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TRADITIONAL ENRICHMENT OF THE FLOUR OF RICE FOR UNEARTH FLOURS AND SOYA FOR THE CONFECTION OF WEANING FOUR.

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ABSTRACT: *The aim of this work is to enrich the powder of rice with pistachio and soya in order to make a weaning food for children. In fact, some traditional methods have been used .The mixture of the powder of soya/rice(SORI) in the one hand and pistachio/rice (PIRI) in the other hand , have been formulated and the biochemical characteristics produced have been compared to first Cerelac rice of Nestle and then to non enriched rice (NER).The enrichment of the rice obtained from the mixture of the powder of pistachio and soya increases the quantity of proteins up to 78% both in SORI and PIRI.The result of these analysis shows that Cerelac rice, Soya/rice and pistachio rice contains respectively, 14.94 ± 0.07 g/100 g MS, 14.62 ± 0.5 g/100 g MS et 14.92 ± 0.8 g/100 g MS of proteins with energetically values of 434.40 ± 3.02 ; 441.72 ± 2.1 and 412.97 ± 2.8/100 g MS kcals.The powder of rice non enriched has less protein values (8.11± 1.12 g/100 g MS) and energetic one (336.19 ± 1.5 kcal).The powder RNE contains less mineral and zinc values (0.4±0.01) and iron values (1,23 ± 0,02)while the highest values founded in the witness are in zinc (3,91 ± 0,02)and in iron (3.74 ± 0.03).The powder RNE, SORI, PIRI and the witness got respectively 5.57 ± 0.6 ; 6.08 ± 0,05 ; 6.24 ± 0.18 et 6.12 ± 0.14 of pH. The pH of powder obtained are statistically the same in the tested sample ($p \geq 0.05$) and different from RNE ($p \leq 0.05$).These results show that the nutrition density of formulated diets are superior to the powder of non enriched rice and comparable to the tested sample (Cerelac rice).These rice enriched with the powder of soya and pistachio could be used as complementary food for children*

KEYWORDS*: enriched, rice, weaning, complementary food*

INTRODUCTION

According to the **(WFO, 2010),** the surface of land for growing rice represents only 11% of the world arable land. But the rice is the first cereal grown in the world, just after wheat and maize (**Benkadri 2010**).It also the basic foodstuffs of more than the half of the world population according to **Benkadri 2010.** In Ivory Coast, rice can be grown in every region and precisely In the western, center and south-western side where unfortunately malnutrition raged (**EDSCI, 2012).**Rice is usually used as powder in infants food to produce complementary food(**Laureys and Geeroms,2002**);it is also different from the other cereals because of its high quantity of gluten and less quantity of prolamine. Although rice contains important quantities of micro nutriments and aroma (**Mohtadji-Lamballais, 1989; Laignelet, 1998**), it is devoiced of some nutriments useful for the growth such as proteins and it is weak in energy (Juliano, 1994 et Laignelet, 1998;Treiche et al.,2004) As the stomach of a child is small(30 ml/kg of his total weight) (**Sawadogo et al., 2003**),he seems satiated when he eats few quantity but he misses essentials nutriments (**Trèche, 2004**) The power of rice doesn't correspond to the internationals institutions' alimentation standard (**Bengaly, 2010**). In order to fulfil the lack, there is a must

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and the aim of this study, is to enrich the powder of rice with pistachio in order to have a proper powder for weaning.

MATERIAL AND METHODS

Alimentary material

Three kind of infant weaning powder have been made from the rice (*Oriza Sativa*), from *Citrullus lanatus* commonly known as pistachio, from soya (*Glycine max*), from sugar, and from palm oil. The powder of rice of Cerelac sold in the common market has been used as a tested simple. Apart from the rice of Cerelac, the other ingredients have been bought in « Forum des marchés » the local market of Adjamé, Abidjan, Ivory Coast. All these seeds have been turned into powder and they have been chosen because they are always available at any seasons in Ivory Coast .These alimentary diet is made up of soya/rice (SORI), Pistachio/rice (PIRI) and the non-enriched rice (RNE).

Table 1: Formulation of alimentary diet

Diet	Ingredients	Quantities (g/100g)
Soya/Rice (SORI)	powder of soya	17.0
	Powder of rice	65.0
	Palm oil	8.0
	Sugar	10.0
Pistache/rice (PIRI)	Pistachio	20.82
	Powder of rice	68.44
	Sugar	10.74
non enriched rice (NER)	Rice	100

METHODS

The production of composed powders process

To start, the seeds are washed, cleaned and polished from dust. Then the seeds of pistachio are pre-cooked for 30minutes in 100 ^{0}c boiled water and dried on sterilizer at 45 ^{0}c for 8 hours. As for the seeds of rice, they are soaked in water at ambient temperature for 8 hours, then dried for 12hours on sterilizer at 45 ^{0}c on stainless steel grill. The seeds of pistachio clean from their pellicules before they are get dried. Afterwards, all the seeds are crushed together in a mixer then roasted at 100 ^{0}C in a stainless steel pan for 10 minutes .The obtained powders are gradually softed by sieves of 500, 400, 160 µm stitich. The different ingredients (powder of rice and pistachio, sugard and oil palm) of composed powder have weighted then mixed in order to get a homogeneous powder (**Egnon *et al.*, 2016**)

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Chemicals analysis
All the analysis have been made in triple.

Rate of proteins
The proteins of the different products are dosed according to the method of Kjeldahl by the convertion of protein into azote (nitrogen) it is about 6.25 (**Bouafou *et al.*, 2007**)

Rate of fat and oil
Fat has been extracted by boiling 5g of sample, then weigh by the balance of Sartorious at 0.001g by pur hexane in the appliance of Soxhlet at 80^0 c. After evaporating Hexane by the rotavapor, the balloon which has been tared in advance, get chilled by the desicator (**Tremolieres, 1977**).

Tenor in Carbohydrates and ash
Carbohydrates has been obtained by the difference between the dosed elements and the prior sample. The tenor in ash has been obtained by weigh the residue of the sample burn at 550^0 C in a mitt oven by six (6) hours maximum.

Determining energetic value
The energetic value of the diet has been obtained by toting the product of each nutriment (Carbohydrates, proteins lipids) with it respective thermic coefficient of Atwater.

Determining pH
The method of Noutetal. (1989) has been used in this case.10g of pure has been deducted in a "bécher" then added by 20ml of distilled water. The mixture got uniformed thank to the magnetic mixer and the pH has been measured. The pH meter used has been calibrated with the stamps solutions of pH=4 and pH=7 and the pH value is directly read on the appliance.

Tenor in minerals
Iron (Fe) and zinc (Zn) are dosed by the atomic absorption spectrometry of flame photometer (PFP 7) from the sample of ash filtered (**Beaufrère, 1993**).

Brutes fibres
The tenor in brute fibres have been determined according to AOAC (2000).

Statistics analysis
The analysis of data have been made by STATISCA software 6.0. The average compare has been made thank to Student Newman-Keuls test with a signification sill fixed at 5%.

THE RESULTS

Chemical composition of diets
The nutritional densities and physico-chemical of nutriment in non enriched rice, soya /rice (SORI), pistachio/rice (PIRI) and those of the rice (CERELAC) is presented in second board (board). The composition in proteins, lipids, Carbohydrates, the energetic values of iron and zinc have also been determined. The rate of proteins in the tested rice, PIRI. SORI and RNE are respectively 14.94 ± 0.07g/100 g; 14.92 ± 0.8g/100 g, 14.62 ± 0.5g/100 g and 8.11± 1.12 g/100g. Any difference of tenor in proteins ($p \geq 0.05$) has been made except the RNE

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(p≤0.05).The highest rate of lipids has been made in the SORI (13.56 ± 4.0g/100 g) and the lowest one in the RNE (0.51 ±0.02g/100 g).The rate of lipids are different from each other (p≤0.05).The total rate of Carbohydrates in different diets (PIRI, SORI, RNE) and those of tested sample of rice are 73.79 ± 2.1 g/100g, 63.05 ± 0.07 g/100g; 60.04± 0.06 g/100g et 66.6 ± 0.12 g/100g. The total rate of Carbohydrates are also different to each other (p ≤ 0.05). The energetic values of different values recorded from 336.19 ±1.5 kcal/100g to 434.40 ± 1.02kcal/100g.They also presented differences compared to the tested rice (p ≤0.05) except those of the SORI diet (432.72 ± 2.0 kcal). As to the tenor in ash, the SORI diet (2.07± 0.07) and PIRI diet (2.10 ± 0.02) are the same but different to those of the tested rice (2.52 ± 0.03) and of RNE (0.26 ± 0.01).

Table 2. Chemical composition of the four diets

	Control	SORI	PIRI	RNE
Lipids g/100 g dm	12,40 ± 2,02^{a}	13,56 ± 4,0^{b}	12,57 ± 3,0^{a}	0,51 ±0.02^{c}
Carbohydrates g/100 g dm	66,6 ± 0,12^{a}	63,05 ± 0,07^{b}	60,04± 0,06^{c}	73,79 ±2,1^{d}
Ash (g/100 g dm)	2,52 ± 0,03^{a}	2,07± 0,07^{b}	2,10± 0,02^{b}	0,26± 0,01^{c}
Fibres g/100 g dm	2,36± 0,08^{a}	2,89±0,07^{b}	2,93±0,13^{c}	1,18 ±0,05^{d}
Energies kcal/100 g dm	434,40 ± 1,02^{a}	432,72 ± 2 ,0^{a}	412,97 ± 2,3^{b}	336,19 ±1,5^{c}

a,b,c: there is no significant difference between two values of the same line topped with the same letter
*Dry matter: dm

Mineral composition

Minerals contained in zinc and iron are recorded in third table 3 and the mineral values of iron varied from 0.4±0.01 mg /100g to 3.74 ± 0.02 mg /100g, and those of zinc varied from 1.23 ± 0.02 mg /100g to 3.91 ± 0,02 mg /100g.

The powder of RNE got the highest tenor of minerals in zinc (0.4±0.01) and in iron (1.23 ± 0.02), but the highest rate in tenor was in the tested rice and in zinc (3.91 ± 0.02) and in iron (3.74 ± 0.03).

Tableau 3 : Composition in Iron et Zinc for diet

Paramètres	Control	SORI	PIRI	RNE
Iron mg/100g dm	3.74 ± 0.03^{a}	3.56 ± 0.62^{b}	1.03 ± 0.47^{c}	0.4±0.01^{d}
Zinc mg/100g dm	3.91 ± 0.02^{a}	2.91 ± 0.0^{b}	1.74 ± 0.02^{c}	1.23 ± 0.02^{d}

abc: There is not important difference between two values of the same line topped by the same letter.
*Dry matter: d.m

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3.3. PH

The RNE, SORI, PIRI and control flours obtained respectively 5.57 ± 0.6; 6.08 ± 0.05; 6.24 ± 0.18 and 6.12 ± 0.14 pH. The pH of the formulated flours is statistically identical to the control ($p \geq 0.05$) and different from the RNE ($p \leq 0.05$).

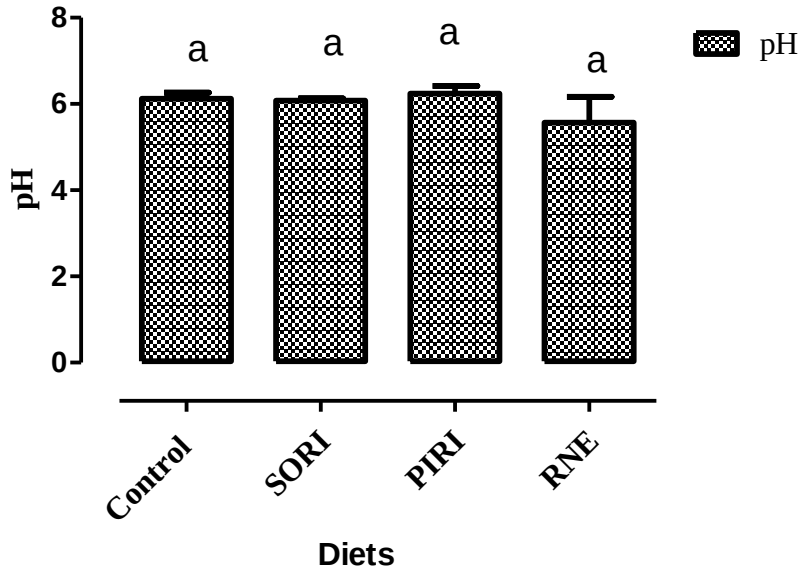

Figure 1: pH

a: there is no significant difference between two values of the same histogram topped with the same letter

DISCUSSION

The nutritional foodstuff of enriched and none enriched flours have been determined and compared to the weaning flow of trading. The result is that the enriched flow of rice is not stable in nutriments. It contains only 8,12 g/100g Ms of proteins with a weak energetical worth of 336. 19 kcal/100g Ms. The purport in protein (8.18 & 1.12/100g Ms) of the ENR of this study is higher than the one found by Ukegbu and Anyika (2012) (2.17 Kg/100g) in mash of boiled maize in Nigeria comparing to that of Ponka and al, 2015 (8.92 – 13.69g/100g) in the consumed mashes in the northern part of Cameroun.

In this study the flow of rice has been enriched in soy and pistachio for obtaining accordingly SORI and PIRI.The enrichment of ENR by the pistachio's and soy's flow has fowered the respective increasing of 82.39% and 78.72% of the purport in proteins of SOKI (14.62 + 0.5g/100g B) and in PIRI (14.92 + 0.85g / 100 Ms). The purports obtained are tenderly equals to that of trading flow (14 -95%). The results in compact with those of Salomon (2005) and Onilude (2009) that revealed in their studies that the working in proteins of enriched cereals is better than that produced from cereals only.

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The working in liquids of flows have revealed different significatives (P<0.05).
The weakest 0.51g/100g is found in meal of SORI. That working (13.56g/100g dm) could be explained by the adjunction of palm oil and soy oil which is an oilseed. All those purports apart of ENR, are higher than the values of mashes of maze (1.66g/100g dm) and millet boiled in Kaduna in Nigeria (Anigo 2010).

Rice is an energetical food with much presented the highest rate of working in carbohydrate (73.73 + 2.1/100g dm), whereas the meal of PIRI has revealed the weakest values (60.04± 0.66/100g dm). All those values have significantly been different each other's. ($P \leq 0.05$). The exalted purport is carbohydrate of ENR is justified by its formulation based only rice. Indeed, the cereals are foods, very rich in carbohydrates that can contain 60.80% of that one (Anse, 2013). Carbohydrate values of all the formula in that study are totally less than the v carbohydrate values (82.10 – 86.85 g/100 g)) of the consumed mashes in Cameroun (Ponka, 2015 and that of the Akamu's mash (73.52g / 100g) consumed in Nigeria at Enugu (Okeke, 2006).

The wording in ashes is the index of the cleanness of the childish farina (Colas, 1998). It is in relation with its extraction rate and the transformation of powding seeds. It defines the type of farina (Feuillet, 2013). In that study, the witness (of trading farina) has presented the highest purport. (2.52g / 100g) in rashes, whereas the none enriched rice has revealed the lowest value (0.26g / 100g). The purport in ash of SORI (2.07%) and PIRI (2.10%) are statistically equals ($P \leq 0.05$). Both of them are different from the witness and from the none enriched rice ($P < 0.05$). Those high purports in arsh pf farinas in that study, a part of the none enriched rice, it could be explained by what composes farinas. Indeed, SORI flows, PIRI and that of the witness are higher than the mash of Gari Karal (1.35g / 100g) consumed in the northern port of cameroun (Ponka and al, 2015).

During the period named "weaning" the child needs a special food providing sufficient energy, proteins and other nutrient substances liked minerals and dietary minerals (Dupont, 2005). Wordings in iron of farina of witness, PIRI and SORI were varying from 2.01g to 2.19g / 100g and are all differents each others. The iron intervenes in the composition of hemoglobin, myoglobin and enzyme that play an important role in many metabolical restrictions (Badham, 2007) the formula ENR (0.4 + 0.01mg) has revealed the lowest purport in iron. It is inferior to the value (2.49 mg / 100g) containing in the porridge of maize produced in Nigeria (Henry – Cinaeze, 2011).

The zinc is in many enzymes vital to the metabolism (FAO, 2001). The purports in zinc of farina vary from 0.4 mg to 3.91 mg / 100g Ms and superior to those found in the porridge of maize (0 – 17 – 0.30 mg / 100g) consumed in Nigeria (Bgbonnaya and Al, 2016). In that study, the diet witness has revealed the higher wording in zinc (3.91 + 0.02 mg) that higher wording is justified by the fact that the witness contains an important quantity of animal protein, particularly milk (Hotz and Gilson, 2001a) these results are in agreement with those of who, (2004) which has shown the superiority of the nutriments in proteins of animal above vegetal protein.

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The weaning farina should also take account of the threads because they can reduce the thermal density of additional foods for children. They should therefore not accede 5g / 100g Ms (FAO, WHO, 1991). The purports in bully threads of flows have presented different datas ($P < 0.05$). The weakest purports is thereby reached with farina ENR (1.18g / 100g Ms.Those values are less than in 100 Ms whereas the highest (2.92 + 0.13 / 100g Ms is less than of cassava and (8g / 100g) (Zannou and Al, 2011) and congruous to the "norm of codex alimentarius" above additional foods destined to babies (< 5g / 100g / (FAO, WHO, 1991).

There weak purport in threads and the upgrading of the density of the nutrient of farinas obtained is possible thanks to the operations of the transformation foster the reduction of certain anti-nutritional aspects they favor the nutritional quality of foods 'Kayodé, 2012). In these work, wetting, precooking and roasting have been used before the process of the diet. The gousses contain antinutritional factors very important that can be destroy through the process of wetting and precooking (Jenkins, 1994; Saskia and Annock, 2005). During that study, the wetting, the precooking and the roasting of the pistachio and the soy could justify the reduction of threads of obtained diet. Although these process contributed the upgrading of the nutritional quality of the formulated diets. They should be combined with other procedures such as milling in the production of flows of babies in order to optimize the energetical density.

The granulometry is a physical characteristic that permits to study the distribution of the size of the particles of a children Africa. It is in direct relation with all the unitary actions of the milling, of splitting, and it permits a more homogenous mixture (religion, 2000). In that study, the farina is changed into the sieve of loop of 150 micron of diameter. These loops are of 500 microns, there times bigger than ours in the production of childishes mashes boiled by the technic of germination and fermentation.

The acidity strongly influences the biological diversity of foods (Nout, 1994). In that study, the acidity of food tests are comparable (6.08; 6.24) to diet witness (6.12) and inferiors to ENR (5.57). These acidity is values recorded with foods test could be explained by the composition of foods. These result are in agreement with those of Kayodé and Al, 2012 that have shown the influence of production's procedures and the composition of the diet in the studies with fermented sorghum on the acidity of finished goods.

CONCLUSION

This task allowed us to compare the nutritional qualities of the diet of soya/rice and pistachio/rice and the tested rice. The result shows that the analyzed diet have almost the same nutritional values to those of the tested rice. Thus, thanks to their soft texture and enriched composition, this new weaning powder can provide nutritional values that children required. Instead of RNE powder, they could also be used to fight against infant malnutrition. Because of it poor nutritional values, the RNE powder can be the cause of infant malnutrition during the period of weaning if it is used only. However, the experimentation with animal and others analysis will be necessary in order to better appreciate the nutritional values of the weaning powder made up of local food.

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