Quality estimation of muffin replaced with watermelon seeds powder

تقدير جودة المافن المستبدل بمسحوق بذور البطيخ

By

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Abstract :

The current investigation's objective was to assess the seed's functional qualities and proximate analysis. Watermelon seeds were investigated. 31.0000±.57735% protein, 7.1433±.09387% moisture, 22.0000±.57735% fat, 4.4333±.33830% ash, 22.6667±1.45297% crude fiber, and 12.7567±.42756% carbohydrates were found by proximate analysis. The seeds are high in crude fat, crude fiber, and protein. The nutritional value of the seed might be advised for maintenance of a healthy diet and daily allowance. According to the seed's functional characteristics, the water and oil absorption capacities of watermelon seed flour were 4.1100±.54836 (milliliters per gram) and 4.8800±.60918 (milliliters per gram), respectively. The bulk density, foam capacity, and foam stability of the seed were 0.6567±.02963 (g/ml), 10.1833±.42850%, and 3.5533±.29356%, respectively, watermelon seeds powder had rather strong capacities for absorbing water, fat, and foam. Watermelon seed flour, however, has good functional qualities. The results showed baked products like muffins could incorporate seeds. Sensory analysis revealed that adding up to 3% WSP. substituted wheat flour in muffins formed satisfactory consumer acceptability. The results of the chemical and sensory assessments indicated that substituting watermelon seed powder for wheat flour could improve the nutritional value and acceptability of the final product.

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المستخلص:-

هدف البحث الحالي هو تقدير الصفات الوظيفية لبذور البطيخ. قدر التركيب الكيميائي للبذور. اذ تحتوي على ٣١.٠٠٠٠ ± .٥٧٧٣٥٪ بروتين، ٧.١٤٣٣ ± .٠٩٣٨٧٪ رطوبة، ٢٢.٠٠٠٠ ± .٥٧٧٣٥٪ دهون، ٤.٤٣٣٣ ± .٣٣٨٣٠٪ رماد، ٢٢.٦٦٦٧ ± ١.٤٥٢٩٧٪ ألياف خام، و ١٢.٧٥٦٧ ± .٤٢٧٥٦٪ كربوهيدرات تم تقديرها من خلال التحليل الكيميائي. البذور ذات محتوى عال من الدهون والألياف الخام والبروتين. لذا يُنصح بالقيمة الغذائية للبذور للحفاظ على نظام غذائي صحي وبشكل يومي .وفقا للخصائص الوظيفية للبذور، كانت قدرة امتصاص الماء والزيت لمسحوق بذور البطيخ ٤.١١٠٠±.٥٤٨٣٦ (مليلتر لكل جرام) و٤.٨٨٠٠±.٦٠٩١٨ (مليلتر لكل جرام)، على التوالي. كانت كثافة الكتلة وسعة الرغوة وثبات الرغوة للبذور ٠.٦٥٦٧±.٠٢٩٦٣ (جم/مل)، ١٠.١٨٣٣±.٤٢٨٥٠%، و٣.٥٥٣٣±.٢٩٣٥٦%، على التوالي، يتميز مسحوق بذور البطيخ بقدرات قوية على امتصاص الماء والدهون والرغوة. وبذلك يتمتع مسحوق بذور البطيخ بصفات وظيفية جيدة. أظهرت النتائج أن المنتجات المخبوزة مثل المافن يمكن أن تحتوي على البذور. كماظهرت نتائج التحليل الحسي أن إضافة ما يصل إلى ٣٪ WSP. نال دقيق القمح المستبدل في المافن قبولًا مرضيًا للمستهلك. اذ أشارت نتائج الاختبارات الكيميائية والحسية إلى أن استبدال مسحوق بذور البطيخ بدقيق القمح يمكن أن يحسن القيمة الغذائية ويجعل المنتج النهائي اكثر قبولا.

Introduction

Seeds from watermelon (Citrullus lantus) are one of the fruit byproducts that is underutilized., the watermelon, is a member of the Cucurbitaceae family. Evidence currently available indicates that the proteins in watermelon seeds have good in vitro digestibility with fewer antinutritional components, the seeds have a modest amount of micronutrients, and they function well (TTak, and Jain, 2016). Because watermelon seeds hold their shape even after the pulp and skin are removed, they have shown promise for usage in the food sector. After six months of storage, the oil and fatty acid content of the seeds remains constant, demonstrating the seeds' ability to be well preserved (Adeyefa et al., 2020). The great nutritional value of watermelon seeds is widely recognized; among their many nutrients are protein,

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vitamin B, fat, and minerals (potassium, magnesium, phosphorus, salt, iron, zinc, manganese, and copper), as well as phytochemicals (Braide, Oranusi, & Peter-Ikechukwu, 2012). It has been shown that watermelon seeds have high functional qualities and work well in baking and other food preparations (Nasr and Abufoul, 2004). The stated nutritional value of watermelon seeds seems to support its use as a food source. The seeds are extremely nutrient-dense and include significant levels of proteins as well as numerous advantageous minerals like manganese, magnesium, calcium, and phosphorus. Iron, sodium, copper, phosphorus, and zinc will be present in the food. growth of an able body (Adeyefa et al., 2020). Due to their flavor and tender texture, muffins are among the most popular baked goods that people enjoy. Muffins and cupcakes are both ready-to-eat snack foods that are typically consumed for breakfast. for tea, as an evening snack, or during other meals. Numerous festivities also serve muffins as appetizers. Muffins are unique in that they have a spongy texture and great volume due to their porous construction (Sandrine et al., 2022).. Our goal in this project was to create muffins with watermelon seeds as a value-added component.

Materials and Methods

Methods of analysis

Materials. We bought the following items from a nearby supermarket:

Watermelon, Ingredients: wheat flour(72% extraction) , sugar, egg, vegetable oil, baking powder, and baking soda.

Preparation of watermelon seeds

The seeds After thoroughly cleaning the watermelon to remove any sand or extraneous elements, it was rinsed under running water, dried in an oven at 600 degrees Celsius for 24 hours,

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ground into a powder using a mortar and pestle, packed, and refrigerated until needed. (Khalid,2022)

Determination of the approximate composition: A conventional procedure was used to ascertain the contents of moisture, ash, crude fiber, and fat.

Functional properties:

Capabilities for absorbing water and oil, bulk density, foam stability, and foam capacity were measured in accordance with the technique developed by Adeleke, et al.,(2021). Coffman and Garica (1977) was used to determine the lowest concentration of gelatinization.

Preparation muffins

One basic recipe, consisting of 150 g wheat flour, 85 g sugar, 75 g eggs, 75 g milk, 75 g vegetable oil, and 5.1 g baking powder, was used to make muffins.

Before weighing, the sugar was first ground into a powder using a blender, and the eggs were whisked by hand with a spoon in a bowl for a minute.

After that, each component was weighed to create six distinct muffin recipes (Table 1). To homogenize the recipe for muffins and determine the sensory- appropriate level of focus of seed watermelon, preliminary baking was conducted. Then, using an electric hand mixer, the necessary number of eggs and sugar were combined until creamy. The creamy mixture was continually mixed in sunflower oil, and then the necessary amount of liquid milk was added. The emulsified gel was gradually supplemented with wheat flour while being constantly stirred in the same direction. for approximately four minutes after the mixture began. The last component to be added to the mixture was baking powder. After that, the dough was placed into muffin tins that had been oiled, and the oven was warmed to 210°C for eight minutes. After the muffins had been in the oven

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for two minutes, they were removed and let to cool for roughly thirty minutes at room temperature. After that, the samples were stored for additional analysis at room temperature in airtight plastic food-grade bags. (**Sandrine et al.,2022)**

Muffin Characteristic Determination

Moisture, Baking Loss, and Volume Muffin were measured utilizing the techniques described by **Sandrine et al. (2022)**. Millet-seed displacement was used to measure the volume. The measured volume was then divided by the muffin's weight (mL/g) to determine the precise capacity.

moisture percentage. The gravimetric technique was employed to ascertain the muffin crumb's moisture level. Using a dry, clean, and precisely weighed aluminum moisture dish, A sample weighing 2 grams was dried at 105°C in an air oven until the weight did not change any more.

The weight of the muffins dough and the finished muffins were used to calculate the % baking loss of the muffins. Using the following formula.

Baking Loss %=Wd – Wm/ Wd × ١٠٠

Sensory assessment.

Six seasoned panel members comprised the sensory committee, who used a 9-point hedonic scale to assess each treatment of the muffin sample. The samples were formed in a muffin mold and subjected to sensory analysis for qualities such as taste, body and texture, color and appearance, and overall acceptance.(Asmita et al., 2012).

Analytical Statistics

The triple test results are displayed as the mean ~ standard deviation (SD). Utilizing SPSS (2019), statistical analysis was performed. Significant differences were found using one-way analysis of variance (ANOVA),

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Results and Discussion

The chemical composition of watermelon seeds

The proximate makeup of watermelon seeds was shown in Table 1. The seed powder had a percentage moisture 7.1433±.09387 %. The result was higher than the 5.98% recorded by Falade et al. (2019) for watermelon seed flour and lower than the 8.0% reported by Adeleke et al. (2021) for Tamarindus indica seed flour. The ash percentage is 4.4333±.33830%. It was, nevertheless, noticeably greater than the 2.98% reported for seed powder from Citrullus colocynthis (Falade et al., 2019). Given that the ash content indicates the concentration of minerals, The fat percentage of the seed powder was 22.0000±.57735%. This was comparable to Kamels et al.'s (1985) report of 26.6% for melon (or "egusi") seed flour. Given the comparatively high fat content, With a composition percentage of 31.0000±.57735%, the protein content was determined to be the highest.

Table 1 : Approximate Analysis watermelon Seed powder

properties	values(%)
Moisture	7.1433±.09387
Protein	31.0000±.57735
fat	22.0000±.57735
ash	4.4333±.33830
fiber	22.6667±1.45297
Carbohydrate	12.7567±.42756

This resuits, however, lower the 37.36% for watermelon seed powder that was reported (Adeleke et al., 2021). This suggested that the seed powder will function as an excellent source of protein and that regular use will support the development of an individual's cells and overall health. There was 22.6667±1.45297% crude fiber in the sample. Compared to

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the 35.85% described for Monodora myristica seed powder (Adeleke et al., 2020), this number was incredibly lower. The percentage of carbohydrates was 12.7567±.42756%. This value, however, was higher than the 8.05% for Monodora myristica seed flour that was published (Adeleke et al., 2020).

Calculating functional characteristics of watermelon seed powder

Table 3. displayed the functional characteristics of WSP. The seed powder had a bulk density of 0.6567±.02963 g/mL. . Emelike et al. (2015) revealed that the bulk densities of undefatted and defatted cashew flour were 0.2% and 0.1%, respectively. This finding was consistent with their findings. Nonetheless, the study's value was less than the 0.83 + 0.01 published value for wheat flour (Anne et al., 2020). When handling and applying packaging materials for processing in the food business, bulk density plays a crucial role. In food formulation, low bulk density is ideal, especially for foods with minimal retrograde. High bulk density, however, is a useful physical characteristic for figuring out how well a given matter mixes (Adeleke et al., 2021).

Table2: functional parameters of watermelon seed powder

Functional parameters	**values**
Bulk Density (g/ml)	0.6567±.02963
Water Holding Capacity (ml/g	4.1100±.54836
Oil Holding Capacity (ml/g)	4.8800±.60918
Foam Capacity (%)	10.1833±.42850
Foam Stability (%)	3.5533±.29356

The percentage foam capacity of 10.1833±.42850% in this investigation was less than the comparable protein watermelon seed powder report of 11.54% (Adeleke et al., 2021). The stability of 3.5533±.29356% indicates that the seed flour's

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foaming capacity is not very good. The watermelon seeds' ability to absorb both water and oil is seen in Table 2. Watermelon seed powder exhibited a great ability for absorbing water (4.1100±.54836 ml/g). Watermelon flour's low protein content could be the reason for its poor ability to absorb water. Watermelon exhibited a high oil absorption capacity (4.1100±.54836 ml/g milliliters per gram). The varying percentage of non-polar side chains of amino acids on the surface of protein molecules may be the cause of variations in oil absorption capacity. The result was higher than the findings of Khalid (2023), who stated that the watermelon WAC and OAC values were 3.20 ml/g and 3.93 ml/g, respectively.

Impact of varying amounts of watermelon seed powder integration on muffins' physical characteristics.

Below is a discussion of how different watermelon seed powder concentrations affect the muffins' physical characteristics. The physical characteristics of the muffin samples made for the study are shown in Table 3. The largest specific volume of experimental muffins was found in level 3% (1.2633±.02603), followed by 1% (1.2567±.00882bc), and 5% (1.1267±.01764). It was discovered that the control muffins' mean specific volume was 1.0367±.01453a. With the addition of watermelon seed, the muffins 's specific volume increased considerably ($p < 0.05$). According to Zhou et al. (2011), rather than the number of air cells in the batter, the final cake volume may be impacted by the batter's ability to hold onto air cells during mixing or baking.

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Table 3: Muffins' physical characteristics after adding of watermelon seed powder

Physical properties	0%	1%	3%	5%
volume mL	170.0000±2.88675a	169.0000±.57735a	175.0000±2.88675a	175.0000±1.73205a
Specific volume mL/g	1.0367±.01453a	1.2567±.00882bc	1.2633±.02603c	1.1267±.01764d
Baking less%	16.0000±2.08167d	28.5900±.70812a	23.0000±1.73205bc	19.3333±1.45297c
Moisure%	22.3333±3.92994a	29.7767±.39985a	27.3333±1.20185a	25.3333±2.90593a

WSP stands for watermelon seed powder mixture muffins. In the same column, different superscript letters indicate significant differences (p<0.05).

Muffin samples had a maximum mean volume of 175.0000±2.88675 ml and 175.0000±1.73205 ml in levels 3% and 5% WSP compared with control. The muffins in 1% WSP had the highest baking loss and moisture percent (28.5900±.70812% and 29.7767±.39985%, respectively), which was followed by 23.0000±1.73205% in3% WSP, 19.3333±1.45297% in 5% WSP, compared with control 16.0000±2.08167%, and 27.3333±1.20185% in 3% WSP, 25.3333±2.90593% in 5% WSP compared with control 22.3333±3.92994%, respectively. The addition of watermelon seed powder resulted in a significant ($p < 0.05$) increase in muffin baking loss. This finding indicates that watermelon seed

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had a higher water-holding capacity than control, which allowed it to keep more water in the batter and prevent water vapor from escaping the surface. In order to make cake, Khan et al. (2023) substituted jackfruit seed flour for 10%, 20%, and 30% of the wheat flour. According to their findings, the cake with the 20% replacement had a higher specific volume than the other cakes.

Sensory assessment of cake samples

Table 4 displays the results of the muffin samples' sensory evaluation. With the exception of the sample, the overall acceptability ranged from 8.5700±.13555 to 6.5517±.43759, enjoyable on a 9-point scale. Because the muffins with 5% WSP had a lower overall acceptability (6.5517±.43759), indicating that the muffins were rated as slightly to moderately.

Table 4: Muffins' Sensory analysis after adding of watermelon seed powder

levels	taste	body	texture	color	Appearance	Over all acceptability
0%	8.0667±.32626 a	8.0667±.34222a	8.3517±.30846a	8.6433±.17960a	7.6817±.23332a	8.5700±.13555a
1%	8.3567±.30999 a	8.7983±.07521a	8.7917±.12249a	8.1350±26842a	8.5950±.12922b	8.6817±.10974a
3%	8.6650±.15912 a	8.5933±.13524a	8.5033±.17179a	7.1783±.30649b	8.8533±.08024b	8.4200±.45770a
5%	5.9333±.53333 ab	6.5833±.45491ab	6.9000±49126b	6.0833±.30623c	6.3283±.15478c	6.5517±.43759b

((Asmita et al.,2012).

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WSP stands for watermelon seed powder mixture muffins. In the same column, different superscript letters indicate significant differences (p<0.05).

Between the control and all the variations of the watermelon seed mixture contained muffins, there was a significant difference ($p<0.05$). Compared to other incorporation levels, muffins with 1% WSP combination had the greatest mean sensory score (8.3567±.30999), taste (8.7983±.07521), body (8.7917±.12249), texture (8.5950±.12922), appearance, and (8.6817±.10974) overall acceptability (Table 4.). Another crucial factor influencing how acceptable a muffin is its color. The watermelon seed powder gave the dark color, particularly at 5%. The color score was not acceptable at the 5% substitution level, but the taste score was unacceptable at the highest substitution levels. Acceptability significantly reduced as the amount of watermelon seed combination increased. As a result, panalists preferred muffins with 1% WSP. The sample's taste received the lowest score, which contributed to its low score. The majority of panelists said it tasted bad and left them feeling bitter after swallowing. On the other hand, the muffins with 1% WSP scored the highest out of all the samples, compared with the controls. Therefore, watermelon seeds powder are a promising addition to new baked products that are high in fiber and protein.

Conclusions

The study's findings demonstrated that watermelon seeds had a high protein and oil content and that, based on their chemical composition,. The current analysis has led to the conclusion that watermelon seed muffins are nutritious and acceptable from an organoleptic standpoint. Consequently, the results suggest that there is a better chance of consuming watermelon seed powder in baked products such as muffins. The muffins' physical properties like volume and specific volume

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increased as the concentration of watermelon seeds increased while baking less and moisture decreased, whereas sensory assessment scores like taste, body, texture, appearance, and overall acceptability except muffins contain 1% WSP. Therefore, watermelon seeds are an excellent by-product for adding richness to muffins, thereby raising their content level. The results of this study could aid in the development of value-added watermelon seed baked products, allowing farmers to profit from the efficient use of this inexpensive agricultural product.

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