Physiochemical Properties Of Dried Cassava Flour From Balls And Chunks

Ogori Akama. F

ABSTRACT: The research work is on physiochemical quality of traditionally processed cassava ball and chunks flours ,lending credence to home use ,small scale or meduim enterprise/factories on the potential of the chunk and balls flours in the market .The quality characteristics properties of cassava flour from meal of retted dried balls and chunks from randomised sampling had their physical , physio-chemical and chemical characteristics analysed using standard method. Physical properties of flour had (2.50-11.25) g/g water binding capacity, (2.15-18.0) w/v gelation capacity and (25.75-45.35) viscosity.physio-chemical properties of flour had titratable acidity (0.011-0.125), (4.07-4.99)pH and (1.85-8.75) mg/100g hydrocyanic acid content from meal of retted balls flour which agreed with standard. Chemical propertis had (1.05-1.53)% crude protein, (3.75-7.0)% ash and (2.87-3.78)% crude fiber. The (79.38-83.1) carbohydrate and (324.49-345.0) energy value from dried chunks flour were high and compared favorably with standard.

Keywords: physiochemical ,hydrocyanic acid ,dried cassava ball flour,dried cassava chunks flour.

INTRODUCTION

Tropical tuber crops constitute one of the most important staple food commodities in the world. The major tuber crops include sweet potatoes, yam, Irish potato, cassava and cocoyam. These are usually high in moisture content which affects storage under ambient conditions. Cassava (*Manihot esculenta crantze)* is a crop belonging to the Euphersiocea family, classified into bitter and sweet cassava type (Onwueme, 1978, Purseglove 1991). About 34 million tonnels of the world cassava produce are from Nigeria (FAO, 2001), Cassava potential uses cut across human consumption, animal feed stock, industrial or medicinal products and valued market profit (Asonye 2001, Nweke *et al;* 2002,).Traditional meal of retted dried cassava ball and chunks are processed by large segment of Nigeria population by peeling washing slicing, fermenting, draining or moudling and drying. Cassava chips flour have been reported to be a better quality food and of long shelf life than potato (Bokanga, 1990).The fleshy portion of cassava contain 62% moisture, 35% starch, 1% protein, 0.3% fat, 2% fiber and 1% ash. The fresh roots contain 35mg/100g of vitamin C, trace amount of niacin and fat soluble vitamins (Purseglove, 1991). Cassava chips has a wide application for dough and paste, for composite flour making and starch as source of fermentable sugar required in the production of alcoholic beverages (Amutha and Gunasekaean, 2001; . Processed cassava flour has been reported to be good weaning food, feed ingredient and bakery substitute (Lekule and Sarwath, 1992). The most economic method of processing cassava is by drying.

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The traditional drying process is carried out by the local women who normally target the period of scarcity as the purpose for preservation. The drying is carried out under unhygienic environment resulting in products of low hygienic quality (Kwaisa, 1988). It is important for food inspectors, processors and handlers to keep dried cassava balls and dried chunks and its food safe from pathogens. Several micro organisms have been known to affect the quality of food outside the natural flora, thereby constituting health hazard when contaminated food are consumed, and posing questions on food safety measures. Meal of retted dried Cassava balls are low acid food during processing with limited and slow rate of water loss on sun drying which generally favours spoilage food intoxication, infection and quality reduction resulting from chemical interaction (Chaftel et al; 1985).Food quality is that whole characteristics of food that make food important chemically, physically and economically, hence the quality of traditional processed dried cassava ball and dried chunks are of much important. The Nigeria government has approved the inclusion of 10% cassava flour in wheat flour for economic purposes. Also the oil company had indicated interest in admixture of alcohol and petroleum as substitute for crude oil, which may require varied source other than modern method of processing cassava root. The technological application of flour from dried cassava balls and dried chunks will depend on some of their functional and nutritive properties. However, limited information are available on traditional processing, preservation or safety and quality of meal of retted dried cassava balls, cassava chunks and products, hence there is need to carryout in-depth study on flour from meal of retted dried cassava balls and dried chunks that are locally dried to furnish intending users with information, encourage production and make possible technical assistance on processing and marketing as raw materials for intending factories, consumers and health inspectors. Processors are concerned on ways of processing cassava into utilizable states. Meal of retted dried cassava ball and dried chunks are common in Benue State with less concern on its quality, therefore there is an urgent need for quick physic-chemical and microbiological analysis of this dried cassava balls and cassava chunks to evaluate it potential quality, ascertain process divisibility for both intending users at industrial and international markets. Cassava roots base technology are rising rapidly and the need to appreciate a long time usage of traditionally processed cassava roots by local consumers or villages in the middle belt region of Nigeria are important.The technological application of meal of retted dried cassava balls and dried chunks will depend on some of their functional and nutritive properties. However, limited information are available on traditional processing, preservation or safety and quality of flour from dried cassava balls and chunks. The research work seeks to establish relationship between traditional processed meal of retted dried cassava balls and dried chunks and its properties , by reasons of local processing approach, not all of their properties may deviate from standard restricting guide for specific processing or production of cassava based traditional products or use as raw materials.The study may add value to limited utilization of traditionally processed meal of retted cassava ball and dried chunks, careful target for health consumer and guide for food safety measures. The knowledge on physical, chemical, quality of food eaten in a place is valuable in identified and solving nutritional and health problems of the population.

MATERIALS AND METHODS

Raw Material

The under study site within the metropolis includes Wurukum, Wadata, North Bank, High-level and Fiidi, were ten respondent processors from each site are interviewed on how the meal of retted dried cassava balls and dried cassava, chunks were traditional processed, based on variety of cassava used, the fermentation equipments, the source of water, sanitary conditions and methods of packing from drying flour.Sample of meal of retted dried cassava balls or simply cassava ball and the dried cassava chunks for the study were obtained from different locations. Random sampling from ten points within a site were done using America microbiological specification of foods (AMSF, 1980), and the three class manual method of mixing, which is adopted by Association of America Feed Control officials (AAFCO, 2000). Samples were sealed in polyethylene bags stored in cooler and then conveyed to the laboratory.

Preparation of Flour from Rettened Dried Cassava Balls

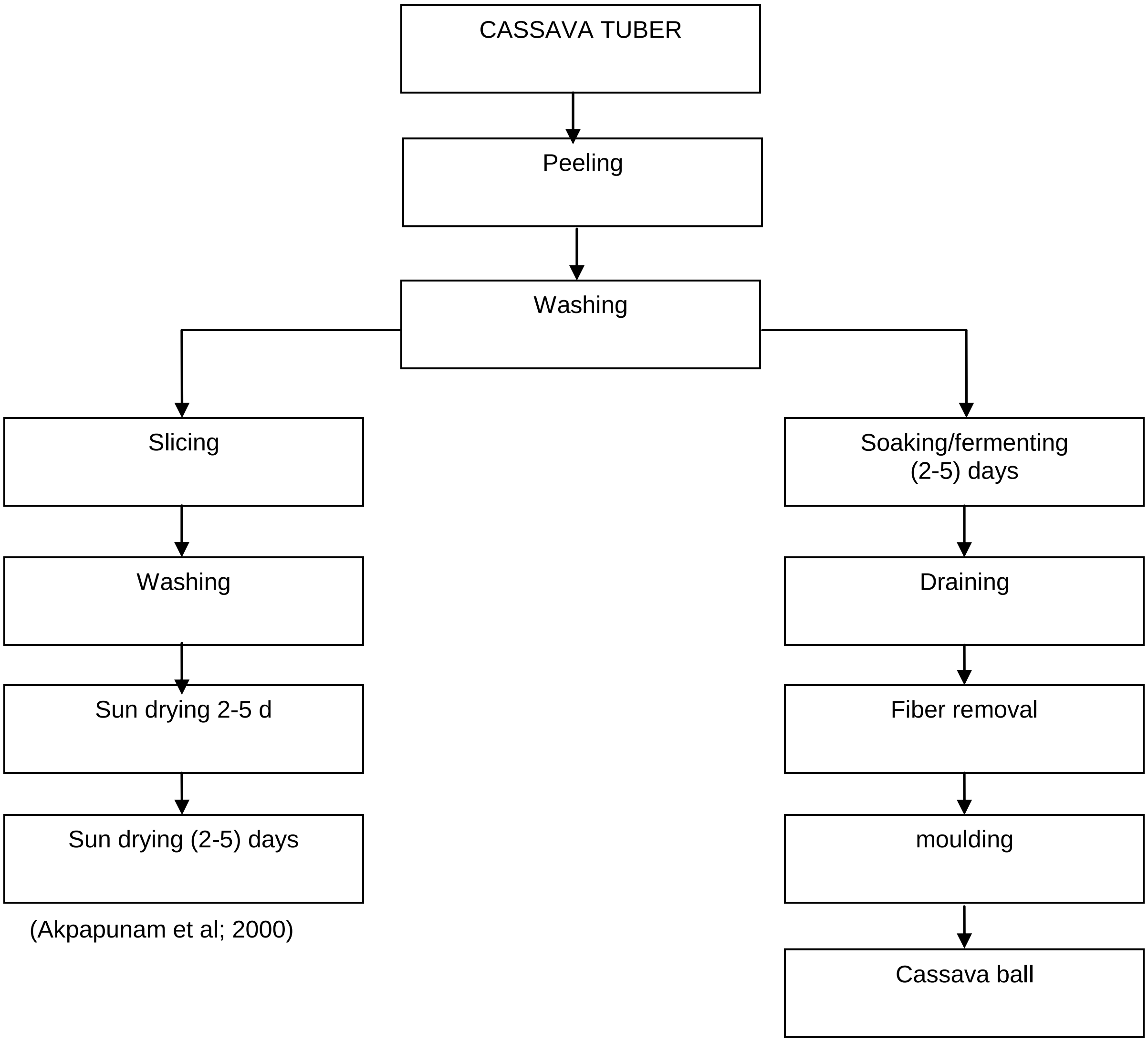
Two kilogram weight of dried cassava balls from each represented sample was thoroughly hand mixed in an aluminum bowl, about 10kg weighed of representative dry sampled cassava balls, were milled with hammer mill (type 8' labmill). The resultant flour were sieved using 100 um aperture size.

Preparation of Flour From Dried Cassava Chunks

Two kilogram weight of dried cassava chunks from each sample was thoroughly hand mixed in an aluminum bowl, about 10kg weighted of preventative dry sampled cassava chips, were milled with the hammer mill (type 8' labmill). The resultant flour was sieved using 100 um aperture size

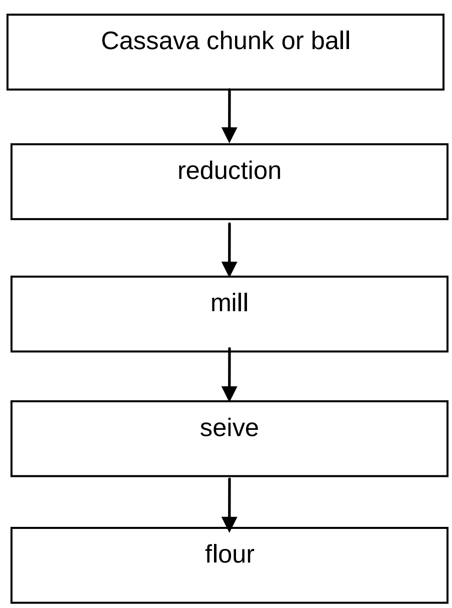
Referal sample or standared: National agency for food drugs adminstration and control with standared organization of Nigeria, flour characteristics properties were use

PROCESSING OF CASSAVA BALLS AND CHNKS FROM CASSAVA TUBER



(Akpapunam et al; 2000)

PROCESSING CASSAVA BALL AND CHUNKS INTO FLOUR



Chemical analysis
Proximate analysis was by AOAC (1995) and carbohydrate was bydifference according to AOAC(1995) Physiochemical analysis for PH was by pearson 1(976),Hydrocyanic acidwas by udira and sighe (1969)and titrable acidity was by AOAC (1995)

Physical analysis
Swelling indexwas by fleming et al (1974)Gelation capacity was by Coffman and Garcia (1977),Water absorption capacity was by okezie and Bello (1988)and Energy value was by Osborne and Voogt (1978

RESULT TABLES

Table 1: Physical properties of flour from dried cassava balls and chunks

Sample	Water (binding) Capacity (g/g)	Gelation Capacity (w/v)	Swelling index 40^{o}C	70^{o}C	Viscosity (cp)
RS	………	…….	…….	……..	34.5
CBWU	0.25$\pm$0.20d	4.35$\pm$0.700a	0.0$\pm$0.00d	2.20$\pm$0.00a	42.9$\pm$0.10b
CBWA	7.75$\pm$0.25a	2.16$\pm$0.32b	25$\pm$0.02b	1.52.5$\pm$0.50b	35.75$\pm$0.3c
CBH	2.50$\pm$0.29c	4.15$\pm$0.50b	20$\pm$0.50b	80.20$\pm$0.50d	35.75$\pm$0.35c
CBFD	3.75$\pm$0.25b	4.25$\pm$0.50b	20$\pm$0.50b	81$\pm$0.20d	25.75$\pm$0.35d
LSD	0.00	0.83	0.00	6.19	0.76
CCWu	2.75$\pm$0.25c	10.35$\pm$0.70c	37.5$\pm$0.5b	196$\pm$0.04a	33.50$\pm$0.50b
CCWA	2.50$\pm$0.00d	2.15$\pm$0.31a	4.0$\pm$0.3c	183.5$\pm$0.11bc	44.90$\pm$0.10a
CCN/B	5.25$\pm$0.25b	18.0$\pm$0.35a	2.0$\pm$0.10c	190.5$\pm$0.12ba	27.75$\pm$0.25c
CCH/L	11.25$\pm$0.45a	4.22$\pm$0.45d	2.0c$\pm$0.20c	190.5$\pm$0.10ba	27.75$\pm$0.25c
CC FD	5.25$\pm$0.25b	16.17$\pm$0.35b	50.0$\pm$0.13c	178.5$\pm$0.13c	45.05$\pm$0.019a
LSD	0.00	0.96	4.06	9.88	4.10

Means in the same column followed by the same superscript are not significantly different (P$\geq$0.05).
Mean $\pm$ standard deviation from duplicate determinations
ND = Non detected
RS = referral Standard
Cbwu=cassava ball flour from wurukum. CCwu=cassava chunksflour from wurukum
Cbwa=cassava ball flour fromwadata. Ccwa=cassava chunk flour from wadata
CBnb=cassava ball from northbank. Ccwn/b=cassava chunk flour from northbank
CBh/l=cassava ball flour from high level. Ccwh/l=cassava chunk flour from high level
CBfd=cassava chunksflour from fiidi. CCfd=cassava chunk flour from fiidi

TABLE 2 : Physio-chemical properties of flour from dried cassava balls and chunks

Sample	P^{H}, pH	Titratable Acidity TA	Hydrocyanic Acid content HCN(mg/100)
RS	5.00	0.1	10.0
CBWU	4.99$\pm$0.1ad	0.011$\pm$0.10a	1.85$\pm$0.10d
CBWA	4.89$\pm$0.1ab	0.013$\pm$0.10a	8.65$\pm$0.50a
CBH	4.07$\pm$0.2cb	0.030$\pm$0.20a	2.75$\pm$0.25a
CBFD	4.40$\pm$0.3ba	0.019$\pm$0.20a	4.25$\pm$0.10c
LSD	0.5	0.01	…….
CCWu	5.0$\pm$0.10c	0.125$\pm$0.01a	4.95$\pm$0.1d
CCWA	5.32$\pm$0.30b	0.106$\pm$0.10b	18.5$\pm$0.65a
CCN/B	6.32$\pm$0.30b	0.019$\pm$0.10c	14.95$\pm$0.60b
CCH/L	6.03$\pm$0.30a	0.004$\pm$0.20d	9.5$\pm$0.35d
CC FD	5.44$\pm$0.25b	0.016$\pm$0.40c	13.0$\pm$0.510c
LSD	0.24	0.007	…….

Means in the same column followed by the same superscript are not significantly different (P$\geq$0.05).
Mean $\pm$ standard deviation from duplicate determinations
ND = Non detected
RS = referral Standard
Cbwu=cassava ball flour from wurukum. CCwu=cassava chunksflour from wurukum
Cbwa=cassava ball flour fromwadata. Ccwa=cassava chunk flour from wadata

CBnb=cassava ball from northbank. Ccwn/b=cassava chunk flour from northbank
CBh/l=cassava ball flour from high level. Ccwh/l=cassava chunk flour from high level
CBfd=cassava chunksflour from fiidi. CCfd=cassava chunk flour from fiid

Table 3: The proximate composition of flour from dried cassava Ball and Chunks

Samples	protein	Crude Fat(%)	Ash(%)	Moisture(%)	Crud fibre(%)	Carbohydrate(%)	Energy Value (kca)
RS -	……..	….	0.60	10.00	2.00	67.50	--------
CB W	1.42±0.00a	1.05±0.23d	4.0±0.50	12.50±0.5a	3.67±0.43a	77.36±0.36a	324.49±0.15a
CB WA	1.20±0.00bc	1.20±0.02c	2.75±0.35a	11.25±0.75b	3.55±0.01a	80.05±0.40a	80±0.16a
CB N/B	1.14±0.01bc	1.60±0.02a	3.75±0.25a	12.62±0.38a	3.48b±0.00ba	77.41±0.10a	328.60±0.6a
CB H/L	1.31±0.01ba	1.31±0.01b	2.75±0.39a	10.0±0.00c	3.12±0.30bc	81.51±0.28a	343.05±0.11a
CB FD	1.09±0.00c	1.05±0.31d	7.0±0.40a	9.0±0.10d	3.07±0.13	79.79±0.39a	329.05±0.10a
LSD	0.19	0.00	5.84	7.53	0.37	11.24	45.30
CC WU	1.31±0.10b	1.25±0.75a	3.65±0.75a	10.0±0.00a	3.78±0.03a	79.82±0.10b	3.36.35±0.4ab
CC WA	1.05±0.01c	1.0±0.00d	4.35±0.00a	7.5±0.75b	3.00±0.21a	83.10±0.00a	345.0±0.00a
CCN/B	153±0.50a	1.20±0	5.0±0.25a	10.0±0.00a	3.67±0.03a	78.60±0.50b	345.0±0.20b
CCH/L	1.31±0.32b	1.0±0.25d	5.0+0.39a	9.75+0.25a	2.87+0.03a	80.10+0.28b	332.65±0.40b
LSD	0.06	0.00	1.49	0.40	0.94	2.54	10.02

Means in the same column followed by the same superscript are not significantly different ($P \geq 0.05$).
Mean ± standard deviation from duplicate determinations

Cbwu=cassava ball flour from wurukum. CCwu=cassava chunksflour from wurukum
Cbwa=cassava ball flour fromwadata. Ccwa=cassava chunk flour from wadata
CBnb=cassava ball from northbank. Ccwn/b=cassava chunk flour from northbank
CBh/l=cassava ball flour from high level. Ccwh/l=cassava chunk flour from high level
CBfd=cassava chunksflour from fiidi. CCfd=cassava chunk flour from fiidi

DISCUSSION

Physical properties of Flour from Dried Cassava Ball and Chunks

The significant high water binding capacity exhibited by cassava ball flour may be due to the presence of more hydrophilic carbohydrate exposed sights maybe due to cell disarrangement of the cassava ball during rettening (Ogbo, 2007).The higher water binding capacity from high level cassava chunks indicate that it is more hygroscopic than the other samples.The low gelation capacity in cassava balls flour showed that fermentation change carbohydrate quality and composition of the product flour. This may be due to activity of hydrolytic enzymes, changing gelling properties to other metabolite resulting in decrease in gelation concentration obtained. This is an advantage to wheat miller and bread maker using cassava ball flour as admixture since little bond may have to be broken by their mixers.The high gelation capacity of cassava chunks flour showed that when where is no fermentation of cassava there is little or no change in carbohydrate composition. (Oorakaol and Maledina, 1981). Little endogenous enzyme activity may have resulted in break down of starch with no further conversions, making more flour available for cell formation hence the increase in gelation concentration obtained. This is an advantage to animal feed and ethanol producer. The observed high swelling power of the flour obtained from cassava chunks at 70oC, indicate that steaming may increase swealliblity of cassava chunks flour (Iwuoha et al; 2003). This may be due to leaching of dextrin because of glucosidic bond breakage. Due to little or no complexity resulting from fermentation of cassava chunks flour, this may encourage sedimentation and flocculation ability for pharmaceutical purposes (Onyekweli et al; 2005). The higher swelling power of flour obtained from cassava chunks indicate that this may give higher yield of fufu past compared to the flour from cassava balls flour. The viscosity values are in confirmation by (Njoku and Banigo, 2006), that granules ruptures so easily on stirring. This may indicate weak type of bonding force to maintain granules structures in cassava balls and chunks flours. The cassava balls flour had higher viscosity value compared to cassava chunks flour, this indicate that cassava balls flour will have high resistance to rupture due to high concentrated metabolites and easy to leaching due to it weak bound forces. The increase in viscosity of the ball flour also observed in Wurukm samples may also be due to activity of hydrolytic enzymes and natural floral during fermentation, producing metabolites, starch, sugar which may have reconcentrated during sun drying.The low viscosity of the cassava chunks flour may be as a release of bound water and unbound water (Gallat, 1989). This indicate that it can be use as weaning formula since it will easily digest (in the absence of cyanide toxicity) , flour concentration would be required to form gell. This will mean more cassava nutrient in fufu past.

P^H Titratable Acidity and Hydrocyanic Acid of flour from dried cassava balls and chunks.

From table 2 above,Cassava chunks P^H of flour were significantly high. The slight increase may be due to little or no fermentation of the slice chunks on sun drying after washing. These were however below P^H values reported by (Iwuoha et al; 2003) for bitter and sweet cassava processed flour.The titratable acidity of both cassava balls and chunks flours were in agreement with the work of (Oluwole et al; 2004) who reported that periodic fermentation of gari from dried cassava chunks increased titratable acidity of the flour. The hydrocyanic acid content of cassava balls flour agreed with (WHO) and the Indonesian standard (Paul et al; 2005), there were significantly lower than cassava chunks. The observed lower value in hydrocyanic acid content from cassava balls flour could be due to rettened dried balls and more hydrophilic sites ,maybe humidity variation during drying which may have changed the chemical make up of the drying balls. According to cassava cyanide disease network(CCDN, 2007) wetting of the flour reduces hydrocyanic acid content to third size of the original quantity.

Proximate Composition of Flour from Dried Balls and Chunks.
From table 3 above,the moisture, crude fibre, carbohydrates and energy values of the flour from cassava balls and chunks flour were similar to the values reported by (Agu and Aliyoh 2004. Njoku and Banigo, 2006. Iwuoha et al; 2005 and Oyenuga 1968). The value in crude protein, Ash, carbohydrate content and energy value from cassava ball flour may be due to enzymatic actions and micro floral activities which might have used soluble substrate during tuber retting (Oboh and Elusiyan, 2007). This is consistent with reports by (Agboolar et al; 1990. Akin gbala et al, 1999. Oboh and Akindahusin, 2003). Fat content were above the value reported by Iwuoha et al; 2003). The similar values in fat content from cassava balls and cassava chunks may be due to reduction in lypolytic enzyme. It may also be due to little or no alteration in protein, ash, crude fibre content of the flour as reflect in table three.The values were consistent will reports by (Iwuoha et al; 2003. Njoku and Banigo, 2006). The high ash content from cassava ball from Fiidi sample may be due to tuber rettening. Since fermentation liberate mineral ions like sodium, iron and soluble zinc.The high values in moisture observed in cassava ball flour from Wurukum, Wadata and North Bank may be due to starch modification during fermentation which could have allowed more hydrophilic regions, this could affect storage of cassava balls flour. The low values observed in moisture from cassava chunks flour may be due to chunks sizing and it small surface area. This corroborate with values by (Njoku and Banigo, 2006. Iwuoha et al; 2003). The high crude fibre values were significantly above referral standard this maybe resulting from poor peeling and sizing before washing and fermenting .The significant difference in cassava ball flour over cassava chunks flour could be due to micro fungi surface contaminations during fermentation (Oboh et al; 2003). This could promote peristaltic movement of gastro intestinal tracks of fufu made from cassava balls.The significant high carbohydrate content of the cassava ball and chunks were consistent with report by (Njoku and Aluyah, 2004). Cassava ball flour had lower carbohydrate content due to hydrolytic enzymes **activity** producing other macro molecules and metabolites (Oboh, 2006). The energy value obtained from cassava balls and chunks collaborate with that reported by (Agu and Aluyah, 2004). The energy value from cassava ball flour samples were significantly below that of cassava chunks flour samples this was obvious in High-level sample. This may be due to rettening resulting to break down of starch (Ihekoronye and Ngoddy, 1990). Fermentation allow little interaction of protein, fat, crude fibre and ash. These bound loss may have resulted to interaction with leaching processes (Apkapunam et al; 1996). The energy value obtained from cassava chunks flour from North Bank samples were significantly high which may be due to less activity of micro flora and hydrolytic enzymes on the slice dried chunks

Conclusion.
Proximate properties of cassava chunks flour were higher than cassava balls, hence an attraction for feed and ethanol productions. Cassava ball flour can keep longer than the chunk flour because of its moisture content.The water binding capacity, viscosity, pH titratable acidity and hydrocyanic acid content in cassava ball flour were high, compared to cassava chunks flour which may be potentially good for composite flour technology and fufu making.Proper hygiene and sanitary practice by processors of dried balls and chunks during hand drying , packing from dried flour should be improved and wire quash ,plate-form and drying using tarpaulins should be adopted on drying instead of drying balls and chunks by the road sides.

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