Development of Biscuits using Composite Flour of Wheat, Finger Millet and Kohila (*Lasia Spinosa)* Supplemented with Garlic Flavor

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Abstract

The consumption of cereal snack food such as biscuits, cookies and shortbread has become very popular in Sri Lanka especially among children because of their variety in taste, crispiness, and digestibility. Composite flours have higher nutritional quality and would be ideal for making nutritious cookies. A study was conducted to evaluate the quality characteristics of biscuits made from finger millet (Eleusine coracana), kohila (Lasia spinosa), and wheat (Triticum aestivum) flour. Various composite blends of wheat, finger millet, and Kohila flours were mixed in the following ratios: 100: 00: 00, 80: 10: 10, 50: 10: 40, 50: 40: 10, and 20: 40: 40 with 1 g of garlic powder in all treatments. The diameter and spreading ratio of the biscuits expanded from 5.90 – 5.95 cm and 14.51-15.59, respectively, while the thickness decreased (4.07 -3.80) as the composite finger millet and Kohila flour increased. Chemical parameters such as protein (4.25 % -5.76 %) and ash (0.66 % -0.83 %) increased, while fat (8.74 % -7.25 %) and moisture content (2.58 % - 1.88 %) decreased significantly (p < 0.05) with the addition of composite finger millet and Kohila flour to the biscuits. When compared to other treatments, the biscuits supplemented with 50 g wheat flour, 40 g finger millet, and 10 g Kohila (T4) were well acceptable in terms of color, texture, taste, flavor, and overall acceptability. As a result, T4 with a combination of 50g wheat flour, 40g crabgrass and 10g Kohila enriched with 1g garlic powder was successful in formulating composite biscuits with improved nutritional and organoleptic properties.

Keywords: Composite flours, finger millet, kohila, Qulaity characters, Wheat flour

I. INTRODUCTION

Millet feeds one-third of the world's population and is an important food source in developing countries. The nutritional value of finger millet [*Eleusine coracana* (L.)] is superior to that of other common cereals. Millets are high in minerals such as iron, magnesium, phosphorous, and potassium. It has the highest calcium content, approximately ten times that of paddy rice or wheat (Bhoite et al., 2018).

Lasia spinosa (L.) is a native vegetable that is high in nutritional and medicinal value. It is a member of the Araceae family. It is widely grown in South and South-East Asian countries, including Sri Lanka (Kumari et al., 2017). It had a lot of phenolic and flavonoid compounds. Its antioxidant constituents, such as vitamin E, vitamin C, flavonoids, and polyphenols, can combat oxidative stress via the free radical scavenging mechanism of phytochemicals (Men et al., 2021). In addition to its use as food, *L. spinosa* plays a significant role in indigenous medicine. Due to its strong flavor, garlic is frequently used as a flavoring or condiment around the world(Bhoite et al., 2018)

Bakery products produced with wheat flour (WF) are a main food in many countries and thus play an important role in global nutrition. WF contains essential carbohydrates and some proteins, but it lacks minerals, particularly calcium and iron. The addition of food groups such as pulses, oilseeds, herbs, and so on can often improve the nutritional quality of WF-containing baked foods. Incorporating such ingredients into bakery products such as biscuits will not only improve nutritional quality but also provide novel textural properties and improved sensory acceptability (Agrahar-Murugkar, 2020). Biscuits are a ready-to-eat, inexpensive, and convenient food for people of all ages. It is regarded as a good product for protein fortification and other nutritional improvements due to its acceptability in all age groups and longer shelf life.

As a result, the current study was conducted in order to assess the chemical and sensory quality of newly made biscuits made of a composite flour of wheat, finger millet, and *Kohila*, along with garlic flavor.

II. MATERIALS AND METHODS

A. Procurement of materials

The Agronomy farm in Nikaweratiya provided high-quality finger millet seeds. Premature *Lasia spinose* rhizome of high quality was purchased from a local market in Anamaduwa. A supermarket in Anamaduwa provided the wheat flour, garlic, sugar, margarine, baking powder, egg, and packaging materials. The finger millet garlic and cloves were cleaned, washed, dried, and ground with a grinder (Senator Dx-2000) then, sieved (60 mesh). *Lasia spinose* rhizomes were washed and cut into small pieces. The mixture was then oven dried at 60 ° C for 15 minutes before being ground with a commercial grinder (Senator Dx-2000) and sieved (250 mesh).

B. Preparation of biscuits

Initially, the sugar (50 g) and margarine (50 g) were thoroughly creamed. The sieved composite flour, baking powder (2 g), and garlic powder (1 g) were gradually mixed into the creamy mixture. The dough was then kneaded to a smooth consistency with water. The dough was refrigerated for 30 minutes. Small balls of dough were formed to make biscuits, placed on a tray, and baked at 180^{0} C for 15 minutes.

Table 01: Treatments combinations

Treatments	Wheat (g)	*Lasia spinosa (g)*	Finger Millet (g)	Garlic Powder (g)
T_1	100	00	00	1
T_2	80	10	10	1
T_3	50	40	10	1
T_4	50	10	40	1
T_5	20	40	40	1

C. Quality analysis

Moisture (oven drying method), carbohydrate (phenol-sulfuric acid method), protein (Kjeldahl Method), fat (AOAC 935.38), and ash (AOAC 900.02) were measured. Physical parameters; thickness, diameter, and spread ratio were measured.

D. Sensory evaluation

The sensory quality of the developed products was judged by 20 trained panelists using a 9-point hedonic scale in terms of color, flavor, texture, taste, and overall acceptability.

E. Statistical evaluation

In the experiments, each formulation was replicated in a completely random design (CRD). The chemical, physical, and organoleptic data were analyzed using analysis of variance (ANOVA) ($\alpha = 0.05$). Duncan's multiple range test was used to compare mean differences through Minitab 17 version.

III. RESULTS AND DISCUSSION

A. Physical parameters

Table 02 indicated that when the concentration of composite finger millet and Kohila was increased, the thickness of the biscuits decreased. T1 had the highest mean thickness value (4.07cm) and T5 had the lowest mean thickness value (3.80cm). Both the diameter and spread ratio increased. T1 had the lowest value and T4 with 50 g wheat, 40 g finger millet, and 10 g Kohila flour had the highest value for both diameter and spread ratio.

Table 02: Physical parameters of the wheat, finger millet and Kohila composite flour biscuits enriched with garlic flavor

Treatment	Thickness (mm)	Diameter(cm)	Spread ratio
T1	4.07 ± 0.03^{a}	5.90 ± 0.03^{a}	14.51 ± 0.12^{a}
T2	4.03 ± 0.08^{a}	5.93 ± 0.08^{a}	14.72 ± 0.32^{a}
T3	3.97 ± 0.06^{a}	5.91 ± 0.07^{a}	14.90 ± 0.24^{a}
T4	3.93 ± 0.08^{a}	5.98 ± 0.28^{a}	15.32 ± 0.26^{a}
T5	3.80 ± 0.20^{a}	5.95 ± 0.23^{a}	15.59 ± 0.94^{a}

The values are means of triplicates ± SE

Mean values with the same superscript letters within the same column do not differ significantly at 5% level

B. Nutritional parameters

1) Fat content

With the substitution of finger millet and Kohila flour, the fat content of freshly made biscuits was reduced. The biscuits made from 100 % wheat flour had the highest fat content (8.74 %). This could be that Kohila and finger millet flours have low fat content whereas wheat flour has the high fat content. The fat content of biscuits was reduced from 8.11 % to 6.37 % by reducing the proportion of wheat flour from 100 percent to 20%. The similar outcomes were observed in the study of finger millet in cookies (Sinha & Sharma, 2017).

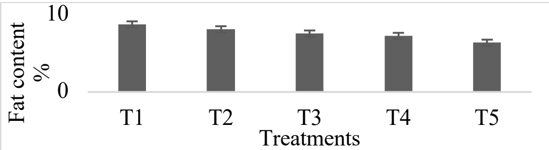

Figure 01: Fat content of the wheat, finger millet and *Kohila* composite flour biscuits enriched with garlic flavor

2) *Protein content*

Figure 02 described that T5 had the highest protein content (5.76 %) and T1 had the lowest mean value (4.25 %). All of the treatments were significantly different from each other. The protein content of newly made biscuits was increased from 4.25 % to 5.76 %. It could be because the concentration of finger millet flour has increased. This results were comparable with the study of biscuits prepared from finger millet seed coat based composite flour (Krishnan et al., 2011).

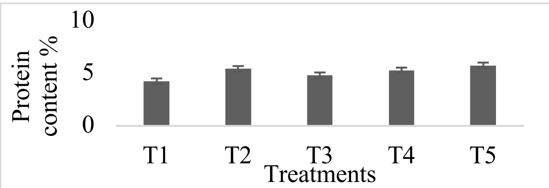

Figure 02. Protein content of the wheat, finger millet and *Lasia spinosa* composite flour biscuits enriched with garlic flavor

3) *Ash content*

Figure 03 depicted the ash content of freshly baked biscuit samples. T1 had the lowest mean value (0.66 %) for ash content, while T5 had the highest mean value (0.83 %) with 20 g wheat, 40 g finger millet, and 40 g *Kohila*. With increasing finger millet concentration, there was a significant increasing trend (0.71 % to 0.85 %). This results were comparable to that of finger millet cookies (0.64 to 1.00 %) (Bhoite et al., 2018).

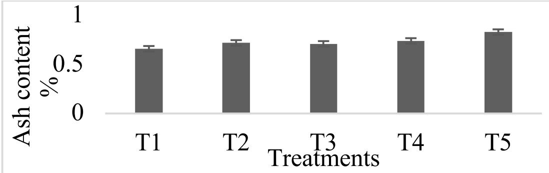

Figure 03: Ash content of the wheat, finger millet and Kohila composite flour biscuits enriched with garlic flavor

4) *Moisture content*

Figure 4 demonstrated that there were significant differences between the treatments. T1 with 100 g wheat flour had the highest mean value (2.58 %) for moisture content, while T5 with 20 g wheat, 40 g finger millet, and 40 g *Kohila* had the lowest mean value (1.88%). The moisture content of freshly made biscuits was reduced from 2.58 % to 1.88 %, while the concentration of wheat flour was reduced from 100% to 20%. It may be that higher moisture level in wheat flour than finger millet and *Kohila* flour.

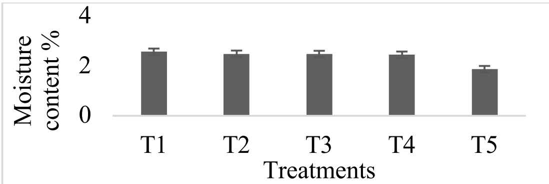

Figure 04: Moisture content of the wheat, finger millet and *Kohila* composite flour biscuits enriched with garlic flavor

C. *Sensory analysis*

The sensory evaluation of the biscuits revealed significant differences ($p < 0.05$) in texture, flavor, taste, color, and overall acceptability between the treatments (Table 03). The biscuits' color changed from very light brown to dark brown. The dark color could be due to the concentration of finger millet. T3 and T4 had the highest color value (5.13), while T1 (control) had the lowest value (3.63). Taste is the primary factor that determines the acceptability of any product, and it has the greatest impact on the product's market success. The taste of all sample were excellent with the addition of garlic powder. T4 with 50 g wheat, 40 g finger millet, and 10 g *Kohila* received the highest taste rating (5.4), while T5 received the lowest rating (4.4). (2.93). Texture analysis is the process of measuring the properties that affect how a food feels in the mouth (initial bite). T5 contained T1, which had the highest texture score (5.3) and the lowest value (2.73). Flavor is primarily determined by the chemical senses of taste and smell. T4 had the highest value for flavor. The overall acceptability, which is an important parameter in organoleptic estimation, included many implications. The biscuits from treatment T4, which contained 50 g wheat flour, 40 g finger millet, and 10 g *Kohila*, had a higher mean value for overall acceptability than the other composite biscuits.

IV. CONCLUSION

A protein-rich biscuits could be made from a composite flour of wheat, finger millet, *Kohila*, and garlic powder. The use of finger millet and *Kohila* flour in baking could significantly reduce wheat flour imports. The study's findings revealed that wheat flour was high in fat. The combination of finger millet and *Kohila* with wheat flour for the production of biscuits had a higher protein and ash content. When compared to other tested combinations, biscuits made with 50 g wheat, 40 g finger millet, and 10 g *Kohila* flour were highly acceptable in terms of nutritional, and organoleptic qualities. The findings could also be useful in making decisions for industries that want to use finger millet and *Kohila* flour as a nutritional alternative or supplement to cereal flours.

Table 03: Sensory analysis of composite flour of wheat, finger millet and *Kohila* enriched with garlic flavor freshly made biscuits prepared

Treatment	**Colour**	**Taste**	**Texture**	**Flavor**	**Overall acceptability**
T1	3.63 ± 0.01^{b}	4.13 ± 0.19^{b}	5.30 ± 0.03^{a}	3.76 ± 0.01^{c}	4.76 ± 0.01^{c}
T2	3.43 ± 0.01^{c}	3.80 ± 0.03^{c}	4.50 ± 0.00^{b}	3.56 ± 0.01^{c}	3.86 ± 0.01^{e}
T3	5.13 ± 0.01^{a}	3.70 ± 0.03^{c}	3.50 ± 0.03^{c}	4.30 ± 0.03^{b}	5.16 ± 0.01^{b}
T4	5.13 ± 0.01^{a}	5.40 ± 0.03^{a}	3.80 ± 0.03^{c}	5.10 ± 0.03^{a}	5.90 ± 0.03^{a}
T5	3.76 ± 0.01^{b}	2.93 ± 0.19^{d}	2.73 ± 0.06^{d}	3.26 ± 0.01^{d}	4.20 ± 0.03^{d}

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