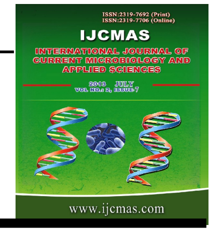

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Original Research Article

Formulation and biochemical characterization of sweet potato (*Ipomoea batatas*) based infant flours fortified with soybeanand sorghum flours

Sanoussi A. F[1], Dansi A[1]*, Bokossa-yaou I[2], Dansi M[1], Egounlety M[3], Sanni L.O[4] and Sanni. A[5]

[1]Laboratory of Biotechnology, Genetic Resources and Plant and Animal Breeding (BIORAVE), Faculty of Science and Technology of Dassa, University of Abomey-Calavi, BP 14, Dassa, Benin.
[2]Laboratoire de Microbiologie et des Technologies Alimentaires,Faculte des Sciences et Techniques.Université d'Abomey-Calavi, Benin.
[3]Département de Nutrition et des Sciences et technologies Alimentaires, Faculté des Sciences Agronomiques.Universitéd'Abomey-Calavi, Benin
[4]Food Science and Technology Department, University of Agriculture, Abeokuta, PMB 2240, 110001, Ogun State, Nigeria
[5]Laboratory of Biocehmistry and Molecular Biology, Faculty of Sciences and Technology(FAST), University of Abomey- Calavi, Benin.
******Corresponding author e-mail:* adansi2001@gmail.com

A B S T R A C T

This study aims to contribute to children's food security at weaning age through sweet potato valorisationin Benin. Two cultivars of sweet potato namely *Bombo* (P_1)and *Mansawin* (P_2),soybean and malted sorghum were in different proportions to develop a various sweet potato based infant flours namely $P_1SF^{75\%-25\%}$, $P_1SF^{50\%-50\%}$, $P_2SF^{75\%-25\%}$, $P_2SF^{50\%-50\%}$, P_1SSIF and P_2SSIF. These flours were analysed for their physicochemical compositions, microbiological status, sensory profiles and their Brine shrimplarvae toxicity. The results of the color determination revealed that no significant differences existbetween P1 and P2 flours for L*, a* and ΔE but their b* values were significantly different ($p < 0.05$) hence indicating that P2 produce more yellowness flour than P1. Comparative analysis of the physicochemical composition of the soybean enriched sweet potato infant flours ($P_1SF^{75\%-25\%}$, $P_1SF^{50\%-50\%}$, $P_2SF^{75\%-25\%}$, $P_2SF^{50\%-50\%}$), showed that only $P_2SF^{50\%-50\%}$ is rigorously consistent to the standard jointly recommended by FAOand WHO. The protein, fat and carbohydrate content of the sweet potato based infant flours fortified with soybean and malted sorghum (P_1SSIF and P_2SSIF) are lower than those of the Benin widely used commercial cereal based complementary infant flour "VIE VITAL VITE" but are still in accordance with recommended standard like their pH, energy density,microbiological qualities and no toxicity (LC_{50} >100 µg/ml). Porridges made with the developed infant flours were more appreciated (sensory profiling) than the one of "VIE VITAL VITE".To promote sweet potato and to contribute to children's food security in Benin, industrial production and commercialization of sweet potato based infant flours fortified with soybean and sorghum was recommended and further research actions suggested.

K e y w o r d s

Benin; Brine shrimp; toxicity; infant flours; proximate composition; sensory profiles; Sweet potato.

Introduction

Malnutrition among infants in low-income countries is an important public health problem and can be related to the composition of the complementary foods introduced after the breastfeeding period. When a baby reaches four to six months of age, breast milk alone is no longer sufficient to meet his nutritional requirement (Adenuga, 2010). Calories and other nutrients from weaning foods are needed to supplement breast-milk until the child is ready to eat the family diet (Nandutu and Howell, 2009). According to Onabanjo (2008) malnutrition, when it is severe, can cause premature death, permanent disability and fragility in face of many deadly diseases. Among different types of malnutrition, micronutrient malnutrition affects more than one-half of the world's population, especially women and preschool children (SCN, 2004). Vitamin A deficiency for instance is widespread in young children especially in the developing world (Low *et al*., 2008) and is a leading cause of early childhood death (Tomlins *et al*., 2012). It is also generally recognized that the insufficient energy density of complementary foods is an etiological factor of protein-energy malnutrition in young children (WHO, 1998; Traoré *et al*., 2004). In low-income countries, most infants are given cereal-based complementary foods prepared at the household level. Such foods are high in phytate, which limits the bioavailability of nutrients, including iron, calcium, zinc, and in some cases proteins, which are crucial to the development of infants (Amagloh *et al*., 2012).

According to Gibson *et al*., (2010), complementary foods based on either root or tuber crops have been shown to be significantly lower in phytate (by 3% to 20%) than cereal- and legume-based foods. Although, they are ample information on weaning foods from cereals, the potential of roots and tubers crops such as sweet potato to serve in the formulation of infant flours, has not yet explored by researchers in Benin.

Sweet potato (*Ipomoea batatas* L.Lam) is widely cultivated worldwide mainly for its edible roots (Ukom *et al.*, 2009) rich in calories and dietary fiber and some biologically active phytochemicals such as beta-carotene, polyphenols and ascorbic acid (Ahmed *et al*., 2010). Sweet potato is one of the most efficient food crops in terms of caloric value per land area. It has many agronomic advantages for marginal lands (including drought tolerance) and is relatively easy to grow even on poor soil (Van oirschot *et al*., 2003). Unfortunately, sweet potato is among the most under-exploited of the developing world's major crops (Tomlins *et al.,* 2012). It is perishable crops as storage of raw roots is not yet clearly solved in the sub-region (Ahmed *et al*., 2010). In Benin it is wildly produced and consumed boiled or fried mainly in the southern part of the country. Different cultivars are produced among which some are of yellow or orange flesh and would be rich in carotene making them very important in alleviating vitamin A deficiency among children below 6 years (Low *et al*., 2008; Amagloh *et al.*, 2012). In addition, a sweet potato based infant food would not require the use of external sweeteners which, in part, reduces its production costs (Nandutu and Howell, 2009; Adenuga, 2010). In fact, it is a good basis in the preparation of baby complementary foods, which can be enriched with protein-rich foods such as soybean (Adenuga, 2010). For an infant flour to give gruels of high energy density, the use of malted cereal flours which also has the advantage of reducing phytate content is recommended (Trèche *et al*., 1995; Traoré *et al*., 2004).

The objective of this study is to formulate new complementary infant flours, by combining yellow or orange fleshed local cultivars of sweet potato flours with soybean and malted sorghum flours and to assess their nutritional, microbiological and sensory properties.

Materials and Methods

Plant material

The plant material used consisted of roots of two cultivars (P1 locally called *Bombo*and P2 known under the named *Mansawin*; figure 1) of sweet potato (*Ipomoea batatas*) and grains of soybean (*Glycine max*; variety Jupiter; yellow grains) and of red sorghum (*Sorghum bicolor*).Sweet potato roots were purchased from producer's farm at Zinvié in southern Benin. Bombo has purple skin and yellow flesh while Mansawinhas brownish skin and orange flesh. Soybean and red sorghum grains were obtained from local market at Abomey - Calavialso located in southern Benin.

Flours preparation and formulation of the weaning food

The raw roots of sweet potato were washed in tap water to remove dirt and soil peeled with a kitchen knife and sliced into pieces following Ahmed *et al*., (2010) sweet potato flour was produced using the method described by CTA (2008) in which bleaching stage is included before drying and solar drying is replaced by oven drying at 55± 2° C for 6 hours (Figure 2). Soybean flour has been processed following the method described by Egounlety (2002).This method includes a boiling step which is among the most effective treatment that drastically reduced the anti-nutritional load of the seeds (Khattab and Arntfield, 2009). Malted sorghum flour was prepared following Kayode *et al*., (2006).

A basic weaning flours (named PSF) was processed by combining sweet potato and soybean flours in 75% -25% ratio ($PSF^{75\% -25\%}$) and in 50% -50% ratio ($PSF^{50\% -50\%}$) using the "create mixture design" application of Minitab 14 Software. Proximate compositions of these basic weaning flours ($PSF^{75\% -25\%}$ and $PSF^{50\% -50\%}$ sweet potato – soybean blend) were determined. The mixtures' optimization were performed for the flour of each sweet potato cultivar infant flour (PSF) using computer program (optimize mixture design) through Minitab software application to calculate the proportions of ingredients needed for a protein level in the range of 16.9 g to 22 g/100 g, and a fat content in the range of 6g to 10 g/100 g, as specified by Sanogo (1994), FAO and WHO Commission (1998) recommendations and Codex Alimentarius Commission guidelines (1991) for infant complementary food for older infants and young children.

To obtain the end product (sweet potato based infant flour fortified with soy bean and malted sorghum flours-PSSIF), the rate of incorporation of sorghum malted flour in the optimized PSF infant flours was estimated following Traoré *et al.*, (2004) recommendation and infant weaning flours fortified with malted cereal flours cooking method described by Trèche *et al.*, (1995). The PSSIF infant flours obtained were then stored in sealed polyethylene bags at room temperature to simulate the conditions of storage in developing countries.

Physico-chemical and microbiological analysis and toxicity level assessment of the formulated products

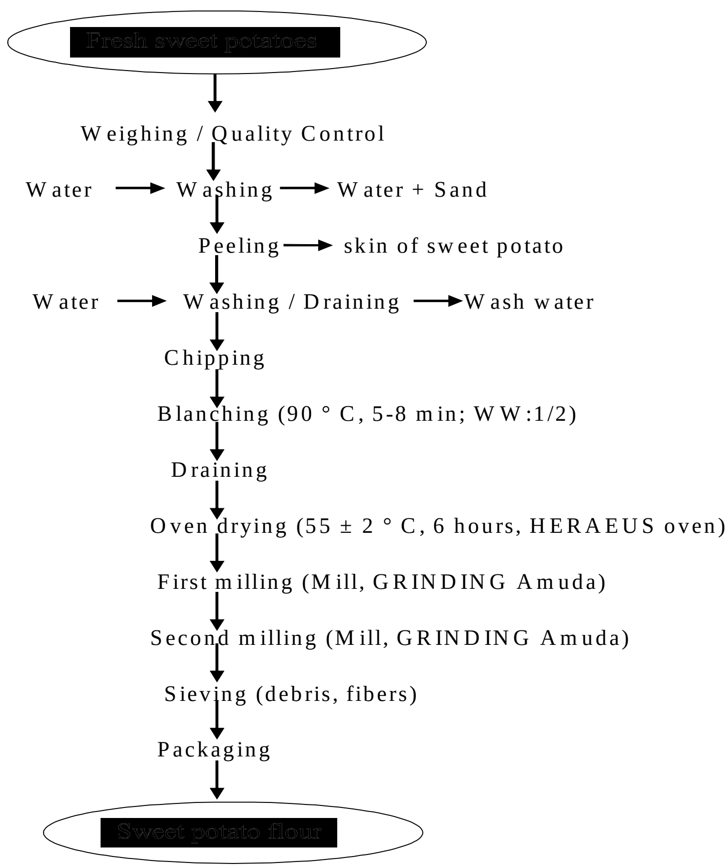
Physico-chemical compositions and caloric energy values assessment of sweet

Figure.1 Photo of sweet potato purple skin and yellow flesh and sweet potato with skin brownish yellow and orange flesh

1a:Purple skin and yellow flesh sweet potato –P1 (*Bombo*)

1b:Brownish yellow skin and orange flesh sweet potato– P2 (*Mansawin*)

Figure.2 Flow sheet of sweet potatoes flours production



potatoes flours, PSF and PSSIF (final sweet potato based infant flours) infant flours were determined using recommended methods. The samples were analysed for moisture, crude protein, crude fat, ash content, pH and titrable acidity. The moisture and solids content was determined by drying 5 g of flour in the oven at 103 ± 2 °C for 24 hours until stable products weight is obtained. Crude protein, crude fat and ash content of the samples were determined following AOAC (1990) and as described by Amagloh *et al*., (2012; 2013).Total available carbohydrate was calculated as 100% minus the sum of moisture, protein, fat and ash content obtained as described above. The pH of the flours was measured using pH-meter and titrable acidity was determined following Nout method (Hongbété *et al*., 2009). In addition color of each sweet potato flours produced was determined with spectrophotometer, following Wrolstad *et al*., (2005) and Ahmed *et al*., (2010), using the CIE (Commission Internationale de l'Eclairage) L*, a*, b* and ΔEcolour system where L* is lightness of the product, a* is redness or red saturation index, and b* is yellowness or yellow saturation index and ΔE is the difference Total color over the white ceramic reference (Wrolstad *et al*., 2005).

The toxicity status of the infant flours was carried out using brine shrimp (*Artemiasalina*) larvae bioassay following Carballo *et al*., (2002), Moshi *et al*., (2010). The shrimp lethality assay is based on the ability to kill laboratory-cultured *Artemia* brine shrimp. The assay is considered as useful tool for preliminary assessment of toxicity and is regularly used for assessing toxicity ofplant extract (Carballo *et al*., 2002; Agbaire *et al*., 2013).

Microbiological analysis was performed using the method described by Guiraud and Galzy (1980). Microorganisms researched included total aerobes, yeasts and molds, faecal coliforms and *Escherichia coli* bacteria. All determinations were carried out in triplicates.

Sensory profiles assessment

Infant weaning flours fortified with malted cereal flours cooking method described byTrèche *et al*., (1995) was used to perform PSF and PSSIF infant flours into gruels. Sensory profiles of gruels were assessed following multiple comparison test carried out on gruels from PSF and PSSIF in comparison to gruels made with Vie VITA VITE commercial infant flour in Benin. Color, aroma, taste, consistency and overall acceptability were appreciated by 25 mothers of children at weaning age and 15 clinic staff dealing with child care, using a 9-point hedonic scale with 1 as least acceptable/dislike extremely and 9 as highly acceptable/ like extremely (Amagloh *et al*., 2013). Samples were simultaneously presented to tasters in cup and tap water was provided for rinsing the mouth between samples.

Statistical analysis

The T Test of Student's and Newman Keuls and ANOVA procedures in Minitab 14 software were used to perform descriptive analysis and compare the means of triplicate measurements of physico-chemical and sensory profiles parameters. 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.

Results and Discussion

The results of the color determination for the flours of the two sweet cultivars (P1 and P2) are shown in Table 1. Significant differences were observed between L*, a* and ΔE values of the flour of the two cultivars used but their b* values were significantly different (p <0.05). The L* values of P1 and P2 flours (86.3 and 86.5 respectively) seem slightly higher than 85.84 found for sweet potatoe flour produced at the same drying temperature without bleaching (Ahmed *et al*., 2010). This result indicates that the flour from sweet potato processing technologies that include bleaching may be lightness than those from a production technology that neglects bleaching. River *et al*., (2009) reported that bleaching inhibit enzymes responsible for alteration, including enzymatic browning of product. ΔE values of the flours produced (86.97 and 87.45; Table 1) were lower than the value (89.57) found by Ahmed *et al.*, (2010). These differences were expected as cultivars used in the different studies were not genetically identical and do not have also the same chemical composition. With regard to the b* flour of P2 appear yellowness than flour of P1.

The dry matter content, the pH, the acidity (% of lactic acid) as well as the protein, fat, carbohydrates and ash content of sweet potato flours, soybean flour and that of the different PSF infant flours were compiled in Table 2. These proximate compositions of the sweet potato flours produced revealed, apart from the total of carbohydrates and caloric energy values, statistically significant differences (P<0.05) between the rates of each nutrient taken independently (Table 2). The high dry matter contents obtained is synonym of better preservation or storage capacity of the produced flours (Badila *et al*., 2009). The protein contents of P1 and P2 flours (3.28% and 2.8% respectively) are lower than those reported by Ahmed et *al*. (2010) and Badila *et al*., (2009) which were 3.59% and 6.31% respectively. According to Ukom *et al.*, (2009) these results can be explained in one hand by the difference between varieties used and in the other hand by slight loss of protein during processing operation. It was also observed (Table 2) that the increase of the amount of soybean flour in the formulations lead to the augmentation of the formulate flours' content in protein, fat and even ash. Similarly, the increase of sweet potato flour in the formulations leads to the improvement of its carbohydrates content (Table 2). These results were expected since it is widely known that starchy food are good source of carbohydrate (Ukom *et al*., 2009;Ade nuga, 2010) while seeds of soybean are rich in protein (40%) and Fat (20%) (Abioye *et al*., 2011). Lipid content of the formulas $P_1SF^{75\%-25\%}$ and $P_2SF^{75\%-25\%}$ (5.13% and 5.16% respectively) are lower than the minimum value of 6% recommended by FAO and WHO (1998) for complementary infants flours. Therefore $P_1SF^{75\%-25\%}$ and $P_2SF^{75\%-25\%}$ are not suitable for direct use as infant flour. Both $P_1SF^{50\%-50\%}$and $P_2SF^{50\%-50\%}$ have protein content above the minimum value of 16.9% recommended by Sanogo (1994). However, the protein amount of $P_1SF^{50\%-50\%}$ is already at the upper limit (5.5% of protein per 100 kcal) recommended by FAO and WHO (1998). Therefore, only $P_2SF^{50\%-50\%}$ is, among the four infant flour formulas, consistent to the standard.

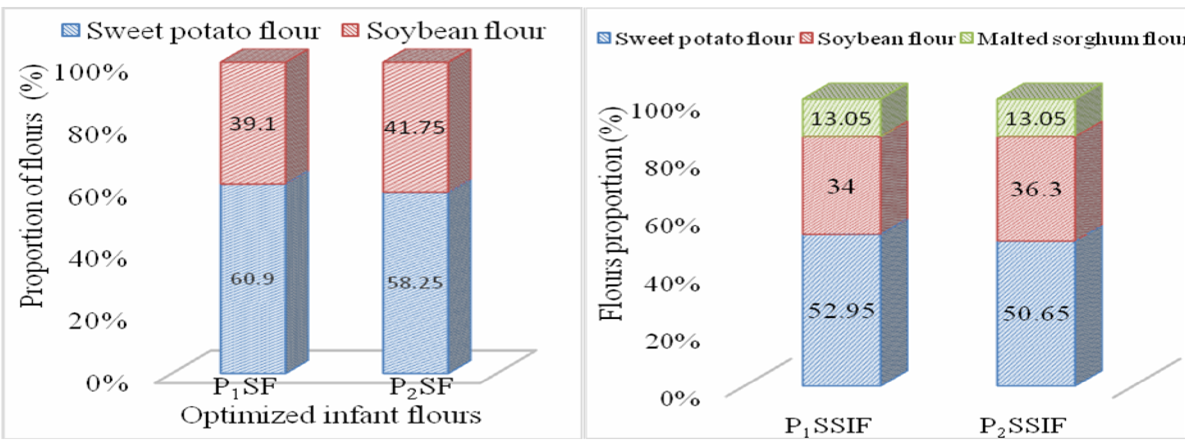
Figure 3a shows the optimized ratios of sweet potato and soybean flours to blend in order to formulate the infant complementary flours P_1SF and P_2SF with

Table.1 Color of flour from sweet potato cultivars with purple skin and yellow flesh and other one with yellow skin and brownish-orange flesh.

Flours color	L*	a*	b*	ΔE
P1 Flour	86.3 ± 0.00^{a}	-2.0 ± 0.00^{a}	10.60 ± 0.05^{a}	86.97 ± 0.00^{a}
P2 Flour	86.5 ± 0.00^{a} P= 0.02	-2.1 ± 0.10^{a} P= 0.01	12.75 ± 0.00^{b} P= 0.525	87.45 ± 0.00^{a} P= 0.004

L * (luminance or brightness of the product), a * (red saturation index), b * (yellow saturation index) and ΔE (difference Total color over the white ceramic reference)

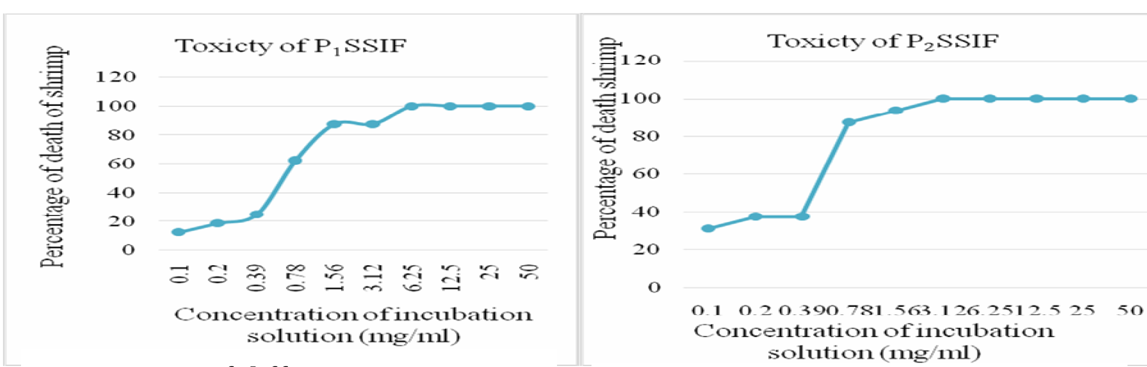
Figure. 3 Optimal sweet potato-soybean flours blend formula for PSF infant flours (Figure 3a) and for PSSIF formula (Figure 3b).



3a: Sweet potato-soybean infant flours (P_1SF and P_2SF)optimized formula

Sweet potato based infant flours fortified with soybean and malted sorghum

Figure.4 Effect of different concentration of P_1SSIF and P_2SSIF infant flourssolution on Brine shrimp larvae



4a: Toxicity of different concentration of P_1SSIF solution on brine shrimp

4b: Toxicity of different concentration of P_2SSIF solution on brine shrimp

Table.2 Physicochemical properties of sweet potato P1 and P2 flour's, soy bean flour and infant weaning flours newly formulated

Flours	Dry matter (%)	Protein % (DW)	Fat (%)	Carbohy-drates (%)	Ash % (DW)	pH	**Titrableacidity**	Energy values (kcal/100 g)
P1 Flour	94.80±0.06^{a}	3.28±0.04^{a}	0.72±0.01^{a}	89.43±0.20^{a}	1.37±0.01^{a}	5.66±0.02^{a}	**5.22±0.47^{a}**	377.32±0.04^{a}
P2 Flour	95.20±0.04^{b}	2.80±0.00^{b}	1.30±0.10^{b}	89.37±0.20^{a}	1.73±0.05^{b}	5.51±0.02^{b}	7.09±0.47^{b}	380.38±0.01^{a}
Soyflour	95.60±0.03^{c}	44.10±0.10^{c}	20.36±0.07^{e}	26.99±0.30^{b}	4.15±0.32^{f}	6.23±0.03^{c}	15.53±0.46^{f}	467.60±0.05^{d}
$P_1SF^{75\%-25\%}$	94.80±0.02^{a}	13.56±0.06^{d}	5.13±0.03^{c}	74.19±0.17^{d}	1.92±0.06^{bc}	6.01±0.01^{c}	5.70±0.00^{a}	397.17±0.01^{b}
$P_1SF^{50\%-50\%}$	95.60±0.02^{c}	23.67±0.13^{e}	11.58±0.21^{d}	57.67±0.37^{c}	2.68±0.01^{d}	6.13±0.01^{c}	9.41±0.04^{c}	429.58±0.03^{c}
$P_2SF^{75\%-25\%}$	95.10±0.04^{b}	13.21±0.08^{f}	5.16±0.01^{c}	74.12±0.43^{d}	2.61±0.30^{d}	5.97±0.01^{c}	8.51±0.04^{d}	395.76±0.01^{b}
$P_2SF^{50\%-50\%}$	95.60±0.02^{c}	23.32±0.13^{g}	12.07±0.02^{d}	57.13±0.39^{c}	3.08±0.22^{de}	6.08±0.05^{c}	10.35±0.93^{e}	430.43±0.01^{c}

$P_1SF^{75\%-25\%}$, $P_1SF^{50\%-50\%}$= Infant weaning flour resulting from mixing of P1 and soy bean flours in ratio 75% - 25%, 50%-50% respectively; $P_2SF^{75\%-25\%}$, $P_2SF^{50\%-50\%}$ = Infant weaning flour resulting from mixing of P2 and soy bean flours in ratio 75% - 25%, 50% - 50% respectively

Table.3 Proximate composition and physicochemical characteristics of infant flours PSSIF compared to that of the commercial infant flour.

Infant flours	Dry matter (%)	Protein (%)	Fat (%)	Carbohy-drate(%)	Ash (%)	pH	Titrableacidity	Energy value (Kcal/100g)
P_1SSIF	92.80±0.03^{a}	19.69±0.06^{a}	7.45±0.02^{a}	63.29±0.13 ^{a}	2.37±0.02 ^{a}	6.00 ±0.01^{a}	2.66±0.02^{a}	398.97±0.94^{a}
P_2SSIF	93.40±0.02^{a}	19.51±0.18^{a}	7.55±0.02^{a}	63.91±0.24 ^{a}	2.43±0.02 ^{a}	6.11±0.01^{a}	2.89±0.03^{a}	401.63±1.60^{a}
C IF	96.00±0.00^{b}	21.54±00^{ab}	8.11±0.00^{a}	64.15a±00	2.20±0.00^{a}	-	-	415.75±0.00^{b}

defined appropriate proximate composition. Trèche *et al*., (1995) reported that to enhance energy density of gruel in order to meet nutritional requirement of young children, malted cereal flour should be add to infant flour in rate depending on raw material. Base on that, the rate of the malted sorghum flour that should be incorporated into the blends to produce with P_1SF and P_2SF the final infant flours (P_1SSIF and P_2SSIF) were determined (Figure 3b). The physicochemical properties of these sweet potato based infant flours fortified with soybean and malted sorghum (P_1SSIF and P_2SSIF) summarized in table 3 revealed that their content in protein (19.69% and 19.51%), fat (7.45% and 7.55%) and carbohydrate (63.29% and 63.91%) are lower than those of the Benin widely used commercial cereal based complementary infant flour "VIE VITAL VITE" (Table 3) but still in accordance with the complementary weaning food standard recommended by FAO/ WHO (1998). The pH of P_1SSIF and P_2SSIF are also consistent with required pH recommended for active amylase activity in some cereal flours at optimal cooking temperature (70°C) (Trèche *et al*., 1999). After cooking and cooling, the formulated PSSIF (P_1SSIF and P_2SSIF) complementary infant's flours give gruel with acceptable consistency and of higher energy density when compared to the recommended energy density of at least 0.8 kcal/g (Dewey and Adu-Afarwuah, 2008). These observations are in agreement with those of Traoré *et al*., (2004) and Kayode (2006) who reported that the malted sorghum flour are good basis in the preparation of infant gruel with good energy density.

According to FAO and WHO recommendations (FAO/WHO, 1994) related to the microbiological qualities of infant flours intended for cooking, the total number of total aerobes, yeasts and moulds, faecal coliforms and *Escherichia coli* should be less than 10^5,$10^{3,}10^2$ and 10CFU/g respectively. The results of microbiological analysis obtained (Table4), showed that all the infants flours produced are consistent with the weaning food microbiological standard. It was observed that the incorporation of malted sorghum flour into the blends led to a slight degradation of their microbiological qualities (increase of yeast and moulds numbers) although they remain consistent to standard.

As reported by Moshi *et al.*, (2010), foods with value of IC_{50}≥100 µg/ml are considered as non-toxic for human consumption. The results of the Brine shrimp larvae toxicity bioassay revealed that none of the flours produced were toxic as their IC_{50} values were all higher than100 µg/ml (Table 5 and Figure 4). Sweet potato based infant flours fortified with soybean flours or with soybean and malted sorghum flours may be a potential complementary baby food with non-toxic effect on the consumers.

The results of the sensory profiles evaluation by panel members for various attributes (acceptability, aroma, consistency, color and taste) of the porridges made with the different PSF and PSSIF flours (Table 4) showed that all the developed sweet potato base flour porridges were more appreciated than the commercial infant flour "VIE VITAL VITE" used in Benin. As reported by Nandutu and Howell (2009), Adenuga (2010) and Amagloh (2013), the results indicated that Sweet potato can serve as basis for nutritious infant flours. In terms of taste, tasters reported that porridge of Sweet potato base flours were sweeter that

Table.4 Microbiological characteristics of P_1SF, P_2SF, P_1SSIF and P_2SSIF infants' flours

Microorganisms	**Importance in the different flours samples (log_{10} $CFUg^{-1}$)**						
	$P_1SF^{75\%-25\%}$	$P_1SF^{50\%-50\%}$	P_2 $SF^{75\%-25\%}$	$P_2SF^{50\%-50\%}$	P_1SSIF	P_2SSIF	Standards
Total aerobes	2.70± 0.16	3.54± 0.06	2.23±0.27	2.70± 0.21	2.90±0.20	2.95± 0.21	<5
Yeasts and molds	2.15±0.21	2.00±0.14	2.10±0.02	2.17±0.18	2.47±0.01	2.60±0.10	<3
Faecal coliforms	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	<2
Escherichia coli	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	<1

Table.5 Lethality concentration of 50% of brine shrimp larvae (LC_{50}) of P1 and P2 flours, soybean flour and their derived infant flours PSIF and PSSIF

Flours	**LC_{50} value (mg/ml)**
P1 flour	1.56
$P_1SF^{75\%-25\%}$	3.12
$P_1SF^{50\%-50\%}$	0.39≤ IC50≤0.78
P2 flour	$1.56 \leq IC_{50} \leq 3.12$
$P_2SF^{75\%-25\%}$	$0.78 \leq IC_{50} \leq 1.56$
$P_2SF^{50\%-50\%}$	0.39
Soybean flour	1.56
P_1SSIF	$0.39 \leq IC_{50} \leq 0.78$
P_2SSIF	$0.39 \leq IC_{50} \leq 0.78$
Standard*	> 0.1

Table.6 Sensory profiles of porridges from PSF and PSSIF compared with that of commercial infant flour Vie VITA VITE

Cooked infant flours	Colour	Aroma	Taste	Consistency	Acceptability
Vie VITA VITE	5.00 ± 0.00^a	5.00 ± 0.00^a	5.00 ± 0.00^a	5.00 ± 0.00^a	5.00 ± 0.00^a
P_1SF $^{75\%-25\%}$	6.10 ± 2.43^{ab}	6.10 ± 2.19^b	6.51 ± 2.42^b	6.68 ± 2.01^b	5.96 ± 2.45^b
P_1SF $^{50\%-50\%}$	6.06 ± 2.18^{ab}	6.34 ± 2.17^b	$6{,}89 \pm 2.14^b$	5.82 ± 2.55^{ab}	6.37 ± 2.14^{bc}
P_2SF $^{75\%-25\%}$	6.55 ± 2.16^b	6.72 ± 2.11^b	$6{,}55 \pm 2.21^b$	$6{,}24 \pm 2.33^b$	6.37 ± 2.25^{bc}
P_2SF $^{50\%-50\%}$	6.55 ± 2.62^b	6.79 ± 2.07^b	7.24 ± 1.95^b	6.93 ± 2.10^b	7.17 ± 1.96^c
P_1SSIF	6.20 ± 2.11^b	7.20 ± 1.42^b	7.53 ± 1.30^b	7.53 ± 1.18^b	7.60 ± 1.35^c
P_2SSIF	7.60 ± 1.40^c	6.86 ± 1.76^b	7.00 ± 1.96^b	7.00 ± 2.07^b	6.60 ± 1.88^b

the one of "VIE VITAL VITE". This result which was expected because of the nature of the sweet potato itself is in agreement with the observations of Nandutu and Howell (2009) and those of Ahmed et al. (2010) who reported that the sweet potato based complementary foods would not require the use of external sweeteners. In terms of cultivars, the gruel made with *Bombo* derived flour (P_1SSIF) was mostly appreciated by tasters than the one of *Mansawin* (P_2SSIF).

This study showed that sweet potato flours have good nutritional quality and are not toxic for human consumption. When enriched with soybean flour in specific ratios, it can be used as complementary infant flour and a potential weaning food of good nutritional, microbiological and organoleptic qualities. For further promotion of sweet potato through its value added products (production of different infant flours) the following research actions are suggested:

*Assessment of the shelf life, the micronutrient, vitamin A and C content as well as the rheological properties and the phytochemical composition of PSSIF flours;

*Phytochemical, physicochemical and vitamin content survey of the different sweet potato cultivars produced in Benin (and their flours) in order to identify the most nutritive ones and the most suitable for processing in values added products.

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