MYCOTOXICOLOGY SOCIETY OF NIGERIA

In Collaboration With

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EVALUATION OF THE ORGANOLEPTIC ATTRIBUTES OF TURMERIC (*Curcuma longa)* FORTIFIED GROUNDNUT CAKE

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ABSTRACT
Turmeric (*Curcuma longa*) is known for its potent bioactive compounds, particularly curcumin, which have numerous health benefits. This study evaluates the organoleptic attributes of groundnut cake (GNC) fortified with turmeric, exploring its sensory qualities and potential as a functional food ingredient. Control (0 g turmeric /100 g GNC (S1), 2 g turmeric/100 g GNC (S2), 4 g turmeric/100 g GNC (S3), 6 g turmeric/100 g GNC (S4), and 8 g turmeric /100 g GNC (S5). Sensory analysis was carried out to assess the impact of turmeric powder on colour, appearance, flavour, aroma, texture, and overall acceptability of groundnut cake, utilizing a 9-point hedonic scale with evaluations conducted by thirty-three semi-trained panelists. The result of the colour was significantly higher in S3 (7.74) than S2 (7.49), when compared to the control S1 (6.77), while S5 (7.37) and S4 (7.34) were statistically similar. In the terms of appearance, S2 (7.37) was significantly better than S4 (7.03) with the least value. With regards to flavour, S2 (7.06) was significantly higher when compared to S5 (5.91) with the least value, while S1(6.55) and S3 (6.46) were statistically similar and higher than S4 (5.94). The S2 (6.79) for aroma has significant improvement when compared to S5 (5.92) with the least value. Texture, S2 (6.85) was significantly better when compared to S4 (6.19) with the least value. The overall acceptability for control group S1 7.29 which was significantly higher when compared to S5 (6.33) with the least value. The result showed that the inclusion of 2 g turmeric powder per 100 g of GNC enhanced all the organoleptic attributes. It is therefore recommended that 2 g/100 g of GNC should be used for improving consumer preference and overall acceptability of this food product.

Keywords: Turmeric, groundnut cake, fortified, organoleptic attributes,

INTRODUCTION
Turmeric (*Curcuma longa*), is a spice that has distinctive flavour, vibrant colour, and numerous health benefits, including antioxidant, anti-inflammatory, and antimicrobial properties (Chakraborty *et al.,* 2023). Its active compound, curcumin, has gained significant attention for its potential applications in functional foods due to its therapeutic effects in mitigating chronic diseases such as arthritis, cardiovascular diseases, and cancer (Patel *et al.,* 2022). Groundnut cake, a by-product of groundnut oil extraction, is a rich source of protein, fibre, and essential nutrients, traditionally used as animal feed but increasingly explored for human consumption (Adeyemi *et al.,* 2021).

The fortification of groundnut cake with turmeric offers an innovative approach for enhancing its nutritional profile while enhancing its organoleptic qualities. Sensory attributes such as taste, colour, texture, and aroma are crucial factors influencing consumer preference, acceptability and marketability (Musa *et al.,* 2020). Therefore, evaluating the impact of turmeric on these sensory characteristics is vital for determining its potential to improve the acceptability of groundnut cake as a functional food (Rasool *et al.,* 2021). This study aims to assess the organoleptic properties of turmeric-fortified groundnut cake and explore its acceptability among consumers, thereby contributing to the development of nutrient-dense food options for diverse populations.

MATERIALS AND METHODS
Sources of raw material
Groundnut seed (*Arachis hypogea*) and turmeric rhizome (*Curcuma longa)* used for this study were purchased from Kure-ultra modern market in Bosso Local Government Area Minna, Niger State.

Preparation of turmeric rhizome powder
The turmeric rhizomes were sorted, thoroughly washed with water to remove soil particles on them. They were further peeled, thinly grated and sundried for six hours each day for two days making a total of twelve hours sun drying. After drying, they were ground into powder and stored in a plastic air tight container.

Production of groundnut cake

Groundnut cake was prepared according to the method described by Chibuzo and Ali (1994). Groundnuts were sorted, washed, sundried and roasted slightly for about 15 minutes under medium heat. The roasted groundnut was cooled and the coats were removed by manual abrasion. Afterwards the roasted groundnut was grinded into paste with the use of harmer mill. Little quantity of warm water was then added gradually to the groundnut paste and stirred until oil oozed out, which took about 30 minutes. The groundnut paste samples were then fortified with varying concentrations of turmeric per 100g of groundnut cake (GNC) control (S1) 0 g turmeric/100 g of GNC, 2 g (S2) turmeric/100 g GNC, 4 g (S3) turmeric/100 g GNC, 6 g (S4) turmeric/100 g GNC, and 8 g (S5) turmeric/100 g GNC. The oil was drained out and put in a separate container. Turmeric was then added to the groundnut paste flattened on a rolling board, cut in small sizes and fried in the extracted oil until a golden-brown colour was obtained. The cake was then drained and cooled. Each sample were fried and stored separately in a labeled air-tight container

Assessment of the organoleptic attributes of groundnut cake fortified with turmeric rhizome powder

The sensory evaluation was conducted using 33 semi-trained panelists from the Federal University of Technology, Minna, campus community. The evaluation followed the method described by Grunert *et al.* (2004), utilizing a 9-point hedonic scale with the following ratings: 9 = like extremely, 8 = like very much, 7 = like moderately, 6 = like slightly, 5 = neither like nor dislike, 4 = dislike slightly, 3 = dislike moderately, 2 = dislike very much, and 1 = dislike extremely.

The panelists assessed the groundnut cake samples based on sensory attributes, namely colour, appearance, texture, taste, aroma and overall acceptability. After tasting each sample, panelists were provided with cracker biscuits and water to cleanse their palates and prevent flavour carryover between samples.

RESULTS

Effect of the Inclusion of Turmeric in Groundnut Cake on Organoleptic Attributes

The results on the effect of the inclusion of turmeric on the organoleptic attributes of groundnut cake is shown in Table 1. The result showed that there were significant differences ($p<0.05$) in all the parameters evaluated. It was evaluated using nine-point hedonic scale with the help of thirty-three semi-trained taste panelists. The result of the colour was significantly higher in S3 (7.74) than S2 (7.49), when compared to the control S1 (6.77), while S5 (7.37) and S4 (7.34) were statistically similar. In the terms of appearance, S2 (7.37) was significantly better than S4 (7.03) with the least value. With regards to flavour, S2 (7.06) was significantly higher when compared to S5 (5.91) with the least value, while S1(6.55) and S3 (6.46) were statistically similar and higher than S4 (5.94). The S2 (6.79) for aroma has significant improvement when compared to S5 (5.92) with the least value. Texture, S2 (6.85) was significantly better when compared to S4 (6.19) with the least value. The overall acceptability for control group S1 7.29 which was significantly higher when compared to S5 (6.33) with the least value.

Table 1: Organoleptic Attributes of Turmeric Fortified Groundnut Cake

Parameters	Samples							
	S1	S2	S3	S4	S5	SEM	P-value	Sig
Colour	6.77^{c}	7.49^{b}	7.74^{a}	7.34^{b}	7.37^{b}	0.10	0.00	*
Appearance	6.74^{c}	7.37^{a}	7.20^{ab}	7.03^{b}	7.09^{b}	0.23	0.00	*
Flavour	6.55^{b}	7.06^{a}	6.46^{b}	5.94^{c}	5.91^{c}	0.46	0.00	*
Aroma	6.42^{b}	6.79^{a}	6.31^{bc}	6.06^{cd}	5.92^{d}	0.33	0.00	*
Texture	6.44^{bc}	6.85^{a}	6.54^{b}	6.19^{c}	6.30^{bc}	0.27	0.01	*
Overall acceptability	7.09^{b}	7.29^{a}	6.79^{b}	6.45^{d}	6.33^{d}	0.38	0.00	*

This was determined by using hedonic scale 1-9: 1=dislike extremely, 2=dislike extremely, 3=dislike moderately, 4 dislike slightly, 5=neither like nor dislike, 6=like slightly, 7=like moderately, 8=like very much, 9=like extremely. Values with different superscript across the row are significantly ($p < 0.05$) different. SEM = Standard error of mean; P-value = Probability value; Sig = Significance; * = Significant; NS = Not significant.

DISCUSSION

The inclusion of 2 g of turmeric per 100 g of groundnut cake (S2) showed significant improvements in various organoleptic attributes compared to other inclusion levels. The results showed that, it enhanced mouthfeel, appearance, flavour, aroma, and texture which led to higher overall acceptability for (S2) that contains 2 g of turmeric in groundnut cake, indicating broad consumer preference (Lopez *et al.*, 2021). The inclusion of turmeric significantly improved the colour of groundnut cake, which is consistent with previous findings that turmeric enhances the colour of food products (Sanchez *et al.,* 2013). The natural pigments in turmeric likely enhanced the groundnut cake colour, improving its visual

appeal (Davis *et al.*, 2020). This suggests that excessive turmeric may negatively impact mouthfeel and flavour quality. This might be due to the bitter and astringent properties of turmeric at higher concentrations (Hossain and Ishimine, 2021). A similar study found that high levels of spice blends can decrease mouthfeel and flavour scores (Jensen *et al.,* 2015). A moderate amount of turmeric improves the appearance, and aroma of groundnut cake, while the overall acceptability makes its more attractive to consumers (Kumar *et al.,* 2018). The optimal inclusion of turmeric (2 g) did better than the control while balancing the flavour, aroma, and colour enhancements which minimize negative effects. Turmeric contains curcumin, which has antioxidant and anti-inflammatory properties that can enhance food quality (Menon, 2023). The inclusion of 2 g of turmeric per 100 g of groundnut cake (S2) is the optimal level for enhancing organoleptic attributes and consumer acceptance. This study supports the use of turmeric as a natural food additive to improve the sensory quality of groundnut cake.

CONCLUSION AND RECOMMENDATIONS

In this study it was established that the inclusion of 2 g of turmeric/ 100 g of GNC (*S2*) significantly enhanced the sensory attributes of groundnut cake, especially colour, flavour, and texture, turmeric concentration above 2 g reduced the perception of sensory attributes. It is therefore recommended to use turmeric at 2 g/100 g of GNC for optimal sensory appeal, consumer preference and overall acceptability.

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