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Effect of Traditional Processing Methods on Pesticide Residue Dissipation in Cowpea (Vigna Unguikulata).

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ABSTRACT

The Effect of traditional processing method (soaking,dehulling, and boiling) on proximate, anti-nutrients, pirimiphos-methyl powder content in cowpeaand the functional properties were investigated. The processed samples were subjected to standard analytical methods. Result from the proximate composition of cowpea is shown in table 1. The crude protein, crude fibre, Ash, carbohydrate were decreased significantly at p<0.05 with ranges 25.72-23.56%,1.86-1.55%,8.21-7.01%,54.44-50.60% respectively while the fat, and moisture content increased slightly at p<0.05 with ranges 3.50-3.73%,9.83-9.54% respectively. Results of anti-nutrients are shown in table 2. The values of the anti-nutrients (oxalate, phytate, saponins, tannins, phenolics) decreased significantly at p<0.05 with ranged between2.93-2.01%, 1.44-1.06%,4.23-4.11%,0.66-0.44%, 11.22-10.60% respectively. The pirimiphos-methyl powder content also decreased significantly at p<0.05 to 0.04 which is slightly above the safe level of 0.038.The functional properties are shown in table 3. The foaming capacity, bulk density, water absorption capacity, emulsion capacity were decreased significantly at p<0.05 with ranges 28.44-15.35%, 0.95-0.62%, 82.34-71.96%, 8.34-6.56% respectively. This study showed that traditional processing methods can significantly increase the nutritional properties of cowpea while it can also significantly reduce or decrease the anti-nutritional properties and decrease pirimiphos-methyl powder in cowpea. I recommend that there should be strict surveillance by monitoring bodies to ensure adherence to the standard approved limits in the use of pesticides in storing cowpea.

Keywords; *Traditionalprocessing methods, Pesticide Residue, Cowpea, and Anti-nutrients, proximate.*

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I. INTRODUCTION

Food quality and safety has become a major concern in recent times due to the use of pesticide residue on farm lands and in storage of food products. The pesticides are used to control the wastage of foods by pest infestation(El-sayed et al, 2012).This wastage if allowed could worsen the challenge of food insecurity. Many studies had shown that pesticide residue penetrate the grain and accumulate over time. Some studies on pesticide residue dissipation in grain established that during storage, the residue of pesticide were able to penetrate with the grain and accumulate with time (Mada et al, 2014). Grain treated with chemical pesticide shows presence of bound residue even after fairly long period of storage, contributing to dietary intake of pesticide (Lalah and Wading, 2002). These pesticides are toxic to non-target species including humans, especially when applied indiscriminately and excessively resulting to high pesticide residue in such foods (Rajwat et al, 2015). Pesticide residue has been implicated in various disorders, allergies and diseases as a result of long-term low doses of exposure .(Kogali et al, 2010).One of such pesticide residue used in Nigeria for the preservation of cereals and legumes in storage is Pirimiphos methyl powder(Actellics) According to Zoey Sky, 2017 Pirimiphos methyl has been reported to cause various symptoms such as head ache,nausea,vomiting, abdominal crambs, diarrhea, dizziness, sweating,extream weakness, ataxia,blurred vision, slow heartbeat, etc.Of recent it was reported that Nigerian agricultural products were rejected at the international export markets due to high pesticide residues (New Telegraph 2017).Earlier on the European Union(EU)had placed a ban on67 processed and semi processed Nigerianproducts which include white and brown beans and were rejected in 2015 and 2016.The ban is yet to be lifted due to failure to comply with international food standards.In addition, poisoning and death of poeplein both rural and urban areasof Borno state and in Nigeriahas been reported as a result of levels of pesticide residues arising from improper application and multiple sprays of sublethal doses of the pesticides.

Recent incidence of food toxicity in Lagos and Gombi, Nigeria had lead to death and hospitalization of many people (Mada et al, 2014). Thus , it is important to investigate the pesticide residues present in grains in storage and their dissipation through traditional house hold processing.

Tradditional processing methods are simple methods and equipmentsthat can be used at house hold level. Examples of traditional processing methods for legumes (cowpwea) include, cleaning, sorting, soaking, dehulling,germination,boiling, roasting, etc. Legumes like cowpea are processed at the house hold by cleaning ,sorting, soaking, boiling, milling etc.Tradditional processing has been reported to reduce anti-nutrients, nutrient content, pesticide residue, improve nutrient bioavailability (Enujiugha, 2010; 2014; Kaushika et al, 2016). One of the major contraints in the production of cowpea especially in West Africa is attacks by various insect pests during the diferent phases of its life cycle even down to storage. Common cowpea pest include Aphid, Thrips, bugs,cowpea weevil etc.They are preserved in storage with pirimiphos methyl powder to prevent watage of the gtains. The need to investigate the pesticide residue present in the grains in storage and their dissipation through processing.This study was therefore aimed at providing information on the levels of pesticide residues in beans samples stored in ware houses in Gboko and Makurdi metropolis of Benue State in Nigeria West Africa.The study also investigated the effects of traditional processing on the anti-nutrient, nutritional and functional of cowpea.

II. MATERIALS AND METHODS

2.1 Source of raw materials; Samples of Cowpea (Vignaunguiculata) were collected in ten storage facilities in two Localgoverrnment council areas LGA: Gboko, and makurdi metropolis Benue State Nigeria to make up one kilograme of cow pea.

2.2 **Chemicals and Reagents; Food grade chemicals and reagents were** gotten from food science and technology laboratory department university of Mkar, MkarGboko Benue State Nigeria.

2.3 Traditional processing methods

2.3 .1 Soaking of beans: Using the method of Alfonso (2006), 100 g of cowpea seed were soaked in distilled water (1:5 w/v) at room temperature (27 ± 2^{0}C), for one hour. At the end of each soaking time, the samples were removed from the beaker and surface water blotted with a tissue paper. Weight of the beans was noted.

2. 3.2 Dehulling of seed coat: After each soaking period, some of the cowpea seeds were dehulled as described by EI-Beltagy (1996), while some remained as whole bean seeds. The seed coats were removed manually by rubbing the wet beans between the palm several times after soaking the beans in water at (27 ± 2 0C) for one hour.

2.3.3 Drying of cowpea seeds: At the end of soaking, after blotting the beans with tissue paper to remove adhering water, the beans were oven-dried at 70^{0}C for 24 hours to constant weight. The dried seeds were milled into flour using laboratory grinding machine and stored in airtight plastic container at until used.

2.3.4 Cooking of cowpea seeds: The beans were cooked in distilled water (1:10 w/v) for 20 min at atmospheric pressure in a stainless steel pot. The beans were drained, dried at 70^{0}C for 24 hours and milled into flour for subsequent testing (Uzoechuna, 2008)

2.4 Evaluation of proximate composition

2.4.1 Determination of moisture content

Moisture content determination; moisture content was determined as described by AOAC (2012) Using hot air oven method. 2g of samples was weighed into petri dishes of known weight, shaking until evenly distributed and covered immediately. These were transferred into oven, uncovered at 105±5°c for3hours and allowed to cool in a desiccator for 15minute before weighing. The process was repeated until constant weigh was recorded and the loss in weight from the 0riginal weight was reported as the moisture content

$$\%\text{moisture content} = \frac{\text{weig ht loss of sample}}{\text{weigt of sample}} \times 100$$

2.4.2 Determination of Crude protein

The crude protein content were determined using AOAC (2012) official methods. 1g of samples were digested in 500cm^{3}kjedahl flask using selenium tablets as catalyst and 12ml concentration H_2SO_4followed by the addition of two selenium tablets. The contents of the flask were heated gently at 420°c in fume cupboard in an inclined position and swirl occasionally untill the liquid is clear. The digested samples after cooling were mixed with 50mls of 40% NaOH solution and then distilled into 30cm^3 of 2% boric acid solution containing screened methyl orange indicator. The distillate was titrated against 0.1M HCL solution. A blank titration was carried out and the percentage protein content estimated as nitrogen x 6.25 assuming that 1ml of 0.1M HCL is equivalent to 0.014g.

$$\%\text{kjedahl} = \frac{(Vs - Vb) \times M \times 14.01}{W \times 10}$$

Crude protein%=%kjedahl x F

Where:

Vs=Volume(cm) of standardized acid used to titrate a test
Vb=Volume (cm)of standardized acid used to titrate reagent blank
M=Molarity of standard HCL
14.01=Atomic weight of Nitrogen
10=factor to convert mg to g

2.4.3 Determination of Fat content

The soxhlet solvent extraction method was used (AOAC 2010). 2g of sample was weighed into the extraction thimble and fixed into the extraction flask of known weight. the extraction was done using diethyl ether for 2hours and thereafter, was removed by evaporation on an electric bath. the remaining fat in the flask was dried at 60oc for 20minutes in an oven, cooled for 15minutes and weighed. The fat content (%) was calculated as follows:

$$\%\text{fat content} = \frac{\text{Weight of fat} \times 100}{\text{Weight of sample}}$$

2.4.4 Determination of crude fibre

The crude fibre was determined by the procedure described by AOAC (2012) five grams of sample was weighed into a 500cm3 beaker and the content was filtered and the residue was washed vigorously with boiling water until it was free from the acid. the residue was then boiled again in a 200cm3 of 0.313M NaOH for 30minutes. The flask content was brought to boil for 30minutes and allowed to stand for 1minute and filtered immediately through a filter paper. The insoluble material was transferred into 100cm3 beaker by means of boiling water to free it from acid. The insoluble material was finally washed with alcohol twice and three times with diethyl ether. the resulting residue was transferred to petri dish (previously ignited, cooled and weighed) with boiling water. the dish containing the residue was dried at 100oc for 2hours cooled in a desiccator and weighed (W1) the dried cooled and weighed residue was them transferred into a muffle furnace and ignited at 600oc for 30minutes cooled and weighed (W2). thepercent crude fibre was calculated as follows:

$$\text{Percentage crude fibre} = \frac{\text{W1-W2} \times 100}{\text{Weight of sample}}$$

2.4.5 Determination of Ash content

Ash content determined according to the method of AOAC (2012). 2g of sample was weighed and placed in an already weighted crucible dish. the dish and content was placed on furnace rack at a furnace temperature of 500oc for 16hours until the sample were completely burned to ashes. the crucible dish was removed and kept in a desiccator to cool and the percentage ash was determined as;

$$\text{Percentageash} = \frac{\text{Weight of the extracted} \times 100}{\text{Weight of sample}}$$

2.4.6 Carbohydrates Determination The percentage carbohydrate content of the samples was determined by summing up the percentages of the moisture, ash, crude protein, crude fat determinations, and subtracting the value from 100(onwuka 2005). The difference in value was taken as the percentage total carbohydrate content of the sample.%carbohydrate content=100-(%protein+%moisture+%fat+%ash)

2.5 Evaluation of phytochemical composition

2..5.1 Determination of Oxalate content ;The oxalate content was determined by titration method as described by onwuka (2005). The sample flour were suspended in 190ml of water in a 250ml volumetric flask at $100^{o}c$ for 1hour after addition of 10ml of 6M HCL. The oxalate was precipitated and titrated against 0.05M standardized KMnO4

2. 5 .2Determination of Phytatecontent ;Phytate was determined using Reddy and Love (1999) method. fourgrammes of the ground sample was soaked in 100 ml of 2% HCl for 5 h and filtered. To 25 ml of the filtered, 5 ml 0.3% ammonium thiocyanate solution was added. The mixture was then titrated with Iron (III) chloride solution until a brownish-yellow colour that persisted for 5 min was obtained.

2.5.3 Determination of saponins content The method used was that of Obadoni and Ochuko (2001). About 20g of sample was put into a conical flask and 100ml of 20% aqueous ethanol was added. The samplewere heated over a hot water bath for 4hours with continuous stirring at about $55^{O}C$. The mixture was filtered and the residue re-extracted with another 200ml (20%) ethanol. The combined extract was reduced to 40ml over water bath at 90oc. The concentrate was transferred into a 250ml seperating funnel and 20ml of diethyl ether was added and shaken vigorously. The aqueous layer was recovered while the ether layer was discarded. The purification process was repeated and 60ml of n-butanol was added. The combined n-butanol extracts was

washed twice with 10ml of 5% aqueous NaCl. Theremaining solution was heated in the water bath. After the evaporation, the samples were dried in the oven to a constant weight and the saponin content was calculated as percentage.

2.5.4 Determination of Tannin contentthe tannin content was determined using the method of Achana et al, 2005. Dried material (0.5g) was extracted with 300ml of diethyl ether for 20 hours at room temperature. The residue was boiled for 2hours with 100ml of distilled water and allowed to cool and was filtered. The extract was adjusted to a volume of 100ml in a volumetric flask. The content of tannins in the extract was determined colorimetrically using folin-denis reagent and by measuring absorbance of the blue complex at 760nm, using tannic solution as a standard solution. The tannins content was calculated as:

$$\text{Tannin (mg/g)} = \frac{\text{optical density at } 500 \times \text{vol. of extract}}{\text{Slope} \times \text{weight of sample}}$$

2.5.5 Determination of Phenolic compounds ;Total phenolics from defatted legume flours were extracted with 80% aqueous methanol containing 1% HCl (1:50 w/v) byrefluxing in a boiling water bath for 30 min (3 times). The refluxed material was concentrated under vacuum in a rotary flash evaporator and the total phenolic content was measured according to the method of (Singleton et al.,1999). The content of total phenolics in each extract was determined, using a standard curve prepared for gallic acid, and expressed as mg of gallic acid equivalents (GAE) per gramme of defatted meal flour.

2.6 Determination of Pesticides Residue in cowpea

2.6.1 Determination of Pirimiphos methyl residue.

Preparation and Extraction of samples ;Take 50g of finely blended sample and add 50ml of H_2O 100ml acetone blend at high speed for 5 minutes, filter the blended samples with suction using filter paper. Transfer filtrate into a separator and bring the extract volume to 200ml with acetone. Concentrate the extract to 10ml by evaporation. The detection and determination of the residues were carried out by injecting 1 µL of the 1.0 cm3 purified extract into the injection port of a Shimadzu GC –MS QP-2010 gas chromatograph with a flame photometric detector. The column SPB-5 (Supelco, Bellefonte, PA) 30 m length × 0.53 mm i.d.× 0.25 µm film thickness. The column temperature was programmed from 50°C at a rate of 25°C /min to 100°C, held for 1 min, and then at a rate of 5°C /min to 300°C, held for 5 minutes. The temperatures of the injector and detector were 250°C and 300°C, respectively. The injection was carried out on a splitless injector at 250°C and the purge activation time was 30s.The carrier gas was N_2 15ml/min. Identification of pesticide residues was accomplished using reference standards and relative retention time techniques while the residues were determined by comparing the peak heights of the samples with the corresponding peak heights of the reference standards of known concentrations. The concentrations of Organochlorines were calculated directly by the gas chromatograph.

2.7 Evaluation of functional properties

2.7.1 Determination of bulk density; the bulk density of the samples was determined by the method described by Onwuka (2005). the sample 50g was gently filled into a graduated measuring cylinder and the bottom of the cylinder was tapped on the laboratory bench several times until there was no further diminution of the sample level. the bulk density was calculated as:

$$\text{Bulk density} = \frac{\text{weight of sample (g)}}{\text{Volume of sample after tapping (ml)}}$$

2.7.2 Determination of water absorption capacity;Water absorption capacity was determined as described by Onwuka (2005). 1g of sample was weighed into a graduated centrifuge. the sample was mixed with 10ml distilled water using a whirring whirl mixer for 30second and allowed to stand for 30minutes at room temperature. This was then centrifuged at 2000rmp for 30minutes. The volume of free water (the supernatant) was ready directly from the graduated centrifuge tube.

2.7.3 Determination of foaming capacity ;The foam capacity was determined following the method of Onwuka (2005). 2g of sample with 100ml distilled water in a warring blender was whipped at 1600rmp for 5minutes and poured into a 250ml measuring cylinder. the volume was recorded after 30seconds. Foam capacity was expressed as percent increase in volume using the formula:

$$\text{Foamcapacity} = \frac{VA - VB \times 100}{VB}$$

Where:

VA = Volume after whipping
VB = Volume before whipping

2.7.4 Determination of emulsion capacity; Emulsion capacity and emulsion stability were determined as described by Onwuka (2005). 2g of the flour was blended with 25ml distilled water at room temperature for 30second in a warring blende rat 1600rmp. after complete dispersion,25ml vegetable oil was added blended for 30seconds. the blender sample was then transferred into a calibrated centrifuge tube and centrifuged at 1600rmp for 5minutes. the volume of oil separated from the sample after centrifuging was read directly from the tube. the emulsion capacity was expressed as the amount of oil emulsified and help per gram of sample;

$$E\,C = \frac{\text{Height of emulsified layer} \times 100}{\text{Height of whole sol.in the centrifuge tube}}$$

Where EC = Emotion Capacity

2.7.5 STATISTICAL ANALYSIS

Data collected were analysed by Analysis of Variance (ANOVA)with the statistical package for social sciences (SPSS) for Windows version 16. The Duncan post hoc test was used to identify the means that differ significantly at $p < 0.05$. Results were expressed as Mean ± SEM.

III. RESULTS AND DISCUSSION

3.1 Chemical analysis

Proximate composition of cowpea; the results of the effect of traditional processing methods on the proximate composition of cowpea are presented in Table1. The crude protein (%) content of the raw beans was significantly higher than soaked and boiled beans. The crude protein of the three cowpea flour ranges from 23.56-25.72% respectively. The result show that there is a decrease in crude protein content during soaking and boiling The minor decrease in protein content during soaking and cooking might be attributed to the leaching of

Table 1:Anti-nutritional and Pirimiphos methyl content in cowpea sample.

Samples	Crude Protein	Fat	Crude Fibre	Ash	Moisture	Carbohydrate
Rb	25.72±0.01^{a}	3.50±0.00^{c}	1.86±0.01^{a}	8.21±0.00^{a}	9.54±0.00^{c}	54.44±0.04^{a}
Sb	24.66±0.01^{b}	3.62±0.01^{b}	1.73±0.00^{b}	7.13±0.01^{b}	9.95±0.00^{a}	53.30±0.04^{b}
Bb	23.56±0.0^{c}	3.73±0.01^{a}	1.55±0.00^{c}	7.01±0.01^{c}	9.83±0.18^{b}	50.65±0.03^{c}

Mean values bearing different letters (a, b, c) in the same row are significantly different (P <0.05) on application of Duncan's multiple range test.
* Results are means ± standard deviation of triplicate determinations.
Key; Sample 1= raw beans (Rb) Sample 2= soaked beans (Sb), Sample 3= boiled beans (Bb)

Table 2:Anti-nutritional and Pirimiphos methyl content in cowpea sample

Samples	Oxalate	Phytate	Saponins	Tannins	Phenolics	Pirimiphos Methyl (mg/kg)	Percentage Reduction Level%	Recommended Safe Level (U.S.FDA, 2014)
Rb	3.88±0.0^{a}	2.44±0.^{a}	5.32±0.0^{a}	0.83±0.0^{a}	12.54±0.0^{a}	0.08±0.0^{a}	100	0.038
Sb	2.93±0.6^{b}	1.44±0.^{b}	4.23±0.0^{b}	0.66±0.0^{b}	11.23±0.0^{b}	0.07±0.00^{a}	13.5	0.038
Bb	2.01±0.^{b}	1.06±0.0^{c}	4.11±0.00^{c}	0.44±0.01^{c}	10.60±0.02^{c}	0.04±0.01^{c}	50	0.038

Mean values bearing different letters (a, b, c) in the same row are significantly different (P <0.05) except oxalate content in soaked beans, on application of Duncan's multiple range test.
* Results are means ± standard deviation of triplicate determinations.
Key; Sample 1= raw beans (Rb), Sample 2= soaked beans (Sb), Sample 3= boiled beans (Bb)

Table 3: Functional properties of samples

Samples	Foaming Capacity %	Bulk Density g/m3	Water Absorption Capacity %	Emulsion Capacity %
Rb	28.44±0.01 [a]	0.95±0.00 [a]	82.34±0.01 [a]	8.34±0.03 [a]
Sb	18.52±0.01 [b]	0.73±0.02 [b]	73.63±0.01 [b]	7.13±0.01 [b]
Bb	15.35[c]±0.02 [c]	0.62±0.01 [c]	71.96±0.01 [c]	6.56±0.01 [c]

Mean values bearing different letters (a, b, c) in the same row are significantly different (P <0.05) on application of Duncan's multiple range test.
* Results are means ± standard deviation of triplicate determinations.
Key; Sample 1= raw beans (Rb)

soluble proteins (Osman ,(2007) Myrene,(2013)).The fat content of cowpea ranged from3.5% - 3.73%**.**The fat content increased significantly at (p<0.05) as a result of processing. The increase in fat content may be due to the heating which helped to break the fat droplets from their cells (Onimawo and Akubor,2005).The crude fibre content of raw beans is significantly higher than soaked and boiled beans. The values ranges from 1.55-1.82% respectively. Dehulled beans contained lower fibre content than raw beans, implying that the seed coat is comprised mainly of fibre and leaching into cooking water. (Bamigboye and Adepoju, 2015).The ash content of the raw beans was significantly higher than soaked and boiled beans. The ash content of the three cowpea flour ranges from 7.01-8.21% respectively. The reduction in ash content might be due to the leaching out of macro and micro elements into the soaking and cooking water (Ahmand&Pathak, 2000).

Anti-Nutritional Factors and Pirimiphos-methyl content

The results of the effects of traditional processing methods on the anti-nutritional properties of cowpea and pirimiphos-methyl powder are presented in Table 2. The oxalate content of cowpea flour ranged from 2.01 to 3.88.The raw cowpea sample had the highest mean value RB 3.88, while boiled cowpea flour had the lowest mean value BB 2.01. There is significant difference (p<0.05) between cowpea flour sample. Dehulling led to significant reduction in the level of anti-nutrients, the reduction in the anti-nutrient level was attributable to the removal of the seed coat indicating that the seed coat contained significant amount of these anti-nutrients. When the seed was soaked and boiled the oxalate content lowered due to leaching during soaking and evaporation during boiling as reported by.(Oloyo, 2004).

The phytate content of cowpea flour ranged from 1.06 to 2.44.The raw cowpea sample had the highest mean value RB 2.44%, while boiled cowpea flour had the lowest mean value BB 1.06. There varied significant difference (p<0.05) with the raw cowpea having the highest value of 2.44 and boiled samples had the lowest value of 1.06. The reduction in phytate content could be due to leaching losses and formation of insoluble complexes between phytate and other components in the beans as reported by (Udensi et al, 2007).This suggest that phytate can be destroyed by heat.

The saponins content of raw cowpea flour was significantly higher p<0.5. Than soaked oven dried and boiled oven dried flour, the saponin content of cowpea with values ranging from 4.11 to 5.32%.reduction in saponins content in soaked and boiled cowpea flour is due to leaching losses during cooking. (Oloyo, 2004).

The tannins content of cowpea flour varies significantly at p<0.5 with the raw having the highest value of 0.44 to 0.83.The raw cowpea sample had the highest mean value RB 0.83, while boiled cowpea flour had the lowest mean value BB 0.44. There is significant difference (p<0.05) between cowpea flour sample. The reduction in tannins values could be due to the effect of time on leaching of tannins from whole beans during soaking. The tannins content reduced with soaking time (Onwuka 2006). Dehulling led to significant reduction in the level of tannins, the high percentage of reduction in tannins content in the duhulled cowpea may be due to the absence of the seed coat. The tannins content on cooked beans reduced this may propably be due to its solubility and leaching into cooking water.

The phenolics compound decrease digestibility of carbohydrate and availability of vitamins and minerals. (Preet and Punia, 2005).The phenolics content of cowpea flour ranged from 10.60 to 12.54.The raw cowpea sample had the highest mean value RB 12.54, while boiled cowpea flour had the lowest mean value BB 10.60. There is significant difference (p<0.05) between cowpea flour sample. When the seed is soaked and boiled the phenolics content lowered due to leaching during soaking and evaporation during boiling (Onwuka 2005).

Pesticide residue results

The pirimiphos-methyl is an organophosphate pesticide widely used in developing countries for the preservation of food stuff in storage for six months. From the results of the present study, pirimiphos-methyl was observed in the cowpea flours in the range of 0.08% to 0.04%.The raw cowpea sample had the highest mean value RB 0.081, while the soaked oven dried flour had SB 0.073, the boiled cowpea flour had the lowest

mean value BB 0.042. There was significant difference (P<0.05) between raw cowpea flour sample 0.081 and boiled sample 0.042.The changes or reduction in soaked and boiled oven dried flour may be due to leaching loses and the result shows 0.042 which is slightly higher than the recommended safe level 0.038 (U.S FDA, 2014). This implies that prolonged boiling may reduce the residue to a safe level.

A study was conducted by Gwary et al 2012 to measure residues of pesticides in samples of Beans (Phaseolus vulgaris) collected in both field and storage facilities in six local area councils of Borno State, northeast Nigeria. This study revealed that DDT, Dichlorvos, and Endrin are heavily utilized in this region due mainly to their easy availability and dependability .Dichlorvos was observed to mainly be utilized in storage of beans from insect attack. Stringent monitoring of use of pesticides in agriculture and food storage in Nigeria is required The study observed that Dichlorvos was mainly utilized in storage of beans from insect attack and suggested that stringent monitoring of use of pesticides in agriculture and food storage in Nigeria is required.

The findings of this study are in agreement with those of (Kaushik et al, 2016) who carried outtheir experiments on the evaluation of levels of pesticide residues present and theireffective removal by different traditional/house hold processing methods. The removal of pesticides from vegetables and their products had been the hall mark of studies. Literature available indicated their effective removal of these residues.Thermal degradation usually led to their effective reductions in the study. In another study, significant amount of residues (including metabolites) were observed even after 5 months of storage which indicates the concern regarding food safety. Hence, the effect of some simple, feasible domestic processing techniques on pesticide residues in chickpea was studied to see whether the grains could be made acceptable and safe for consumption. The processing methods include soaking coupled with germination, ordinary open cooking, pressure cooking and microwave cooking. The dissipation pattern of chlorpyrifos and its metabolites under grain storage conditions for 5 months revealed that the residues exceeded the maximum residue limit (MRL) values right from the beginning of the storage. The effect of processing techniques showed that soaking and germination eliminated almost all the pesticide residues. Storage of grains leads to accumulation of residues which are eliminated by household processing techniques.Another concern is the presence of metabolites viz. oxon (along with TCP) generated during grain storage which is even more toxic than the parent compound, chlorpyrifos. Here, it is important to note that existing MR values (by International Authorities) do not reflect any information about the harmful metabolites generated in grain matrix. Therefore, concerted efforts by considering toxic metabolites for evolving dietary guidelines for ensuring food safety have to be made. Fortunately, domestic processing techniques can thus reduce the residues of chlorpyrifos thus decontaminating the grains for human consumption. It was found that soaking and germination eliminated almost all the residues in stored chickpea while cooking processes also resulted in high chlorpyrifos dissipation but the build-up of toxic metabolite oxon especially during pressure and microwave cooking is a matter of great concern regarding food safety.Hence, fast cooking by microwave has to be recommended carefully and significance of traditional cooking system (though require more time) should be reinvestigated from the view point of food safety. Further, extensive and intensive investigation considering successive spray of various pesticides used in the warehouse for controlling storage pests needs to be carried out in the context of food safety.

Sonchiehu(2013) (dichlorvos, methyl-parathion, malathionalso observed high amounts of Six OP pesticides (dichlorvos, methyl-parathion, malathion, profenofos, diazinon and chlorpyrifos) in concentrations ranging from 0.02 to 5.4 mg/kg in peripheral zone while only five OP pesticides, profenofos and chlorpyrifos) were found in the urban area (0.02 to 4.62 mg/kg). High amounts of these compounds were found in koki and fritter. Malathion, methyl-parathion and dichlorvos were the most frequent (27 to 89%) and some levels exceeded the maximum residue limits (MRLs) or the acceptable daily intake (ADI) per FAO; high values of RQ were found between February and May for all foodstuffs showing high risk for consumer at this period.

Another research was carried out by Sheik et al 2015 to determine the pesticide residues and effects of house hold processing methods from bitter gourd peel and were found helpful in reducing the pesticide residues up to 95%.

Functional properties of samples

Table 3showig the results of functional properties of the cowpea sample. The foaming capacities of cowpea flour sample ranged from 15.35% to 28.44%. The raw cowpea flour sample RB 28.44 had the highest foam capacity mean value than boiled sample BB 15.35 which had the lowest foam capacity mean value.

There was a significant difference (P<0.05) recorded among the foam capacities mean value of the cowpea flour samples, and slightly lower in soaked SB 18.52 and lower in boiled cowpea sample BB15.35. This could be traced to treatment methods. Boiling could have denatured the protein leading to decrease in the foaming capacity. Foam capacities and foam stabilities are used as indices of formability of protein dispersion protein forms are important in many processes in the beverage and food industries and this has stimulated interest in their formation and stability foams are used to improve texture, consistency and appearance of foods. Foam formation and foam stabilities are functions of the type of proteins, P^H, processing methods viscosity and

surface tension. Foaming is also known as aerating, leavening power or Whiping properties of foods. It means the ability to incorporate air by itself or in a mixture with other ingredients and to hold the aerated structure long enough so that it can be set by heat or by heat or other means. Foam is a two phase system consisting of a mass of helium gas bubbles dispersed in a liquid or solid with the gas bubbles being separated from each other by thin films of liquid or solid (Narayanaand Narasinga, 1982).Flexible protein molecules which can reduce surface tension give good foam ability but highly ordered globular molecules, which are resistance to surface denaturation give poor foamability. Foamability is thus, related to the rate and decrease of surface tension of the air-water interface caused by absorption of protein molecules. Heat processing decreases thenitrogen solubility of proteins by denaturation and also reduces their foaming capacities (Akubor and Onimawo, 2005).
The Bulk densityof cowpea flours ranged from 0.955 gm^{-3} to 0.62gm^{-3}. Which is similar with (Ghadge, 2008).Where raw cowpea flour sample RB 0.95 had the highest mean value, and boiled cowpea flour sample BB 0.62 had the lowest mean value. There was significant difference ($P<0.005$) in the overall mean densities of the cowpea flours. Bulk density is the ratio of mass per unit volume of a substance. And is an indication of the porosity of a product which influence the package design and the filling weight of the product. It is used in determining the packaging requirement of flour as it relates to the load the sample could carry if allowed to rest directly on one another. Bulk density for flour foods would be an advantage in the preparation of most complementary foods and is affected by moisture content. It is therefore known that, bulk density determines the particle size distribution of flours like cowpea flours. Therefore that an increase in Bulk density of a flour decreases fat absorption meaning, the higher the bulk density (in gm^{-3}), the lower the oil absorption capacity of such a product (sample).(Osundahunsi and Aworh, 2002).This is in disagreement with the published work by (Akubor and Onimawo, 2005).who published that an increase in bulk density of flour enhances fat absorption(Akubor and Onimawo, 2005).

The Water Absorption Capacity of cowpea flours ranged from 71.96% to 82.34%. The cowpea flour sample RB 82.34 had and the highest mean value with boiled cowpea flour sample BB 71.96 with the lowest mean value. There was significant difference ($P<0.05$) in the cowpea flours. Water absorption capacity of flour play an important role in the food preparation process because it influences other functional and sensory properties. The range of application of flour as food ingredients is dependent to a large extent on their interaction with water. (Ghavidel and Prakash, 2006).It is known that polar amino acid residues of proteins have an affinity for water molecules and differences in water absorption capacity of cowpea could be due to the content of these amino acid in cowpea. In addition, carbohydrate composition may also be a factor influencing the water holding capacity of the flour.

The Emulsion Capacity of cowpea flours ranged from 6.56% to 8.34%. The raw cowpea flour sample RB 8.34 had and the highest mean value with boiled cowpea flour sample BB 6.56 with the lowest mean value. There was significant difference ($P<0.05$) in the cowpea flours. The emulsion activity reflects the ability and capacity of a protein to aid in the formation of an emulsion and is reflected to the proteins ability to absorb to the interfacial area of oil and water in emulsion. The emulsion stability normally reflects the ability of the proteins to impact strength to emulsion for resistance to stress and changes and is therefore related to the consistency of the interfacial area over a defined time period (Pearce & Kinsella 1978). Traditional processing had significant effects on the functional properties of processed beans probably due protein denaturation by heat.

IV. CONCLUSION

These results provide important information on the current contamination status of a key agricultural product in Benue state since cowpea produced in Nigeria is sold in the whole country. This study points to the need for urgent action to control the use and management of some excessively applied pesticides since recent literature reveals that the largest proportion of human acute toxicity data is related to pesticide intoxications.

The result of this study indicates that traditional processing methods can help in the dissipation or reduction of pesticide residue in foods. It also reduces anti-nutrient which will enhance the digestibility and bioavailability of the beans. The proximate composition of the beans was also affected significantly by traditional food processing.

V. RECOMMENDATIONS

I recommend that since the pesticide residue level 0.042 is slightly above the specified limit 0.038, there is need for strict surveillance by monitoring agencies to increase awareness to famers and traders on the need for strict adherence to the standard approved limits in the use of pesticides in storing cowpea. Stringent monitoring of use of pesticides in agricultureand food storage in Nigeria is required

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