Microbial Quality Of Ready To Eat Cassava (Fufu) Sold In Owerri Metropolis

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ABSTRACT

Cassava fufu is an acid-fermented product produced through submerged fermentation of cassava root in water for days, which is poised to contamination during processing practices and may risk food poisoning. This study was set to determine microbiological quality and the effects of storage on ready to eat cassava Fufu. Thirty (30) different samples of ready to eat cassava fufu was purchased from different markets in Owerri metropolis, Imo state. From the Thirty samples, Six(6) was removed and stored for day 0-9 to assess the effects of storage on ready to eat fufu. The media used for this research were Nutrient Agar,MaCconkey agar,Salmonella shigella agar and Sabouraud dextrose agar(for fungi). The media were prepared according to the manufacturer`s instructions.A standard microbiological method was used in enumerating and identifying bacteria and fungi specie isolates which includes morphological,cultural,microscopic and biochemical characteristics.The result revealed that(7) bacteria isolates.The bacteria isolated includes Escherichia coli, Staphylococcus aureus,Salmonella spp,Enterobacter spp,Lactobacillus spp,Pseudonomas spp and bacillus spp. The total mean bacteria count from the result ranges from (9.74 x10^6 -3.80 x10^8)cfu/g. The result shows that relief market has the highest total mean bacteria of(3.80 x10^8) and the least is Ekeonunwa market (9.74 X10^6). It was investigated from the research that Salmonella has the highest percentage occurrence of 26.09%,Escherichia coli has 21.74%,Staphylococcus aureus has 17.39%,Lactobacillus spp has 13.04%, Pseudonomas spp and bacillus spp has 8.7% respectively and the least is Enterobacter spp 4.34%.. This study also investigated that there were increase in microorganism counts as the storage time increases. The result obtained showed that ready to eat cassava fufu samples that were sold in the market is poised to high contamination due to exposures which might poise risk to health. Therefore good manufacturing practices,proper sanitary conditions and best processing and packing practices is encouraged among the producers and retailers of ready to eat fufu to reduce contamination and proliferation of pathogenic microorganism in fufu.

Background of the study

Cassava [Manihot esculenta crantz] is the staple root crop of over 800 million people in the humid tropics and ranks sixth in terms of overall global crop production. (Nassar et al 2007, Hanetal 2001). Fufu is an acid fermented cassava product produced through submerged fermentation of peeled cassava roots in water and consumed, in Nigeria, West African countries and other part of the world. (Opara, 2020).

Fufu is usually processed by households and rural processors whose practices may differ by culture and regions (Flibert et al 2016). Fermentation is a key component of fufu production an important step to detoxify the cassava pulp [i.e. degrade cyanogenic glucosides]develops the characteristics aroma and flavour of the fufu and also helps in preserving it. Fufu is produced by first, peeling and washing the cassava roots and cutting them into smaller chunks. (Mokemiabeka, et al 2011). The method of soaking/steeping of roots differs among states and processors in south east Nigeria. Soaking steeping or fermentation of the cut roots may be carried out either by continuous soaking of chunked roots for a period of 3-5 days of fermentation. The fermented roots and mash are finally sieved and dewatered to obtain the wet paste. The sour taste, flavor, appearance and texture. (Bammideleetal,2015).Fermentation of fufu, Lactic acid bacteria, yeast and other bacteria contributes significantly to starch breakdown, acidification, detoxification and flavor development.(Uyoh et al 2009,Opara 2020)

Among the fermented products of cassava, Fufu is one of the favourites consumed in many parts of West Africa countries. Fermented cassava is sieved to remove the fibers and allow to sediment (Sannii et al 2007,Opara2020). After sedimentation, the water is decanted and the sediment is dried, milled and the fufu flour is obtained. Cassava fufu has a very strong odour and is an important staple food widely eaten in Nigeria, many parts of the west Africa and the tropics. Cassava fufu has gained popularity and acceptance to the point that is being sold in markets and hawked in the streets of most cities and metropolis of south east south- south and south west Nigeria. The cooked ready-to-eat cassava fufu is wrapped in low density polyethylene bags that are transparent and packed in plastic buckets,while some qualities are displayed on plastic/stainless trays for prospective buyers.Cassava fufu as sold in the market is a ready-to-eat food that does not require further heat treatment before consumption.

Moreover,it is convenient as no further processing is needed.The fufu as it were,is usually exposed to sunlight and the shelflife depends on the vagaries of weather. As microorganisms are known to thrive under different temperatures,the fufu is prone to weather changes giving rise to the development of some microorganisms in the fufu. Besides,the fufu usually lasts for 4 to 7 days before the sales could be finished. The fufu is exposed to post processing contaminations just like every other food largely due to poor handling and marketing/channel of distribution. Hence, this study is undertaken with a view to evaluating post processing qualities of cassava fufu as sold and marketed in the study area.

MATERIALS AND METHODS

MATERIALS AND REAGENTS:

The materials and reagents used during the course of this research includes; weighing balance, beaker, conical flasks, autoclave, petric dishes,70% ethanol[alcohol],non-absorbent cotton wool, Aluminum foil, test tubes, wire loops, incubators, microscope, nutrient agar, MaCconkey agar and Salmonella Shigella agar,peptone water and distilled water.

COLLECTION OF SAMPLES

Thirty (30) ready to eat fufu was purchased from six different markets in Owerri Metropolis market. Five from different vendors from each location. The fufu was purchased in the early hours. They were placed into sterile polythene bags and each of the fufu was transferred into different plastic containers well labeled to differentiate them based on the vendors they were bought from and it was taken to the laboratory immediately for analysis.

PROCESSING OF CASSAVA TUBER

The submerged fermentation process as describe as describe by (Booth and Coursey, 2004) was adopted. The cassava tubers was peeled, washed and fermented in water in 3:1(water/volume) for four days. After the stipulated time, the tubers were removed from the water and were washed, then mashed in sieved 20mm

(sieved opening) and the fibrous material were removed. The wet mash was allowed to sediment, packed in cloth bag and then pressed to remove water until a firm cake is obtained the wet mash [fufu].

PROCESSING OF BOILED CASSAVA [FUFU]

Boiling method: Six and half grams (6.5g) of the cassava mash was moulded and introduced into boiling water and allowed to boil for 20 -25 minutes at 100C,after which it was pounded and moulded again and introduced into boiling water and was allowed to boil for another 20-25 minutes then it was pounded again to get boiled fufu.

PROCESSING OF STIRRED FUFU

STIRRING METHOD: Six and half grams (6.5g) of the cassava mash were mixed with 50ml of water to form a uniform mash. The mash was stirred continuously over a low heat 80C for 30 minutes to get the stirred fufu.

STERILIZATION OF MATERIALS:

The various glass wares for the practical were properly washed and rinsed using distilled water and sterilized using autoclave at 121C for 15minutes. These glasswares include petric dish, conical flask and measuring cylinder.

PREPARATION OF CULTURE MEDIA

The media used were Nutrient agar, MaCconkey agar, Salmonella Shigella agar and Sabouraud Dextrose agar and peptone water. They were prepared according to the manufacturer's instructions of each medium. The required amount of the powdered medium was weighed following manufacturer's specification and dissolved in distilled water in a conical flask. The dissolved media were sterilized in pressure cooker for 40 minutes at 100°c.

SERIAL DILUTION, CULTURING AND BIOCHEMICAL TESTING.

Inoculation and isolation: One gram from each of the fufu was added into a beaker containing10ml of distilled water and was homogenized separately. it is in the ratio of 1:10 and was minced until a paste of the fufu was formed. This serves as the stock solution and it was labeled as such. A Tenfold serial dilution of each sample was performed until 10-5 level of dilution was obtained. [Inetianbor et al 2014]. Bacteria were grown in Nutrient Agar [NA] and were grown at 37C for 24h. From the appropriate dilution 0.1ml were pour plates on Salmonella Shigella agar and MaCconkey agar for the determination of microbial counts in each sample of the respective agar media followed by incubation at Laboratory (ambient 48hours and 72 hours)respectively. Pure cultures of the different isolates were obtained and stored in a nutrient broth slant as describe(Cheese, 2006). For fungi isolates the inocula were grown in SDA for 72 hours at room temperature (Udochukwu et al., 2016). Cultural and morphological characterization of bacterial and fungal isolates were determined according to (Hoit et al, 1994). The high acidic level that is involved in fermented fufu is sufficient to eliminate most of the microorganism but post processing contamination may occur which affects the quality of the final product. (Odom et al., 2012). Total viable counts of bacterial isolates were determined by enumerating the colony forming units (cFu/g) at the end of the incubation period using the following formula as describe by (Jideani and Jideani 2006).

PURIFICATION OF ISOLATES

The resulting colonies from CLED agar, SSA and nutrient agar plates were purified by sub- culturing on freshly prepared nutrient agar plates. The plates were incubated at 35C for 24hours. After overnight incubation the resulting discrete colonies were stored in agar slant for further use.

IDENTIFICATION OF BACTERIA ISOLATES

Isolates were analyzed based on morphological features. Gram staining and biochemical characterization which includes: catalase, oxidase, coagulase, citrate, motility, indole and urease test of the isolates were carried out to verify the identity of the organisms. The bacterial isolates were identified and confirmatory identities of bacteria were made using Bergey's manual of determinate bacteriology (1957).

RESULTS

About Thirty (30) ready to eat fufu was sampled, their total mean bacteria counts were determined which range from (9.74 x10^6 – 3.80 x10^8cfu/g). As shown in table 1 amongst the six (6) different locations (markets) samples sourced from relief market has the highest total mean bacteria count (3.80 x10^8), followed by New Owerri Market (3.27 x10^8), followed by world bank market (2.59 x10^8), followed by Nkwo Orji (1.39 x10^8), followed by Douglas market (4.429 x10^7) and the least is Ekeonunwa (9.74 x10^6).

The bacteria isolated includes Escherichia coli, Staphylococcus aureus, Bacillus spp, Salmonella, Pseudonomas spp, Enterobacter spp and Lactobacillus spp.

Table 2 also it was shown that Salmonella spp had the highest percentage occurrence of 26.09%, followed by Escherichia coli 21.74%,Staphylococcus aureus 17.39%,Lactobacillus spp 13.04%, Pseudonomas spp and bacillus has 8.7% respectively and the least is Enterobacter spp 4.34%.

Table 3 shows the morphological characteristics of the bacteria isolated their size, colour, shape, margin, cell type, cell arrangement, motility and capsility. The biochemical reaction, sugar reaction and staining reaction of the bacteria isolated were shown in table four (4).

The Effect of storage on ready to eat fufu was shown in table seven (7) where increased in days of storage of fufu increases bacteria proliferation in ready to eat fufu.

Day 9 of storing ready to eat fufu had the highest total mean bacteria count 7.37 x 10^6 while day 0 has the least 8.6 x10^5. The physical appearance of stored ready to eat fufu were seen with changes in the fufu due to microbial growth.

Table 1: MEAN BACTERIA COUNTS

Location (Markets)	Number of Samples from each Location	Bacterial Isolates	Mean Bacterial Counts Cfu/g	Total Mean Bacterial Count cfu/g
Ekeonunwa	5	Escherichia coli	4.6x 10^5[cfu/g] 1.25x10^6	9.74x10^6
		Staphylococcus	[cfu/g] 0.3x10^5[cfu/g]	
		Bacillus specie	0.8x107[cfu/g]	
		Salmonella		
Douglas	5	Salmonella	0.4x10^7[cfu/g]	4.429 x10^7
		Escherichia coli	3.9x10^7[cfu/g]	
		Pseudomonas	8.3x 10^5[cfu/g]	
		Enterobacter	4.6x 10^5[cfu/g]	
Relief	5	Salmonella	0.7x10^7[cfu/g]	3.80 x 10^8
		Escherichia coli	1.09x 10^8[cfu/g]	
		Staphylococcus aureus	2.64x10^8[cfu/g]	
		Bacillus specie	0.5x 10^3[cfu/g]	
Nkwo orji	5	Salmonella	0.1 x10^8[cfu/g]	1.39 x10^8
		Escherichia coli	1.25x 10^8[cfu/g]	
		Lactobacillus specie	3.6 x10^6[cfu/g]	
World bank	5	Salmonella	0.2 x10^3[cfu/g]	2.59 x10^8
Market		Escherichia coli	0.8x10^7[cfu/g]	
		Staphylococcus aureus	2.16 x10^8[cfu/g]	
		Lactobacillus	3.5 x10^7[cfu/g]	
New owerri	5	Pseudomonas	5.2 x10^3[cfu/g]	3.27 x10^8
Market		Salmonella	0.6 x10^5[cfu/g]	
		Staphylococcus aureus	1.81 x10^8[cfu/g]	
		Lactobacillus specie	1.46 x 108[cfu/g]	

TABLE 2: **DISTRIBUTION OF BACTERIA AND FUNGAL ISOLATES THE FUFU SAMPLE**

ISOLATES	NUMBER OF OCCURENCE	PRECENTAGE OF OCCURENCE	DISTRIBUTION OF ISOLATES(%)					
			Ekeonunwa	Douglas	Relief	Nkwo Orji	World bank Market	New Owerri Market
Escherichia coli	25	21.74%	+	+	+	+	+	_
Staphylococcus aureus	20	17.39%	+	_	+	_	+	+
Bacillus specie	10	8.70%	+	_	+	_	_	_
Salmonella	30	26.09%	+	+	+	+	+	+
Pseudonomas	10	8.70%	_	+	_	_	_	+
Enterobacter	5	4.34%	_	+	_	_	_	_
Lactobacillus	15	13.04%	_	_	_	+	+	+
TOTAL= 115	100							

TABLE THREE (3): MORPHOLOGICAL CHARACTERISTICS OF BACTERIAL ISOLATES

BACTERIA ISOLATES	SIZE	COLOUR	SHAPE	MARGIN	CELL TYPE	CELL ARRANGEMENT	MOTILITY	CAPSILITY
Escherichia coli	1 – 4mm in diameter	Pink	Large	Mucoid, Smooth	Rods	Cluster	motile	Capsulate
Staphylococcus aureus	1-2mm in diameter	White/ Yellow	Small	Raised	Cocci	Singly/pairs	Non motile	Non Capsulate
Bacillus cerus	5-8 x1.5um(2-5) in diameter	Grey-white	Large, Irregular	beaded	Spores	Chains	Non motile	Capsulate

Salmonella	2-3mm in diameter	Pink- red with black Centers	Large	Mucoid	Rods	Singly	Motile	Capsulate and non Capsulate
Pseudonomas	1-5um Long and 0.5-1.0um wide	Dark greenish blue	Large, Flat	Mucoid	Rods	Singly	Motile	Capsulated
Enterobacter	1-5um in length(0.3-0.6 x0.8-2.0um)	Grey	Medium to Large size		Rods		Motile/Non motile	
Lactobacillus					Rods		Non motile	

TABLE FOUR(4):BIOCHEMICAL TESTING OF BACTERIA ISOLATES/STAINING REACTIONS/SUGAR RE

BACTERIA ISOLATES	STAINING REACTION	BIOCHEMICAL REACTIONS							SUGAR REACTION		
	GRAM STAINING	CATALASE	COGULASE	OXIDASE	INDOLE	CITRATE	VOGAS Proskauer	UREA	Glucose	SUCROSE	LACTOSE
Escherichia coli	-Ve	+	_	_	+	+	+	_	+	D	+
Staphylococcus aureus	+Ve	+	+	_	_	+	_	_	+	D	_
Bacillus cereus	+Ve	+	_	_	-	-	-	_	+	D	+
Salmonella	-Ve	_	_	_	-	-			+	-	_
Pseudonomas	-Ve	+	_	+	-	-	-	-	+	D	_
Enterobacter	-Ve	-	-	-	-	+	+	-	+	D	+
Lactobacillus		-	ND	ND	ND	ND	-	ND			

NOTE: ND =NOT DETERMINED

D=DIFFERENT STRAINS GIVES DIFFERENT RESULTS

TABLE SEVEN(7):EFFECTS OF STORAGE ON READY TO EAT FUFU

DAYS OF STORAGE	LOCATION	MEAN BACTERIA COUNTS	TOTAL MEAN BACTERIA COUNT
DAY 0	Ekeonunwa Douglas	3.2 x10^5(cfu/g)	8.6 x10^5
	Relief	3.2x10^5 (cfu/g)	
	Nkwo orji market	7.0x 10^4(cfu/g)	
	New owerri market	7.0 x10^4(cfu/g)	
	World bank market	4.0 x10^4(cfu/g)	
		4.0 x10^4(cfu/g)	
DAY3	Ekeonunwa Douglas	5.1 x10^5 (cfu/g)	2.43x10^6
	Relief	7.2 x10^5(cfu/g)	
	Nkwo orji market	2.2 x10^5(cfu/g)	
	New owerri market	5.1 x10^5(cfu/g)	
	World bank market	2.1 x 10^5(cfu/g)	
		2.6 x105(cfu/g)	
DAY 6	Ekeonunwa Douglas	6.8 x10^5(cfu/g)	4.42 x10^6
	Relief	9.9 x10^5(cfu/g)	
	Nkwo orji market	4.8x 10^5(cfu/g)	
	New owerri market	1.11x10^6(cfu/g)	
	World bank market	5.1 x10^5(cfu/g)	
		6.5 x10^5(cfu/g)	
DAY 9	Ekeonunwa Douglas	8.5 x10^5(cfu/g)	7.37 x10^6
	Relief	1.17 x10^6(cfu/g) 1.08	
	Nkwo orji market	x10^6(cfu/g)	
	New owerri market	1.2 x10^6(cfu/g)	
	World bank market	1.2 x10^6(cfu/g)	
		1.87x10^6(cfu/g)	

TABLE EIGHT(8):PHYSICAL APPEARANCE OF STORED READY TO EAT FUFU

DAYS OF STORAGE	LOCATION(MARKET)	PHYSICAL APPEARANCE
DAY 0	Ekeonunwa	No visible change
	Douglas	No visible change
	Relief	No visible change
	Nkwo orji market	No visible change
	New owerri market	No visible change
	World bank market	No visible change
DAY 3	Ekeonunwa	No visible change Moistened
	Douglas	Crust observed Dirty brown
	Relief	colour
	Nkwo orji market	Dirty brown colour
	New owerri market World	Dirty brown colour Mould
	bank market	growth
DAY 6	Ekeonunwa	Reddish Spots
	Douglas	Moistened Crustobserved
	Relief	Dirty brown colour Reddish
	Nkwo orji market	Spots
	New owerri market World	Blackish brown colour
	bank market	Moistened Crust observed
DAY 9	Ekeonunwa	Reddish Spot
	Douglas	Moistened crust observed
	Relief	Yellowish green colour
	Nkwo orji market	Reddish Spots
	New owerri market World	Blackish brown colour
	bank Market	Yellowish green colour

Discussion

This research study showed that a Total of Seven (7) bacteria strains and two(2) fungal was isolated from the fufu Sample. They includes Salmonella, Escherichia coli, Lactobacillus, staphylococcus aureus, bacillus, Pseudonomas and Enterobacter. According to Odo et al (2016) isolation of these organisms may be attributed to poor handling during Post processing, packaging and storage. The presence of these Microorganisms could be as a result of post processing contamination from poor handling; during the process of mixing with hands, kneading, Moulding, Hawking, pounding with motar and other human activities.

The fermentation of Cassava roots, allows softening for further processing and reduction of potentially toxic Cyanogenic glucosides present in the roots(Achi and Akomas 2006).The traditional methods of fermentation usually produce mash which contains a foul odour resulting from uncontrolled fermentation and storage technique.(Achi and Akomas 2006,Okolie et al1992). According to (Ogumbawo et al 2004), this type of fermentation, although the Simplest way to achieve fufu through cassava fermentation involves a complex microbial process. The high acidic level that is involved in fermentation of fufu is sufficient to eliminate most of the Microorganisms but post processing contamination may occur which affects the quality of the final product. (Odom et al 2012). The total mean bacterial and fungal counts evaluated in this study varied from one Sample to the other and are higher than the normal/acceptable standard of plate count. The Maximum permitted standard plate count is 5.0x10^5 (International commission of microbiological Specification for food (ICMSF), 2009) and 1.0 x10^3cfu/ml according to Gulf Standard (2000). The Occurrence of the Microorganism on the fufu sample suggest a relationship with the amount of moisture present which enhance proliferation of Microorganisms. High moisture content accelerates food spoilage and generally provided a good media for the growth and proliferation of Microorganisms especially bacteria.

Most of the fufu sample stored for 7days exceeded the stated microbial limits and were unfit for consumption. The longer the storage period of the sample (fufu) the higher the microbial population. High bacteria count as recorded by wrapped fufu shows that storage temperature and packaging

material favoured the growth of bacteria. This could be attributed to increased temperature of the wrapped fufu. According to Aderinto(2003) Fufu will be kept best when packaged in leaf and stored under refrigeration as Ph and more stable than those stored at 28°c(ambient temperature). Total titratable acidity of fufu stored at 8°c remained. Since the fermentation used to produce the fufu product was natural fermentation, which involves a Complex microbes population during fermentation, the microbes recovered from the fufu samples may be the organisms involved in the fermentation. Despite the possibility that this is the case, it is indisputable that some of these Microorganisms may have been introduced by humans, packaging materials, Storage temperature, pH levels or even the immediate location where the processed Cassava was stored (Odom et al 2012).

The presence of Lactobacillus Suggests that the acid fermentation of fufu is brought about by Lactic acid bacteria (LAB). The presence of staphylococcus aureus could be due to contamination from the skin, Mouth or nose of the handlers or hawkers since it is a member of the normal flora of the skin and though the percentage of the isolated is high, this does not portray a serious concern since the temperature of most of the fufu is raised before final consumption. According to (Umeh 2009) contamination by staphylococcus aureus could be from human skin, mouth when coughed, nose when sneezed. Staphylococcus aureus produce a number of disease - causing factors such as coagulase, alpha exotoxin and haemolytic beta toxin which are the principal agents in food borne intoxication. The symptoms of staphylococcal intoxication include extreme distress, nausea, diarrhea and vomiting. (Okaka et al 2006). According to (Amusan et a l2010) Vomiting, nausea, diarrhea and abdominal pain are few signs of staphylococcal food poisoning.

The environment in which food is prepared, handled and kept as well as the person handling it can all harbour staphylococcus bacteria. Staphylococcus aureus produces various heat - stable extracellular chemicals known as enterotoxins that makes the food dangerous. These enzymes aid in the staphylococcal invasiveness of the immune system (Prescott et al. 2005). Depending on the amount of inoculum consumed and the individual's susceptibility to the toxin, the intensity of the symptoms may change. According to (Mbayei and Iroegbu 2010),air pollution and other environmental factors are

potentially sources of staphylococcus. The appearance of staphylococcus aureus is largely due to human interface. This reflection is as a result of unclean practices during production and sale, as the organisms is usually found on the skin and nose, may be due to contamination from the mouth or nose.

Bacillus cereus, is an opportunistic pathogen of humans, is a frequent inhabitant of soil leaf surfaces and wrapping materials.

According to (Odom et al 2012) stated that bacillus presence in fufu may be as a result of soil and materials used in wrapping, covering the fermentation tank or drum and packaging. Bacillus cerus produces an exotoxin which causes an intoxication characterized by abdominal pain, flatulence, diarrhea, headache, dizziness, Vomiting and dehydration. It occurs from contamination from packaging materials as well as eating cold fufu after being held at room temperature for several days/hours. (Umeh, 2009). It was observed that the fufu as marketed in the study area is usually eaten as purchased thereby exposing the consumer to bacterial contamination. The presence of Escherichia coli in the indicated that such fufu has been contaminated with faecal materials and such food might not be safe for human consumption. The main route of E.coli of the fufu Samples in this research may have come from the water used to wash the mortar and pestle before and after pounding the fufu or from the water used to mold or beat the fufu,an unhygienic environment may also contribute and the storage for a long time by the sellers if not sold in time. In general, most strains of E.coli are harmless and are part of the normal guy flora, although some serotypes causes Serious food poisoning in humans. E.coli is being found in the urinary tract, which is it's natural habitat.

Reduction of the odour in Fufu by enhance technology (optimization) will make fufu to be more liked and generally acceptable to a wider population. The odour in Fufu can as well be reduced by addition of some certain substance which includes Kerosene, Scent leaf, Sieving out the water used in processing the fermented Fufu (According to my Questionnaire). Cassava is one of the very few tropical crops where cyanide content has not restricted its use, An Important staple food for human consumption. This is because a variety of processing technique have been developed in different parts of the world to make Fufu more palatable. (Aweke et al 2012). The degree of reduction of cyanide in the final product varies

greatly with the type of processing technique used (Nhassico et al 2008, Cardoso et al 2005, Bradbury 2004). As cassava has long history of Cultivation and consumption in other parts of the world, different processing methods had been developed to neutralize the toxin (cyanide). According to (Aweke et al 2012) few processing methods such as washing, boiling, drying and fermenting with cereals are used to remove or reduce cyanide in Cassava. Solar drying and fermentation were found to be the best Methods in removing cyanide content and detoxifying Cassava basei food (Aweke et al 2012).

Conclusion

The result obtained from this research shows that Fufu is a fermented product, Which can be contaminated through post poor handling effects either at the processing site when it is being cooked(this is usually because it is with bare hands that they usually use to mold fufu into the pot) or contamination from the market place. The quality is also often Compromised as some processors make use of back slopping to reduce the length of time for fermentation so as to meet high customer's demand and high quality.

The result in this research shows that the fufu sold at various Locations (market) in Owerri Metropolis is contaminated with several Microorganisms and there is need to reheat Fufu before Consumption.

Some of the bacteria and fungi isolated and identified in the Fufu Sold in Owerri are of public health Importance thus their presence are considered as major Cause of gastrointestinal disorders, Food poisoning and food borne diseases. The presence of Salmonella, Escherichia coli, Staphylococcus aureus, Bacillus species, Lactobacillus specie, Pseudonomas aerginosa and Enterobacter.

Personal hygiene and good processing practices of the food vendors are major factors that determine the safety in the Consumption of the ready - to- eat Fufu. Hawking and storage of Fufu at ambient Temperature for more than 5days predisposes the fufu to microbial growth and Spoilage which is detrimental to health. The Longer the time of storage, the higher the possibility of being Contaminated and the more the microbial Load.

Recommendation

It is recommended that regular microbiological quality Control programs and Education (Enlightenment) of the food handlers/food vendors on food safety practices should be encouraged. The use of chemicals and other Artificial Substance to enhance the fermentation and quality of Fufu should be discouraged. Strict Supervision of ready to eat fufu sold to the general public should be properly investigated by the relevant authorities to prevent epidemics of food borne illness within the Owerri Metropolis.

The government and regulatory agencies Such as:National Agency for food and drug Administration and control should particularly regulate, Control and Set up a local body Nationwide that will monitor the production/processing Site of production (Location), packaging of the Fufu in order to reduce health Hazard and guarantee good health for the Nation.

There is need for establishment of national Legislation that would restrict and Control Sales of Fufu in strategic Locations to reduce the Level of Contamination of the products.

Customers should always reheat purchased Fufu to ensure destruction of vegetative Cells before Consumption.The producers Should be discouraged from packaging ready- to eat Fufu in Market places.The need for periodic Screening of producers and retailers for Convalescent Carriers of Microorganisms should not be over emphasized.There is need to educate Fufu producers or retailers on good sanitation, personal hygiene and its relevance to food production.The producers should be encouraged to Source for neat and treated water for fufu production.The Public health education programme is of necessity to enlighten the general public about the health implication of Consuming Contaminated Fufu.

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