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Proximate, In-Vitro Digestibility, Cooking Characteristics and Acceptability of Defatted Sesame Seeds Flour Enriched Whole Wheat Pasta

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ABSTRACT

Defatted sesame seed flour is an under-exploited by-product of sesame seeds oil extraction which is usually discarded. It has high dietary fibre, protein and minerals which could be harnessed for pasta production in developing countries. The objective of the study was to prepare pasta from whole wheat and defatted sesame seeds and to assess the proximate, in-vitro digestibility, acceptability, and cooking characteristics. Defatted sesame (*Sesamum indicum L.*) seed flour (DSS) was produced using n-hexane (1 litre:500 g). Pasta was made using whole wheat flour with partial replacement of defatted sesame seed flour at 0 (control), 5, 10, 15, and 20 %. Standard methods of analyses were used to assess the proximate, in-vitro digestibility, cooking characteristics, and acceptability of the pasta, and the results were subjected to analysis of variance (ANOVA). Higher content of protein, crude fibre, ash, and fat was observed with increased DSS substitution while the estimated glycaemic index and in-vitro protein digestibility ranged between 64.58 -70.69 and 67.69-80.06 %. The cooking characteristics were significantly ($p<0.05$) different. Sensory values indicated acceptability of up to 10 % substitution; above this, a decline in acceptability was observed. However, the acceptability of the pasta at DSS substitution of 5 % and control showed no significant difference. The consumption of pasta substituted with defatted sesame seeds can be considered a healthier option owing to the increase in the macronutrients, lower glycaemic index starch, and higher protein digestibility.

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INTRODUCTION

Pasta is produced and consumed all over the world, and it is one of the main components of the Mediterranean diet (IPO, 2024). It has a wide acceptance, ease of preparation, and in recent times it has been used as nutrients carrier. Its affordability, and versatility make it a significant part of diet in every household in Nigeria. Wheat is the major ingredient in pasta production (Ajiboye et al., 2024). Whole wheat flour has been reported to be a good source of fibre and phytochemical content, which has had positive effects in reducing type 2 diabetes exposure, cancer and some cardiovascular diseases. However, whole grain consumption is reported to be extremely lower than the recommended levels which stipulates half of all daily grains intake to be whole grain (Li et al., 2019; Olamiti and Ramashia, 2024). Hence the consumption of whole wheat flour has been advocated for and possible way of inclusion in diets (Morey et al., 2025).

Sesame is an extensively cultivated cash crop in Nigeria, and according to the National Bureau of Statistics report (NBS, 2021), it is presently the second largest agricultural export earner after cocoa. Sesame is an all-purpose nutrient underutilized crop with a characteristic desirable aromatic odour. It also confers other health benefits such as cholesterol-lowering abilities, anticancer and antioxidant properties on humans (Nouska, 2024). The whole seed protein is most desired for its oil, of which the extraction generates a nutrient dense defatted sesame cake as byproduct. The awareness of the utilization of the defatted sesame seed flour in food is still low as it is usually discarded or used as animal feed.

Also in recent times, enrichment of flour with various ingredients to improve pasta quality has been encouraged (Olorunsogo, 2023), and in our previous study (Ojo et al., 2024a), improved chemical properties, and functional attributes of defatted sesame seed flour substituted for whole wheat composite flours was reported and its use in pasta production was suggested. This prompts the application of these composite flours, which could result in further nutritional enhancement, sensory appeal and may positively influence the digestibility, thereby making it a healthier option for consumers.

Therefore, this study aims at assessing some quality parameters such as the proximate, in-vitro digestibility, cooking characteristics, and acceptability of defatted sesame seed flour substituted whole wheat flour. This could subsequently increase sesame seeds production, and its waste utilization thereby increasing the economic status of the local farmers, and at same time, saving the country's foreign exchange earnings.

MATERIALS and METHODS

Source of Materials

Whole wheat (Triticum durum) grains were obtained from the local Jos main market, Plateau State and the white variety of sesame (*Sesanum indicum*) seeds was purchased from the National Research Institute Badegi, Minna, Niger State, Nigeria, respectively. Processing and other analyses were carried out in the Food Processing Laboratory, Federal University of Technology Minna, Nigeria. Analytical grade chemicals used were purchased from a reputable agrochemical vendor in Ilorin, Kwara State Nigeria.

Preparation of whole wheat flour and defatted sesame seeds flour

The whole wheat grains extraneous matter, and adhering particles were removed by sorting, followed by wet cleaning, drying (50 °C, 5 h) in a conventional oven (Model: PE-4610, China) and milling using an attrition mill (Model R175A Locally Fabricated, Nigeria). This was made to pass through a 100 µm sieve to obtain the flour (WF). The flour was then packaged in a Ziplock bag and stored prior to usage.

The defatted sesame seeds (DSS) flour was produced by following Chinma et al. (2012) procedure. Essentially, 1.5 kg of sesame seeds were sorted, and all foreign and unwanted particles were removed, soaked (12 h) in clean tap water at ambient temperature, hand dehulled by rubbing between palms followed by removal of the coatings by floating in water. The dehulled seeds were water blanched at 100 °C for 5 min, drained, solar dried (DEHYTRAY™, USA) for 72 h finely milled using a blender (Kenwood model: BY-823, Japan) to have the full-fat sesame seed flour. In order to have the DSS, oil extraction from the full fat sesame seed flour was carried out by weighing 1 kg into a white muslin cloth, and two litres (2 l) of n-hexane was added, and the oil was extracted into an aluminium pan after it was made to stand for 12 hours. This process was repeated, and the mixture was allowed to stand for 6 hours, followed by decanting of the top layer, and air drying of the defatted sesame seed flour for 4 h to ensure complete evaporation of the solvent's odour. This was finely milled in a blender (Kenwood model: BY-823, Japan), sieved (100 µm), packaged (Ziplock bags) and stored at 10±2°C prior to use.

Production of Pasta from Whole Wheat and Defatted Sesame Seed Flour Blends

Whole wheat and defatted sesame seed flours were blended at ratio of 100:0 (WH), 95:5 (WHS1), 90:10 (WHS2), 85:15 (WHS3), and 80:20 (WHS4) and homogenized using a Kenwood Chef Mixer (A901, China). The WH (100% whole wheat flour) flour sample was the control. Pasta was produced by using 180 g of flour mixed with 0.30 g carbon methyl cellulose and water (32 ml) using the slightly altered protocol of Animashaun *et al.* (2017). Exactly 500 g each of the flour blends were fed into the mixing chamber of the laboratory cold extruder (A100: Model, locally fabricated, Nigeria) and uniformly mixed for 10 min after the addition of water. The individual pasta length was fixed to 5 cm at 35 mm die, and the samples were then dried at 50 °C in a hot air oven (Model: PE-4610, China) until a constant moisture content was attained. The dried and cooled pasta was subsequently packaged in polyethylene packs and stored at ambient temperature for further usage and analyses (Figure 1).

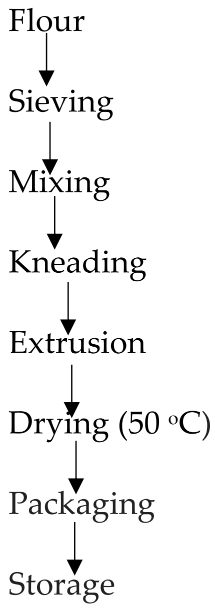

Figure 1. Flow diagram for the production of pasta samples

Determination of Proximate Properties

The pasta samples proximate properties, which include the moisture content, crude protein, crude fat, crude fibre and ash were assessed using the AOAC (2005) protocol. Basically, the oven-dry method was employed in the moisture content, while the micro-Kjeldahl technique with 6.25 nitrogen conversion factor was used to assess the crude protein content. For the crude fat, the Soxhlet extraction method using petroleum ether as solvent was employed. This was further digested with diluted acid and alkali to determine the crude fibre, while the ash content was analysed by incinerating at 600 °C for 5 h in a muffle furnace (BR17M-1, China). The difference (100 – the total of moisture, ash, fat, and protein) was used to compute the value of carbohydrate while energy was calculated using the Atwater factor;

$$E = (\text{Carbohydrate} \times 4) + (\text{Fat} \times 9) + (\text{Protein} \times 4) \quad (1)$$

E= Energy (Kcal)

In-vitro protein digestibility

The Hsu et al. (1977) multi-enzyme technique was adopted for the determination of the in-vitro protein digestibility, while the standard method of AACC (2000) and Goñi et al. (1997), with minor alterations was employed for the In-vitro starch digestibility determination. Succinctly, the digestion kinetics non-linear model was used to assess the rapidly digestible starch (RDS) and slowly digestible starch (SDS) following incubation for 30 and further for 120 minutes, respectively. The hydrolysis index (HI) was determined by the ratio of the area under the hydrolysis curve (AUC) of each sample to the AUC of glucose, which served as the reference food.

$$\text{Hydrolysis index} = \frac{\text{AUC of sample}}{\text{AUC of reference material}} \text{ x } 100 \qquad (2)$$

The expected glycaemic index (EGI) was computed using Equation 3 (Goñi et al., 1997).

$$\text{Estimated glycemic index } (\%) = 39.71 + 0.549\text{HI} \qquad (3)$$

Evaluation of The Cooking Characteristics of Pasta

To a 300 ml of boiling water, 10 g of pasta was added and allowed to cook, and at every 30 seconds pasta strands were taken out and squeezed on two transparent glass slides. The optimal cooking time (OCT) was determined as the time at which it is observed that the white core centre of the pasta has disappeared totally (AACC, 2000).

The pasta weight increase (WI) was determined by weighing the cooked pasta and the percentage increase in weight was obtained using equation (4). While for the cooking loss, the cooked pasta used for the determination of OCT was rinsed with 100 ml of cold water and allowed to drain for 30 s with the residual water used in the cooking was then poured into an aluminium vessel, and the water was evaporated off at 105 °C in an oven until constant weight was attained. The percentage weight of the residue to the starting material was reported as the cooking loss (AACC, 2000). Cooking loss was calculated using equation 5.

$$\text{WI } (\%) = \frac{Wp - Wo}{Wo} \times 100 \qquad (4)$$

$$\text{CL } (\%) = \frac{Do}{Wo} \times 100 \qquad (5)$$

Wp= Weight of cooked pasta

Wo=Weight of uncooked pasta

Do= Dried pasta residue after cooking

Evaluation of Sensory Properties

The method of Iwe (2005) was employed for the sensory attributes' determination. A 30 semi- trained panellist comprising students and staff of the Department of Food Science and Technology, Federal University of Technology, Minna, Niger State was used. The hedonic scale rating of 9 (like extremely) to 1(dislike extremely) was used to evaluate the appearance, flavour, glossiness, chewiness, and overall acceptability of the various pasta samples.

Statistical Analysis

Triplicate sample analyses were conducted and the data were analysed statistically using the statistical package for the Social Scientist SPSS (version 20.0). The means were determined using one-way analysis of variance (ANOVA) and Duncan multiple range test was used to separate the means at $p<0.05$ significance level.

RESULTS and DISCUSSION

Proximate properties of whole wheat-defatted sesame seeds flour-based pasta

The result of the proximate composition is as presented in Table 1. Largely, the proximate composition is enhanced by the addition of defatted sesame seed flour with crude protein, crude fibre, ash, and crude fat content ranging between 11.30–17.02 %, 2.55-7.04 %, 1.00–2.43 % and 5.45-7. 51 %. The control (WH) was the lowest and WHS4 having the optimum values, respectively. The addition of legumes in cereal-based products is one of the solutions to increase ash, fibre and protein quantity and quality (Naveed et al., 2024) and this is corroborated in the results of this study with 22.65- 50.62 % and 98 -176 % increase in protein and fibre respectively.

Fibre in food functions as a prebiotic, impacting the microbiota and acts as a defence against pathogens thereby enhancing the digestion ability of the host's organism (Melo *et al.,* 2021). Lower values for carbohydrate and energy at 55.29 to 68.35 %, and 361.40 - 383.68 Kcal respectively were however observed as the DSS flour substitution increased in the pasta.

Table 1. Proximate properties of whole wheat and defatted sesame seed flour- based pasta

Parameters	**Pasta s**amples				
(%)	**WH**	**WHS1**	**WHS2**	**WHS3**	**WHS4**
Moisture	7.35±0.01^{c}	9.55±0.05^{a}	7.10±0.10^{d}	7.40±0.10^{c}	8.51±0.01^{b}
Crude protein	11.30±0.10^{e}	13.86±0.10^{d}	15.07±0.50^{c}	16.11±0.00^{b}	17.02±0.00 ^{a}
Crude fibre	2.55±0.05^{e}	5.05±0.00^{d}	6.50±0.00^{c}	6.84±0.01^{b}	7.04±0.01^{a}
Ash	1.00±0.00^{d}	1.50±0.00^{c}	1.51±0.01^{c}	2.00±0.00^{b}	2.43±0.00^{a}
Crude Fat	5.45±0.05^{d}	5.70±0.10^{a}	6.51±0.01^{b}	7.10±0.10^{c}	7.51±0.01^{b}
Carbohydrate	68.35±0.10^{a}	60.31±0.05^{c}	60.31±0.02^{c}	57.81±0.01^{b}	55.29±0.01^{d}
Energy(Kcal)	383.68±0.01^{a}	364.22±0.00^{d}	372.07±0.02^{b}	370.54±0.02^{c}	361.40±0.00^{e}

Values are means ± standard deviation of triplicate determinations. Significant (p≥0.05) difference exists where means with different superscripts are indicated in the same row. WH=100 % wheat flour, WHS1 =95 % whole wheat flour and 5 % Defatted sesame seed flour. WHS2 =90 % whole wheat flour and 10 % Defatted sesame seed flour. WHS3 = 85 % whole wheat flour and 15 % defatted sesame seed flour. WHS4 =80 % whole wheat flour and 20 % Defatted sesame seed flour.

Increase in crude fibre content in the composite flour pasta could provide the FAO recommended 25 g of fibre per day (Animashaun et al., 2017) when consumed in substantial amounts. Fat content is of importance during storage as this could predispose the pasta samples to rancidity. However, Oyedepo and Evbuomwan (2024) reported resistance to rancidity of sesame seeds fats. Therefore, the increase in crude fat content in the composite flour pasta may not influence the quality during storage. Instead, the presence of fat could contribute to the pasta flavour and also facilitate extrusion process.

There was a decrease in carbohydrate content in the DSS substituted pastas and this contributed to the reduced energy density of the pasta. Nevertheless, the increased protein, crude fat, and fibre in these pasta samples could offer a more nutrient-dense, balanced and nutritionally advantageous product. The energy values are within the recommended range of 344 - 425 kcal/day (Al-Khamaiseh et al., 2024).

In-Vitro Protein and Starch Digestibility of Whole Wheat-Defatted Sesame Seed Flour-Based Pasta

The results of the in-vitro starch and protein digestibility are as presented in Table 2. The RDS, SDS, RS, and TS ranged from 31.59 % (WHS4) to 43.65 % (WH), 23.65 % (WHS4) to 30.17 % (WH), 1.99 % (WH) to 7.57 % (WHS4), and 62.80 (WHS4) to 75.79 % (WH) respectively. In addition, the HI, EGI and SD ranged between 41.87 to 58.90 %, 64.58 to 70.69 %, and 50.30 to 57.59 % with WHS4 having the least value and WH the highest value in these parameters.

The SDS and RDS have potential health benefit and the steady release of SDS has been linked to diabetes, cardiovascular diseases, and obesity management (Doan et al., 2025). Low RDS may also be of preference to diabetic patients. A higher amount of crude fibre in the DSS flour substituted pasta could have resulted in higher values of RS in these samples. Resistant starch is a distinct type of starch that can regulate postprandial blood glucose levels. RS resists enzymatic hydrolysis and remains intact through the small intestine and stomach reaching the large intestine intact (Doan et al., 2025). Low GI foods favourably affect the glucose metabolism and health status (Dodi et al., 2021) whereas, high GI foods when consumed for a prolonged period, predispose an individual to hyperglycaemia after meals and may result in increased occurrence of metabolic complications such as diabetes and cardiovascular disease (Chi et al., 2021). The HI and EGI decreased with an increase in DSS substitution, and the control having the highest values of 58.90 % and 72.06 % respectively The EGI decreased by 2.12 - 13.02 % in the defatted sesame seeds flour substituted pasta at 5-20%. Previous study by Yargholi et al. (2021) reported hypoglycaemic effects of sesame seed suggesting that the DSS substituted pasta can control the postprandial blood glucose spikes.

Table 2. In vitro starch and protein digestibility of defatted sesame seed enriched pasta

Parameters (%)	WH	WHS1	WHS2	WHS3	WHS4
RDS	43.65±0.01[a]	40.04±0.01[b]	37.52±0.01[c]	36.46±0.01[d]	31.59±0.02[e]
SDS	30.17±0.01[a]	28.48±0.06[b]	25.78±0.02[d]	26.08±0.03[c]	23.65±0.00[e]
RS	1.99±0.01[e]	3.32±0.01[d]	3.87±0.00[c]	5.66±0.04[b]	7.57±0.04[a]
TS	75.79±0.01[a]	71.82±0.06[b]	67.16±0.01[d]	68.20±0.05[c]	62.80±0.06[e]
HI	58.90±0.03[a]	56.14±0.01[b]	51.68±0.02[c]	47.61±0.01[d]	41.87±0.01[e]
EGI	72.06±0.01[a]	70.53±0.01[b]	68.08±0.01[c]	65.85±0.01[d]	62.68±0.01[e]
SD	57.59±0.01[a]	55.75±0.06[b]	55.86±0.08[b]	53.45±0.06[d]	50.30±0.01[e]
IVPD	67.69±0.02[d]	71.23±0.02[b]	73.62±0.16[c]	74.27±0.02[b]	80.06±0.01[a]

Values are means ± standard deviation of triplicate determinations. Significant ($p \geq 0.05$) difference exists where means with different superscripts are indicated in the same row. WH=100 % whole wheat flour, WHS1 =95 % whole wheat flour and 5 % Defatted sesame seed flour. WHS2 =90 % wheat flour and 10 % Defatted sesame seed flour. WHS3 = 85 % whole wheat flour and 15 % defatted sesame seed flour. WHS4 =80 % whole wheat flour and 20 % Defatted sesame seed flour. RDS=Rapidly Digestible Starch, SDS= Slowly Digestible Starch, RS = Resistant Starch, HI = Hydrolysis Index, EGI =Expected Glycaemic Index, TS = Total Starch, SD= Starch Digestibility. WH=100 %whole wheat flour, WHS1 =95 % whole wheat flour and 5 % Defatted sesame seed flour. WHS2 =90 % whole wheat flour and 10 % Defatted sesame seed flour. WHS3 = 85 %whole wheat flour and 15 % defatted sesame seed flour. WHS4 =80 % whole wheat flour and 20 % Defatted sesame seed flour.

There was a slight percentage increase from 1.69 to 9.37 % and the pasta samples WHS2, WHS3, and WHS4 falls within the intermediate (56 and 69) range on the GI scale (Pandolfo, 2021). The IVPD increased with increase in DSS flour addition following the order WHS4>WHS3>WHS2>WHS1>WH0. According to Jeong *et al*. (2019) and Shaghaghian et al. (2022), in-vitro starch and protein digestibility are important in the nutritional quality of food. The IVPD indicates the degree of enzymatic hydrolysis of protein into amino acids or smaller peptides for intestinal absorption (Laishram et al., 2024). Generally, legume enriched pasta increases the in-vitro protein digestibility (Pinel et al., 2023). In this study IVPD percentage increase was from 5.23 to 18.27%. Similar increase of 17–79% of IVPD was also reported in the addition of 10–50% of wheat- faba bean flour pasta (Laleg et al., 2017). In-vitro starch and protein digestibility can be influenced by a number of extrinsic variables such as the enzymatic modification, physical and chemical treatments and additionally, endogenous substances including lipids, proteins, dietary fibres, and polyphenols (Sharma and Gujral, 2019).

Cooking Quality of Defatted Sesame Seeds Enriched Pasta

The cooking quality of the various pastas is as presented in Figure 2. The optimum cooking time observed in this study ranged from 5.30 to 16.37 min. The cooking qualities signify the cooking performances which is an important pasta quality determinant. It is the ultimate test of acceptability of pasta. During cooking, structural changes such as starch gelatinization and protein coagulation, increase in volume, and loss of dry matter occur while maintaining the shape without any disintegration (Shameena et al., 2021). Marana et al. (2023) reported an OCT range of 13.00 – 15.30 min for high protein pasta. However, Jalgaonkar et al. (2019) reported a preferred cooking time of 5.15 min as one of the desirable traits of pasta. Substitution with DSS showed a significant (*p*<0.05) effect on cooking time. Physical disruption of the gluten matrix by the defatted sesame seed flours probably created a path for water absorption in the pastas, hence a reduction of the cooking time. The WI of the pasta samples ranged from 68.15 to 83.04%. Higher WI in composite flour pastas could be as a result of higher fibre contents disrupting the protein matrix continuity and leading to a higher penetration of water in pasta during cooking. The cooking loss ranged from 5.48 to 6.95%, the control WH had a slightly higher cooking loss. This could have been due

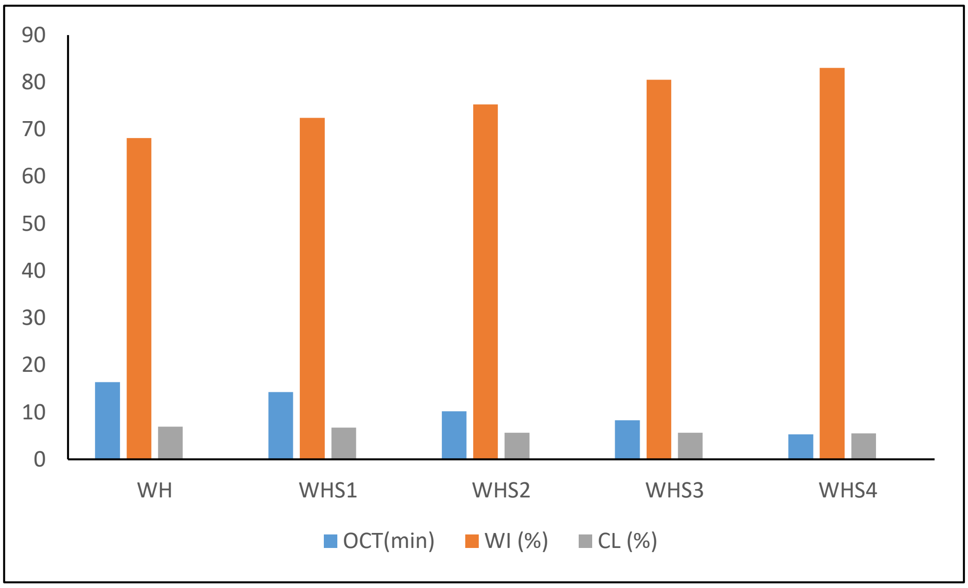

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Figure 2. Cooking loss characteristics of sesame seeds enriched pasta

WH=100% whole wheat flour, WHS1 =95% whole wheat flour and 5% Defatted sesame seed flour. WHS2 =90% wheat flour and 10% Defatted sesame seed flour. WHS3 = 85% whole wheat flour and 15% defatted sesame seed flour. WHS4 =80 % whole wheat flour and 20% Defatted sesame seed flour.

to higher water uptake into the gelatinized structure of the pasta due to the DSS inclusion (Koh et al., 2022). The values in this study are lower than the technologically accepted value of ≥ 8 % (Shameena et al., 2021). Additionally, the values are also lower compared with the cooking loss of 7.90-13.40 % values for pasta produced from wheat, rice and millet composite flour reported by Bidyalakshmi et al. (2024) and 6.63 -12.00 % reported by Ajiboye et al. (2024) in wheat orange fleshed potatoes, and pigeon pea-based pasta. Cooking loss determines the extent of starch leaching during boiling and the capacity of the pasta to regain its structural strength at the time of cooking. Larger particle size may increase the cooking loss by loosening the compact structure of pasta. Longer optimum time of pasta cooking corresponds to greater cooking loss (Diamante et al., 2019) and this assertion is confirmed in this study.

Sensory Properties of The Whole Wheat and Defatted Sesame Seeds Pasta

The result of the sensory properties of the whole wheat and defatted sesame seed pasta is as presented in Table 3. The mean sensory score for appearance, flavour, chewiness, and glossiness ranged from 5.44(WHS3) to 8.24 (WH), 4.49 (WHS3) - 7.68 (WH), 4.96 (WHS3) -7.28(WHS2) and 5.44 (WHS3) -7.42 (WHS1) respectively. Notably, the pasta sample WH (control) had the highest acceptability at 7.96 while WHS3 was the lowest at 5.32. there was no significance difference between the control (WH) and the 5 % substituted pasta in the overall acceptability. Largely, consumers prefer a bright yellow colour, but fortification with defatted sesame seed flour significantly decreases brightness as reported in our previous publication (Ojo et al., 2024b). This could have contributed to the low appearance mean sensory scores of defatted sesame seeds substituted pasta. Generally, it has been reported that substitution of ingredients with nutrient-dense alternatives, such as legumes decreases the physical quality of pastas due to changes in the raw materials (Ayustaningwarno et al., 2025), thus reducing consumer acceptance of the final product.

Table 3. Mean sensory scores of defatted sesame seeds enriched pasta

Parameters	WH	WHS1	WHS2	WHS3	WHS4
Appearance	8.24^{a}±0.72	7.92^{a}±0.81	7.16^{b}±1.54	5.44^{c}±1.32	5.40^{c}±1.34
Flavour	7.68^{a}±0.90	7.32^{ab}±0.85	6.84^{b}±1.54	4.49^{c}±1.46	4.60^{c}±1.32
Chewiness	6.84^{a}±1.21	7.00^{a}±0.85	7.28^{a}±1.30	4.96^{b}±1.83	5.08^{b}±1.32
Glossiness	7.12^{a}±0.92	7.24^{a}±1.05	7.04^{a}±1.42	5.44^{b}±1.35	4.56^{b}±1.63
Overall acceptability	7.96^{a}±0.73	7.80^{ab}±0.76	7.12^{b}±1.56	5.32^{c}±1.72	5.44^{c}±1.12

High chewiness at 5-10 % DSS substitution compared with the control indicates a firmer texture. The decrease in chewiness at higher DSS substitution could have been due to higher concentration of fibre, starch, and DSS dilution of the gluten network,which plays a crucial role in textural properties (Gong et al., 2020).

Values are means ± standard deviation of triplicate determinations. Significant (p≥0.05) difference exists where means with different superscripts are indicated in the same row. WH=100% whole wheat flour, WHS1 =95% whole wheat flour and 5% Defatted sesame seed flour. WHS2 =90% wheat flour and 10% Defatted sesame seed flour. WHS3 = 85% whole wheat flour and 15% defatted sesame seed flour. WHS4 =80% whole wheat flour and 20 % Defatted sesame seed flour.

There was a drastic reduction in sensorial appeal at 15- 20% DSS substituted pasta. The panel expressed off taste in 15% and 20% defatted sesame seeds substitution. This could be attributed to lingering intense nutty aroma linked to sesame seeds. This impairment of flavour characteristics could limit the amount of DSS substitution in food applications. Gernah et al. (2014) reported a similar observation in defatted sesame seed substituted biscuits.

CONCLUSION

The consumption of whole wheat enriched defatted sesame seeds pasta could contribute to an acceptable intake of macro-nutrients, including dietary fibre, and protein. The significant increase in resistance starch content and decreased glycaemic index could possibly control blood glucose levels at higher percentage of substitution. However, the panellist observed the off taste at higher concentration of defatted sesame seed flour inclusion. Amongst the substituted defatted sesame seed pasta, the 5 % was the most accepted. Further study is recommended on bioprocessing of sesame seeds to reduce off-taste in order to increase its composite flour utilization in food systems.

Conflict of Interest

The authors declare no conflict of interest

Authors contribution

Equal contributions was made by the authors

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