

Trends and Constraints of Grain Slurry Food Processing in Kaduna State, Nigeria

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Abstract

Purpose: Grain slurry diet are described as food obtained from ground grain paste. They serve as highly nutritious food for both adults and infants in Nigeria because of their immense nutritive and economical value. However, the production of these grain slurry diets is confronted with challenges that have hampered their commercialization. This study examines the trends and constraints of grain slurry food processing in Kaduna State. **Methods:** A survey was conducted using a structured questionnaire to elicit information from 192 selected processors, including both men and women. The survey was structured in line with the study objectives. The information was collated and synopsized into frequency distribution. **Results:** These findings revealed that 80% of the respondents processed between 1.0 tons and 13.0 tons of grain slurry per month. More than 90% of the processors processed grain slurry into koko, kunu, agidi, and pito. Accordingly, 80% of the interviewed processors indicated that sieving is one of the major constraints. Furthermore, inadequate modern machinery required to perform this operation makes it highly discouraging. One of the major challenges faced by the grain slurry producers in Nigeria is the lack of processing machinery for most operations (39.1%), followed by the tedious processing nature (27.1%), high labor cost (18.1%), and lack of market (9.4%). The traditional method of grain slurry processing was more popular than using modern equipment, except milling (96.5%), which is the only mechanized unit operation in grain slurry processing. **Conclusion:** Grain slurry processing and marketing were found to be profitable. However, these limitations could extremely reduce the level of grain slurry production, processing, and economic returns, thereby affecting the general wellbeing of the processors. The study also raised concerns about the safety and hygiene associated with traditionally processed grain slurry diets in the investigated areas.

Keywords: Constraints, Equipment, Grain slurry, Processing, Sieving

Introduction

Grains are important cereal crops that belong to a grass family (Gramineae) producing small edible seeds. Over the years, grains are said to have originated from Mexico (Iwena, 2002). They provide the staple food of the world's human population (Ojo, 2004). Grains are popularly cultivated for their edible components, which are composed of endosperm, germ, and bran. Maize, sorghum, wheat, and millets are the most common types of grain cereals,

popularly known in Hausa as "masara," "dawa," "alkama," and "gero," respectively. Grains are a vital raw material in the cosmetics, pharmaceutical, food, and beverage industries. Cornstarch, corn oil, corn syrup, and sugar are the chief industrial products obtained from maize (Kochar and Kenneth, 1988). They can be consumed after roasting, boiling, or being processed into products, such as bread, biscuits, pasta (from wheat), or grain slurry diets, such as koko, kunu, agidi, and sorghum meal (Nwankwojike et al., 2015). The importance of food slurry diets as adult food and weaning foods for infants in Nigeria is outstanding because of their high nutritive values and availability (Osagie and Eka, 1999; Simolowo and Adeniji, 2011). Grain

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slurry processing is constrained by inadequate processing equipment, high cost of hired labors, and low returns from small scale. The poor quality of locally produced grain slurry products has been linked to the traditional sieving method used to process these grain slurries. The traditional method involves hand stirring of the ground paste in a sieve cloth to separate the filtrate from the chaff. This method introduces contaminants in the product, and the process is labor intensive (Fayose, 2008). It is evident that the mechanization of the operations in grain slurry production will enhance human capacity, leading to production increase and improvement. Therefore, improving the traditional method of processing these slurry diets into industrial standard is necessary.

The main objective of this study is to identify major factors influencing grain slurry processing among the processors in Igabi and Birni-gwari local government areas (LGAs) of Kaduna State. The specific objectives are as follows:

- i. determine the socio-economic characteristics of grain slurry processors in the survey area;
- ii. identify and describe the various types of grain slurry products and their uses in the survey area;
- iii. examine the processing activities involved in the survey area;
- iv. ascertain the causes of poor grain slurry product quality in the study area; and
- v. identify the problems encountered by processors in grain slurry processing and marketing.

Materials and Methods

A survey of the trends and constraints of grain slurry food processing in Kaduna State using Igabi and Birni-gwari LGAs as a case study was conducted using a structured questionnaire.

These LGAs are primarily agricultural with about 80% of the population working as grain farmers and processors. More than 50% of these food products are sold to urban towns in the LGA and other LGAs in Kaduna State.

Sampling techniques

Four major areas (i.e., Afaka, Kangimi, Labara, and Turunku) in the Igabi LGA of Kaduna State and four major areas in the Birni-Gwari LGS (i.e., Mando, Kagi, Dokan-ruwa, and Tudun Jega) were visited. Eight respondents each of

the grain slurry processors, product consumers, and rural dwellers were randomly selected from each of the eight communities. This number provided a total of 192 respondents that constituted the research sample.

Data collection

Data were collected with the aid of a well-structured questionnaire. The following parameters were evaluated:

- unit operation in grain slurry processing;
- food products obtained from grain slurry;
- level of technology involved in various unit operations of grain slurry processing;
- energy demand in grain slurry processing;
- time demand in various unit operations in grain slurry processing;
- production constraints;
- effect of unit operations on the product quality; and
- socio-economic characteristics of the respondents.

The data collected were analyzed using a simple descriptive statistic.

Results and Discussion

Unit operation in grain slurry processing

The unit operation in grain slurry processing involved soaking, washing, milling, sieving, and draining (Figure 1). This order of arrangement was the same for each of our respondents.

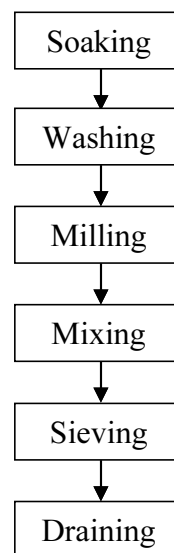


Figure 1. Flow chart of the unit operation in grain slurry processing.

Grain slurry-based products

Koko (32.9%) is the most popular among all the food products, followed by kunu (25.6%), agidi (19%), and pito (11.5%) (Figure 2). These results show that almost every household consumes koko as a daily diet. Koko is being served as breakfast in most families because of its fast preparation process.

Table 1 presents the level of technology involved in the grain slurry processing. The traditional method of grain slurry processing was the highest, whereas the use of modern equipment was low. The unavailability of technology needed to perform these operations could have contributed to the highest percentage obtained from there. From this table, it is evident that milling is the only unit operation that is mechanized. Accordingly, 96.5% of the respondents use wet burr mills. Meanwhile, all other operations are performed manually using the traditional method. This method introduces contaminants into the product, which makes it highly unhygienic. This result agrees with the findings of Fayose (2008). This gap calls for the need of a grain slurry–sieving machine.

Time demand (h/kg) in grain slurry processing

Table 2 shows the time demand for each unit operation. The grain soaking time was between 48 h/kg and 72 h/kg. It is believed that grain softening and fermentation

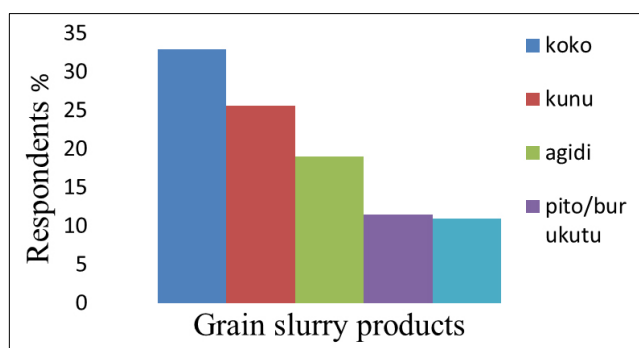


Figure 2. Grain slurry food products.

Table 1. Level of technology involved in grain slurry processing

Operation	Methods	
	Manual	Mechanical
Soaking	100%	0%
Washing	100%	0%
Milling	3.5%	96.5%
Sieving	100%	0%
Draining	100%	0%

will occur during this time, followed by washing (0.1-0.3 h/kg), sieving (0.3-0.6 h/kg), milling (0.2-0.3 h/kg), and draining (0.04-0.08 h/kg). The availability of the processing technology for grain slurries will not only minimize time, but also lead to production increase and improvement.

Energy demand in grain slurry processing

Table 3 shows the energy demand in grain slurry processing. Accordingly, 85.51% of the respondents ranked sieving as a highly energy-intensive operation in grain slurry processing, while 10.35% ranked the energy demand in sieving as moderate. Sieving, as a unit operation in grain slurry processing, is still largely undertaken by hand stirring the ground paste on a sieve cloth. The high percentage (85.51%) obtained from our respondents could be the result of the stress and boredom encountered during the operation, which tend to discourage the processors because of the high labor cost that reduces their profit.

Production constraint

The results on the production constraints of grain slurry revealed that the strenuous nature of grain slurry processing, high labor cost, and lack of specialized market and machinery for most of the operations are the major bottlenecks facing the processors. Table 4 shows that the lack of machinery ranked highest (39.1%), followed by the tedious processing nature (27.1%), high labor cost

Table 2. Time demand in various unit operations in grain slurry processing

Operation	Time required in hours per kg
Soaking	48-72 h/kg
Washing	0.1-0.3 h/kg
Milling	0.2-0.3 h/kg
Sieving	0.3-0.6 h/kg
Draining	0.04-0.08 h/kg

Table 3. Energy demand in grain slurry processing

Energy demand in processing method	Extremely high (%)	Moderately high (%)	Slightly high (%)	Not high (%)
Soaking	0.00	3.52	4.11	92.37
Washing	0.00	4.22	22.57	73.21
Milling	5.41	38.11	38.22	18.26
Sieving	85.51	10.35	4.14	0.00

Table 4. Constraints in grain slurry production processing

Production constraint	Respondent	Respondent %
Strenuous processing	52	27.1
High labor cost	35	18.1
Lack of market	18	9.4
Machinery	75	39.1
Other	12	6.3

Table 5. Effect of unit operations on the product quality

Effect of unit operations on the product quality	Extremely important (%)	Moderately important (%)	Slightly important (%)	Not important (%)
Soaking	65.4	20.82	9.20	4.58
Washing	53.37	30.75	10.17	5.61
Milling	62.55	22.63	9.58	5.24
Sieving	78.74	12.84	6.10	2.32

(18.1%), and lack of market (9.4%). The high- energy demand in sieving coupled with stress could be responsible for the high cost charged by labor. Market-related constraints is caused by the lack of a reliable market in which processors could sell their produce or poor road infrastructures in some areas, which result in high transportation cost with poor proceeds on produce sales.

Effect of unit operations on the product quality

A cursory look at Table 2 shows that 78.74% respondents ranked sieving as an extremely important operation that affects the grain slurry product quality, while 12.84% ranked sieving as moderately important. Its importance may be attached to the fact that it is the only unit operation in grain slurry processing that separates the filtrate from its chaff. None of these processors has made use of modern sieving equipment in their business, which may be because of the lack of adequate sieving machines to perform the separation process or the high cost of imported ones.

Socio-economic characteristics of the respondents

The highest number of processors is within the age of 31-40 (33.84%). Accordingly, 34.9% of these processors

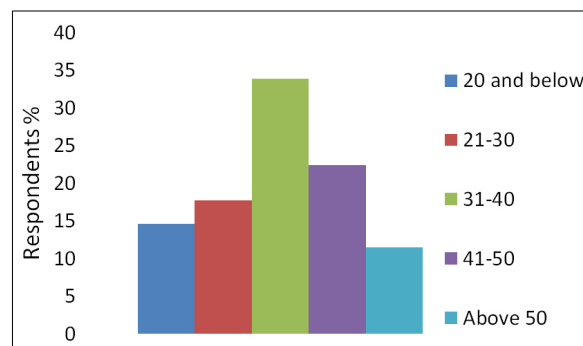


Figure 3. Age of respondents.

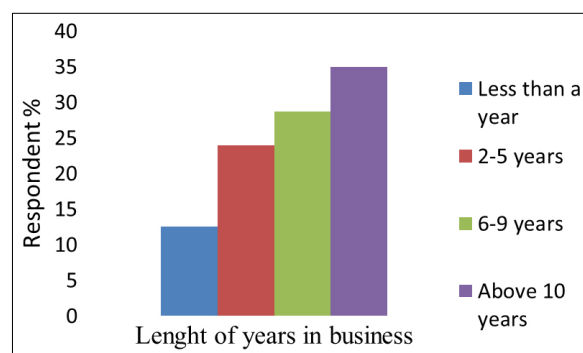


Figure 4. Length of years in operation.



Figure 5. Respondent's view on the acceptability of a grain slurry-sieving machine.

have been in the business for more than 10 years (Figures 3 and 4).

Respondents' view on the acceptability of a grain slurry-sieving machine

The processors were asked to express their view toward the acceptability of a sieving machine for use in their business. A total of 86% agreed that a grain slurry-sieving machine will be acceptable, 10% disagreed, and 4% showed neither of the two responses (Figure 5).

Conclusions

This study has analyzed the processing trends and constraints of grain slurry. The traditional processing method was more commonly used than the modern method. It can be concluded that sieving is the major constraint in the grain slurry processing. Furthermore, none of the processing centers has a sieving machine. Many technological investments will be needed in these processing areas to promote improved production, processing, and marketing. Such investments may be conveyed through categories of processors who have demonstrated interest in grains and grain slurry production.

Further work

The following recommendations were made based on the research findings:

1. There should be a market ready for the produce. The markets must be well organized so that people can benefit from the exploitation of these processed products, which will bring rural development.
2. The government should provide processing machines, such as milling, sieving, and other processing machines, for rural processors at a reduced rate in order to support them and improve grain slurry processing.

Conflict of Interest

The authors have no conflicting financial or other interests.

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