Technical Sheet of Cookies Prepared from Flour of Wheat, Corn and Cashew

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Abstract

Most of the biscuits sold in the shops are made mainly from wheat and several other inputs of Western origin. Biscuits sold in supermarkets are thus expensive products for ordinary consumers in developing countries. Incorporating local products that are more accessible could help reduce the cost of producing these biscuits. The objective of this work was to produce biscuits from wheat, but mostly from cashew and maize, of which Côte d'Ivoire is the world's largest producer. For this, cashew meal and maize were produced and then incorporated into wheat flour, and each of these flours was brought to precise proportions to make different formulations. To these formulated flours were added ingredients (sugar, sunflower oil, water, yeast, bicarbonate, vanilla sugar) and the resulting paste was kneaded for 10 minutes and then baked at 180 ° C for 20 min. The various biscuits obtained were submitted to a panel of consumers who appreciated their textures, colors and tastes. The biochemical characterization of these biscuits has also shown that they have good levels of ash, total carbohydrates, proteins, fibers and energy with values between 1.99 and 2.85% respectively; 59.58 and 79.03%; 9.62 and 14.74%; 4.86 and 6.23%; 451.17 and 499.83 Kcal. These biscuits also have a satisfactory microbiological quality because they have non-significant levels of germs, without the presence of salmonella.

Keywords - *Biscuits, Cashew, Organoleptic characteristics*

I. INTRODUCTION

Ivorian production of raw cashew nutsincreasedfrom 450,000 tons in 2012 to 531,488 tons in 2013 and 607,300 tons in 2016 ([1], [2]). Due to the exponentialgrowth in its production, Côte d'Ivoire isranked 2nd world producer of cashew afterIndia (671,000 tonnes) and 1stexporter of inshell cashew nuts. Despiteitshonourable position as a producer country, Côte d'Ivoire exports almost all of its production (95%) mainly to Asian countries. Inorder to make Côte d'Ivoire as much a consumer as a cashew nutproducer, several consumer by-products,

particularly biscuits with cashew incorporated, need to bedeveloped. The objective of thisstudywas to produce biscuits made frommaize, wheat and cashew, whichwillbe accessible and likely to effectively combat foodinsecurityamongIvorian populations, especiallythose on lowincomes.

II. MATERIAL AND METHODS

A. BIOLOGICAL MATERIAL

Cashew (*Anacardium occidentale L.*), maize (*Zéamays*) and wheat (*Triticumturgidum*) are the biologicalmaterialsused to prepare the biscuits. Almonds (cashew) and grains (maize and wheat) weregroundintoflour, respectively.

B. METHODS

1) FLOURS USED

- Cashew flour

The cashew kernels were removed from the nuts and crushed using a blender to make cashew flour (CF) (Photo 1).

- Corn flour

The corn kernels weredestoned from the cob and then ground with a blender to make corn flour (FM) (Photo 2).

- Wheatflour

Type 45 wheatflour (FB) waspurchasedfrom a supermarket in the square and used as itwas (Photo 3).

2) FLOUR FORMULATION

A total of 500 g of flourcomposedeitherfrommaize and cashew flour (FMC0, FMC20, FMC25, FMC30) or fromwheat and cashew flour(FBC0, FBC20, FBC25, FBC30) in the proportions indicated in

TableI.Forexample,theFMC20formulatedflourconsisted of 400 g of corn flour (80%)+100 g of cashew flour (20%) to which theotheringredients(sugar, oil, water, etc.)wereaddedbefore cooking.



Photo 1: Fromnuts to cashew flour ; (a) : Cashew nuts ; b: Cashew kernel ; c: Cashew flour (CF)



(a)(b)

Photo 2: From grains to corn flour ; (a) : Corn grains; (b): Corn flour (FM)



Photo 3: Wheatflour (FB)(a) Purchased from the supermarket (b) Transferred to a container

Formulatedflours	Wheatflour (%)	Corn flour (%)	Cashew flour (%)
FMC0	-	100	0
FMC20	-	80	20
FMC25	-	75	25
FMC30	-	70	30
BCF0	100	-	0
BCF20	80	-	20
BCF25	75	-	25
BCF30	70	-	30

Table I : Flour formulations for the preparation of biscuits

3) COOKIE MAKING

Figure 1 shows the differentsteps to follow whenpreparing cookies. From the various simple flours (FM, FC, FB), formulatedflours have been formed (FMC0, FMC20, FMC25, FMC30, FBC0, FBC20, FBC25, FBC30). Ingredients (sugar,

sunfloweroil, water, yeast, bicarbonate, vanillasugar) wereadded to the formulatedflours (*Step 1*) and thenground in a mixer for 10 minutes (*Step 2*). The resulting paste wasshaped (*Step 3*), baked in the oven at 180° C for 20 min and thenleft to cool for 30 min (*Step 4*).





4) ORGANOLOPTIC, BIOCHEMICAL AND MICROBIOLOGICAL CHARACTERISTICS OF BISCUITS

To verifytheiracceptability, the biscuits obtained have undergoneorganoleptic, biochemical and

microbiological tests. All these tests werecarried out using standard methods. **Organolepticcharacteristics** The organolepticcharacteristics (texture, colour, aroma, taste, acceptability) weredeterminedusing the AFNOR method [3].

Biochemicalcharacteristics

Ash and fibre weredetermined according to the methoddescribed by [4]; total carbohydrates by difference according to the following formula: GT (%) = 100% - (% Moisture + % Ash + % Fat + % Fat + % Protein); proteins by the Kjeldahl method[5] and the energy value according to the Atwater and Rosa coefficient [6].

Microbiologicalcharacteristics

Total coliforms, Salmonella, mesophilicaerobicgerms (GAM), Escherichia, sulfite-reducinganaerobicgerms, Staphylococcus aureus, yeasts and moldsweredetermined by [7] and [8] methods.

5) STATISTICAL ANALYSES

The results are processed from the statistica software version 7.1 using the ANOVA analysis of variance method. The averages that a a significant difference we recompared to each other by the DUNCAN test, at the 5% significance level.

III. RESULTS AND DISCUSSION

A. ORGANOLEPTIC CHARACTERISTICS OF BISCUITS

The various biscuits obtained (Photo 4, Photo 5) weresubmitted to a panel of trained tasters. The panelists all appreciated the texture, colour, aroma, taste and satisfaction of these cookies (Figure 2, Figure 3).



Photo 4: Wheat and cashewbiscuit





Photo 5: Corn and cashewbiscuit Figure 3: Sensory profile of biscuitbased on corn and cashew

B. BIOCHEMICAL CHARACTERISTICS OF BISCUITS

These biscuits have a good biochemical composition withash and total carbohydrate contents of between

1.99 and 2.85 g/100g, 59.58 and 79.03 g/100g respectively, due in particular to the mineral content of cashew and the high amount of carbohydrates in wheat and maize (80 g per 100 g wheat, 75 g per 100 g maize) (Table II). Also, these biscuits are real

sources of energywith451.17 to 499.83 Kcal/100g. These biscuits couldthereforeberecommended for childrenwhoneedthis type of food (energy and mineral-rich) for harmoniousgrowth[9]. Theycould also be beneficial for people with diabetes, thanks to their high fibre content (4.86 to 6.23 g/100g), which could help control postprandial glucose levels after consuming these cookies [10].

$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	Product biscuits	Ashes (%)	Total carbohydrates (%)	Proteins (%)	Fibres (%)	Energy value (Kcal)
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	BMC0	1,99 ± 0,31 ^a	$73,49 \pm 0,56$ ^d	$10,12 \pm 0,75a$	$5,51 \pm 0,15a$	$451,17 \pm 1,23a$
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	BMC20	$2,29 \pm 0,15$ ^b	$62,88 \pm 1,52$ °	$12,86 \pm 0,01b$	$6,22 \pm 0,60b$	490,31 ± 1,08 ^b
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	BMC25	$2,61 \pm 0,14^{c}$	62,23 ± 1,79 ^b	$13,30 \pm 0,55c$	$6,22 \pm 1,22b$	$491,35 \pm 0,14$ °
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	BMC30	$2,81 \pm 0,04^{d}$	$59,58 \pm 0,25$ ^a	$14,74 \pm 0,01$ ^d	6,23±0,10 ^b	$497,38 \pm 1,06$ ^d
BBC20 $2,66 \pm 0,42$ b $70,61 \pm 1,78$ c $12,06\pm 1,75$ $5,97 \pm 0,87b$ $486,58 \pm 0,11$ b BBC25 2.72 ± 0.42 bc $68,51 \pm 0,23$ $12,67 \pm 0,23$ $6,10\pm 1,59c$ $494,03 \pm 0,95$ c BBC30 $2,85 \pm 0,48$ c $66,70 \pm 0,22$ $13,28 \pm 1,01$ $6,04\pm 1,61c$ $499,83 \pm 0,78$ d	BBC0	$2,01 \pm 0,28$ ^a	79,03 ± 1,49 ^d	$09,62 \pm 1,75^{a}$	$4,86 \pm 0,20a$	$456,75 \pm 1,05$ ^a
BBC25 2.72 ± 0.42^{bc} $68,51 \pm 0,23^{b}$ $12,67 \pm 0,23^{c}$ $6,10 \pm 1,59c$ $494,03 \pm 0,95^{c}$ BBC30 $2,85 \pm 0,48^{c}$ $66,70 \pm 0,22^{a}$ $13,28 \pm 1,01^{d}$ $6,04 \pm 1,61c$ $499,83 \pm 0,78^{d}$	BBC20	2,66 ± 0,42 ^b	$70,61 \pm 1,78$ ^c	12,06±1,75 ^b	$5,97 \pm 0,87b$	$486,58 \pm 0,11$ ^b
BBC30 $2,85 \pm 0,48$ ° $66,70 \pm 0,22$ ° $13,28 \pm 1,01$ ° $6,04 \pm 1,61c$ $499,83 \pm 0,78$ °	BBC25	2.72 ± 0.42 bc	68,51 ± 0,23 ^в	$12,67 \pm 0,23$ °	$6,10\pm 1,59c$	$494,03 \pm 0,95$ °
	BBC30	$2,85 \pm 0,48$ °	66,70 ± 0,22 ^a	$13,28 \pm 1,01$ ^d	6,04±1,61c	$499,83 \pm 0,78$ ^d

Table 2: Biochemical composition of biscuits

The values are the means \pm standard deviations of threemeasurements (n = 3). The sameletter in the same line indicatesthatthere is no significant difference at the 5% threshold between the samples for the parameter concerned.

C. MICROBIOLOGICAL CHARACTERISTICS OF BISCUITS

The biscuits have insignificant contents of all germs (Mesophilicaerobicgerms, Total Coliforms,

Thermo-tolerantColiforms, Yeasts and Molds, Eschericia Coli, Staphylococcus aureus, SulphitoreducingAnaerobes) and do not contain salmonella (Table 2). This shows thatthey have a satisfactorymicrobiological quality and are therefore not dangerous for the health of the consumer

FLOURS (UFC/g)	GAM	TC	TTC	YeastM oulds	Salm.	E. coli	Staphylo. aureus	Anaerob. Sulfito-red.
BMC0	3,3 10 ³	< 1	< 1	< 10	-	< 1	< 1	< 1
BMC20	1,5 10 ³	$1,1^{101}$	< 1	< 10	-	< 1	< 1	< 1
BMC25	3,3 10 ³	$2,4^{101}$	< 1	< 10	-	< 1	< 1	< 1
BMC30	1,3 10 ³	< 1	< 1	< 10	-	< 1	< 1	< 1
BBC0	$1,2\ 10^{3}$	< 1	< 1	< 10	-	< 1	< 1	< 1
BBC20	$2 \ 10^{2}$	$3,4^{101}$	< 1	< 10	-	< 1	< 1	< 1
BBC25	1,1 10 ³	< 1	< 1	< 10	-	< 1	< 1	< 1
BBC30	3 10 ³	$2,3^{101}$	< 1	< 10	-	< 1	< 1	< 1
Standards	< 10 5	< 10 2	< 10 2	< 10 3	-	< 10	< 100	< 10
Quality o				Sat	isfactory			

Table 2: Germsdetermined in biscuits

GAM: Mesophilicaerobicgerms: CT: Total Coliforms; CTT: Thermo-tolerantcoliforms; Salm. : *Salmonella* ; E. Coli: *Escherichia coli*; Staphylo. aureus: *Staphylococcus aureus*; Anaerobicsulphito-red: Anaerobicsulphito-reducing; Quality g.: overallquality, (-): absence

IV. CONCLUSION

Cashew-incorporated cookies have a significantsensory profile for children and diabetics. Theyalso have a good nutritional composition and a satisfactorymicrobiologicalquality. The popularization of suchproductscouldfamiliarizeIvorian populations with the regularconsumption of cashew trees, of which they are major producers.

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