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INFLUENCE OF SPROUTING ON OIL YIELD AND ORGANOLEPTIC PROPERTIES OF GROUNDNUT CAKE (KULI KULI)

Musa Halilu[1], K.B. Filli[1,2] and Haziel, H[1].
[1]Department of Food Science and Technology, Federal University of Technology Yola
[2]Swedish Institute of Food Biotechnology
E-mail:musa.halilu@yahoo.com

ABSTRACT

Groundnut cake (Kuli Kuli) was processed with slight modification of the traditional methods by germinating the seeds/nuts. The groundnut seeds/nuts were soaked for five hours I each of the samples (B, C, D and E) and were germinated for 0, 20, 30, and 40 hours respectively. Non soaked and non sprouted groundnuts were processed as control sample (sample A). Sensory analysis, physicochemical properties of the cake and oil yield were determined. The results show that the acceptability of treated samples (20 and 30 hours sprouting) were significant ($p>0.05$) in all parameters tested. Percentage oil yield indicated that the germinated seeds had higher oil yield (47-48%) compared with the control sample (46%). The oil content (47-48%) was increasing as germination time was equally increasing, also the refractive index of the oil was decreasing as germination time increased, which is an indirect method of checking free fatty acid components in oils (unsaturation). The modification of these products is one sure way of improving Kuli-Kuli processing so as to make it more acceptable.

INTRODUCTION

Groundnut or peanut (*Arachis hypogea.* L) originated in South America. It is a short herbaceous annual plant produces its pods in the soil. Groundnut was brought to West Africa through slave trade. It is the 13th most important food crop of the world. It is also the 4th most important food source of edible oil and 3rd most important source of vegetable protein (Hammons, 1994). Groundnut and its products are popular and consumed in all five continents. Globally, 50% of the groundnut produced is used for oil extraction, 37% for confectionery and 10% for seed purposes. It is grown on 26.4 million ha. Worldwide with a total production of 36.1 million metric tons and an average productivity of 1.4 metric tons/ha (FAO, 2000). The quality of stored groundnut of developing countries is considered low due to high percentage of free fatty acids. Free fatty acid tends to accumulate during storage and transport. The practice of wetting pods prior to decortications or shelling accelerates the development of free fatty acids (Craig, 1957). Shriveled and immature kernel also contain more free fatty acids than fully developed kernels, free fatty acid contents may be reduced by harvesting mature pods, drying the produce properly, carefully shelling to avoid breakage and splits, better storage and avoiding unnecessary handling (Chiou., et al 1991). Groundnut contains 47-50% oil, 25-30% protein. It contains minerals and vitamins too. However about 80% of the fat in the kernel comprises of unsaturated fatty acid making it prone to oxidative and hydrolytic changes, thus affecting its quality and desired nutty flavour. Groundnut cake, a product of groundnut is readily acceptable in Nigeria which is a cheap protein source and popular snack that can be eaten alone or combined with soaked garri, beverages, used with spices etc. Groundnut cake has a limitation as it is not generally acceptable by all and most people tend to look down on the product commonly called Kuli-Kuli due to the unhygienic conditions surrounding its production, the hardness, poor handling, mode of packaging etc. Production process is not optimized and the method of processing is still at the village level. An attempt is made in this work therefore to improve on the hardness/texture and mouth feel through steeping and sprouting of groundnut seed. Kuli-kuli one of the indigenous foods in Nigeria is not generally acceptable by many due to hard its texture. Sprouting is expected as one of the methods that can improve the texture through modification of its value components. The call for the use of local available materials and improvement on the traditional methods of food processing is always emphasized to improve food production. Kuli-kuli a traditional snack has the potential of increasing available nutritious food in our community.

MATERIALS AND METHODS

Groundnut (Kampala specie), salt ginger (zingier officinale) were purchased from Jimeta market Adamawa state Nigeria. The equipment used includes; viscometer, refractometer, thermometer, hot plate, wooden spoon, test tubes, conical flask, oven, desscicator, pot, measuring cylinders, weighing balance, plastic containers etc. These were obtained in the department of food science and technology FUT Yola and The federal Polytechnic Mubi, Adamawa State, Nigeria.

METHODS

The main factors of the experiment are soaking periods of 8000g of sample for five (5) hours and samples were divided into 2000g each and sprouted for 0 hours, 2 hours, 30 hours and 40 hours respectively. The control the control sample of 2000g was neither soaked nor sprouted. The groundnut seeds were sorted and weighed (1.65Kg) for each sample (A,B,C,D and E). 5g of samples was initially placed in an oven to determine the initial moisture content which was 7.0-7.2g. Sample was soaked with 2800ml of water and each sample was soaked for five hours, except the control sample A. The water was drained after the soaking using a basket and samples were covered with jute bags and sprouted from 0, 20, 30, and 40 hours respectively. Germinated seeds were washed and dried after each sprouting period. The drying of 17 hours to moisture content of 8.0% at a temperature of 42± 03^{o}C. The dried seeds were roasted in an oven at 150^{o}C for 30 minutes. The testa were rasped and winnowed, the seeds were then milled using attrition mill. Hot water (100^{o}C) was added (210-265ml) and the mixture was stirred using a wooden spoon in a pot, until the oil was separated from the paste. The oil was then scooped off the surface and the remaining oil was squeezed from the dough by pressing manually. Salt and ginger powder was added (2-3g) respectively to the dough and was molded into shape. The molded dough was then fried using some of the extracted oil into Kuli-kuli (groundnut cake) at a temperature of 220-230^{o}C for 3-5 minutes, the cake was then cooled and packaged into transparent polythene bags. Only one variety of the groundnut was used for this experiment (Kampala) and the level of spices was same for all the samples.

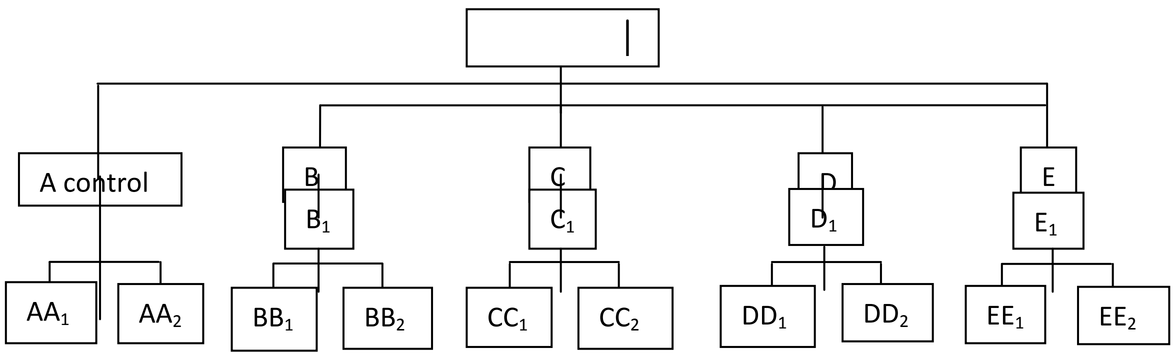

Figure I: Experimental Design.

Key: Description of sample code

A: Control sample of groundnut non soaked and non sprouted
B,C,D and E: - Groundnut soaked for 5 hours
B_1 Groundnut sprouted for 0 hours
C_1 " " 20 hours
D_1 " " 30 hours
E_1 " " 40 hours
AA_1 Oil extracted from Control sample
AA_2 Kuli-Kuli produced from control sample
BB_1 Oil extracted from groundnut sprouted for 0 hours
BB_2 Kuli-Kuli produced from sample sprouted for 0 hours
CC_1 Oil extracted from groundnut sprouted for 20 hours
CC_2 Kuli-Kuli produced from sample sprouted for 20 hours
DD_1 Oil extracted from groundnut sprouted for 30 hours
DD_2 Kuli-Kuli produced from sample sprouted for 30 hours
EE_1 Oil extracted from groundnut sprouted for 40 hours
EE_2 Kuli-Kuli produced from sample sprouted for 40 hours

Analysis Conducted

Bulk density determination: This was determined as described by (Filli, 1999). 10g of sample was weighed into 25cm^3 graduated measuring cylinder. The cylinder was firmly tapped 30 times on a bench top to settle. The measurements were made 10 times each and the results averaged. Swelling capacity was also determined, Hydration power was determined using the method described by (Bhattacharaya et al., 1986). Wettability was determined for the product according to the method described by Onuma and Bello (1988). Effect of quality of water was done according to the method described by Filli and Nkama, (2007). Viscosity of the sample was also measured.

Groundnut seed
↓
Sorting and Grading
↓
Weighing
↓
Soaking
↓
Sprouting
↓
Drying
↓
Roasting
↓
Cooling
↓
Removal of skin by rasping and winnowing
↓
Milling
↓
Extraction of oil
↓
Defatted dough (cake)
↓
Addition of salt and spices
↓
Molding into shapes
↓
Frying
↓
Cooling
↓
Packaging

Figure II: Kuli-Kuli and oil processing

Results and Discussions

Table I. Percentage oil yield, refractive index, viscosity and density of the oil yield

Sample Treatment	Yield (%)	Refractive Index	Kinematic Viscosity (mm^2/s)	Density Kg/m^3
AA_1	46	1.4720±0.3	53.41±0.2	0.0024
BB_1	47	1.4714±0.2	51.29±0.3	0.0024
CC_1	48	1.4700±0.1	59.14±0.2	0.0024
DD_1	48	1.4690±0.1	58.31±0.9	0.0024
EE_1	48	1.4679±0.1	60.54±0.2	0.0024

Means are triplicate determination ±SD

AA_1 - EE_1, are oil extracted from sample treatments respectively; (control, 0, 20, 30, and 40 hours sprouting). The physical properties of the oil in Table I compares well with those reported on percentage oil yield (38-50%) by TPI (1997). The result compares favourably and even surpasses those of most edible oil, example soybean 22%, cotton seed 15-22% etc singh (1986). The results on oil yield (46-48%) from this work shows that germination did not have a negative effect on oil yield, instead it could be said to have also increased yield and improved colour. The refractive index (1.4720-1.4679) which was decreasing as the germination time increases compares favourably with that reported by (Farmer et al., 1943), of refractive index (1.4679-1.4719). The refractive index according to (Farmer et al., 1943), it can be explained that the lower the refractive index , the lower the level of fatty acid composition which is shown as we go down the table I, since refractive index is a function of stability of oils (iodine value and peroxide value) which measures unsaturation and from the result, since refractive index was decreasing as germination increased, the oil could be said to be of greater stability being that it is lower in unsaturation, as explained by Albright (1963), that iodine value of an oil is a measure of unsaturation and correlates with refractive index of an oil the reason being that refractive index of oil increases with increasing chain length of fatty acids in triglycerides and also with increasing unsaturation. Hydrogenation of oils (Vanaspati, 1960) is monitored by measuring refractive index of the oil. The results of viscosities was seen to increase as germination time increased and the effect is that this increase may have given stability to the oil, since according to farmer et al., (1943) that the viscosity of fats increases with increasing chain length of fatty acids and decreases with increasing unsaturation. The resultant increase in viscosity may be as a result of germination. The result on density did not show any change as germination increased and this shows further the important parameter which provides a means of estimating solid-liquid ratio called solid fat index (SFI) or solid content index (SCI) of the fats, Craig (1957). Thus, it may be said that the oil has the same solid fat index since germination did not alter the density of the oil.

Table II. Degree brix, Bulk density, Swelling capacity, effect of water quantity and wettability of cake

Treatment of Samples	Refractive index (brix)	Bulk density (g/cm^3)	Swelling capacity (g/cm^3)	Effect of water (g/cm^3)	Wettability (sec)
AA_2	3.20±0.2	0.66±0.2	22.16±0.3	0.55±0.01	240
BB_2	2.90±0.1	0.66±0.2	22.12±0.2	0.38±0.02	180
CC_2	2.50±0.4	0.64±0.4	22.00±0.1	0.24±0.01	120
DD_2	2.00±0.2	0.65±0.1	22.00±0.1	0.09±0.01	115
EE_2	1.60±0.3	0.64±0.1	22.00±0.1	0.01±0.02	115

Means are triplicate determinations ±SD

The functional properties of the traditional snack (Kuli-Kuli) as shown in Table II, gives the effect of germination on the cake when compared with the control sample. The result on the soluble solids is shown to decrease as germination increased which further explained that increase germination leads to decrease in sugar content hence the results ranges from 3.20-1.60 and this justifies the refractive index of oil which was equally decreasing as germination time increases. The bulk density of the cake ranged from 0.66±0.2-0.64±0.1g/Kgm^3 showing that the ability of the cake to compact was reducing gradually as germination was increasing. The result on the swelling capacity and wettability of the samples was shown to compare favorably with 70±1.2 reported by Tagode and Nip (1994) for Taro (*colocasia esculanta*) flour showing the elasticity. The high water absorption may suggest that the traditional snacks may be suitable in the formulation of some food such as sausages, doughs, and soups, Oshodi et al., (1997). From the results, it shows that germination has a slight effect on the texture and chemical composition of the cake, the result of viscosity of the various samples shows how germination affected the texture of the cake when compared with the control sample A.

Table III. Sensory Evaluation Scores

Sample Testing	A	B	C	D	E
Colour	3.7±1.6	3.7±0.8	4.2±1.0	2.6±1.2	1.8±0.8
Fineness	3.3±1.1	3.8±0.9	3.9±1.3	2.0±1.1	2.0±1.2
Hardness	3.7±1.3	3.3±0.9	2. 8±1.3	3.0±1.1	2.7±1.1
Taste	4.3±0.7	3.9±0.9	2.3±1.3	2.6±1.1	1.9±1.1
Flavour	4.5±0.7	4.0±0.8	3.1±0.7	2.3±0.9	1.3±0.7

Means are triplicate determinations ±SD

A result for the sensory evaluation is presented on Table III. The results indicated that there is significant differences ($p<0.05$), in the organoleptic properties of the germinated cake sample (colour, fineness, hardness, taste and flavor) when compared with the control sample which was untreated. The result also indicated that the desired quality needed in snacks (crispness, colour, taste, flavor and fineness) were obtained in the analysis of the Kuli-Kuli, superscripts without similar letters shows that significant difference ($p<0.05$) exist in the samples when compared with the control (sample A). Thus, sample B, C, and D can be said to possess the desired qualities, whereas sample E has dull appearance, unappealing taste, cakery mouthfeel which is not desired in the snack. According to Agisegiri and Chukwu (2004), the only explanation on germination improvement is that perhaps the cycle breaks dormancy in grains and this may have affected the grain properties in two ways; water acting as solvent seems to impact mobility to chemical constituents of grains by dissolution. This would account for changes in the chemical components of snacks, which may have contributed to the observed changes in colour, taste, flavor, hardness and fineness of the Kuli-Kuli. From these results, it can be inferred; if germinated groundnuts are to be used in Kuli-Kuli production, the germination time should not exceed 30 hours.

CONCLUSION

This study has revealed that groundnut quality and stability is affected by steeping and germination which from theoretical background resulted in modification of the starch. The treatments caused perceptible changes due to possible changes in structural components and hence weakening of the native components. This can affect the nutritional properties. The influence of germinating and steeping affects the rate of dry matter loss in the grains, colour, taste and texture of the grain which has a positive effect on the final product hence the cells have been opened up, if controlled at 30 hours (germination), it may therefore be concluded that germination has affected the quality of Kuli-Kuli in terms of texture softening, it has also positively influence the oil yield because the oil yield was increasing as germination period increases.

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