
ENVIRONMENTAL IMPACT ASSESSMENT OF GARRI PROCESSING IN OMADEWU-EFFOYO, EDUMOGA, OKPOKWU LOCAL GOVERNMENT AREA, BENUE STATE, NIGERIA

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Abstract

Garri is an important staple food that is likened to a hot-cake which provides food security to a good number of persons, and it is a bye product of cassava termed magic crop in Nigeria. The study which investigated the processes and the environmental impact of garri production in Omadewu-Effoyo, Edumoga in Okpokwu Local Government Area of Benue State, Nigeria was guided by two research questions. A survey research design was adopted for the study in the five garri production sites sampled for the study area. Two sets of instruments used for the study were HANNA COMBO Digital pH meter and pictures snapped from the garri production sites within the study area. The analysis of soil samples, well water and effluents obtained from the study sites showed low pH range from 3.5 - 5.4, indicating the acidic nature of the study area, portending an unfavourable living environment, particularly, to humans. Though garri processing which undergoes multi-stage processing is a profitable and worthwhile venture to the processors to whom their source of livelihood is attached to its apron string, the consequences of the large amount of effluents generated from the processes torpedoed the purity of the environment, hence recommendations to mitigate the environmental disaster impact as well as the impact on the garri processors themselves were highlighted.

Keywords: Processes, Effluents, Pollution, Environment, Food Security, pH

INTRODUCTION

Garri, being one of the major bye products of Cassava crop, is ubiquitously consumed by many households in Africa, Nigeria inclusive. The preceding statement substantiates that of Ezech, Anyiro, Obioma and Maduagwu (2012) that Garri accounts for about 70% of cassava consumption in Nigeria and by millions of persons in West Africa, being a staple food eaten by the rich and poor alike. Garri is a fried, granulated and fine particle size made from Cassava tubers after having undergone various stages known as its processing.

Garri is also termed as Cassava flakes according to Chidozie and Chukwuebuka (2022) who further stated that Garri can be produced at subsistence level using manual methods or on a commercial scale by a fully mechanized process with any of which methods used having some significant environmental impact. As aptly captured by Nwankpa (2010) to substantiate the above, Garri is a pre-gelatinized grit with particle size ranging from below 10um to over 200um, fine and coarse respectively.

Garri processing which on the whole is hectic and does not give its processor any breathing space until the onerous task is accomplished, commences with the harvesting of cassava tubers from farm, transportation of the tubers, peeling of the cassava tubers, sequentially down to its final stage (the granules). That is, the task (of processing garri) is done in a jiffy, and it includes all activities from harvesting of Cassava until it gets to the market according to Kolawole (2014). It was equally reported by Kolawole (2014) that Garri processing involves the efficient and effective deployment and allocation of all resources like finance and human skills when and where they are needed. It is mostly undertaken by women with intermittent assistance from men. That Garri-processing is traditionally women affair is attested to by Kehinde and Subuola (2015).

There are a number of problems associated with garri processing which the processor cannot escape, especially in rural areas. But be that as it may, garri remains a proverbial “Hot Cake” that provides food security to many homes.

STATEMENT OF THE PROBLEM

A good number of persons depend on garri as their daily meal. In fact, there is hardly any family in Nigeria that garri is not a component of their daily menu. Today, garri is akin to popular *‘hot cake’* being referred in our cliché.

As important as this seemingly simple food stuff is, its processes are not only rigorous, time consuming and cost intensive but also associated with a lot of attendant environmental impact in the study area, hence the need for the study.

The study takes a critical look at the peculiarities and intricacies in the processes involved in the production of this all important food stuff in Omadewu side by side the engendering problems of doing so. The problem of this study, therefore, is to give a lucid picture of how garri is processed in a given locality in Edumoga in Benue State, with a focus on the environmental problems arising from garri processing in the area under focus.

Since Garri processing methods adopted in the study area are presumably very primitive, crude and archaic, accompanied with high level of environmental degradation, there is, therefore, the need to undertake this study so as to recommend appropriate measures

to alleviate the environmental problems caused by the effect of processing garri in Omadewu – Effoyo Edumoga and other neighbouring communities.

BENEFITS OF THE STUDY

1. The study highlights the general implications of the current garri production processes in the study area
2. It will as well be beneficial to Garri producers in Omadewu Community and a host of others in the business of garri production as the consequences of their actions will be clearly made known to them.
3. The study will make a significant contribution to the knowledge bank as it will provide a credible source of literature material to other researchers.

RESEARCH QUESTIONS

The following questions were formulated to guide the study/research:-

- i. What are the processes involved in the production of Garri in Omadewu, Effoyo Edumoga, Okpokwu LGA, of Benue State, Nigeria?
- ii. Of what impact is garri production to garri processors and the Omadewu environment?

AIMS OF THE STUDY

The aims of this study are to:-

1. Investigate the processes of producing garri in Edumoga in Okpokwu LGA, Benue State, Nigeria.
2. Assess the environmental impact of the entire processes of garri production in Omadewu, Effoyo, Edumoga in Okpokwu LGA, Benue State, Nigeria.

OBJECTIVES OF THE STUDY

In as much as garri produced from the area under study is much sought after, with buyers clamouring for garri from this zone, the processes applied here are archaic, crude and primitive as well as hazardous.

In specific terms, the main objectives of this study include but not limited to the following:-

1. Researchers elsewhere will get to know more about the processes of producing garri in other climes (areas).
2. The study will bring the efforts of those within the study area to limelight and attention may, from the study, be focused on their activities for possible assistance and upgrade.
3. The study is targeted at the environmental impact assessment of garri production in the study area in question.
4. The study subsequently suggests ways to mitigate the negative impact associated with garri production in the study area.

SCOPE OF THE STUDY

This study which was geographically limited to Omadewu-Effoyo in Edumoga of okpokwu LGA, Benue State focused only on any of the stages/steps in garri processing in the study

area that were deemed to impact negatively on the processing environment and not all the stages/steps involved in garri processing.

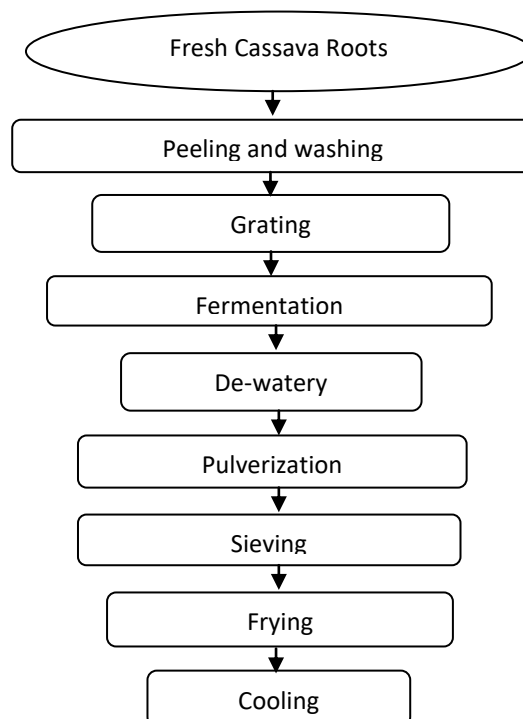
LITERATURE REVIEW

The literature review for this study was done under the following subheadings: -

- Garri processing techniques
- Problems associated with garri processing

GARRI PROCESSING TECHNIQUES

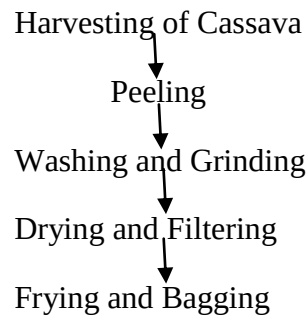
About 600 million people in Africa as reported by Ozigbo *et al* (2020) depend on cassava for their food, of which garri is the major cassava product eaten by them on daily basis. It becomes imperative therefore to look at the nitty-gritty involved in garri production. There are so many stages in the production of garri to the extent that its production requires so many hands. This assertion is attested to by Ozigbo *et al* (2020) and Obiakoeze (2022). Garri production is a primary responsibility of women just as Kehinde and Subuola (2015) accordingly reported that, traditionally, women are largely involved in all cassava processing. The major Garri production processes are as captured in Ozigbo's (2022) chart below:-



Flow chat 1: Garri production process – Ozigbo *et al* (2022).

The steps above from Ozigbo *et al* amplify the assertion by Chidozie and Chukwebuka (2022) that ‘the processing of cassava into garri is a multistage process...’

Closely related to the processes of producing garri as shown by the preceding flow chart are the processes of garri production pointed out by Obiakoeze (2022) as follows: -



Flow chart 2: Garri Production processes Obiakoeze

In almost all cases, these processes are done manually and they are very demanding. Simply put, the processes are energy-sapping just as Obiakoeze also noted that garri production processes are done manually and are very tedious. Those who process garri do not find the job comfortable as reiterated Obiakoeze, (2022). There is, therefore the need to shift grounds from this hectic approach of garri production which is why Obiakoeze suggested introduction of modern techniques of processing garri which will not only improve the system but will also increase garri production to meet with the ever increasing demand for garri.

PROBLEMS ASSOCIATED WITH GARRI PROCESSING

Garri production goes through so many processes or steps with each process or step embarked upon overwhelmed with many challenges; starting from harvesting of cassava tubers to transportation of the bulky cassava tubers from the farm to the site where the tubers will be peeled, down to the frying and bagging stages.

For the purpose of this study, emphases was strictly on the environmental problems associated with garri processing as articulated here by Chidozie and Chukwuebuka (2022) some of which include:-

- Deterioration of the environment by heaps of cassava peels and cassava water pressed out (effluents) which constitute a lot of nuisance to the people living close to where garri is being daily produced as the main source of livelihood.
- Contamination of sources of drinking water e.g. wells.
- Erosion of roads by the cyanide contents from the cassava paste being pressed (effluents).
- Ugly sight of heaps of cassava peels.
- Foul odour emanating from heaps of cassava peels and the effluents.
- Specifically, Obiakoeze maintained that the processing environment is always dirty and smelling.
- Choking smoke from the peels when burnt, etc.

In the opinion of Chidozie and Chukwuebuka (2022), garri production results in the emission of gaseous, liquid and solid substances that cause environmental degradation.

All of the aforementioned are being attested to by Iyagba and Anyanwu(2012), Oghenejoboh (2015), Ozigbo et al (2020) and Wikipedia (2022) among many several scholars.

As side the environmental impact of garri processing, the garri processors specifically are at a great health risk, as they do stand close to heat from oven or furnace-like structure made with earthen wall on which shallow cast-iron pans or open stainless steel tray popularly known as Agbada are mounted in a moulded earthen wall (a kind of oven or furnace). The earthen wall absorbs heat to the extent that those frying the garri will not be too directly exposed to the heat from the oven. Nonetheless, after standing and frying for some hours the heat will be felt to the extent that those in this practice will lose their original skin complexion and at times dizziness may set in. The manual frying is done in such a way that the person frying cannot look sideways or else the garri will burn, and must be in standing position all through. It requires constant turning, releasing of the fried granules and replacing with freshly pressed and grated cassava powder (Ozigbo et al, 2020).

A study conducted by Chidozie and Chukwuebuka (2022) on the assessment of environmental degradation due to processing of cassava into garri flakes in Nsukka metropolis in Nigeria was aimed at determining the impact of cassava processing into garri on the environment in the study area. The study made use of soil, waste water and sludge as samples collected from four different locations which were subjected to physico-chemical analysis. The results obtained identified the impact of garri processing in the study area to include soil loss, litter generation, air pollution, water pollution, greenhouse gas emission, water demand and energy demand with soil samples from three of the locations sampled being severely polluted and one moderately polluted.

The study reviewed though related to the present study in the sense that both studies have processes and problems as common parameters in garri production, the current study is specifically on environmental impact assessment of garri processing. The study reviewed was conducted in Nuskka metropolis while the current study is in Omadewu Effoyo, in Edumoga, Okpokwu LGA, Benue State of Nigeria.

METHODOLOGY

The method and procedures used for the study arranged as follows:- design of the study, area of the study, sample and sampling techniques and instruments for data collection.

DESIGN OF THE STUDY

Quasi-experimental as well as survey research designs were used for this study for purpose of addressing the aims and objectives of the study.

Quasi-experimental research design was being embarked upon by collecting waste water (sludge) or effluents and soil samples as well as well water from different garri production locations to determine the pH level so as to assess the impact garri production poses to well water and soil in the study area.

The study is as well a survey research as critical observations were made of the various sites of garri production in the study area. Various pictures or snapshots of garri production sites as observed by the researchers were taken.

AREA OF THE STUDY

This study was carried out within Omadewu Community in Effoyo Edumoga, Okpokwu Local Government Area of Benue State. Omadewu is a microcosm of Okonobo in Edumoga, Okpokwu LGA of Benue State, Nigeria. Omadewu settlement is separated from Ugbokolo community by the old Otukpo-Enugu Road. It is predominately populated by indigenous farmers with a good number of women whose primary occupation is garri production, hence the justification for the choice of the study area.

SAMPLE AND SAMPLING TECHNIQUES

The samples for the study were collected from 3 sources namely:-

- i. Waste water (sludge/effluent) obtained from five different garri-production sites in Omadewu.
- ii. Soil samples collected using hand trowel to scoop soil from five garri-production sites/locations in Omadewu.
- iii. Pictures snapped from the garri production sites in the study area.

INSTRUMENTS FOR DATA COLLECTION

Two main instruments considered appropriate in the course of collecting data from garri-production sites/locations in Omadewu were used for the study. They are:

- HANNA COMBO Digital pH meter
- Digital Camera for Snaping pictures from the operation areas/Garri production sites.

Snap shots/Pictures from garri production sites taken are as shown in appropriate places here. Soil samples, well water and effluents collected from five (5) different garri processing locations were subjected to pH Scale for alkalinity or acidity indication with HANNA COMBO Digital pH meter.

RESULTS

The results of the study's findings are as presented here.

From the study conducted it was found out that the processes involved in garri production that are impactful to the Omadewu environment are peeling of cassava tubers, washing of peeled cassava tubers, Grinding of peeled and washed cassava tubers into mash, Dewatering or pressing of the mash and frying of the pressed mash into fine granules all of which are shown in pictures 1 – 6.



Picture 1: Peeling of cassava Tubers



Picture 2: washing of peeled cassava tubers.



Picture 3: Grinding of cassava tubers into mash.



Picture 4: Cassava mash after grinding



Picture 5: Dewatering/Pressing of mash with a hydraulic Jack

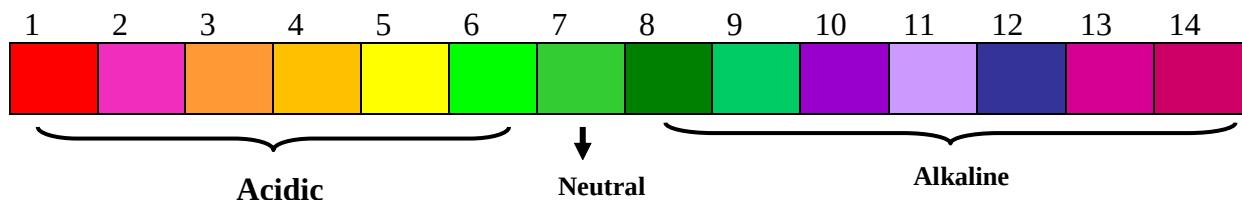


Picture 6: Frying of Cassava Mash after pressing

The table 1 below shows the results obtained from the physiochemical tests carried out in five different garri production sites in Omadewu with the aid of HANNA COMBO Digital pH meter.

S/N	SITE	SAMPLE	PH	CONDUCTIVITY
1	A	Well water Soil Effluent	4.86 5.40 3.45	24 30 127
2	B	Well water Soil Effluent	4.56 5.35 3.62	66 24 316
3	C	Well water Soil Effluent	5.10 5.86 3.42	102 25 295
4	D	Well water Soil Effluent	3.72 3.49 3.35	132 199 294
5	E	Well water Soil Effluent	5.40 5.35 3.50	65 194 102

pH RESULTS FROM STUDY SITES



pH Scale

Of particular interest from the above table is that Hydrogen Ion Concentration (pH) of the various garri production sites sampled are relatively highly acidic. The well water and the soil obtained from the study's sites were all acidic with the effluent being obvious.

Furthermore, there are indications that garri production affects the residential areas of Omadewu Effoyo as depicted by pictures taken from the production sites in pictures 7, 8 and 9 below:-



Picture 7: Heaps of cassava peels.



Picture 8: Effluents.



Picture 9: Eroded Portion of the Omadewu road, caused by the effluents.

Summary of findings

The following constitute the study's major findings.

- Garri production processes in Omadewu-Effoyo Edumoga in Okpokwu Local Government Area of Benue State, Nigeria are cumbersome involving transportation of cassava tubers from farm or markets with wheel barrow or keke, peeling of the tubers, washing manually, grinding of the tubers, dewatering or pressing (with Hydraulic Jacks or by Screwing), sieving and frying of dewatered mash.
- Garri production processes in the study area (Omadewu) have telling effects on the processors as they are left with little or no time to attend to their primary chores and other social engagements.
- The sites where garri is processed on a regular basis become highly acidic thereby not encouraging the survival of ornamental plants as well as the well water being polluted by the discharge from the effluents
- Roads are affected by the effluents discharged
- Offensive odour is characteristic of the sites where garri is processed

Discussion of findings

The discussion of the findings are organised under the following sub-headings.

- Processes involved in the production of garri in Omadewu-Effoyo-Edumoga, Okpokwu LGA of Benue State, Nigeria
- Impact of garri production processes on Omadewu community

Processes involved in garri production in Omadewu-Effoyo

The results of the study shows that the processes involved in the production of garri in Omadewu-Effoyo Edumoga in Okpokwu Local Government Area (LGA) of Benue State, Nigeria include the following:-

- Transportation of bulky cassava tubers from farm or markets
- Peeling of cassava tubers
- Washing
- Grinding of the peeled tubers
- Dewatering/pressing
- Sieving
- Frying

The processes outlined above, are in tandem with the earlier assertion here that the production of garri requires so many hands and secondly they aptly corroborate those of James *et al* (2012) and Ozigbo *et al* (2022), Obiakoeze (2022) and Chidozie and Chukwuebuka (2022) that the processing of cassava to garri is a multistage processing, starting from cassava harvesting, peeling, washing and grinding, drying and filtering to frying and bagging..

Impact of garri production processes in Omadewu-Effoyo settlement

Results of the study's findings revealed two aspects of the impact of garri production processes in Omadewu community which are

1. The impact on the garri processors as individuals and
2. The impact of garri processing on the environment.

On the impact of garri processing on the individuals, it was found out that garri-processing leaves garri processors with little or no time to attend to domestic chores and other social engagements. As succinctly stated by Chidozie and Chukwebuka, almost every stage of the processes (of garri processing) exerts significant amount of energy on the processors. All of these findings are supportive of Obiakoeze (2022) that garri production processes are very tedious and that those who process garri do not find the job comfortable. As reported by James et al traditional garri processors are exposed to direct heat, smoke and fumes which over a long time may affect their health and those of their family members in garri processing activities

Impact of garri processing on the environment

The physiochemical tests conducted in respect of this study revealed that well water and soil sampled collected from the various sites selected for the study were all very acidic with the pH there ranging from 3.50- 5.86 as shown in table 1 of this study already, in contra distinction from the PH values of adjoining areas of 6.35 to 6.50.

The pH values found in this study were relatively in accordance with those of Ogbodo and Ikape (2023) in their study on the assessment of heavy metals in garri effluents in Ugbokolo, Okpokwu Local Government Area of Benue State. The low pH of water or soil samples according to Ogbodo and Ikape (2023) is a indication of high acidic contents of water or soil concerned as a result of dissolved heavy metals in the effluent when the waste water is dissolved into the soil. One main consequences of the effect low pH of soil is that soil cannot be used for farming as many crops cannot survive in a condition of PH less than 5.57 (Ogbodo and Ikape). Low PH is also an indication of environmental pollution, which is being manifested by foul odour leading to contamination of surface and underground water and soil as highlighted by Kolawole (2014).

Pictures 7, 8 and 9 graphically attest to the negative impact of garri processing in Omadewu Effoyo, buttressing other previous scholars' positions on the impact of garri processing on an environment. Specifically, pictures 7, 8 and 9 here justify the report by Kolawole (2014) that significant amounts of waste are generated during cassava processing to garri. It was further reiterated by Kolawole that the wastewater from garri processing is never treated but disposed freely into the environment as seen in picture 9 here, thereby contaminating nearby water and soil- a situation which by implication tends to aggravate Chidozie and Chukwebuka's (2022) fear that already there is an overwhelming burden of solid waste management in Nigeria.

CONCLUSION

This study on environmental impact assessment of garri processing in Omadewu, Effoyo Edumoga in Okpokwu Local Government Area, Benue State, Nigeria, was anchored on two research questions posed which were empirically verified with the following conclusions drawn:-

Processes involved in garri production in Omadewu are cumbersome involving mostly human labour that demands a lot of energy on the part of the processors. The processes are not fully mechanized. Soil and water from garri production sites in the study area were characterized by low pH, an indication that the area in question was highly acidic, hence polluted. Simply put garri production processes have negative impact both on the individuals involved in the processing and the surrounding environment where the production takes place. The long term effects of environmental degradation arising from garri processing pose a greatdeal of health challenges to individuals.

Surface areas littered with cassava peels and effluents have lost environmental aesthetics. Road onto which effluents are being often discharged got damaged due to acidity of the effluent containing cyanides.

IMPLICATIONS OF THE STUDY

The study conducted on the environmental impact of garri processing in Omadewu Effoyo, Edumoga mirrored the involvements in the processes of garri production in the study area and hereby highlights the implications associated with garri production as follows:-

- The beauty of the environment is lost
- Personal hygiene of the processors-not cared for
- Poor standard of living as seen in open defecation by small children
- Sources of drinking water contaminated making people to go far to places to source for quality drinking water
- Increased human labour which can affect life expectancy

RECOMMENDATIONS

Based on the findings of this study, the following recommendations are hereby made

- 1 Sites for garri production should be far away from residential area so as to minimize the greenhouse-effect and associated environmental pollution problems.
In the same way as Rice mills, and Wood depots are sited far away from residential areas, garri production 'factories' should be sited far away.
- 2 Garri production factory should be specifically built in designated but serene environments in Omadewu where all the processes involved in garri production starting from peeling of the cassava tubers to frying and bagging of fine granules (garri) will be undertaken, as seen as in Aidogodo Okpoga, a neighbouring town to Edumoga, about 13km away.

Suggestion for further studies

Based on this study, the following suggestions are made for further studies. That:-

- 1 The geographical scope of the study be widened to obtain more results
- 2 More researches that can help to improve sustainability of healthy environment be encouraged.
- 3 Impact of garri processing on the health status of garri processors should be thoroughly researched into.

SUMMARY OF THE STUDY

The study laid bare the processes involved in garri production in Omadewu-Effoyo, Edumoga in Okpokwu Local Government Area(LGA) of Benue State, Nigeria, as well as the environmental impact assessment associated with the processes X-rayed in the study.

Garri, a major staple food for many, is produced from cassava termed a magic crop in Nigeria which passed through many stages until the fine/coarse granules are obtained after strenuous efforts.

It was found out from the study that almost all the stages involved in garri processing from the peeling of the cassava tubers to the frying stages were prone to a lot of environmental hazards. The processors of garri were also subjected to so many health risks; being exposed to heat emanating from the frying process, smoke discharged from

the effluents with high cyanide content to the act of frying, to even worst still, the emanating odour from heaps of cassava peels which when not packed/cleared on time led to deterioration of the environment.

However, garri processing was found out to be a means of livelihood to those who engaged in one stage or the other of the processes.

The study finally pointed out some of its limitations and subsequently made some recommendations for further studies.

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