Development of Nutritious Savory Rusks by Utilizing Nigella Sativa. A Sustainable Solution for Food Accessibility

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ABSTRACT

Fennel Flower (Nigella Sativa), a black, drop-shaped seed, is renowned for its myriad pharmacological properties and health benefits, chiefly owing to its high protein content and its potential to treat various severe diseases. Nigella seeds are notably rich in proteins (20- 85%), fats (38.20%), fiber (7-94%), and carbohydrates (31.94%). The primary aim of this study was to explore the functional and nutraceutical properties of Nigella Sativa and to assess its impact on the nutritional value and consumer acceptance of wheat flour rusk. This rusk was prepared using a blend of whole grain flour with nigella seed powder in a 70:30 ratio, enhanced with selected seasonings. The production process involved multiple unit operations including sieving, baking at 180°C for 25-30 minutes and roasting at 160°C for 20 minutes. A significant challenge encountered in the market was the existing variety of flavors in rusks, yet our product distinguished itself by meeting the organic and functional demands of consumers. As part of our quality assurance protocol, the rusks underwent comprehensive testing, including Solvent Retention Capacity (SRC), Gluten Test, Ash Content, Moisture Content, Texture Analysis, Crude Fat, and Sedimentation Value assessments. The findings of this study substantiate that the integration of Nigella Seeds at permissible levels can be effectively realized in the formulation of bakery products, consequently augmenting their nutritional and sensory attributes.

Keywords: Functional, Nigella Seeds, Organoleptic Properties, Protein, Rusks.

INTRODUCTION

The baking industry is one of the largest globally, with popular products like cakes, cookies, biscuits and rusks due to their convenience and long shelf life (Gupta, 2011). Incorporating Fennel Flower (Nigella Sativa) into baked goods in health-beneficial amounts could increase sales if the flavor remains similar (Verbeke, 2006). Native to the Mediterranean, Nigella seeds resemble black sesame seeds and offer excellent nutrition, including proteins (20-85%), fats (38.20%), fiber (7-94%), carbohydrates (31.94%), and minerals like iron, copper, thiamine, niacin, and folic acid. The seeds contain high levels of amino acids like arginine, glutamate, and methionine. Nigella oil plays a key role in nutrition, with antitumor, antioxidant, anti-inflammatory and antibacterial properties, also boosting immunity and treating respiratory issues like asthma and bronchitis. Its compounds, especially thymoquinone, have shown benefits for diseases like cirrhosis, skin melanoma, pancreatic and breast cancer, and brain tumors (MF, 2007). With growing interest in food products enriched with natural antioxidants, Nigella's bitter taste presents a challenge in product development (Dhull, 2020). Despite its health benefits, Nigella's use in rusks and baked goods remains limited, making this study significant in promoting an herb with centuries of medicinal use. The goal of the innovative savory rusk with nigella seeds is to offer a unique, healthful snack. Incorporating nigella seeds provides digestive aid, anti-inflammatory benefits, and immune support. With a savory flavor, it caters to non-sweet snack preferences, appealing to health- conscious consumers.

OBJECTIVE

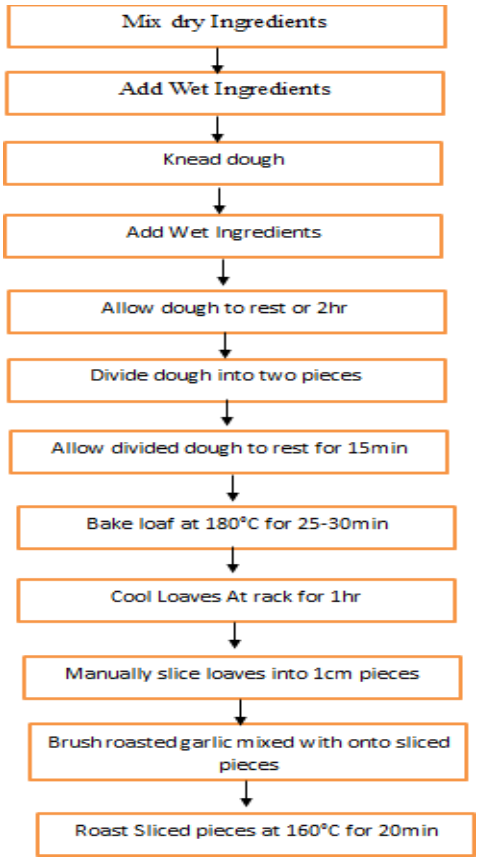
The objective of creating an innovative savory rusk with nigella seeds is to provide a unique and healthful snack option that stands out in the market. Additionally, the savory flavor profile caters to those who prefer non-sweet snack options, potentially expanding the consumer base.

METHODOLOGY

Raw Material

Nigella seeds and garlic powder were acquired from Imtiaz super mart. Whole grain flour (WGF) is acquired from a local market. All chemicals and solvents used were of analytical grade and obtained from Imtiaz super mart.The methodology is extracted from (Yaseen,2000)

Product Development



RESULT & DISCUSSION

Functional Properties of Flour

Various functional properties of control and composite flours are summarized in Table **1**. Bulk density of NP decreased with increase in level of NP by 30%. The control sample showed the highest value of bulk density (0.79 g/mL). Sedimentation test is used to assess gluten quality and bread-making potential of flour (Gupta, 2011). The control sample exhibited the highest sedimentation value of 62.67 mL. A progressive reduction in sedimentation value with increase in the level of NP by 30%.

Functional property of control and composite flour.

Table 1. Functional Property of Flour.

Parameters	Bulk Density g/ml	SRC %	Zeleny Test	Gluten Content
Control	0.79 ± 0.01	39.67 ± 0.01	62.67 ± 0.01	96.75±0.01
(WGF 70% + 30% NP)	0.442 ± 0.01	28.2 ± 0.01	43.67 ± 0.01	84.57±0.01

Note: Control represents rusk with 100 % APF. Abbreviations (APF = all-purpose flour, WGF = whole grain flour, NP = nigella powder). Values are an average of triplicate observations; n = 3 (± SD).

This reduction could be attributed to decrease in gluten content of the flour with the increasing level of NP to the blend. The results obtained in this study indicated that solvent retention capacity for NP with WGF was low that is 28.2%. While on other hand control sample had highest SRC value that is 39.67% compared to composite blends. The gluten content reduction value was estimated of 84.57%, while the gluten value of control sample was 96.75%.

Physical Property of Flour

Texture Analyzer was used to determine the crumb hardness or the force needed to crush the sample. The values are summarized in Table **2**.

Hardness and color properties of rusks made with WGF and NP.

Table 2. Hardness and Color Properties of Flour.

Parameter	Hardness 1	Hardness 2	L^*	a^*	b^*
Control	10±0.01	6.97±0.01	58.08±0.01	-1.86±0.01	-0.71±0.01
(WGF70%+NP30%)	10.519±0.01	7.064±0.01	58.16±0.01	-1.70±0.01	-0.57±0.01

Note: Control represents rusk with 100 % APF. abbreviations (APF = all-purpose flour, WGF = whole grain flour, NP = nigella powder). Values are an average of triplicate observations; n = 3 (± SD).

Color Measurement

Appearance, mainly color, is an important attribute of flour quality. Wheat flour had higher luminance (L*) and whiteness index (WI) value. Analysis of control and WGF sample luminance (L*) has the same result (58.16±0.01 to 58.08±0.01). While the WGF sample had high value of b* than control (-0.57±0.01 to -0.71±0.01) this change may occur because of the ingredient present in the control sample.

Water Activity

In the water activity test of rusks, the estimated amount of Aw is 0.396.

Proximate Analysis

Table **3** shows in comparison to the control rusk, the (WGF+NP) rusks ash, moisture, protein, fat, fiber content were assessed. The nutritional profile of rusk (WGF+ NP) was improved by inclusion of nigella powder and whole grain flour by increasing their fiber and ash content.

Proximate analysis of Rusk (WGF70%+NP30%)

Table 3. Proximate Analysis of Rusk.

Parameters	Ash%	Moisture%	Crude Fat%	Crude Fiber%	Crude Protein%	Aw%
Control	1.2±0.1	3±0	27±0.36	1.3±0.01	10±0.5	0.267±0.01
(WGF70%+NP30%)	1.69±0.01	2±0	40±0.25	2.0±0.01	14.1±0.17	0.395±0.01

Note: Control represents rusk with 100 % APF. abbreviations (APF = all-purpose flour, WGF = whole grain flour, NP = nigella powder). Values are an average of triplicate observations; n = 3 (± SD).

In proximate comparative analysis of rusks, one formulated with 70% WGF (whole grain flour) and 30% NP (nigella powder) and the other as the control WGF-NP has higher levels of ash (1.69% ± 0.01%) compared to the control rusk (1.2% ± 0.1%) as shown in Table **3** indicating a significant increase in mineral content as the WGF-NP rusk contain a higher amount of minerals due to the addition of nigella powder... Similarly, the WGF-NP rusk exhibits elevated crude fiber (2.0% ± 0.01%) compared to the control rusk (1.3% ± 0.01%), suggesting enhanced dietary fiber intake. Additionally, WGF-NP rusk has a higher crude protein content (14.1±0.17) compared to the control rusk (10±0.5). This higher protein content could make the rusk with nigella powder a more nutritious option (M. Tauseef Sultan, 2012), moreover, slightly WGF- NP has a lower moisture content (3±0) compared to the rusk with whole wheat flour and nigella powder (2±0). This suggests that the rusk are slightly more moist, which could affect its texture and mouthfeel Furthermore, WGF-NP has a significantly higher crude fat content (27±0.36) compared to the control rusk (40±0.25) as NP contain omega-3 fatty acids. (Huseini, 2022).

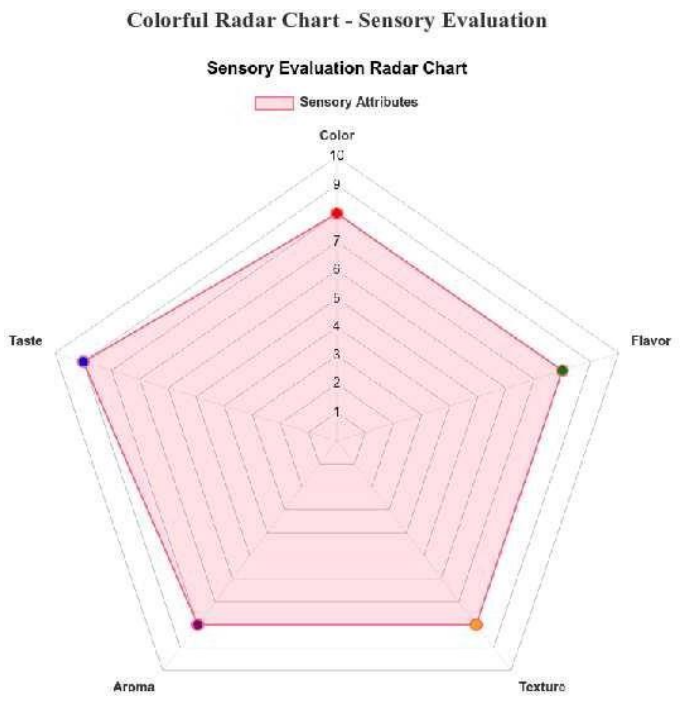


Figure 1. Sensory evaluation of savoury rusk by trained 9 panelists.

CONCLUSION

Whole grain flour as a rich source of fiber and minerals seems to suitable for the formulation of rusk. The following study concluded that the substitution of 30 % of NP in 70%WGF collectively showed the good organoleptic properties and enhanced the nutritional profile of the savory rusk. A significant increase in (color) hardness (texture) ash, fiber, crude protein, crude fat is observed in the composite sample comparatively to control sample. On the other hand, reduction is noticed in functional properties such as bulk density, sedimentation value, SRC followed by gluten content than control sample. Despite these changes, the overall sensory evaluation showed positive acceptance. In a nut shell, supplementation of WGF with 30% NP in the rusks is a useful strategy for the consumption of foods rich in functional ingredients. Further research will be continued on optimizing the blend ratio and to maximize the nutritional profile and consumer acceptance for the incorporation of nigella sativa in baked goods

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