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Qualification nutritionnelle des pains produits dans la ville d'Abidjan

[Nutritional qualification of breads produced in the communes from Abidjan]

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ABSTRACT: Bread may be made entirely with wheat or may contain other ingredients. A survey was therefore conducted in the ten municipalities to identify the type of bread provided in bakeries. This survey was followed by the analysis of nutritional quality. It appears that: four types of bread, namely bread made from 100% wheat flour and three other composite breads made respectively from 15% corn flour, also 15% bran flour and 20% flour of soy. The bakeries all produce 100% wheat bread. Only 30% of bakeries in Cocody offer 100% wheat bread, corn bread, bra n bread and soy bread. The water content therefore varies from 33.08% for soy bread to 37.22% for corn bread, whereas it is 32. 36% for 100% wheat bread. Corn and bran breads contain 62.78% and 63.58% dry matter respectively. it is soy bread that contains more protein with 6.13% followed by corn bread with 5.52%. As for the fiber levels, they vary from 7.39 (soya bread) to 14.31% (100% wheat bread). The carbohydrate content of soy bread is 48.56%. The energy values range from 293.64 kcal (soya) to 241.50 kcal (bran). The nutrient content in soy bread approaches that of standard bread. Its consumption can therefore be promoted.

KEYWORDS: Bread, nutritional quality, Abidjan.

RESUME: Le pain peut être Fait entièrement avec du blé ou renfermé d'autres ingrédients. Une enquête a donc été conduite dans les dix communes afin de recenser le type de pain fourni dans les boulangeries. Cette enquête a été suivie de l'analyse de la qualité nutritionnelle. Il ressort que : quatre types de pains à savoir le pain fait à base de la farine 100 % blé et trois autres pains composites faits respectivement de 15 % la farine de maïs, aussi 15 % de la farine de son et 20 % de la farine de soja. Les boulangeries produisent toutes des pains 100 % blé. Seules 30 % des boulangeries de Cocody présentent à la fois du pain 100 % blé, du pain au maïs, au son et du pain au soja. La teneur en eau varie donc de 33,08 % pour le pain au soja à 37,22 % pour le pain au maïs alors qu'elle est de 32,36% pour le pain 100 % blé. Les pains au maïs et au son contiennent respectivement 62,78 % et 63,58 % de matière sèche. C'est le pain au soja qui contient plus de protéines avec 6,13 % suivi du pain au maïs avec 5,52 %. Quant aux taux de fibres, ils varient de 7,39 (pain au soja) à 14, 31 % (pain 1 00% blé). Le taux de glucide du pain au soja est de 48,56 %. Les valeurs énergétiques sont comprises entre 293,64 kcal (soja) à 241,50 kcal (son). La teneur en nutriments dans le pain au soja se rapproche de celle du pain standard. Sa consommation peut donc être promue.

MOTS-CLEFS: Pain, qualité nutritionnelle, Abidjan.

1. INTRODUCTION

Food security remains one of the major problems in many developing countries. Nowadays, cereals are the most important food crops in the world. In sub-Saharan Africa, particularly in Côte d'Ivoire, certain cereals such as rice, millet and maize are intensively cultivated for food self-sufficiency [1]. However, wheat that is not grown in sub-Saharan Africa is highly prized and

is the subject of massive imports. Indeed, the products derived from this cereal, are widely consumed especially bread. According to [2], bread has become the second staple food after rice. This is the reason why it serves as a transit medium for food in macro and micronutrients essential but rare in some countries [3]. Bread is a food obtained by baking a kneaded, shaped and fermented dough, consisting mainly of wheat flour, water, salt and a fermentation agent which is either yeast or sourdough [4]. Basically, bread is an energy food since it contains an average of 50% starch [5]. It is high in fiber, almost devoid of simple sugars and low in fat [6]. WHO recommends 2/3 to 3/4 of a baguette to women and 3/4 to a 1 baguette of bread to men [7] But if we want to prevent obesity, diabetes and maintain health, these amounts must be reduced.

Although bread is rather perceived as a healthy food, its nutritional benefits remain unknown [8]. This lack of knowledge gives way to many health issues due to the quality of the product. It is therefore essential to highlight all the criteria of nutritional quality of bread [9]. Moreover, with the change in eating patterns, its future is far from assured, especially if its genesis and consumption do not meet the criteria of a sustainable and preventive diet [10]. Bread must meet a number of criteria of appearance, taste, texture and compositions controllable and governed by rules published and adopted by States and consumers. This would reduce the prevalence of diseases that can be carried by this food. This is the case of reducing the level of salt incorporated into bread in order to reduce the prevalence of hypertension, obesity etc. [11].

However, the import of wheat is a serious shortfall for the Ivorian economy. In order to contribute to improving the diet of Ivorian populations through the promotion and popularization of local crops, new incorporations in the field of bread making are possible for certain local products such as maize and soybeans as a promising alternative. For example, composite breads contain 15% of corn flour and bran flour and 20% of soybean flour combined with wheat flour.

The general objective of this study is therefore to assess the nutritional quality of breads produced in certain bakeries in the communes of Abidjan. More specifically, it will be a question of conducting a production survey, of determining some biochemical parameters breads sold in these bakeries and finally to compare the breads studied according to their biochemical compositions.

2. MATÉRIEL ET MÉTHODE

2.1. PLANT MATERIAL

The material consists of 100% wheat bread and composite breads (15% corn and wheat bran and 20% soybeans.

2.2. METHODS

2.2.1. STUDY MEDIA

The survey on the nutritional quality of breads was carried out in bakeries in 10 communes of Abidjan: Abobo, Adjamé, Yopougo n, Plateau, Cocody, Attécoubé, Treichville, Marcory, Koumass and Port-Bouet. The autonomous district of Abidjan is home to almost all of the country's industrial activities. As such, it represents the Ivorian economic lung. It includes all social strata within it. The investigation is carried out on twenty people

2.2.2. MEDIUM USED

The medium used is a survey sheet developed taking into account the objectives of this.

The technique used is the simple stratified random plane. Indeed, this plan consists of dividing the study population into groups called strata, and then selecting independent samples within each stratum. The selection of bakeries is made at random. This technique made it possible to collect information on different types of breads produced in Abidjan. The survey covered 30 bakeries in 10 communes of Abidjan including three per commune. Thirty loaves of bread were sampled at the end of the survey in the 10 municipalities. They were purchased for the same day and were transported to the laboratory. These breads of different types were crushed using a blender before carrying out the tests (moulinex type IM 2201).

2.2.3. BIOCHEMICAL ANALYSES

Dry matters were determined by drying in an over at 105°C during 24H to constant weight [12]. Total ash was determined by incinerating in a furnace at 550°C [13]. Crude protein was calculated from nitrogen (N x 6.25) obtained using the Kjeldahl method by [14]. Crude fat was determined by continuous extraction in a Soxhlet apparatus for 8H using hexane as solvent [15].

The total carbohydrate is determined from the difference in the total materials of the other biochemical compounds according to the method [16].

The crude fiber contents were determined according to the method [17]. The energy value was determined with the coefficients of [18]. The millet seed process was used to measure the volume of bread. This consisted in determining the volume of the bread using its weight and the density of millet seeds.

2.2.4. STATISTICAL ANALYSES

The results obtained were the subject of analysis of variance (ANOVA) with the STATISTICA 7.1 software. In case of significant difference between the parameters studied, the homogeneity test was done according to the Duncan test. The significance level is $\alpha = 0.05$.

3. RESULTS

3.1. RESULTS OF THE SURVEY IN SOME BAKERIES IN ABIDJAN

In the municipalities of Adjamé, Yopougon, Abobo, Port-Bouet, Koumassi and Attécoubé, bakeries do not produce bread with wheat bran, corn and soy at the same time. They all produce 100% wheat breads. In the commune of Treichville and the plateau, 30% of bakeries produce corn bread and 100% wheat bread. In Marcory, 30% of bakeries produce wheat bran bread and 100% wheat bread. However, in Cocody 30% of bakeries in Cocody produce both wheat bran bread, soy corn and 100% wheat bread (Table 1).

Table 1. Percentage of bakeries for different municipalities

Types of breads / Common	Sound (%)	Maize (%)	Soybeans (%)	100% Wheat (%)
Adjamé	0	0	0	100
Treichville	0	30	0	100
Plateau	0	30	0	100
Cocody	30	30	30	100
Marcory	30	0	0	100
Yopougon	0	0	0	100
Abobo	0	0	0	100
Port-Bouet	0	0	0	100
Koumassi	0	0	0	100
Attécoubé	0	0	0	100

3.2. MEASUREMENTS OF THE VOLUMES OF THE DIFFERENT LOAVES

All breads namely bran bread, corn bread have the same volume as 100% wheat bread which is 1056.33 cm3, except soy bread which has a lower volume (704.22 cm3). The different measurement of the calculated volumes are listed in the following Table 2:

Table 2. Measurements of the volumes of the different breads

Type of breads	Volume of bread measured cm3
Wheat Bran	1056,33=4605b
Maize	1056,33=52,24b
Soybeans	704,22=36,13a
100% Wheat (%)	1056,33=49,29b

In columns, numbers with the same letter do not differ significantly (test by Duncan, p = 0.05) n=3.

3.3. NUTRITIONAL COMPOSITION OF DIFFERENT BREADS

The results of the comparison of the nutritional composition of the different breads are presented in (Table 3). This table shows the water, dry matter, ash, fat, protein, fiber, carbohydrate and the energy value content of the different breads in the municipalities of Abidjan. The statistical tests carried out indicate a significant difference in the water, dry matter, ash, fat, protein, fiber and carbohydrate content of the four different breads (P <.0,05). The moisture content is 36.42± 1.18% for bran bread and 37.22± 1.35% for corn bread, 32.36± 0.60% for 100% wheat bread and 33.08± 0.81% for soy bread. The water contents in bran and corn bread did not differ between them but differed significantly in 100 % wheat and soy breads. The dry matter rate are 67.6 4 ± 4.13% for 100% wheat bread, 62.78± 5.43% for corn bread, 63.58± 4.8% for wheat bran bread and 66.92± 6.47% for soy bread. The protein rates are 4.43 ± 0.44% for 100% wheat bread and 4.47± 0.22% for bran bread; 5.52 ± 0.31% for corn bread and 6.13± 0.47% for soy bread. The protein content in 100% wheat bread does not differ significantly fr om that of bran bread. However, these two contents are statically different from that of corn and soy bread. As for the fiber levels, the amount contained in corn bread and that contained in bran bread are identical but differ significantly from those contained in bread 100 % wheat and soy bread. The average fiber content value is 14.31 ± 0.25% for 100% wheat bread, 8.32 ± 0.27% for corn bread, 8.38± 0.31% for bran bread and 7.39 ± 0.51 for soy. The ash levels differ significantly for the 4 different breads. The average ash value is 1.44 ± 0.00% for 100% wheat bread, 2.12 ±0.03% for corn bread, 1.92± 0.03% for bran bread and 1.75± 0.06% of soy bread. Fat and carbohydrate levels also differ significantly. The average fat value is 4.53 ± 0.40% for 100% wheat bread, 3.69 ± 0.25% for corn bread, 0.82 ± 0.08% for bran bread, and 8.32± 0.33% for soy bread. The average carbohydrate value is 55.74 ± 0.88% in all wheat bread, 51.77 ± 0.77% in corn bread, 54.06± 1.18% in bran bread and 48.56± 0.50% in soy bread. The energy values are also between 293.64 kcal to 241.50 kcal. The results of biochemical analyses show that soy breads, have a high energy content (greater than 100 kcal / 100 g of bread).

Table 3. Variation in biochemical analysis of 100% wheat breads and composite breads (corn, bran and soybeans)

Measured Variable	100% Wheat Breads	Corn Breads	Breads To The Sound	Soy Breads
TE (%)	32,36 ± 0,60b	37,22 ± 1,35a	36,42 ± 1,18a	33,08 ± 0,81b
Dry matter (%)	67,64 ± 4,13b	62,78 ± 5,43a	63,58 ± 4,48a	66,92 ± 6,47b
Fat (%)	4,53 ± 0,40b	3,69 ± 0,25c	0,82 ± 0,08d	8,32 ± 0,33a
Ash (%)	1,44 ± 0,00d	2,12 ± 0,03a	1,92 ±0,03b	1,75 ± 0,06c
Protein (%)	4,43 ± 0,44b	5,52 ± 0,31a	4,47 ± 0,22b	6,13 ± 0,47a
Fiber (%)	8,32 ± 0,28a a	8,32 ± 0,27b c	14,31 ± 0,31b b	7,39 ± 0,51c d
Carbohydrate (%)	55,74 ± 0,88	51,77 ± 0,77	54,06 ± 1,18	48,56 ± 0,50
Energy Value (Kcal/100g)	281,45 ± 32,08b	262,61± 33,42c	241,50 ± 30,80d	293,64±34,77a

4. DISCUSSION

The results of the survey showed that in the communes of Adjamé, Yopougon, Abobo, Port-Bouet, Koumassi and Attécoubé, bakeries do not produce bran, corn and soy bread at the same time. They produce 100% wheat bread. This can be explained by the fact that people do not like these types of breads. In addition, some bakers claimed that the customer base for these compound breads was very limited. Still others mentioned the quality aspect of bread. According to them, bread made from 100% wheat is highly appreciated by consumers, rather than breads made from corn, soy and bran, because of the organoleptic and even nutritional characteristics. Indeed, wheat bread would be very nutritious and very soft on the palate unlike other breads. This hypothesis is supported by that of [19]. Some employees mentioned the fact that most bakers are French, Egyptian and Lebanese preferring the use of wheat over local products. They would like to sell their product (wheat flour) to the detriment of our local products (cassava flour, corn, soy etc.). In addition, the cost of these compound breads generally not being the same and most often high could be the cause of their disappearance on the market. In other municipalities such as Treichville and Plateau, in addition to 100% wheat bread, 30% of bakeries produce corn bread while in Marcory 30% of bakeries produce bran bread. However, in the commune of Cocody, 30% of bakeries produce both bran, corn and soy bread. The people of this commune like to consume corn, bran and soy bread in addition to 100% wheat bread. Thus, the chefs of these bakeries allow the production of these types of breads in order to increase their clientele. This practice is approved by the survey report conducted by [20]. In terms of the morphology of the loaves studied, it should be remembered that all the loaves were purchased in different places. All breads namely bran bread, corn bread have the same volume as 100% wheat bread which is 1056.33 cm3, except soy bread which has a lower volume (704.22 cm3). This difference in volume can be explained by the fact that there are protein activities of gluten. Indeed, wheat flour contains a large amount of gluten unlike other baking flours. In

addition, the identical volume of corn and bran breads can be explained by the amount of wheat flour incorporated. For example, in our survey, bakers incorporated 15% for bran and corn breads against 20% for soy bean flour. The differences in volumes can also be explained by quantity baker's yeast us ed for each type of bread. In fat, yeast makes it possible to inflate the bread by producing carbon dioxide inside the dough. This gas in trying to get out swells the bread and gives it a good volume. During this study we evaluated the nutritional value of corn bread, bran bread and soy bread and that of control bread namely 100% wheat bread. The lowest protein content is given by bran bread (4.47%) followed by corn bread with 5.52% protein and soy bread which has the highest value (6.13%). These three types of bread all have a higher protein rate higher than that of 100% wheat bread and the values found by [21] (3.2% of bran bread, 4.01% of corn and 5.1% of soy bread). This could be explained by the fact that the varieties of corn and soy used are significant sour ces of protein, the breads having undergone the same treatments.

The highest dry matter content is obtained with the soy bread (66.92%) which is significantly identical ($p > 0.05$) to that of bread control bread (67.64%). The bran and corn breads contain less dry matter compared to the other two breads namely 63.68% and 62.78% respectively. Conversely, the first two breads mentioned contain less water compared to the other two breads. This is explained by the type of starch that each bread contains. Indeed, the type of starch, depending on its amylose and / or amylopectin composition, can influence the water content of the flour and therefore the bread that comes from it. These moistures are between 32.36% for 100% wheat bread and 37.22% for corn bread, therefore less than 48%, the threshold for having a good bread [22]. Indeed, the water content is a very important parameter for the preservation of breads. Too high a water content in bread promotes the development of microorganisms and negatively influences its preservation. The fat content of soy bread (8.32%) is almost double that of wheat bread which is 4.53%. This significant difference can be explained by the fact that soy is a protein crop, therefore a real source of fat. This content attests to that found by [23] in soy bread (8.52%). Corn bread and wheat bran bread have 3.69% and 0.82% fat respectively. The low-fat level in corn-based bread is because corn is a grain. Regarding bran bread, the low oil content can be justified by the fact that bran is a material generally devoid of lipid. The carbohydrate contents of corn bread and wheat bran bread are respectively 51.77% and 54.06% then are close to that of the control bread which is 100% wheat bread. The lowest carbohydrate content is provided by soy bread namely 48.56%. This difference in carbohydrate levels could be due to the higher starch content in wheat, corn and wheat bran than in soy. The ash content of breads varies from 1.75% (soy bread) to 2.12% (corn bread) and are all higher than the content of wheat bread (1.44). These levels are close to those obtained by [24] which is 1.67%. However, they are significantly lower than the values reported by [25] which are 2.2% for soy bread and 3.2% (corn bread). The fiber levels of the breads analyzed are between 7.39% to 14.31%. The highest value is obtained with bread followed by 100% wheat bread (9.31%) and corn bread (8.32%). Soy bread has the lowest fiber content.

The carbohydrate contents of the 100% bread obtained are relatively identical to those obtained by [26]; Ahmed et al, (2010) who are (55.5%). The energy values are also between 293.64 kcal to 241.50 kcal. The results of biochemical analyzes show that so y breads, have a high energy content (greater than 100 kcal / 100 g of bread). These breads can be recommended for the diet of the sick people

5. CONCLUSION

The main objective of this study was to assess the nutritional quality of breads produced in some bakeries in the communes of Abidjan. It appears that most of the breads produced in the city of Abidjan are made from wheat flour with interesting nutritional and technological peculiarities. Comparison of biochemical analyses of corn, wheat bran and soy breads with 100% wheat bread revealed that these four types of breads are similar. Soy breads are identical to all wheat breads with respect to protein and dry matter content. However, soy bread which is high in energy value, carbohydrate, protein and low in ash, has more nutritional benefits compared to others that are not to be eliminated. Thus, it is recommended to incorporate wheat flour with those of local cereals and oilseeds in Bread making.

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