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Research Article

Study on the Sensory and Proximate Analysis of Muffins Made Using Okra Mucilage Extract as an Egg Replacer

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A B S T R A C T

Okra mucilage has recently been investigated as a possible food emulsifier, which can improve the stability, texture and appearance of food.The study aims to examine the effect of okra mucilage on replacing eggs in muffin formulation, and analyze these muffins for physio-chemical and sensory analysis. Three variations along with standard were prepared i.e. SM (57g of egg), OMV1 (57g of okra mucilage), OMV2 (77g of okra mucilage) and OMV3 (114g of okra mucilage). Sensory evaluation was conducted to select the level of addition of okra mucilage in muffin and selected sample along with standard carried for further study. The study reveals that OMV1 has the highest overall acceptability. Proximate analysis of the sample and OMV1 suggest that there is a sharp decrease in the fat content in OMV1.

(The variations are coded as follows, SM = Standard muffin, OMV1 = okra muffin variation 1, OMV2 = okra muffin variation 2, OMV3 = okra muffin variation 3).

Keywords: Okra Mucilage, Egg Replacer, Muffin, Emulsifier, Whipping Agent, Proximate Analysis

Introduction

Eggs are one of the most widely utilized food preparation items in the world. They are nutritionally complete animal-derived ingredients that are employed in a variety of baking goods due to their exceptional functional properties.[1] Due to their high price, cholesterol, and nutritional concerns, eggs are being substituted with other protein sources. Additionally, consumers who are vegans, vegetarians, or have egg allergies are unwilling to utilize eggs.[2] Emulsifiers are substances that are frequently used in the baking industry. During the baking process, they offer aeration and gas bubble stability.[3] Consumers have been exposed to a variety of emulsifiers and hydrocolloids as egg substitutes to generate a cake with great quality and acceptance.

The plant Abelmoschusesculentus L. is commonly referred to as lady's finger or okra. It is grown in many countries tropical, sub-tropical and warm temperature climates, ranging from Africa through Asia, Southern Europe and America. It is indigenous to Africa and it is the member of the Malvaceae family.[4] Okra's immature green pods are often eaten as vegetables, but the extract from the pods is also used in many recipes to increase the viscosity of soups and sauces. Okra contains polysaccharides, which are utilized in baked goods and sweetened frozen foods

like ice cream because of their advantages to health and extended shelf life.[5] The mucilage of okra, which is thick and slimy, contains sugars glycosides and acids like glucose, galactose, rhamnose, amino acids, and galacturonic acid, respectively. It also contains considerable amounts of protein, carbohydrate, vitamin, and minerals like zinc.[6] A whipping agent for reconstituted egg whites, an additive in the creation of flour-based adhesives, and additives to clarify sugarcane juice are just a few of the applications in food processing. As an emulsifier, thickening, gelling agent, or texture modifier, it is also utilized to alter the food's stability, texture, and aesthetic qualities. Okra mucilage also helps food items work well by improving their ability to bind water, emulsify, and froth.[7] Therefore, the study aims to examine the effect of okra mucilage on replacing eggs in muffin formulation, and analyze these muffins for proximate and sensory analysis.

Materials and Methods

Extraction of Okra Mucilage

Extraction of okra mucilage is done by collecting unripe pods of okra from the local market, then cutting them into small slices with seeds. Sliced okra is then evenly spread on a tray and dried at 80°C for 4-6 hours in a hot air oven. The dried okra is then ground into a fine powder and sealed in a food-grade polyethylene pouch.

7.5 g of dried okra powder and 500 ml of water are combined, and the mixture is heated to 45 °C for an hour while being constantly stirred. The extract is then collected after the liquid has been filtered through muslin cloth.

Preparation of Standard Muffin

The recipe involves creaming butter and sugar, followed by adding a whole egg, all-purpose flour, vanilla essence, baking powder, salt and milk. The batter is baked for 18-20 minutes at 180°C in a preheated oven.

Variations Using Okra Mucilage

Muffins were prepared with okra mucilage and with control treatment as mentioned in the following table 1:

Table 1.Proportion of egg and okra mucilage in muffin preparation

Variations	Egg	Okra mucilage
SM	57 g	-
OMV1	-	57 g
OMV2	-	77 g
OMV3	-	114 g

Selection of Level of Okra Mucilage In Muffin Preparation

The sensory evaluation of three variations and the standard sample will determine the level of okra mucilage addition in muffins, which will then be subjected to proximate analysis for further study.

Sensory Evaluation

Sensory evaluation of the freshly baked muffins was carried out by 15 semi-trained panelists using a five-point hedonic scale. The panelist received four samples of each muffin and were requested to rate the sensory properties (i.e. crust color, taste, aroma, texture, crust moistness, crumb color, denseness, crumb moistness, and overall acceptability as (1) dislike very much, (2) dislike moderately, (3) neither like nor dislike, (4) like moderately and (5) like very much.

Proximate Analysis

Proximate analysis of okra mucilage muffin and the control muffin was carried out for moisture, ash content, protein, carbohydrate and fat. The tests were performed according to the respective methods described inAACC (2000).[8]

Moisture. Muffin moisture percentage is estimated according to the method #44-15A (AACC, 2000). In this way, 10 g of the sample is heated and dried overnight in a compressed air oven at 105±5 °C. Calculate the weight loss of the cake and represent it based on moisture percentage from the given formula:

$$\text{Moisture (\%)} = \frac{\text{Weight of sample before drying} - \text{Weight of the sample after drying}}{\text{Weight of sample before drying}} \times 100. \quad (1)$$

Total Ash. The Ash content of the muffin was estimated using the AACC model ((#08-01, 2000). In this method, 5 g of the sample is weighed in a porcelain crucible and burned in a muffle furnace at 550°C for 5 hours until a light gray residue remains. Ash content is calculated by the following formula:

$$\text{Ash (\%)} = \frac{\text{Weight of ash}}{\text{Weight of sample}} \times 100.$$

Crude Protein. 0.2 g of the sample along with 3 g of catalyst mixture and 10 ml of concentrated sulfuric acid added to the digestion tube. The digestion is carried out for 90 minutes at 420°C. the digestion tube needs to be neutralized and distilled using 40 ml of 40% NaOH followed by 25 ml of 4% boric acid. The distillation proceeds for 9 minutes for each distillation tube. The ammonia generated through distillation is collected in boric acid receiver which is further titrated against 0.1 N HCl. Once the titration is complete, the total % of nitrogen could be calculated. For the final calculation of protein, use the conversion factor 6.25.

$$\text{Nitrogen (\%)} = \frac{\text{Vol. of } H_2SO_4 \times 0.1 \times 0.014}{\text{Weight of sample}} \times 100. \quad (3)$$

Crude Fat. In estimating crude fat, the standard method was followed. Soxhlet apparatus containing 5 g of the sample was added with petroleum ether, and fat was extracted for 4 hours. Percentage of crude fat was calculated as follows:

$$\text{Crude fat (\%)} = \frac{\text{Weight of fat}}{\text{Weight of sample}} \times 100. \quad (4)$$

Total Carbohydrates. A subtraction method was adopted to estimate the total carbohydrate in the sample

To estimate total carbohydrates, a subtraction method was adopted as follows:

Result and Discussion

Sensory Evaluation

Sensory characteristics of muffins with and without okra mucilage was estimated in terms of crust color, taste, aroma, texture, crust moistness, crumb color, denseness, crumb moistness, and overall acceptability. When eggs were substituted and no okra mucilage was used, the color of the muffin crust was preferred. Okra mucilage gave the muffins a lower sensory score for the color of the crust. There was no significant difference in the taste among the variations and standard. Okra mucilage did not impart any flavor or taste to the muffins and was not noticeable. The texture and crust moistness was better in SM compared to other variations. Samples with okra mucilage had a sticky surface texture which was disliked by the panelist. Muffin with egg (SM) showed an increased firmness and a springy texture whereas, (OMV3) with high levels of okra mucilage showed a softer and a weaker texture. As the level of okra mucilage increases, the softness of the muffin increases but the stability of muffin structure decreases. For samples containing okra mucilage showed pale dull crumb color compared to standard which had yellow crumb color, which reduced the acceptability of muffin. As the percentage of okra mucilage increases, the denseness of the muffin also increases. The crumb moistness increased with mucilage content, resulting in reduced acceptability among the panelists. In terms of overall acceptability, the panelists disliked the muffin with the highest quantity of okra mucilage (OMV3), whereas the muffin with the lowest amount of okra mucilage (OMV1) remained as acceptable as the control (SM). The results obtained from sensory evaluation showed that OMV1 was estimated high, followed by OMV2 and OMV3. Findings suggested that OMV1 samples had promising organoleptic properties in par with the standard samples.

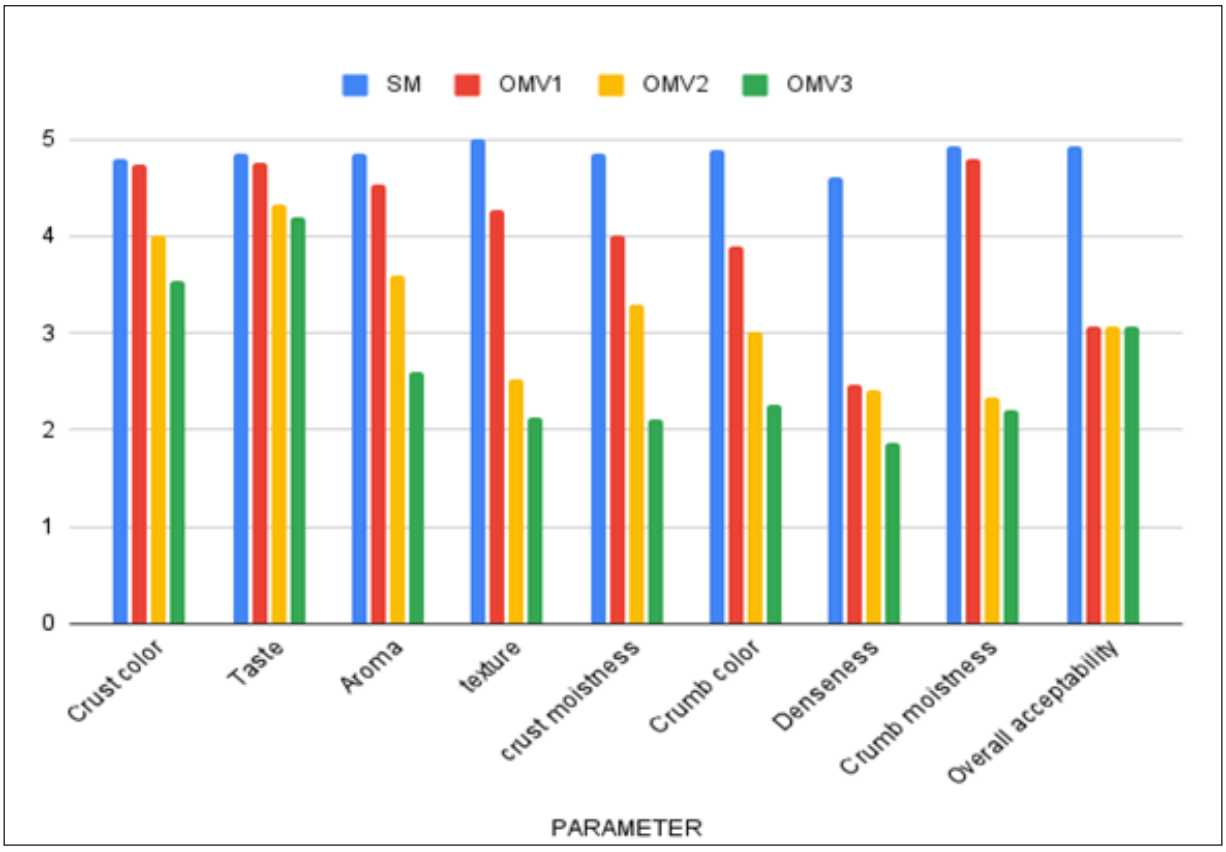

Figure 1.Sensory evaluation of samples SM, OMV1, OMV2 and OMV3

Proximate Analysis

The proximate analysis of the muffin with and without the okra mucilage are shown in Table 2. Moisture is the most desired sensory attribute in order to obtain light and fluffy baked goods like muffin, and it also reflects the quality of the dish. There exist no notable difference in the moisture with addition of okra mucilage in the muffin.

In case of ash content, the sample with okra mucilage (OMV1), was lower when compared to the standard sample (SM). SM muffin contains more fat content (19.2051%) as compared to substituted okra mucilage muffin (57g mucilage) with reduced fat content (15.044%). With the addition of okra mucilage, the protein content in the muffin decreased from 20.59% (SM) to 17.89% (OMV1).

The carbohydrate was notably higher in OMV1 muffin (50.262%) compared to SM muffin (43.4162%).

Table 2.Proximate analysis of muffin samples SM and OMV1

Samples	Moisture (%)	Ash (%)	Fat content (%)	Protein content (%)	Carbohydrate content (%)
SM	15.6883	1.10	19.2051	20.59	43.4162
OMV1	15.904	0.9	15.044	17.89	50.262

Ahmad, 2021, reported that with the addition of flaxseed mucilage in the muffin showed a decreasing trend in the protein and fat content.[9]

Dantas, 2021, reports indicated that okra mucilage could be used as an emulsifier in the food industry and that it could enhance the stability, texture and the appearance of food as well as serve as a gelling agent or texture modifier[4]. In this study, it reveals that okra mucilage, due to its emulsifying properties, can replace the eggs in the muffin formulation.

Conclusion

This study showed that okra mucilage did not have any undesirable effect on the proximate and sensory properties of muffin. The sensory properties of OMV1 muffin were the most acceptable by the panelists for all attributes. In addition, it did not affect the moisture content of the muffin but decreased the protein, fat content. In conclusion, this mucilage can be used to enhance the sensory and physical qualities of foods like muffins. It is advised to conduct additional research to ascertain whether this innovative addition may be used in other bakery goods.

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