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Proximate, Sensory Properties and Mineral Composition of cookies Produced from Composite Flours of Breadfruit (*Artocarpus altilis*) and Sesame Seeds (*Sesamum indicum*)

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Abstract

This study analyzed nutrient composition and sensory attributes of cookies produced from composite flour of breadfruits and sesame seeds. It is an experimental design. Breadfruit and sesame seeds were processed into four composite flours comprising of: BSC1 (90:10), BSC2 (80:20), BSC3 (70:30), BSC4 (60:40) of breadfruit and sesame seed respectively and BSC5 (100% breadfruit) and compared with the control (stored purchased cookies (BSC 0). A 20-man panel evaluated using the samples 9-point hedonic scale. Findings show that protein values ranges from (8.33 to 9.93), fat ranges from (13.88 to 15.71) and carbohydrate ranges from (65.41 to 68.41%). Mineral composition shows Zinc content ranges from (4.00mg/kg in BSC1 to 9.05mg/kg in BSC3), Iron content ranges from 7.80mg/kg in BSC1 to 11.45mg/kg in BSC3), Calcium content ranges from 0.045% in the control to 0.074% in BSC3. Results of the sensory attributes show significant differences across all parameters. Mean value for taste ranges from (5.00 in BSC3 to 8.31 in BSC 1); colour also ranges from (4.56 into BSC3 to 7.81 in the control) indicating that BSC3(70:30) yields cookies with enhanced protein and fat content and also peaked in mineral analysis but was least acceptable in sensory attributes. Alsop, BSC1 (90:10) significantly surpass both the commercial control and all other formulated samples in sensory attributes. This study shows that breadfruit-sesame cookies has increased nutrient than stored purchased cookies.

Keyword: Composite Flours, Breadfruit, Sesame Seeds, Cookies, Proximate Analysis.

Introduction

Cookies are traditional wheat-based products consumed all over the world and are the most desirable snacks for all age groups, ready to eat, convenient to prepare and known for their palatability and increased shelf life. They are high in fat and sugar but low in protein, fibre, vitamins and minerals. (Edima- Nyah et al 2023; Ogori et al. 2022) Cookies are often produced from wheat flour which is imported into Nigeria and thus expensive. It is necessary to reduce reliance on wheat by introducing composite flours based on locally available food.

Composite flour involves blending wheat flour with other non-wheat flours derived from locally available crops such as cereals, roots, tubers, legumes & oil seed (Olamiti et al, 2024). The use of composite flour reduced importation and improved nutritional quality of baked products, leverage underutilized crops, contributing to food scarcity and agriculture biodiversity.

Breadfruit (*Artocarpus altilis*) is a tropical fruit belonging to the Moraceae family and is widely consumed as a staple food in many developing countries due to its high carbohydrate content (Khairol Nadia et al 2024; Mehta et al 2023). Breadfruit (Artocarpus altilis) is an excellent source of complex carbohydrates, with moderate amounts of protein, dietary fibre and essential nutrients, including vitamin C, B-complex vitamins, minerals and essential amino acids, particularly leucine, isoleucine, and valine (Chukuma et al;2021; Mehta et al 2023,). *Artocarpus altilis* is prepared by boiling, roasting, or frying, and it may also be processed into flour for the production of various food products and it serves as a valuable substitute for root crops, a practice that has long been part of traditional diets in southwestern Nigeria. Breadfruit is called Ukwa in Igbo, Barafuta in Hausa while the Yoruba called it Gberebutu or Jaloke (Akuru et al 2025) Although both *Artocarpus altilis* and *Treculia africana* (Ukwa) are commonly known as breadfruit species, they differ considerably in their nutritional and economic importance. *Artocarpus altilis* is mainly valued for its carbohydrate-rich starchy fruit pulp that serves as an important source of energy whereas *Treculia africana* is primarily cultivated for its protein-rich edible seeds, which contribute substantially to dietary protein intake. In Nigeria, breadfruit (*Artocarpus altilis*) is predominantly grown and consumed in the southern states, particularly in the South-Western region. Its starchy fruit pulp is utilized as a food source and is increasingly recognized for its potential contribution to sustainable food systems and improved food security, in contrast to *Treculia africana* (Ukwa), which is a traditional staple food among the Igbo population of South-Eastern Nigeria. (Ojimelukwe et al 2021; Mehta et al 2023). So this study focus on Artocarpus altilis and not on Treculia Africana Sesame seeds (*Sesamum indicum*) are nutrient-dense oilseeds rich in protein, healthy fats, and essential minerals such as iron, calcium, magnesium, and zinc. They are highly valued for their substantial oil content, as well as their contributions of carbohydrates, dietary fibre, and plant-based proteins, in addition, sesame seeds provide important micronutrients, including calcium and phosphorus (Wei et al 2022,). They also contain bioactive compounds such as lignans and polyphenols, which help neutralize free radicals and enhance the body's natural antioxidant defense system, thereby reducing the risk of chronic conditions such as hypertension, cancer, and other metabolic disorders (Wacal *et al*, 2019). Despite the industrial benefits of breadfruit and sesame seeds, limited studies have explored their combined use in composite flour formulation for cookies production. It is therefore necessary to explore the potential of using breadfruit and sesame flours in development of nutritious and acceptable cookies addressing its proximate, mineral composition and sensory properties.

Objective of the study

This study analyzed the nutrient composition and sensory attributes of cookies produced from composite flour of breadfruit and sesame seeds. Specifically, the study determined:

1. proximate composition of cookies produced from breadfruit and sesame seed.
2. mineral composition of cookies produced from composite flours of breadfruit and sesame.
3. sensory attributes of cookies made from breadfruit and sesame seeds.

Materials and Method

***Design of the Study*:** This study employed a laboratory-based experimental.

Procurement of Materials: Mature breadfruits (*Artocarpus altilis*) were purchased from Ijebu-Imushin market in Ijebu-Imushin, Ogun State, sesame seeds (*Sesamum indicum*) were obtained from Bodija Market, Ibadan, Oyo State, while sugar, margarine, salt, vanilla essence, eggs, and baking powder were purchased from Oke-Aje Market, Ijebu-Ode, Ogun State, Nigeria

Preparation of Materials: materials were processed into flours as follows.

Breadfruit Flour: The breadfruits were washed thoroughly, peeled, and sliced into small pieces before being dried in an oven at 105°C until adequately dehydrated. The dried slices were milled into flour, sieved to obtain a uniform particle size, and stored in airtight containers until required for cookie production.

Sesame seed Flour: Sesame seeds were sorted manually to remove stones and other foreign materials, washed, oven-dried, and roasted at 60°C for 30 minutes. The roasted seeds were milled using an electric blender to obtain flour, which was then stored in airtight containers pending use.

Formation of Composite Flour Ratio and Code: Breadfruit and sesame seed flours were
blended in the following five ratios of composite flour:

BSC0: Commercially purchased cookies made from wheat flour (Control)

BSC1: breadfruit flour and sesame seed flour (90:10)

BSC2: breadfruit flour and sesame seed flour (80 :20)

BSC3: breadfruit flour and sesame seed flour (70:30)

BSC4: breadfruit flour and sesame seed flour (60:40)

BSC5: 100% breadfruit flour (100:0)

Preparation of Cookies: Cookies were produced using the method described by Ishera et al. (2021) with slight modifications. Four composite flour blends (90:10, 80:20, 70:30, and 60:40 breadfruit-to-sesame ratios) together with 100% breadfruit flour were used to prepare cookie samples. The commercially purchased cookies served as the control.

Recipe for Cookies

Ingredients	**Measurements**
Composite flour	200g
Sugar	100g
Margarine	100g
Baking powder	2g
Salt	0.5g
Vanilla essence	5ml

Procedure for cookies production

- margarine were creamed together until a fluffy creamy mixture was achieved for the five samples (BSC1-BSC5).
- egg and vanilla were added to creamed mixture for five samples.
- dry ingredients (composite flour, baking powder, a pinch of salt) were

incorporated to wet mixture and mixed together until a smooth dough was formed.

- dough was transferred onto a baking sheet and rolled out evenly on a board using a rolling pin.
- rolled dough was cut into desired shapes using a cookie cutter and baked in the oven at a temperature of 200^0c for 15mins.
- The same procedures were repeated for each sample as described by (Ishera et al 2021).

Proximate Analysis: To determine the nutrient content, standard procedures of the Association of Official Analytical Chemists (AOAC, 2005), were used as follows:

Moisture: Drying method by oven-drying approximately 5g of homogenized sample at 105°C to constant weight.

Crude Protein: Kjeldahl method was used, following digestion, distillation and titration. Total nitrogen content was multiplied by a conversion factor of 6.25 to obtain crude protein values.

Crude Fat: Solvent extraction by the Soxhlet method was used, extracted lipids were recovered after solvent evaporation and expressed as percentage fat content.

Ash: incinerating a known weight of sample in a muffle furnace at 550°C until light grey ash was obtained.

Crude Fibre: Sequential acid and alkali digestion was used. The residue obtained was dried, incinerated, cooled in a desiccator, and weighed to estimate crude fibre content.

Carbohydrate: Calculated by difference as 100 minus the sum of moisture, protein, fat, ash and fiber. All assays were performed in duplicate and expressed as mean ± standard deviation.

Mineral Analysis: The concentrations of Iron, Magnesium, Zinc, and Calcium were determined using the Atomic Absorption Spectrophotometer method as described by international Institute of Tropical Agriculture (2002), The dry ash was reconstituted with 20ml of 6NHCl, heated, filtered into 100ml volumetric flask and made up to 100ml with deionized water. The supernatant was used in AAS to determine each microelement at set wavelength for detection (IITA 2002), while phosphorus was determined by the flame photometric method following AOAC (2005) procedures, the samples containing 25 (mu)L of aqueous phosphate solutions are placed in the atomizer with a micropipet. The atomizer dries the sample at 100^0C, then vaporizes the phosphorus compound at 2500^0C. The phosphorus vapor is swept into the flame and the HPO emission is measured. Intensity is directly proportional to phosphorus concentration. The analyses were performed in duplicate and the results expressed as mean ± standard deviation.

Sensory Evaluation: Sensory evaluation was conducted using 20 semi-trained panelists who were purposively selected from undergraduate and postgraduate students of Lead City University, Ibadan. Instrument for data collection was a 9-point hedonic scale, where 1 = dislike extremely and 9 = like extremely. The sensory attributes evaluated by included taste, colour, crunchiness, crispiness, and overall acceptability, Cookie samples coded BSC0–BSC5 were presented in random order to minimize bias. Drinking water was provided between sample evaluations to cleanse the palate.

***Data Analysis Techniques*:** Data obtained from proximate, mineral analysis and sensory evaluation were analyzed using mean, standard deviation and one-way Analysis of Variance (ANOVA). Where significant differences existed among the treatment means. Duncan's Multiple Range Test (DMRT) was employed for mean separation at a 5% level of significance ($p < 0.05$). Results were presented as mean ± standard deviation.

Results

Table 1 **Proximate Composition of Samples**

Sample	Ash	Fat	Fibre	Protein	Moisture	Dry Matter	Carbohydrate
Control	3.69	14.04	0.32	8.33	5.22	94.79	68.41
BSC1	3.47	13.88	0.58	8.73	5.85	94.16	67.51
BSC2	3.34	15.25	0.44	9.43	5.67	94.34	65.88
BSC3	3.25	15.49	0.35	9.93	5.47	94.54	65.52
BSC4	3.30	15.71	0.41	9.63	5.55	94.45	65.41
BSC5	3.40	14.13	0.50	8.93	5.77	94.23	67.29

Note: *BSC 1 =90% breadfruit and 10% sesame flour; BSC 2 =80% breadfruit and 20% sesame flour; BSC 3= 70% breadfruit and 30% sesame flour; BSC 4 =60% breadfruit and 40% sesame flour; BSC 5 =100% breadfruit and 0% sesame flour; Control = Store-bought cookies*

Table 1 shows the proximate composition of the cookie samples, including the breadfruit-sesame composite cookies (BSC1 to BSC5) and the control (BSC 0). The ash content ranged from 3.25% in BSC3 to 3.69% in the control. Crude fat was highest in BSC4 (15.71%) and lowest in BSC1 (13.88%). Crude protein content increased from 8.33% in the control to 9.93% in BSC3, reflecting the protein enrichment conferred by sesame flour, particularly at the 30% inclusion level.

Table 2: Mineral Composition of Samples

Sample	Fe	Zn	Ca	Mg	P
Control	8.20 ± 0.14^{b}	5.75 ± 0.21^{d}	0.045 ± 0.003^{a}	0.06 ± 0.002^{a}	0.141 ± 0.09^{b}
BSC1	7.80 ± 0.14^{a}	4.00 ± 0.57^{a}	0.062 ± 0.001^{d}	0.075 ± 0.002^{d}	0.137 ± 0.01^{a}
BSC2	9.50 ± 0.14^{c}	4.80 ± 0.14^{b}	0.055 ± 0.002^{b}	0.067 ± 0.002^{b}	0.154 ± 0.02^{c}
BSC3	11.45 ± 0.21^{f}	9.05 ± 0.43^{f}	0.074 ± 0.002^{f}	0.092 ± 0.001^{f}	0.18 ± 0.03^{f}
BSC4	10.7 ± 0.14^{e}	6.90 ± 0.57^{e}	0.067 ± 0.001^{e}	0.08 ± 0.002^{e}	0.171 ± 0.02^{e}
BSC5	10.05 ± 0.21^{d}	5.70 ± 0.14^{c}	0.058 ± 0.002^{c}	0.071 ± 0.003^{c}	0.163 ± 0.03^{d}

Values are means with duplicate samples determination ± SD (Standard Deviation) Note: BSC-0= Control/ Store-purchased cookies, BSC 1 =90% breadfruit and 10% sesame flour; BSC 2 =80% breadfruit and 20% sesame flour; BSC 3= 70% breadfruit and 30% sesame flour; BSC 4 =60% breadfruit and 40% sesame flour; BSC 5 =100% breadfruit and 0% sesame flour;

Table 2 shows the mineral composition of the formulated cookies and control, Calcium (Ca) content ranged between 0.045% and 0.074%, with BSC3 and BSC4 having the highest levels. Magnesium (Mg) levels increased with sesame flour inclusion, from 0.06% in the control to 0.092% in BSC3. Iron (Fe) content rose substantially with increasing sesame flour: from 7.80 mg/100g in BSC1 to 11.45 mg/100g in BSC3, compared to 8.20 mg/100g in the control.

Table 3: Sensory Attributes Scores of Samples Based on Duncan's Multiple Range Test (Mean ± SD)

Sample	Taste	Colour	Crunchiness	Crispiness	Overall Acceptability
Control	6.13±2.34^{b}	7.81 ± 0.91^{c}	7.94 ± 1.12^{c}	7.38 ± 1.09^{c}	7.33 ± 1.09^{c}
BSC 1	8.31±0.79^{d}	7.69 ± 1.58^{c}	7.88 ± 1.26^{c}	7.75 ± 1.29^{d}	7.89 ± 1.14^{d}
BSC 2	7.00±1.27^{c}	6.69 ± 1.25^{b}	6.69 ± 1.01^{b}	6.88 ± 0.96^{bc}	6.77 ± 1.01^{bc}
BSC 3	5.00±0.89^{a}	4.56 ± 1.32^{a}	5.25 ± 1.69^{a}	5.00 ± 1.63^{a}	4.85 ± 1.20^{a}
BSC 4	6.31±0.87^{b}	5.94 ± 1.00^{b}	6.19 ± 0.91^{b}	6.13 ± 1.03^{b}	6.14 ± 0.82^{b}
BSC 5	6.56±0.73^{b}	6.50 ± 0.73^{b}	6.50 ± 0.73^{b}	6.50 ± 0.82^{b}	6.54 ± 0.67^{b}

Values are means with duplicate samples determination ± SD (Standard Deviation) Note: BSC-0= Control/ Store-purchased cookies, BSC 1 =90% breadfruit and 10% sesame flour; BSC 2 =80% breadfruit and 20% sesame flour; BSC 3= 70% breadfruit and 30% sesame flour; BSC 4 =60% breadfruit and 40% sesame flour; BSC 5 =100% breadfruit and 0% sesame flour;

Table 3 shows the sensory evaluation results for the formulated cookies (BSC1–BSC5) and the control (BSC 0). The analysis was conducted using a one-way ANOVA followed by Duncan's multiple range test to identify significant differences ($p < .05$) among the samples across all sensory attributes. The values are reported as mean ± standard deviation, with superscript letters indicating statistically homogeneous groups. Taste scores revealed significant differences ($p < .001$) among the samples. BSC1 recorded the highest taste score (8.31 ± 0.79), significantly outperforming all other samples. BSC3 had the lowest score (5.00 ± 0.89) and was significantly less preferred compared to others. The control (6.13 ± 2.34) was rated lower than BSC1 and BSC2, but not significantly different from BSC4 and BSC5.The overall acceptability followed similar trends: BSC1 (7.89 ± 1.14) was rated significantly higher than all other samples, including the control (7.33 ± 1.09). BSC3 received the lowest overall score (4.85 ± 1.20), showing consistent sensory rejection.

Discussion

Result on proximate composition of cookies samples reveals that increasing the percentage of sesame flour inclusion had a measurable effect on fat and protein content. Notably, sample BSC3 (70:30) exhibited the highest crude protein and crude fat contents among all samples, even surpassing the control (BSC-0). This result aligns with prior studies indicating that sesame seeds are particularly rich in high-quality protein and unsaturated fatty acids (Oladeji et al 2026, Wei et al 2022). Ash and crude fibre contents also showed slight variations across samples, with fibre peaking in BSC 1 (90:10) and BSC5 (100:0) and declining progressively as sesame increases, this study mirrors (Adegunwa et al 2024, Ishera et al 2021) states that breadfruit has a high Crude fiber than wheat flour. The moisture content ranges between (5.22- 5.85%) which are within the acceptable limit of less than 10% for long term storage and also inhibit the survival and growth of microorganism in food (Bello et al 2020). Overall, the proximate data suggested that a modest inclusion of sesame flour in the range of 10% to 30%, meaningfully enriches the macronutrient profile of the cookies (lombor et al 2016). Mineral composition reveals that sesame flour enrichment significantly boosted the mineral content of the formulated cookies this align with the findings of Ugwuona et al,(2017). Iron content reached its peak in BSC 3, recording values approximately 40% higher than the control, a finding reflects sesame's naturally high iron content and its potential contribution to addressing iron-deficiency anaemia, which remains a significant public health concern globally. Zinc levels also peaked in BSC 3, a particularly important outcome given zinc's critical role in enzymatic activity, immune function, and growth, making these cookies beneficial for children and adolescents. The sensory evaluation of the cookies assessed five key attributes, namely taste, colour, crunchiness, crispiness, and overall acceptability, using a one-way ANOVA followed by Duncan's multiple range test. Significant differences were observed across all parameters, highlighting the considerable influence of flour composition on consumer perception. In terms of taste, BSC 1, formulated with 10% sesame and 90% breadfruit flour, received the highest score and was significantly preferred over all other samples, including the commercial control. This indicated that a low level of sesame inclusion enhances the flavour profile of breadfruit-based cookies(Oladeji et al 2026) without overwhelming its natural sensory characteristics, a finding that aligns with earlier research demonstrating improved flavour perception in cookies with sesame inclusion below 20% (Ogori et al 2022). A study by Ishera 2021 also states that the acceptability of the taste is due to the caramelization of free sugar in breadfruit during baking. Colour acceptability also followed a similar trend, with both the control and BSC 1 receiving the highest ratings. Texture-related attributes, particularly crunchiness and crispiness, were also highest in BSC 1 and the control. The ultimate synthesis of all sensory dimensions, overall acceptability, reflected a consistent pattern. The highest overall score was attributed to the sample with minimal sesame inclusion, indicating that this ratio achieved a harmonious balance between nutrition and sensory appeal. It was significantly preferred over both the control and the samples with higher sesame substitution. This echoes the findings of Bello et al 2020 which states that functional cookies containing 10–15% sesame flour were not only nutritionally superior but also enjoyed wider sensory acceptance among adolescent and adult panels The overall acceptability scores reflected these trends consistently, with BSC 1 achieving the highest rating and BSC 3 receiving the lowest, demonstrating that while higher sesame inclusion improves nutritional value, it simultaneously compromises the sensory qualities that drive consumer preference and dietary adoption.

Conclusion

The study established that breadfruit-sesame composite flour cookies hold considerable promise as functional snack products, offering enhanced protein, fat, and mineral content compared to conventional store-purchased alternatives. However, the findings also highlighted the critical tension between nutritional enrichment and sensory acceptability. BSC 1(90% breadfruit and 10% sesame cookies) is the most acceptable cookies. This study will promote locally available food crops, reduce reliance on wheat flour and support food security.

Recommendation

1. The cookies from this research could serve as nutrient-rich snacks for children, pregnant women, and low-income populations.
2. Teachers can conduct seminars or health talks highlighting the benefits of breadfruit and sesame cookies and demonstrate simple methods of preparing them.
3. Future studies should measure the glycemic response as this will help understand if they are suitable for diabetic individuals.

References

Association of Official Analytical Chemist (AOAC) (2005) Official Method of Analysis, 22nd Ed. Washington, D.C, USA

Adegunwa M.O, Ogungbesan B.O, Adekoya O.A, Akinloye E.E, Idowu O.D, Alamu O.E(2024): *Production and characterization of snacks utilizing composite flour from unripe plantain (Musa paradisiaca), breadfruit (Artocarpus altilis) and Cinnamon (Cinnamomum venum) foods* 13(6), 852

Akuru U.B, Odinga-Israel T.B, Nwachoko N, Chukwu C.N, Tetam J.G, Amechi, P.A.C and Ibiama B.G (2025) : *Optimizing breadfruit processing for nutritional, phytochemical and antioxidant properties: Enhancing food security in Nigeria. Annual Research & Review in Biology*, *40*(2), 1–12.

Bello,E.A, Akpan F.E ,& Ntukidem V (2020) *'Development and quality characteristics of cookies from sprouted sorghum, pigeon pea and orange fleshed sweet potato flour blends" European Journal of Nutrition & Food Safety, 12*(2), 30–39.

Chukwuma O.G, Eze J.I, & Nwosu J.N, (2021). *Development of nutrient-dense cookies from composite flours. International Journal of Food Studies, 10*(2), 119–128.\

Edima-Nyah A.P, Ntukidem V.E., Ekanem M.C, Ojimelukwe P.C & Nwabueze T.U (2023) "*Effect of processing and substitution levels of Ukwa (*Treculia africana*) on the anti-nutrient factors, in-vitro starch and protein digestibility and total essential amino-acid content of snack bars". Frontiers in Sustainable Food Systems, 6*, 1071821

International Institute of Tropical Agriculture IITA (2002) Method of mineral analysis, atomic absorption photometer

Ishera, L. R., Mahendran, T., & Roshana, M. R. (2021). Incorporating breadfruit flour to prepare high-quality cookies with health benefits. *Tropical Agricultural Research, 32*(1), 114–123.

Iombor T.T, Onah M.I, and Girgih A.T (2016). "*Evaluation of the Nutritional Quality and Consumer Acceptability of Wheat-Sesame (Triticum aestivum–Sesame indicum) Composite Bread Blends,"Journal of Nutrition Health & Food Science* 4(3) 1–7.

Mehta K A Quek Y.C.R; Henry C.J.(2023): *Breadfruit (Artocarpus altilis): Processing, nutritional quality, and food applications, Nutrition and Food Science Technology* . Volume 10

Khairol Nadia A.H; Russly A.R & Nur Hanan Z.A (2024) *"Development of breadfruit flour (Artocarpus altilis) with the addition of gelatine as a potential edible film" Food Research* 8 (3) 384 - 393

Ogori A.F., Amove J, and Okponya, O.J (2022): "*Physiochemical Properties of Composite Cookies Made from Unripe Plantain, Groundnut Flour and Sesame Seeds Influenced by Blend Variation," Journal of Food Science & Nutrition* 8 (147)

Ojimelukwe, P. C., & Ugwuona, F. U. (2021). *The traditional and medicinal use of African breadfruit (*Treculia africana *Decne): An underutilized ethnic food of the Ibo tribe of South East Nigeria. Journal of Ethnic Foods, 8*(21), 1–12

Oladeji B.S, Nwabuike O.F (2026), "*Functional properties and nutrient composition of composite flour from wheat and fermented sesame seed and baking cum sensory properties of its bread" Global Nexus Journal of Multidisciplinary Research, (GNJMR),* 1(2), 109-116

Olamiti G and Ramanshia S.E (2024): *Impact of Composite flour on Nutritional, Bioactive and*

Sensory characteristics of Pastry foods: A Review. Current Research in Nutrition Food Science J 12(3) 1018-1034

Ugwuona F, Uju E (2017) *"Effect of added sesame seed on quality characteristics of wheat bread" Journal of Home Economics* 24(2), 1-12

Wacal, C., Ogata, N., Basalirwa, D., Handa, T., Sasagawa, D., Acidri, R., Ishigaki, T., Kato, M., Masunaga, T., Yamamoto, S., & Nishihara, E (2019). *"Growth, seed yield, mineral nutrients and soil properties of sesame (Sesamum indicum L.) as influenced by biochar addition on upland fields converted from paddy. Agronomy"* 9(2) a, 55

Wei P, Zhao F, Wang Z, Wang Q, Chai X., Hou G., & Meng Q (2022)*"Sesame (Sesamum indicum L.): a comprehensive review of nutritional value, phytochemical composition, health benefits, development of food, and industrial applications". Nutrients*, 14(19) 4079.