PROCESSING OF CASSAVA TUBERS INTO GARI, KOKONTE, FUFU AND TAPIOCA AND THEIR UTILIZATION IN GHANA.

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PROCESSING OF CASSAVA TUBERS INTO GARI

(a) CASSAVA TUBERS

The cassava tubers should be of big sizes, about 1kg in weight. The smaller tubers have much higher peeling losses, additionally they have high moisture contents which gives lower yields of GARI.

The tubers should be freshly harvested and should not be more than 24 hours old. Old tubers in addition to losing weight as a result of respiration, also undergo physiological damage and microbial deterioration. The physiological damage occurs within 48 hours resulting in brown or dark recrosis, normally appearing as rings around the periphery of the cortex. Microbial deterioration begins with vascular streaking, then soft rot, fermentation of roots and finally maceration of the root tissues (CIAT, 1977).

(b) PEELING

This should be done carefully to minimize losse . It is important to emphasize here that the bigger the tubers, the less the peeling loss and the greater the yield of GARI.

For those cassava varieties with relatively loose peels, it will be better to split the peel along one side and pull off the peel by hand. However for those varieties in which the peels do not pull off readily it will be better to actually cut off the peels with the knife. Care should be taken in such cases so as not to cut deep into the flesh and at the same time not leaving any peels on the flesh. Residual peels will increase the cyanide content of the product and this is known to be toxic to human beings in high concentrations. The peels will also increase the fibre content and thus lowering the energy (nutritive) value of the final product.

(c) WASHING

This should be done thoroughly using as much water as the circumstances permit. The washing can be done in a large container or trough, and the washing water should be changed when it becomes opaque.

It is important to note that splitting and pulling off the peels facilitates washing as cutting off the peels leaves rough surfaces which are much more difficult to wash thoroughly.

(d) GRATING

Grating is essentially a size refuction process, and the washed peeled tubers should be thoroughly drained before grating. The efficiency of the grating process (in terms of particles size) affects the quality and yield of the final product. The coarser the grated particles the greater the sifting (before roasting) losses and therefore the lesser the yield. Ideally the grated particles when dewatered should pass through ASTM Mesh No.5 ie. should be less than 4000 microns in diameter.

It is important that the grater be thoroughly cleaned with water after usage to remove pockets of grated mash which would otherwise encourage microbial build-up and the subsequent contamination of the next batch. This can result in abnormal fermentation producing off-flavours in the final product.

(e) LOADING INTO SACKS

The sacks should be preferably woven mesh sacks of polypropylene, as these are much stronger and easier to clean after usage than the jute sacks.

(f) DEWATERING AND FERMENTATION

Dewatering is done by applying pressure progressively on top of the loaded sacks. This causes some of the cassava liquor or exudate to ooze out from the grated mash. The liquor collected initially (within about the first six hour) can be pulled together and used for starch or tapioca production. The subsequent exuded liquors would have undergone some fermentation and can be mixed with a batch of freshly grated mash at a rate of 1kg liquor/50kg of grated mash before being loaded into the sacks. This will substantially reduce the fermentation period from about 60 - 72 hours to about 30 - 36 hours.

The fermentation process is a spontaneous one, and is the single most important step responsible for the distinctive flavour of gari. It is therefore essential that proper control is exercised over this step. The grated mash should be loaded into clean sacks and the temperature and humidity should be ambient.

Fermentation it is believed librates hydrogen cyanide from the cyanogenic glucoside PHASEOLUNATIN by spontaneous hydrolysis at low pH valves and also develops the characteristic flavour of gari. The fermentation process is first carried out by the bacteria Corynebacterium manihot which attack the starch with the production of lactic and formic acids, and then later by the fungus Geotrichum candida when the pH has fallen to about 4.2, increasing the acidification and producing the characteristic flavour associated with gari (Grace, 1977; Collard and Levi, 1959).

The fermentation is allowed to take place for about 60 - 72 hours with the pressure applied being increased about every 10 - 12 hours. The acidity of the mash should be about 0.70% (as lactic acid) at the end of fermentation and this is usually indicated by the appearance of froths on the outside of the sacks.

(g) GRANULATING AND SIFTING

The fermented pressed cake is then disintegrated, and it should be dewatered to such an extent that it sould be possible to force it through a sieve of 4000 microns (0.157 ins.) ie. ASTM Mesh No.5 on the application of moderate hand pressure. This has been found to correspond to a moisture content of about 43-45%. The sifting after granulating is done to remove coarse particles and fibres from the fermented pressed cake before roasting.

(h) ROASTING/FRYING

The sieved fermented meal is roasted in large slightly concave metalware pans gently heated underneath with firewood. The sieved meal is spread thinly in the pan, about 2 - 3kg at a time and continuously stirred till the correct degree of crispness and a light-yellow colour is attained. The determination of the end of the roasting process is subjective and depends largely on the experience and the correct judgement of the processor.

(i) SIFTING

The roasted gari is thoroughly cooled and sifted over a ASTM Mesh No.5 sieve. As with the sifting before roasting the traditional bamboo woven cane sieve was found to be suitable. The coarse particles retained on the sieve can be rolled-milled and added back to the main batch, this ensures a more uniform product.

(j) PACKAGING

The final gari should preferably be packed in 1 or 2kg batches in polythene bags. Bulk packaging can be done in 50kg jute bags lined with polythene sheets.

UTILIZATION OF GARI IN GHANA

Doku (1969) has given a brief account of the various forms in which gari can be consumed in Ghana. It also needs to be emphasised that because of its ease of preparation, long shelf-life (storability) and the diverse ways in which it can be prepared and consumed, gari has come to assume a very prominent place in the diet of many Ghanaians.

BY-PRODUCTS OF GARI UTILIZATION

(i) PEELS - The peels should be preferably washed initially in salt water before drying on a raised platform. The dried peels can be used as feedingstuff for animals especially goats and sheep.

(ii) CASSAVA LIQUOR - The liquor exuded initially, about the first few hours, should be collected and pulled together in a large bowl. It should then be allowed to stand undisturbed for about six hours. The supernatant can then be drained off, and the residual starch washed thoroughly with clean water, filtered through a muslim cloth and again allowed to settle. This can be preferably washed a second time, settled and drained before being dried for starch or slightly roasted for tapioca.

(iii) SIFTINGS BEFORE ROASTING - These should be spread thinly and dried in the sun. If too fibrous can be added to the dried peels and used as feedingstuff, otherwise should be milled and added to a kokonte batch.

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PROCESSING OF CASSAVA TUBERS INTO KOKONTE (FERMENTED CASSAVA FLOUR), FUFU AND TAPIOCA

(a) KOKONTE (FERMENTED CASSAVA FLOUR)

The initial preparation of the cassava ie. handling on harvesting, peeling and washing is similar as with gari production.

In the traditional method of preparing kokonte (or cassava flour) the washed peeled cassava tubers are cut into chips of approximate sizes 1x1x2cm or into 1-2cm cubes. The chips are washed, thoroughly drained and spread in thin layers on trays, concrete, floors, roof-tops etc. The chips are turned periodically to give uniform drying, and are usually collected or covered at night or when raining. The chips should be dried to a moisture content of below 14% and this takes about 3 days in a clear weather. The dried chips are milled into flour and packed in polythene bags for storage.

However, in another method developed at the F.R.I., the washed peeled cassava tubers are grated, loaded into bags or sacks and pressed to squeeze out as much of the cassava liquor as possible. The partially dewatered cake is then loaded into aluminium trays at a rate of 12 - 15kg/sq. metre, allowed to stand for about 8 - 12 hours for a slight fermentation to take place and then dehydrated in a cabinet dryer to the desired moisture content. Alternatively, the loaded trays can be placed soon after loading in a solar dryer and dried to the desired moisture content of below 14%. The dried product can then be milled into cassava flour.

Kokonte is prepared by adding a quantity of the cassava flour to boiling water and stirring continuously till the right degree of gelatinization and consistency is obtained. Depending on the method of preparation, the final product can vary in colour from dull yellow to dark brown.

Kokonte is usually taken with groundnut or palm soup.

(b) FUFU (FERMENTED CASSAVA DOUGH)

The process used in the preparation of fufu is same as for gari up to the dewatering (or pressing) stage. However in fufu preparation, pressure is not applied on the loaded sacks and the fermentation period is much shorter, about 30 - 48 hours. The resulting fermented cassava dough is Fufu (or Agbeli Ma).

The preparation of Fufu (or Agbeli Ma) is similar to that of kokonte. The required quantity (mostly determined by experience) is added to boiling water and stirred continuously till the right degree of gelatinization and consistency is obtained. Sometimes varying proportions of fermented corn dough is added to increase the consistency. The final products usually white to cream in colour.

Fufu is usually taken with okro (okra) soup or stew.

(c) TAPIOCA

This is usually prepared as a by_product in gari preparation. The cassava liquor exuded during the initial pressing of the grated mash is allowed to stand undisturbed for about six hours, during which time the starch settles.

The supernatant is decanted and the residual starch washed with clean water, filtered through a muslim cloth and again allowed to settle. The supernahant is again drained, and the resulting starch is partially dried and roasted as for gari but over a low fire to give tapioca.

Tapioca is prepared for consumption by first soaking in water for about 2 - 3 hours, and then heated to boil during which it changes from white to a glassy jelly-like appearance. Sugar, salt and milk are added to taste. Tapioca thus prepared is mostly consumed as a breakfast porridge.

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