percent of taste descriptors of fermented porridge could be due at soluble sugar and organic acid which producing in this porridge during fermentation. These compound which present an agreeable taste and savour have also identified in "Gowé" a fermented and malted red sorghum dough consumed in Benin (Vieira-Dalodé *et al.*, 2007). The higher odour and fluidity percent of malted porridge were due to soluble sugar which developed during the germination maize and red sorghum grains by the amylase activity. These soluble sugar have a higher fluidity capacity and agreeable flavour and natural sweet savour (Traoré *et al.*, 2004; Kayodé *et al.*, 2006). These characteristics of soluble sugar permit to obtain of higher fluidity and energy density with a natural sweet porridge (Kouassi *et al.*, 2015; Kouton *et al.*, 2017). Specially the higher taste and sweet savour percent was due to the agreeable flavour and odour of sugar soluble in maize and red sorghum malted flour used in preparation of infant flours.

**Table 2.** Organoleptic profiles of three infant porridges.

Porridges	Means of appreciation percent (% ± ET) of organoleptic descriptors				
	Color (Attraction)	Odour	Density (Fluidity)	Taste (Savour)	Global appreciation
Fg3	73.3 ± 0.4 <sup>a</sup>	90 ± 0.57 <sup>a</sup>	83.3 ± 0.51 <sup>a</sup>	83.3 ± 0.51 <sup>b</sup>	82.4 ± 0.34 <sup>b</sup>
F3	73.3 ± 0.25 <sup>a</sup>	85 ± 1 <sup>b</sup>	75 ± 0.52 <sup>b</sup>	98 ± 0.52 <sup>a</sup>	82.8 ± 0.1 <sup>a</sup>
G1	40 ± 0.57 <sup>b</sup>	73.3 ± 0.40 <sup>c</sup>	70 ± 0.57 <sup>c</sup>	60 ± 0.57 <sup>c</sup>	60.8 ± 0.11 <sup>c</sup>

G1: low energy density porridge, Fg3: high energy density malted porridge and F3: high energy density fermented porridge

### Preference of porridges

The mothers' preference (n=30) of porridges has permit to calculate the preference' score of each porridge (Table 3). In increasing order of mothers' preference, was a fermented porridge (F3), malted porridge (Fg3) and low energy density porridge (G1). All three porridges, the mothers preferred the fermented porridge (56.66%).

The low energy density porridge was less preferred (13.34%) by the mothers. The preference of fermented porridge by mothers could be due to sweet and fermented savour of "Mawè" a fermented maize dough using in preparation of this porridge. Their sweet and fermented savours were due to the soluble sugar (fructose, maltose, sucrose and raffinose) and organic acid (lactic, citric, oxalic and acetic acid)

which present in this porridge during fermentation. These compound which presented an agreeable taste and savour have also identified in "Togwa" a Tanzanian fermented food and "Gowé" a fermented malted red sorghum dough consumed in Benin and (Mugula *et al.*, 2003; Vieira-Dalodé *et al.*, 2007).

The same compounds were identified also in "Kenkey" a fermented maize dough at Ghana (Annan *et al.*, 2003).

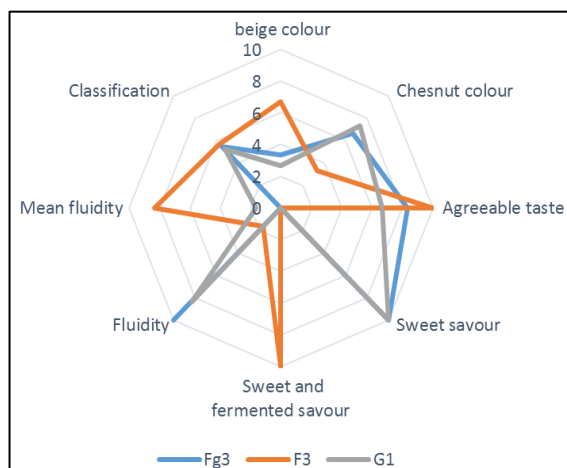
**Table 3.** Preference of three infant porridges.

Porridges	Preference of porridges		
	Fg3	F3	G1
Percent (%)	30±0.57 <sup>b</sup>	56.66±0.52 <sup>a</sup>	13.34±0.4 <sup>c</sup>

G1: low energy density porridge, Fg3: high energy density malted porridge and F3: high energy density fermented porridge

### Sensory profiles of three infant porridges

Descriptive quantitative analysis of porridges has permit to quantify the appropriate sensory descriptors such as savour, colour, odour and fluidity on a scale (Fig. 1). On based of the quantify sensory descriptors, the malted porridge (Fg3) was chestnut colour, presented a sweet savour and high fluidity compared of fermented porridge (F3). The fermented porridge presented as sensory profile a descriptor of beige colour, a sweet and fermented savour, a mean fluidity and an agreeable savour. The sensory profile of low energy density porridge (G1) presented a chestnut colour, a sweet savour and agreeable savour. On based classification, the fermented porridge (F3) has presented a sensory profile which obtained the higher point compared of malted (Fg3) and low energy density porridges (G1).



**Fig. 1.** Sensory profiles of three infant porridges.

### Conclusion

Organoleptic and sensory profiles of three infant porridges were determined. The fermented porridge (F3) has presented the higher percent of taste descriptors and contrary a malted porridge (Fg3) has presented the higher percent respectively for odour and fluidity descriptors. The low energy density porridge (G1) present the low percent of appreciation and preference. Fermented porridge was higher appreciated by mothers with a higher global score and it has presented the higher percent of taste descriptors. The mothers had appreciated the fermented porridge. On based sensory profiles classification, the fermented porridge (F3) has

presented a sensory profile which obtained the higher point compared of malted (F3) and low energy density porridges (G1).

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