

EFFECT OF WALNUT FLOUR ON THE NUTRITIONAL AND AMINO ACID PROFILE OF BISCUITS

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Abstract

Biscuits are ready to eat, convenient and inexpensive food product, containing digestive and dietary content of vital importance and made mostly from wheat flour. Overdependence on wheat flour at the expense of some other flour needs to be reviewed. As a result, flour from walnut, an underutilized nut, was blended with wheat flour in the following proportions: A (2%:98%); B (4%:96%); C (6%:94%); D (8%:92%) and E (10%:90%), respectively. Plain whole wheat flour served as the control. The flour blends were mixed with other ingredients to produce biscuit and the samples were baked 180°C for 20-30 minutes. Biscuits were analysed for proximate composition, amino acid profile, and sensory evaluation using standard methods. The protein, moisture content, ash, crude-fat, crude-fibre and carbohydrate contents, respectively ranged thus: (9.27-14.28%), (4.35-6.05%), (2.13-2.54%), (13.5-16.81%), (0.62-1.16) and (60.37-69.05%), showing increase in nutrients of biscuit samples enriched with African walnut compared to the control sample. The amino acid profile showed an increase in the amount of leucine (6.65-7.29), tryptophan (1.36-1.68) and methionine (1.04-1.23) in the samples containing walnut compared to the control. Sensory evaluation showed that biscuit sample with 2% African walnut flour was better preferred and as a result, it can be concluded that inclusion of African Walnut flour into biscuit production improved the nutritional composition, amino acid profile and consumer acceptability of the product. It can equally improve the health status of consumers, their resistance to diseases and as well prevent malnutrition among people of all age groups.

Introduction

Biscuits are snacks that are produced from unpalatable dough, which when baked in an oven is transformed into an appetizing product (Onabanjo and Ighere, 2014). Biscuits are produced from the mixture of flour, water, baking powder and other optional ingredients such as eggs. This snack is enjoyed by children and adults. Biscuits are a rich source of fat and carbohydrate, hence are energy giving food and a good source of protein and minerals. Wheat (*Triticum* spp.) is an ancient grain and one of the leading cereal crops, and ranked third in the world. It is used in making flour for leavened flat and steamed bread, biscuit, cookies, cakes, breakfast cereal, pasta, noodles, couscous (Cauvain, 1998). It is a good source of protein, carbohydrates, minerals, B-group vitamins and dietary fiber. Grains refining leading to mineral and dietary fiber losses may have important consequences on diseases such as large bowel cancer, coronary artery disease, and diabetes (Shewry, 2007). As increased consumption of unrefined grains may reduce the risk of these diseases. The health promoting effects of whole wheat or whole wheat based products are mainly due to the presence of phytochemicals such as phenolic, carotenoids, lignans and vitamin E which accelerates health promoting events.

Walnuts are edible seeds, widely cultivated for their delicacy and are consumed as snacks and refreshments. The tropical African walnut, known as *Tetracarpidium conophorum* or *Plukenetia conophora* (Oyekale *et al.*, 2015), belongs to the family *Euphorbiaceae* (Edem *et al.*, 2009). The plant is popularly known as awusa or asala by the Yorubas, ukpa, or oke okpokirinya in Igbo and gawudi bairi by Hausas.

Among the Bini tribe of Edo State Nigeria, it is known as okhue or okwe among (Chijoke *et al.*, 2015; Kanu *et al.*, 2015). They are an excellent source of B-complex vitamins and vitamin E, rich source of minerals like manganese, copper, potassium, calcium, iron,

tesium, zinc, and selenium. Malnutrition is a major problem of most third world countries including Nigeria. This has contributed to infant mortality, poor physical and actual development in infants and some adults and low resistance to diseases. Enriching it flour with walnut flour will increase the nutritional level and may equally reduce cost. In this study was designed to produce biscuit from composite flour of whole wheat/walnut flours at different ratios and to evaluate the physicochemical, amino acid and sensory properties of biscuit samples.

Materials and Methods

Walnut was obtained at a farm at Ilesha, Ogun State, wheat flour and other ingredients needed for the biscuit production such as baking powder, sugar and egg were purchased at 'Oja Oba' market in Ilorin.

Biscuit production

Walnut flour was produced using previously described method [11]. Biscuit was produced using a modified method of Lucretia *et al.* (2016). Briefly, composite flours were mixed together and weighed. The flours were mixed with other ingredients and kneaded. The batter was cut into the desired shapes using moulds and the cut batter was baked at 180°C for 30 minutes. Biscuit samples were cooled, packaged and used immediately for further analysis.

Analysis

Proximate and amino acid composition

Proximate composition of the biscuit samples was evaluated using standard methods (AOAC, 1989), while the amino acid profile was determined using the method of Benitez, (1989). Fatting was done using the Soxhlet extraction apparatus using AOAC, (2006). Due to the fact that tryptophan is destroyed by 6N HCl during hydrolysis, it was determined separately.

Sensory evaluation

Sensory evaluation was carried out on the biscuit samples to determine consumer acceptability. The scores were based on the intensity of organoleptic quality attributes of taste, colour, aroma, and overall acceptability. Each sensory attribute was rated on a 9-point hedonic scale (1= disliked extremely while 9= liked extremely). Fifty (50) semi-trained panelists, selected from student of the Department of Home Economics and Food Science, University of Ilorin, Nigeria were used for the evaluation.

Statistical analysis

All data obtained from the analyses were subjected to one-way analysis of variance (ANOVA) with a probability level of $P > 0.05$ and differences separated using Duncan multiple test range (Duncan, 2001).

Results and Discussion

The proximate composition varied significantly ($P < 0.05$) among the biscuit samples (Table 1). Moisture content of the biscuit samples varied between the control and the treated samples. The value of moisture ranged from 4.35% to 5.76%. Sample F had the highest fat content of 16.81%, followed by sample E with 15.98%. However, Sample A (100% whole wheat flour) had the least fat content (14.19%). This could be due to the high percentage of oil present in walnut flour. According to Romoke (2009), oil from African walnut is an excellent source of omega 3 essential fatty acids, a special type of protective fat the body

cannot manufacture. The ash content of the biscuit samples ranged from 2.19% to 2.54% and increased with increasing levels of the walnut flour. The protein content ranged from 9.27% to 14.28% and similarly increased with increasing quantity of walnut flour. The control sample A had the least crude protein content (9.27%) while Sample F had the highest (14.28%). This confirmed earlier report that African walnut has a high protein content (Ndie *et al.*, 2010; Ekwe and Ihemeje, 2013). Significant differences ($p < 0.05$) were recorded among the samples for crude fibre (0.62%-1.16%). The carbohydrate content of the biscuit samples ranged from 60.37%-69.05%. Generally, carbohydrate content was decreasing with increasing quantity of the walnut flour.

Table 1: Proximate composition of biscuit samples (%)

Sample	Moisture	Crude fat	Ash	Crude protein	Crude fibre	Carbohydrate
A	5.75 ^b ±0.02	14.19 ^e ±0.03	2.3 ^d ±0.00	9.27 ^f ±0.04	0.62 ^b ±0.02	69.05 ^a ±0.01
B	5.22 ^c ±0.03	14.62 ^d ±0.02	2.19 ^d ±0.03	11.84 ^e ±0.04	0.87 ^f ±0.04	65.27 ^c ±0.03
C	4.37 ^d ±0.01	13.50 ^f ±0.03	2.45 ^b ±0.04	12.29 ^d ±0.11	1.05 ^e ±0.04	66.36 ^b ±0.19
D	5.76 ^b ±0.04	15.81 ^c ±0.28	2.34 ^c ±0.04	12.67 ^c ±0.57	0.96 ^e ±0.04	62.42 ^d ±0.13
E	6.05 ^a ±0.04	15.98 ^b ±0.04	2.51 ^{ab} ±0.03	13.99 ^b ±0.04	1.12 ^b ±0.02	60.37 ^f ±0.00
F	4.35 ^d ±0.00	16.81 ^a ±0.02	2.54 ^a ±0.03	14.28 ^a ±0.02	1.16 ^d ±0.01	60.87 ^e ±0.00

Values are means of duplicate readings (mean ± standard deviation). Within each column, values with different subscript differ significantly (< 0.05).

A-100% Whole Wheat Flour

B- 98% Whole Wheat flour, 2% African walnut

C-96% Whole Wheat flour, 4% African walnut flour

D- 94% Whole Wheat flour, 6% African walnut

E- 92% Whole Wheat flour, 8% African walnut flour

F-90% Whole Wheat flour, 10% African

walnut flour

Amino acid composition

Amino acid profile of the biscuit samples is shown in Table 2. The outlined data revealed that the biscuit samples contained all the essential amino acids and are increasing in quantity with increasing content of walnut flour. This implies an improvement in the nutritive content of the biscuit samples. Leucine, followed by phenylalanine was the major amino acid present in the biscuit samples. Other amino acid were present in fairly good quantities.

Mean sensory scores of the biscuit samples showed that there was significant ($p < 0.05$) differences in appearance, hardness, aroma, taste, and overall acceptability (Table 3). The appearance and hardness of the biscuit samples were strongly influenced by the substitution level. Aroma scores were the same for all samples which signifies that the aroma of the biscuit sample were not affected by the substitution level. Taste is an important attribute in the acceptance of a food product. Among the biscuit samples, Sample A had the highest mean score while the enriched samples had low mean scores. Sample C was the least preferred in terms of aroma and appearance, while sample A was the most preferred in terms of aroma, taste, hardness and overall acceptability.

Table 2: Amino acid profile of biscuit samples

Sample	Leucine	Lysine	Isoleucine	Phenylalanine	Tryptophan	Valine	Methionine	Histidine	Threonine
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A	6.65	3.02	3.01	4.43	1.36	3.86	1.04	2.30	3.16
B	6.83	3.18	2.94	4.43	1.42	4.00	0.91	2.36	3.04
C	6.94	3.20	3.40	4.42	1.46	4.01	0.94	2.33	3.03
D	7.06	3.23	3.18	4.51	1.48	4.08	0.95	2.38	3.12
E	7.12	3.33	3.24	4.60	1.55	4.22	1.10	2.40	3.23
F	7.29	3.52	3.40	4.70	1.68	4.29	1.23	2.43	3.38

Values are means of duplicate readings (mean $\pm$ standard deviation). Within each column, values with different subscript differ significantly (<0.05).

B- 98% Whole Wheat flour, 2% African walnut

D- 94% Whole Wheat flour, 6% African walnut

F-90% Whole Wheat flour, 10% African

Sensory properties

walnut flour

flour E- 92% Whole Wheat flour, 8% African walnut flour

C-96% Whole Wheat flour, 4% African walnut flour

flour

A-100% Whole Wheat Flour

Table 3: Mean sensory scores of biscuit enriched with walnut flour

Sample	Aroma	Appearance	Taste	Hardness	Overall acceptability
A	6.98 ^a $\pm$ 1.44	6.68 ^{ab} $\pm$ 1.36	7.39 ^a $\pm$ 0.96	7.30 ^a $\pm$ 1.11	7.46 ^a $\pm$ 1.20
B	6.58 ^a $\pm$ 1.53	7.10 ^a $\pm$ 1.17	6.44 ^b $\pm$ 1.94	6.58 ^b $\pm$ 1.70	6.74 ^b $\pm$ 1.58
C	6.36 ^a $\pm$ 1.64	6.20 ^a $\pm$ 1.20	6.72 ^b $\pm$ 1.44	6.74 ^{ab} $\pm$ 1.72	6.84 ^b $\pm$ 1.32
D	6.55 ^a $\pm$ 1.47	7.02 ^a $\pm$ 1.24	6.16 ^b $\pm$ 1.58	6.69 ^{ab} $\pm$ 1.45	6.88 ^b $\pm$ 1.29
E	6.48 ^a $\pm$ 1.68	6.68 ^{ab} $\pm$ 1.33	6.50 ^b $\pm$ 1.69	6.78 ^{ab} $\pm$ 1.20	6.64 ^b $\pm$ 1.54
F	6.81 ^a $\pm$ 1.53	6.94 ^a $\pm$ 1.25	6.04 ^b $\pm$ 1.79	6.35 ^b $\pm$ 0.33	6.41 ^b $\pm$ 1.74

Values are means of duplicate readings (mean $\pm$ standard deviation). Within each column, values with different subscript differ significantly (<0.05).

A-100% Whole Wheat Flour

B- 98% Whole Wheat flour, 2% African walnut

D- 94% Whole Wheat flour, 6% African walnut

F-90% Whole Wheat flour, 10% African

flour E- 92% Whole Wheat flour, 8% African walnut flour

C-96% Whole Wheat flour, 4% African walnut flour

flour

walnut flour

Conclusion

The result obtained from the study has shown that supplementing whole wheat flour with walnut flour for biscuit production resulted in considerable improvement in the protein and fat content of the biscuit samples. The biscuit samples also indicated the presence of essential amino acids. The sensory evaluation showed that biscuit samples produced from whole wheat flour and African walnut flour could be acceptable by consumers.

References

- AOAC, (2012): *Official Methods of Analysis*. Association of Official Analytical Chemists. Washington; D.C. USA.
- Benitez, L. V. (1989). *Amino acid and Fatty acid profiles in aquaculture nutrition studies*. In S.S. De Silva (Ed.) *Fish nutrition Research in Asia: Proceedings of the Third Asian Fish Nutrition Network Meeting*. Pp. 23-25.
- Cauvain, S.P. (1998) *Improving the Control of Staling in Frozen Bakery Products*. *Trend in Food Science and Technology*, 9, 56-61.
- Chijoke, O.C., Anosike, C.A. and Ani, C.C., (2015), 'Studies on the phytochemical and nutritional properties of *Tetracarpidium conophorum* (black walnut) seeds', *Journal of Global Bioscience* 4(2), 1366-137.
- Dauda, A.O., Abiodun, O.A., Oyeyinka, S.A. and Arise, A.K., (2018). *Nutritional and consumers' acceptance of biscuit made from wheat flour fortified with partially defatted groundnut paste*. *LWT - Food Science and Technology* 90 (2018) 265-269.
- Duncan, M. (2001). *Biscuit, cracker and cookies recipes for the food industry*. Cornwall England: Woodhead publishing.
- Edem, C.A., Dosunmu, I.M. & Bassey F.I., 2009, 'Determination of proximate composition, ascorbic acid and heavy metal content of African walnut (*Tetracarpidium conophorum*)', *Pakistan Journal of Nutrition* 8, 225-226. <https://doi.org/10.3923/pjn.2009.225.226>
- Ekwe CC, Ihemeje A (2013). Evaluation of physiochemical properties and preservation of African walnut (*Tetracarpidium conophorum*). *Acad. Res. Int* 4(6): 501 - 512.
- Kanu, A.M., Kalu, J.E., Okorie, A.C., Olabinri, B.M., Eniyansoro, O.O., Okoronkwo, C.O. et al., 2015, 'Evaluation of chelating ability of aqueous extract of *Tetracarpidium conophorum* (African walnut) in vitro', *International Journal Applied Research in Natural Products* 3(3), 1-13.
- Lucretia I. Barber and Patience C. Obinna-Echem: *Nutrient composition, physical and sensory properties of Wheat-African walnut cookies*. *Sky Journal of Food Science* Vol. 5(4), pp. 024
- Ndie EC, Nnamani CV, Oselebe HO (2010). *Some physicochemical characteristics of defatted flours derive from African walnut (Tetracarpidium conoforum): an underutilized legume*, *Pak. J. Nutr.*, 9 (9): 909 - 911.
- Onabanjo, O.O., and Ighere, D.A., (2014). *Nutritional, functional and sensory properties of biscuit produced from wheat-sweet potato composite*. *Journal of Food Technology Research*, 1(2), 111-121.
- Oyekale, K.O., Odutayo, O.I., Esan, E.B., Ogunwemimo, K.O., Denton, O.A. and Bolaji, D.T., (2015), 'Comparative studies on phytochemical and proximate composition of four morphological distinct segment of the conophor seedlings (*Tetracarpidium conopphorum* Hutch and Dalziel)', *Brazilian Journal of Biological Sciences* 3, 91-100.
- Romoke WA (2009). *Nutritional value of walnut*, Daily trust September 18, 2009, Nigeria.
- Shewry, P.R., (2007). *Improving the protein content and composition of cereal grain*. *Journal of Cereal Science*, 46: 239-250.