ISSN No:-2456-2165

Determination of the Effect of Pumpkin (*Cucurbita maxima*) Seeds Flour and Cooking Method on Quality Properties of Maize (*Zea Mays* L.) Flour Fritters (*Zitumbuwa*)

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Abstract:- Protein-energy malnutrition (PEM) and overweight continue to be health problems in sub-Saharan African countries like Malawi as a result of poor diets resulting from higher poverty levels. Maize flour fritters consumed in Malawi by both adults and children in urban and rural areas contain high levels of carbohydrates but have very low levels of protein and energy hence contributing to PEM. The maize fritters are mostly cooked using the frying method which means they absorb a lot of oil during the cooking process which may lead to overweight. To enrich low protein products such as maize flour fritters, Compositing is among the widely used methods while baking is an ideal preparation method that has the potential to deal with overweight. In this study, maize flour was replaced with pumpkin seeds flour at different levels of 15%, 30%, and 45% to prepare fried and baked highly nutritious fritters. To determine the effect of pumpkin seeds flour formulation levels and processing methods on the proximate composition of raw flour and fritters like moisture, ash, fibre, fat, protein and carbohydrates contents were determined.

Consumer acceptability of the fritters was determined using a 5-point hedonic scale. The results showed that the addition of pumpkin seeds flour to maize flour significantly increased the protein content of pumpkin seeds flour fried and baked fritters from 9.10-21.90 % and 8.50-19.60 respectively where the control recorded lowest. The cooking method significantly reduced some proximate except in fat content which increased by 22.07% and 8.57% while protein decreased by 2.47% and 4.77% in fried and baked fritters respectively. Supplementing maize flour fritters with 30% pumpkin seeds flour using baking and fried method can also produce fritters which are highly acceptable by consumers. The results of this study may contribute to food security since pumpkin seeds are locally available and also alleviate malnutrition following the use of pumpkin seeds flour which contains a high amount of nutrients and baking when making fritters.

Keywords:- *Protein Energy Malnutrition (PEM), Fritters, Food Security, Pumpkins, overweight, enrichment.*

I. INTRODUCTION

Malnutrition continues to be a health problem globally, especially in sub-Saharan Africa (Malawi included) due to poor diet (WHO, 2018). PEM occurs in both children and adults due to the consumption of foods that are insufficient in protein and energy (calories) to satisfy nutritional needs (Bessada *et al*., 2019). On the other hand, overweight mostly occurs due to high intake of energy-dense foods like maize snacks that are high in fat and sugar (WHO, 2018). Malnutrition results in adverse effects including death, for example, over three million child deaths annually across the world are due to malnutrition(Black *et al*., 2013). Pumpkin (*Cucurbita maxima*) is locally referred to as '*maungu*' in Malawi and is cultivated in different parts of the country as a traditional vegetable crop. The leaves are usually prepared as a vegetable dish, the pulp is boiled while the seeds are either eaten together with the pulp, rarely roasted or wasted when the pulp is cooked. According to Maheshwari *et al.* (2015), pumpkin seeds contain a lot of nutrients, particularly proteins and unsaturated fat which may help in reducing PEM and overweight.

Processing method may improve food digestibility and nutritive value depending on the processing methods used (Otemuyiwa *et al.*, 2018). In Malawi whole maize flour fritter snacks are prepared by deep frying and are mostly consumed by both adults and children at breakfast, midmorning or between meals. Lately, products which have low-fat or fat-free are becoming more popular. This follows studies conducted on the effects of consuming foods that have high quantities of saturated fats which found that the foods are associated with obesity and other cardiovascular diseases (Lumanlan *et al.*, 2020; Venkata and Subramanyam, 2016). Hence there is a need of finding another alternative way of preparing nutritious and healthy cereal snacks that do not absorb more oil to meet consumers' preferences. In this study, the effects of enriching maize flour with pumpkin seeds flour and processing methods namely deep frying and baking on the proximate composition and consumer acceptability of the flour and fritters were evaluated.

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II. MATERIALS AND METHODS

The study was conducted at the Department of Dairy and Food Science and Technology, Egerton University Kenya. Dried Pumpkin seeds (variety Cucurbita pepo), dried maize grain, salt, sugar and oil were purchased from Nakuru market, Kenya.

A. Sample and Fritters Preparation

➢ *Preparation of pumpkin seeds flour*

First, the seeds were sorted to remove some foreign matter and then cleaned using tap water to avoid contamination, then the seeds were then oven-dried at 60 °C for 3 hours, milled into flour, packed in a container and then stored under refrigeration (4-5˚C) to avoid oxidation of the flour until further analyses.

➢ *Preparation of maize flour*

High-quality dry maize was purchased from the Nakuru market to prepare flour. Maize was sorted to remove some foreign matter. Then milled into flour, then the flour was stored in an airtight container until needed for further analysis.

➢ *Study Design*

The design involved mixing maize flour with pumpkin seeds flour in four rations 100:0, 85:15, 80: 70:30 and 55: 45% in the formulation of fritters using frying and baking method. The control fritters were prepared from maize flour only.

➢ *Preparation of Maize Flour and Maize-Pumpkin Seeds Flour Fritters Using Deep Frying and Baking Method*

Composite maize and pumpkin seeds fritters were prepared by mixing water (250 mL) into 500 g of each of the flour blends, 50 g of sugar and 5 g of salt. The mixture was continuously stirred until a stiff dough was formed and it was hand-kneaded for 5 min. The dough was moulded into small rounded portions and for the deep-frying method, the shaped dough was fried in hot top fry vegetable oil at 180℃ for 5-10 min using a deep fryer until the fritters were cooked. The second mixture followed the procedure mentioned above but frying was replaced by baking at 275℃ for 50min. Then fried and baked fritters were transferred into a tray lined with paper and left to cool at 37oC for 1h and this was followed by grinding of fritters using blender ARMCO blender (model ABL-742RX, China), to homogenize the samples after which they were kept in 250mls of plastic bottles under refrigeration condition for further analyses.

➢ *Proximate composition analysis*

Ash, moisture, crude protein, crude fibre and fat content were determined by following the standard methods of the Association of Official Analytical Chemists

(AOAC, 2000) method number 923.03, 925.09, 979.09, 962.09 and 920.39 respectively. Carbohydrate was determined by difference.

➢ *Sensory Evaluation of the fritters*

The consumer acceptability of fritters was done by 30 panellists to give the general acceptability and likeability of the fritters. The panellist were students from Egerton University. Some of them are from Malawi and are familiar with the product. The students were given a questionnaire attached in Appendix 1 to evaluate the quality characteristics of fritters based on colour, flavour, texture (crispness), aroma, and overall acceptability. Panellists were asked to rate the samples using a 5-point hedonic scale (5=like extremely; 4=like moderately; 3=neither like nor dislike; 2=dislike moderately; and 1=dislike extremely). Samples were blind-coded with three-digit random numbers. The order of presentation of samples was randomized as shown in figure (1). Tap water was provided for the panellists to clean their mouths before tasting another sample (Hashempour*et al*., 2018).



Fig. 1: Sample presentation order

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III. RESULTS AND DISCUSSION

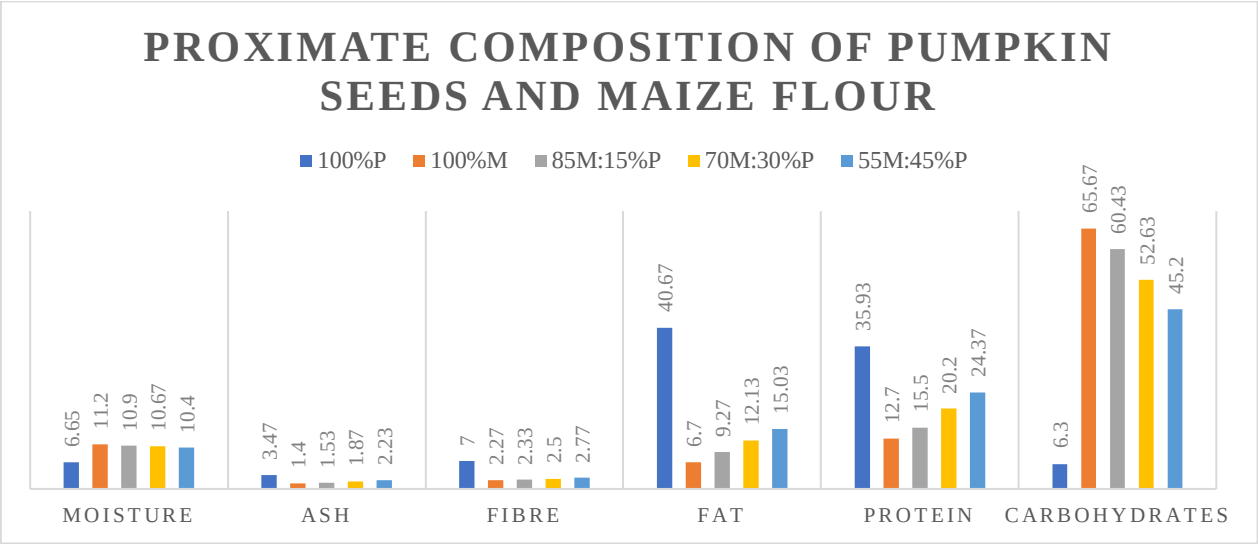


Fig. 2: Proximate composition of pumpkin seeds and maize flour (%) on a dry basis(db)

A 0: 100 (Maize: pumpkin seeds flour); B 100: 0 (Maize: pumpkin seeds flour); C 85: 15 (Maize: pumpkin seeds flour); D 70: 30 (Maize: pumpkin seeds flour); E 55: 45 (Maize: pumpkin seeds flour)

Mean ± standard deviation of three replicates. Values with the same superscript along the same column are not significantly different from each other (Tukey, $p \leq 0.05$)

Fig 2. shows the proximate composition of maize flour with different substitution levels of pumpkin seeds flour to know how much nutrients were lost or gained during cooking after adding pumpkin seeds flour to maize flour. From the findings, there is a significant difference ($p \leq 0.05$) in all the proximate compositions of the flour blends. The proximate composition results show that pumpkin seeds flour contains higher nutritional value as compared to control (maize flour 100%) and this justifies why pumpkin seeds flour was used in this study to improve the nutritional content of the maize flour fritters.

Table 1: Proximate composition of fried and baked fritters made from maize and different levels of pumpkin seeds flour (%) on a dry basis (db)

Sample	Moisture	Ash	Fibre	Fat	Protein	Carbohydrate
AF	9.5±0.00^{a}	1.37±0.06^{a}	1.40±0.00^{a}	10.80±0.00^{a}	9.10±0.00^{a}	67.80±0.10^{a}
BF	9.20±0.00^{b}	1.47±0.06^{a}	1.77±0.06^{ab}	16.70±0.00^{b}	13.40±0.00^{b}	57.43±0.06^{b}
CF	8.93±0.06^{c}	1.63±0.06^{ab}	2.10±0.00^{bc}	24.10±0.00^{c}	14.20±0.00^{c}	46.00±0.10^{c}
DF	8.77±0.06^{d}	2.07±0.06^{bc}	2.40±0.00^{c}	37.10±0.00^{d}	21.90±0.00^{d}	27.77±0.06^{d}
EB	7.83±0.06^{e}	1.37±0.12^{a}	1.37±0.12^{a}	8.27±0.06^{e}	8.50±0.00^{e}	72.60±0.17^{e}
FB	7.70±0.00^{f}	1.57±0.12^{ab}	1.73±0.32^{ab}	13.17±0.06^{f}	12.30±0.00^{f}	63.60±0.44^{f}
GB	7.00±0.00^{g}	1.83±0.23^{b}	2.27±0.21^{c}	18.10±0.00^{g}	16.87±0.06^{g}	53.97±0.42^{g}
HB	6.73±0.06^{h}	2.17±0.12^{c}	2.47±0.06^{c}	23.60±0.00^{h}	19.60±0.00^{h}	45.37±0.06^{c}

AF= 100: 0; BF= 85: 15; CF=70: 30; DF 55: 45; EB= 100: 0; FB= 85: 15; GB=70: 30; HB 55: 45 (Maize: pumpkin seeds flour %) where F stands for fried and B stands for baked fritters

Mean ± standard deviation of three replicates. values with the same superscript along the same column are not significantly different from each other.

A. Moisture

The current study results in Table 1.0 show that there was a significant difference in the moisture content of the fritters at all levels. The moisture content of the maize flour (control) was high 9.29%. As the pumpkin seeds flour substitution level increased, the moisture content of the fitters decreased. The highest level of maize-pumpkin seeds flour fritters blends 55: 45 recorded the lowest moisture content of 6%. The decrease in moisture as the pumpkin seeds flour increases in fritters might be due to the increase in protein which leads to an increase in hydrogen bonds hence facilitating water binding and entrapment (Twinomuhwezi *et al.*, 2020). Comparing the two methods of processing, fried fritters had slightly high moisture content ranging from 8.77-9.5% while for baked fritters, moisture ranged from 7.83- 6.73%. The low moisture content in baked fritters is due to the high level of dehydration during baking since it was baked at 275℃ for 60 min while frying was done at 180℃ for 10 min. These findings correspond to what other researchers found on the moisture content of the biscuits and cookies made from wheat flour with various flour blends of pumpkin seeds flour (Abdelgadir and Mohamed, 2019; Alshehry, 2020). Other researchers also reported the same trend in the fried snacks (koro koro) which are made from maize and different levels

ISSN No:-2456-2165

of coconut and groundnut flour (Adebowale and Komolafe, 2018; Otunola *et al.*, 2012). The study findings are in contrast with what other researchers reported when cereal was blended with pumpkin seeds flour. For Instance, Batista *et al.* (2018) found an increase in moisture following the addition of pumpkin seeds flour to cupcakes.

B. Ash

Pumpkin seeds are known to have high minerals than maize and, in this study, findings show that the substitution of pumpkin seeds flour had an impact on the ash content of the fritters. The ash content of the fried and baked maize and maize-pumpkin seeds flour fritters ranged from 1.37-2.07% and 1.37-2.17%%, respectively, where 100% maize flour fritters (control) recorded the lowest. Although there was no interaction between the pumpkin seeds flour substitution level and the cooking process, the results show that the addition of pumpkin seeds flour causes a slight increase, especially at a ratio of 55:45 maize-pumpkin seeds flour in both fried and baked fritters. The increase of ash as the level of pumpkin seeds flour and African oil bean flour in snacks was also reported (Akinola and Enujiugha, 2017; Batista *et al.*, 2018). Compared with the raw flour results in Figure 2, frying and baking slightly decreased the ash content. The results are in line with what was reported by Akintade *et al.* (2019) who reported that roasting significantly reduced the ash content of pumpkin seeds. However, an increase in minerals was also reported by other researchers who explained that the increase might be due to the thermal degradation of anti-nutritional factors present in raw seeds which forms complexes with minerals, hence causing the liberation of minerals in unroasted seeds (Alderaywsh *et al.*, 2019).

C. Crude Protein

The findings of the study show that crude protein levels of fried and baked maize pumpkin seeds flour fritters were higher than those of the control (100%). The crude protein content increased significantly ($P \leq 0.05$) in both fried and baked fritters as the level of the pumpkin seeds flour increased. The highest crude protein was recorded in the sample with a ratio of 55:45 for both baked and fried. The protein content after enrichment as found in this study are within the recommended minimum value by the Food and Agriculture Organization/World Health Organization which emphasised that the protein content of any food should be more than 10% (Ojinnaka *et al.*, 2016). Based on current findings enriched fritters at each level have more than 10% except on control and this justifies why pumpkin seeds flour was used to improve the protein content of the fritters. These findings are similar to those reported by various researchers who reported that as the level of pumpkin seeds flour and lupin flour increases the level of protein in flour blends and products also increases (Adem, 2020; Kaur and Sharma, 2017; Kumari and Sindhu, 2019). Based on current findings enriched fritters at each level have more than 10% except on control and this justifies why pumpkin seeds flour was used to improve the protein content of the fritters. These findings are similar to those reported by various researchers who reported that as the level of pumpkin seeds flour and lupin flour increases the level of protein in flour blends and products also increases Otemuyiwa *et al.* (2018), nutrients in food might be lost or gained depending on the processing method used". Comparing the proximate results for raw flour blends and fritters, the results show that the cooking process decreased the protein content of the fritters. Comparing two processing techniques fried fritters had high protein which ranged from 9.10-21.90% while baked ranged from 8.50-19.60%. For example, the protein content in flour blends with 55:45% maize-pumpkinseeds flour was 24.37% but after frying and baking it decreased by 2.47% and 4.77 respectively. The reduction in protein content in both fried and baked at each substitution level after the cooking processes might be due to protein denaturation since the food was heated at high temperatures for a long time, especially during baking. However, a study by Syeunda *et al.*, (2021), reported that there was an increase in protein content after the cooking process and this was due to the type of cooking method which was used to prepare the porridge did not cause any loss or gain in nitrogen content.

D. Crude Fibre

The crude fibre content in the fritters increased slightly as the levels of pumpkin seeds flour substitutions increased. This may be because of the presence of crude fibre in pumpkin seeds which had a greater effect on the cereal(maize). The fibre content in raw flour blends and fritters increased as the level of pumpkin seeds flour increased (Table 1). These results are in line with what other researchers reported on flour blends and various snacks as the level of pumpkin seeds flour and other legumes increases(Adebowale and Komolafe, 2018; Costa *et al.*, 2018; Dauda *et al.*, 2020). On the contrary, the decrease in fibre as the level of lima bean seed flour increases in maize snacks has also been reported (Oluwafemi *et al.*, 2018). Cooking slightly decreased the fibre content where fried fritters had 1.40- 2.40 while baked fritters had 1.37-2.47%. The decrease in fibre after cooking was also reported and this might be due to the breakdown of some weak bonds between polysaccharide chains and glycosidic linkages found in polysaccharides fibres (Căpriţă *et al.*, 2011).

E. Fat

There was also a significant increase in the fat as the level of pumpkin seed flour increased in both flour blends and fritters. This is because pumpkin seeds used in this study had more fat (40.67%) Figure 2. The processing method also caused an increase in fat where baked fritters ranged from 8.27- 23.60% while fried fritters ranged from 10.80- 37.10% and the control was lowest (Table 1). According to (Onyeike *et al.*, 2015) the Increase in fat might be due to heat which caused the fat to melt due to cell disruption and also the high absorption of oil, especially during the frying of the fritters. The increase in fat content was also observed in wheat-soy fat cake, cookies and korokoro as the soy, pumpkin seeds and groundnuts flour addition increased (Dauda *et al.*, 2020; Liomba *et al.*, 2018; Oluwafemi *et al.*, 2018). According to FAO/WHO the oil content of fritters is within the recommended range of 10 to 25% oil per 100% of food for supplementary feeding of young children except for the fried sample which had 55:45% maize and pumpkin seeds flour since it had 37.10%.

ISSN No:-2456-2165

F. Carbohydrates

There was a significant difference ($p \leq 0.05$) in carbohydrate content among samples. The values for the fried fritters and baked fritters ranged from 27.77- 67.80% and 45.37 - 72.60%, respectively. The decrease in carbohydrates as the level of pumpkin seeds flour increases in all samples was expected because of the high increase in fat and proteins in maize-pumpkin samples. The results are in agreement with what other researchers reported as the level of substitution of pumpkin seeds and Bambara flour increased the carbohydrates level of the different products decreased(Alshehry, 2020; Arise *et al.*, 2018).

IV. EFFECT OF PUMPKIN SEEDS FLOUR AND COOKING METHOD ON SENSORY EVALUATION OF THE FRITTERS

A. Appearance and Colour

Good sensory attributes such as appearance and colour are very important factors to consider when developing any consumable product this is because they determine both product acceptability and marketing. The results show that as the level of pumpkin seeds flour increased the mean scores for colour and appearance also increased but there was no difference in both colour and appearance among fried samples as the level of pumpkin seeds flour increases while in baked samples were highly significant. It was also observed that the cooking method (baking or frying) significantly affected the colour characteristics of the fritters where the fried samples had high mean score than baked samples. This might be due to sugar caramelization and Maillard reactions between sugars and amino acids which occur more rapidly during frying than baking (Özcan et al., 2021). Another reason why there is less score in baked samples might be due to the yellowish or whitish colour of the crust hence panellists regarded the fritters as not well cooked since they are familiar with fried fritters which have a golden-brown colour. For instance, the mean score for appearance and colour in fried samples ranged from 4.58-4.90 and 4.26-4.65 while in baked samples ranged from 1.74-3.19 and 1.66-3.42 respectively. Study findings are in line with what other researchers found when pumpkin seeds flour was added to wheat flour to make biscuits, cookies and bread and as the level of pumpkinseeds kept on increasing at a certain level appearance and colour mean score was decreasing (Abdelgadir and Mohamed, 2019; El-Demery and Lotfy, 2015; Ifesan, 2020). The study found that the effects of pumpkin seeds flour formulations, cooking processes and interaction between pumpkin seeds flour and cooking process were significant at $p<0.05$ on appearance and colour.

Table 2: Sensory evaluation of maize and pumpkin seed flour fritters prepared using fried and baked methods

SAMPLE	APPEARANCE	FLAVOUR	TASTE	COLOUR	TEXTURE	OVARALL ACCEPTABILITY
AF	4.58 ± 0.62^{d}	3.87 ± 0.92^{c}	3.94 ± 0.10^{c}	4.26 ± 0.73^{c}	4.16 ± 1.10^{c}	4.26 ± 0.10^{c}
BF	4.61 ± 0.56^{d}	4.06 ± 0.57^{c}	4.10 ± 0.65^{cd}	4.32 ± 0.70^{c}	4.26 ± 0.93^{c}	4.35 ± 0.55^{c}
CF	4.90 ± 0.30^{d}	4.84 ± 0.52^{d}	4.71 ± 0.59^{d}	4.58 ± 0.56^{c}	4.48 ± 0.81^{c}	4.81 ± 0.54^{c}
DF	4.68 ± 0.70^{d}	3.58 ± 0.67^{bc}	3.52 ± 1.0^{bc}	4.65 ± 0.55^{c}	4.55 ± 0.51^{c}	3.48 ± 0.68^{b}
EB	1.74 ± 0.51^{a}	1.87 ± 0.92^{a}	1.84 ± 0.86^{a}	1.68 ± 0.60^{a}	1.71 ± 0.69^{a}	1.97 ± 0.66^{a}
FB	2.35 ± 0.61^{b}	2.42 ± 0.72^{a}	2.29 ± 0.69^{a}	2.26 ± 0.68^{a}	2.35 ± 0.80^{a}	2.10 ± 0.70^{a}
GB	3.16 ± 0.69^{c}	3.74 ± 1.03^{bc}	3.48 ± 1.06^{bc}	3.26 ± 1.13^{b}	3.19 ± 1.08^{b}	3.03 ± 0.91^{b}
HB	3.19 ± 0.75^{c}	3.16 ± 0.82^{b}	3.00 ± 1.16^{b}	3.42 ± 1.12^{b}	3.26 ± 1.06^{b}	2.94 ± 0.89^{b}

AF= 100: 0; BF= 85: 15; CF=70: 30; DF 55: 45; EB= 100: 0; FB= 85: 15; GB=70: 30; HB 55: 45 (Maize: pumpkin seeds flour %) where F stands for fried and B stands for baked fritters

Mean ± standard error of three replicates. values with the same superscript along the same column are not significantly different from each other (Tukey, $p \leq 0.05$)

B. Flavour and Taste

Significant differences in flavour and taste were found to exist between some samples as pumpkin seed percentage increased. The mean score for flavour in fried and baked fritters varied from 3.58 to 4.84 and 1.87 to 3.74 respectively. It was observed that the mean scores increased with increasing the concentration of pumpkin seed flour, and decreased at 45% pumpkin seeds flour in both fried and baked fritters. This means that the fritters were not liked by the panellists.

Taste is a very significant parameter when evaluating the sensory properties of the product. This is because no matter how appealing the product is but if the taste is bad, such a product is likely to be unacceptable. It was observed that the mean scores increased with increasing the concentration of pumpkin seed flour, and decreased at 45% pumpkin seeds flour in both fried and baked fritters. The panellist's scores were higher in fritters with 30% pumpkin seeds flour. These findings are in line with what was reported in another study as the level of pumpkin seeds flour exceeded 30% in biscuits the means score decreased(Kaur & Sharma, 2017). The study found that the effects of pumpkin seeds flour formulations, cooking processes and interaction between pumpkin seeds flour and cooking process were significant at $p<0.05$ on flavour and taste.

C. Texture

In terms of texture, significant differences were recorded between fried and baked fritters. There were no significant differences among fried samples although as the level of pumpkin seeds flour increased, the mean score of the sample increased too and the control sample got the lowest mean score (4.16) while fritters supplemented with 45% pumpkin seed flour recorded the highest score (4.55). The study also found that there was a significant difference in baked samples

ISSN No:-2456-2165

where the control recorded the lowest score (1.71) and the fritters with 45% pumpkin seeds flour recorded the highest (3.26). the increase in texture as the level of pumpkin seeds flour could be due to the higher protein content of the fritters as the level of pumpkin seeds flour increases (Atuonwu and Akobundu, 2010). The findings show that the cooking process affects the sensory properties of the product. The current study found that the effects of pumpkin seeds flour formulations and cooking processes were significant at $p<0.05$ while the interaction between pumpkin seeds flour and the cooking process was significant at $p<0.001$ on texture. The present results agree with what other researchers reported on biscuits and cookies as the level of pumpkin seeds flour increases the texture score were also increasing (Abdelgadir and Mohamed, 2019; Ifesan, 2020).

D. Overall Acceptability

The present study shows that overall acceptability differs significantly among the treatments. The highest scores (4.81) and (3.03) were recorded by fried and baked samples containing 30% pumpkin seed flour respectively. however, although the mean score keeps on increasing as the level of pumpkin seeds increases after 30% the scores decreased in both fried and baked and this might be panellist did not accept fritters supplemented with 45% pumpkin seeds flour may be due to too much smell of the pumpkin seeds flour also on fried the panellist may not like the product because of too much fat, especially for the fried and too much pumpkin seeds flavour. On baked control (EB 100% maize flour) scored less (1.97) may be due to poor sensory attributes of the sample hence it was disliked by panellists. The current study is in line with what was reported by Kaur and Sharma (2017) who stated that at 30% whether it's raw or roasted pumpkin seeds flour the product was highly acceptable. This finding contradicts with what other researchers reported which indicates that at 40% and 50% cakes can also be more acceptable (Batista et al., 2018; Mem Shehata and El-Sayed, 2020). The control sample obtained lower acceptability scores, especially in baked samples than the composite samples due to the improved appearance, colour, nutty flavour and taste. The study found that the effects of pumpkin seeds flour formulations, cooking processes and interaction between pumpkin seeds flour and cooking process were significant at $p<0.05$ on overall acceptability.



Fig. 3: A picture of fried and baked fritters

V. CONCLUSION

In this study, the addition of pumpkin seeds flour to maize flour when making fritters significantly increased the proximate composition of the fritters whereas cooking methods reduced ash, fibre, proteins and moisture while fat increased. The study also revealed that the interaction between the cooking process and the pumpkin seeds flour substitution levels were significant in some proximate compositions except for ash and fibre. On sensory the study found out that the effects of pumpkin seeds flour formulations, cooking processes and interaction between pumpkin seeds flour and cooking process were significant at $p<0.05$ on appearance, colour, taste, flavour, texture overall acceptability. Supplementation of pumpkin seed flour up to 30% level is maximum acceptable.

ACKNOWLEDGEMENTS

The authors would like to thank the Centre of Excellence in Agriculture and Agribusiness Management (CESAAM) at Egerton University for the research funds.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest regarding the publication of this paper.

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