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Functional Qualities of Raw and Processed Melon (*Cucumeropsis edulis*) Seeds

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Abstract. Meal samples prepared from raw, boiled, toasted, and germinated melon (*Cucumeropsis edulis*) seeds and were analyzed for their functional properties. On a dry matter basis, the boiled sample contained 210% water absorption capacity, 66% oil absorption capacity, 65% foaming capacity and 12% least gelation capacity. These values were generally higher than other processing methods and a significant difference ($P < 0.05$) existed among the samples. There were also significant differences for protein solubility in the processed samples. The minimum pH of the protein solubility varied as raw (5.5); boiled (5.0); toasted (6.5) and germinated (5.0). Emulsion stability was low in all the samples and boiled sample was the most stable for 24h. Only boiled sample produced foam which collapsed within 25 min.

Keywords: *Cucumeropsis edulis*, processed samples, functional quality, significance difference.

Introduction

Melon seed (*Cucumeropsis edulis*) is a very important component of tropical agriculture. It is easily available and highly nutritious to human and animal food. The parched seeds are chewed or ground into an oily paste, which is called 'egusi' in Nigeria. This paste is used in baking and frying or as an addition to soup. The amount of oil present in melon seeds varied from 15 to 45% among different species and cultivars The dehulled seeds contain a significant amount of protein 25 - 35% (FAO, 1989).

The use of plant proteins in food formulations depend largely upon their functional quality, the quality shows the behaviour of plant proteins in a food system (Abulude *et al*., 2005). In Nigeria, industrial utilization of this seed as a source of oil is in existence.The use of seeds depend largely on knowledge of its functional properties. Little information had been published on the nutritive values of this seed (Olaofe *et al*., 1994; FAO, 1989; Akobundu and Cherry, 1982). There is dearth of information on the possible effect of processing on the functional property of the seed.

The aim of present study is to investigate the effects of processing (germination, boiling and toasting) on the functional quality, with a view of ascertaining its utilization as a food resource and adding to existing data in the literature.

Materials and Methods

The seed samples were obtained in June, 2003, from a market in Akure, Ondo State, Nigeria. The experiments were carried out in the Chemistry Laboratory, Federal College of Agriculture Akure, Ondo State, Nigeria.

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Preparation of samples: ***Raw seed sample (hulled).*** The samples were hand picked. Stones and unhealthy seeds separated from good ones.100 g of raw seed sample was washed with distilled water, drained in a sieve and sun dried for 6 h, milled in a Kenwood blender, sieved (40 mm mesh) and stored in an air-tight plastic container at 20 °C prior to analyses.

Boiled seed sample (dehulled). Raw seed sample was dehulled by hand-breaking of the shell.100 g (dehulled) sample was boiled in 150 ml distilled water for 20 min, cooled at 25 °C, then sun-dried for 6 h. Dried seed sample was milled in a Kenwood blender, sieved through a 40 mm mesh sieve and stored in an air-tight plastic container at 20 °C prior to analyses.

Toasted seed sample. One hundred gram of dehulled seeds were toasted in a saucepan by heating on a gas burner for 35 min, stirring with a wooden spoon at intervals, cooled at 25 °C and subsequently sun dried for 6h. The seeds after drying were ground to pass 40 mm sieve and stored in air tight container at 20 °C.

Germinated seed sample. One hundred gram of raw seed sample was placed in a 1 liter beaker and moistened with distilled water every day and left for 7 days to germinate. The germinated seeds were sun-dried for 6h and ground to 40 mm mesh sieve and stored in an air tight plastic container 20 °C prior to analyses.

Procedure. Oil and water absorption capacities were measured by the procedures of Sosulski (1962), oil emulsion stability was determined by the method of Beuchat (1977). The foam capacity, foaming stability and least gelation capacity were determined using the method of Coffman and Garcia (1977). All values recorded were averaged of a least four determinations and analyzed statistically using SPSS 10 for windows.

Results and Discussion

Water absorption capacity. Results of some functional qualities of four processed samples are depicted in Table1. The water absorption capacity (WAC) of the samples was lower than the results obtained for raw and pre-cooked cocoyam flour (247.5–565.5%) by Fagbemi and Olaofe (2000) and for raw, soaked and cooked rice flour (225–250%) Abulude (2004b). The raw and boiled samples had the same results (200 and 210%) recorded for *Cola nitida* and *Cola acuminata* (Abulude 2004a) but higher than values for African yam bean (AYB) seeds reported by Adeyeye and Aye (1998). On examination,WAC of the boiled sample was higher than the processed samples, this might be due to the increase in water retention ability of the flour. Pre-boiling may be necessary, where the use of the seed as thickener was desired. The WAC of the samples decreased significantly ($P < 0.05$).

WAC is considered a critical function of protein in viscous foods like soups, gravies, doughs, bake products etc. hence, melon may be useful in these food formulations.

Oil absorption capacity. The oil absorption capacity (OAC) ranged between 18.0 – 95% from germinated to raw seeds (Table1). These values were much lower than literature values (Abulude, 2004a; Abulude, 2004c; Adeyeye and Aye, 1998). OAC decreased significantly ($P<0.05$), when compared with the raw sample. Toasting and germination drastically reduced the OAC result. Similar reduction in OAC was observed by Abulude (2004b).OAC is important since oil acts as flavour retainer and increases the test of foods (Kinsella, 1976).

Foam capacity and foaming stability. The results of foam capacity (FC) and foaming stability (FS) are shown in Tables 1 and 2, respectively. The FC results varied in between 3.9% toasted and 6.5% boiled samples. These results were not comparable to that of AYB (54–55%) reported by Adeyeye *et al.* (1994), and bread-nut reported by Nwabueze *et al*. (2001). In this study, it was observed that foaming decreased with processing. The different processing methods may have affected the foam ability ($P< 0.05$). The low foaming capacity of the sample may not enhance the functionality of melon in its uses for the production of cakes (Johnson *et al.*, 1979) and whipping toppings where foaming is important property (Cherry, 1981).

Results were not obtained for raw, toasted and germinated samples, boiled sample produced a low result of 10.5 cm^3 which collapsed within 25 min. The collapse could be due to protein denaturation due to the effect of heat during sample preparation.

Emulsion stability. Table 3 shows the emulsion stability (ES) of samples. At zero hour, raw sample gave 45 cm^3value while boiled, toasted and germinated samples produced 43 cm^3, 35 cm^3 and 35 cm^3, respectively. These values were lower than those reported by Adeyeye and Aye (1998) on AYB (93.19-99.23cm^3) and Abulude (2004c). Though these results are comparable with results of rice (40.68-42.25cm^3) reported by Abulude (2004b). Significant differences ($P < 0.05$) were noted in the stabilities within 24 h period of study.

However, ES value was higher in boiled sample compared to those of raw, toasted and germinated samples, possibly due to denaturation, which might have destroyed hydrophobic domains thereby reducing the fat binding.

Least gelation capacity. The values for the least gelation capacity (LGC) for all the samples are shown in Table 1. The values varied from 10 to 12%. The present results conform to the results of earlier workers (Akintayo 1997; Oshodi and Ekpergin, 1989) but higher than results for cowpea, Abulude (2001), and wheat (Adeyeye and Aye 2005). It had been suggested that seeds flour may be linked to the relative ratios of different constituents like protein, carbohydrates and lipids and the interaction between such components may affect functional properties (Sathe *et al*, 1982). The ability of protein to

Table 1. Functional properties of the raw and processed seeds*

Sample	WAC (%)	OAC (%)	FC (%)	LGC (%)
Raw	200± 0.5	95±0.1	5.8±0.2	10±0.2
Boiled	210±0.2	66±0.1	6.5±0.1	12±0.2
Toasted	95±0.5	18±0.1	3.9±0.3	10±0.3
Germinated	90±0.5	18±0.2	6.0±0.1	10±0.1

* = [a](n=4),[a] = mean ± standard error, values for OAC, FC and LGC showed significant difference at ($P< 0.05$). WAC = Water absorption capacity; OAC = Oil absorption capacity, FC = Foaming capacity, LGC - Least gelation capacity.

Table 2. Foaming stability (cm^3) of raw and processed seeds

Time (min)	Raw	Boiled	Toasted	Germinated
0.00	0.00	10.50	0.00	0.00
25.00	0.00	5.00	0.00	0.00
50.00	0.00	0.00	0.00	0.00
Mean	0.00	7.75	0.00	0.00
Std error	0.00	3.85	0.00	0.00
Coff. var (%)	0.00	50.18	0.00	0.00

form gels and provide a structural matrix for holding water, flavours, sugars and food ingredients is useful in food applications and in new product development, thereby providing an added dimension to protein functionality.

Protein solubility as function of pH. The results of protein solubility are shown in Table 4 and Fig 1. Boiled sample showed high solubility in acid and alkaline media. Raw, toasted and germinated samples had low pH solubility values on both acid and alkaline media. The isoelectric point i.e. minimum pH solubility values were, raw (5.5), boiled (5.0), toasted (6.5) and germinated (5.0). Boiling improved solubility of the sample. The improved solubility of the sample may be useful in the formulation of acidic food. Reduction in protein solubility due to heat processing had been reported in the case of soya bean and peanut flours (Abbey and Ayuh, 1991). The common thing was noted in all the samples that they all contained major protein.

Table 3. Emulsion Stability (cm[3]) of raw and processed seeds

Time (hr)	Raw	Boiled	Toasted	Germinated
0.00	45.00	43.00	35.00	35.00
1.00	40.00	43.00	35.00	34.00
2.00	40.00	43.00	35.00	33.00
3.00	40.00	43.00	20.00	30.00
4.00	35.00	43.00	20.00	19.00
5.00	35.00	43.00	20.00	19.00
22.00	28.00	43.00	15.00	14.00
24.00	28.00	43.00	15.00	14.00
Mean	36.38	43.00	24.38	29.76
Std error	6.07	0.00	9.04	9.13
Coff. var(%)	16.69	0.00	37.08	36.89

Raw, toasted and germination samples were significant ($P<0.05$)

Table 4. Protein solubility of samples as a function of pH

pH	Raw	Boiled	Toasted	Germinated
2	24	82	30	60
3	28	50	32	45
4	30	45	32	32
5	10	30	25	10
6	28	60	12	22
7	30	65	8.0	28
8	31	66	20	26
9	30	70	21	26
10	30	77	20	26
11	30	65	20	26
12	30	62	20	26
Mean	27.4	61.1	21.8	29.7
Std error	6.1	14.8	7.7	13.0
Coff. var (%)	22.2	24.1	35.1	45.6

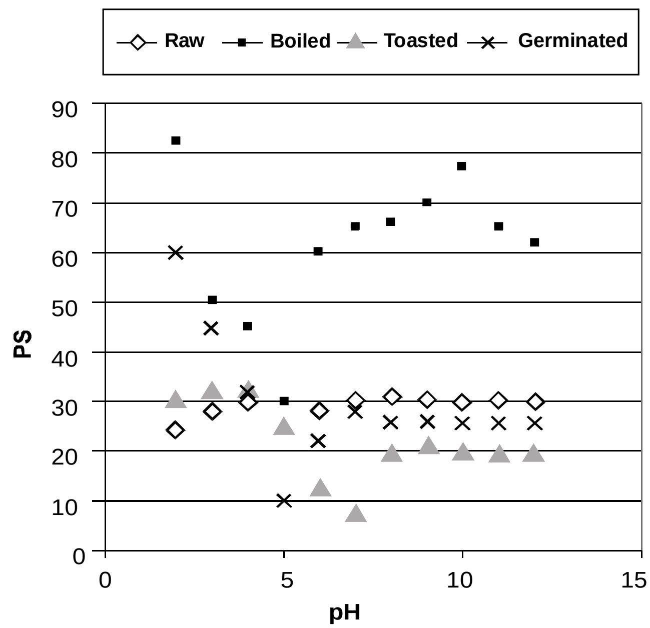

Fig. 1. Protein solubility (PS) of samples as a function of pH

The shape of the pH solubility curves followed the results obtained by Adeyeye and Aye (1998) and also compared with the results obtained for prawns (Abulude *et al.*, 2006).

Conclusion

It was apparent from these findings, that the functional properties of the samples were affected (reduction) by the processing methods, especially by germination and toasting methods while, boiling method improved them. However, the result showed that melon (*Cucumeropsis edulis*) seeds may be suitable for the formulation of some foods (soups, gravies, dough, and baked products).

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