Fabrication And Development Of Suitable Machinery For Increased Production And Consumption Of Cashew Apple Juice

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Background

Nigeria is one of the World leading producers of cashew nuts, producing about 270, 000 M.T. nuts in 2021 estimated at about 2.2 million M.T cashew apples. According to (Oluyole *et al.* 2022) cashew is a major source of cash income to many smallholder farmers in Nigeria and it is second crop after cocoa as collaborated by Akinnibiosun and Oyetayo, (2018); Ibirogba, (2019). Cashew fruit which produces the nut also consists of the apple which is about 9 – 12 times the weight of the nut (Dimoso, 2020); every one tonne of cashew nut produces estimated 8 – 10 tonnes of cashew apples reported Dagadkhair *et al.* 2018. Surprisingly, cashew apples are currently left to rot on the farms despite its enormous potentials and opportunities for commercial exploitation (Igbinadolor *et al*., 2017). Only 6 – 10% of the Nigeria's cashew apple production is utilized (Ugwu and Okonkwo, 2022, Olalusi *et al,* 2020 and Ogunwolu *et al.,* 2019). Very small percentage utilized is mostly consumed raw by squeezing fresh through the mouth. Cashew apples are also seasonal and highly perishable resulting in low utilization. The astringency of the apples due to high content of tannins causing harsh taste has also been identified as a major factor for low consumption of the juice. This must be appropriately removed to a reasonable level through blanching/boiling before extraction (Bolarinwa *et al.* 2020 and Sahie *et al.* 2023). Increase in urban population required increase in the demand for cashew products which include cashew apple juice (Oluyole *et al.* 2022). Notwithstanding the high Vitamin C and minerals contents of cashew apples, a large proportion of Africa population suffers from lack of major vitamins (hidden hunger) according to Ogunjirin *et al*., (2023) which has led to influx of some poor quality imported juices.

The high juice content of about 85% of cashew apple and its by-products such as residue/pulp will be utilized through proper juice extraction. Cashew apple is also rich in Vitamin C (262 – 300mg/100ml) which is reportedly to be 5 and 10 times that of oranges and pineapples respectively (Ugwu and Okonkwo, 2022 and Adou et al, 2019). It is also a good source of minerals and antioxidant compounds and recommended for prevention of some ailments, such as dysentery and gastritis according to Diana *et al.*, 2021. Farmers' income would also increase averagely by 15.5%% with about 0.9 billion US dollar increase in G.P.D of producing countries in Africa as further stated. Further utilization of by-products from juice extraction will be promoted. For instance, the high fibre content of 15 - 18% of cashew apple (Dagadkhair et al., 2018) can be used as dietary fibre in foods or as base in animal feeds. Ibirogba (2019) claimed cashew has higher production capacity and lower production cost than those of its competitors such as cocoa which make it well suitable for economic recovery and industrialization. Utilization of cashew apples is an additional income since it is an integral part of the fruit that produces the nut which is a significant economic commodity. Proper extraction of cashew apple

juice will promote its consumption and reduce losses of the apples. Extraction of the juice through appropriate indigenous sustainable technologies will encourage storability and availability during off seasons.

Problem Statement

Nigeria is one of the World leading producers of cashew nut, derived from the apples; contributing significant proportion of the world's supply. But very low percentage of about 6-10% of this cashew apple production is utilized, resulting in its decomposition and potential health hazards through pollution. This very high wastage level of cashew apples has been linked inappropriate juice processing including inadequate suitable machines for juice extraction. Some of the few available cashew apple juice extractors are deficient one way or the others considering the reports of Adeleke *et al*. 2017, Adeleke *et al*. 2023. This is worsened by unsuitability of multipurpose juice extractors for cashew apple due to its unique nature. Presence of pulp particles in cashew apple juice has been also observed as a barrier during storage by processing industries according to Preethi *et al*. (2020). Seasonal production and very high perishable nature of cashew apples resulting in serious loss of nutrients and revenues has also been observed as another major issue. Low consumption and utilization are also attributed to poor taste due to astringency caused by tannins presence which is also responsible for browning which has led to poor appearance and acceptability. Notwithstanding the high content of Vitamin C and minerals of cashew apples, a large proportion of the population suffers from lack of major vitamins as reported (Ogunjirin *et al*., 2023).

Main Objective

To reduce cashew apple waste through production of quality cashew apple juice and consumption among Nigerians in order to derive the abundant nutritional benefits thereof.

Specific Objectives

i. Performance tests and necessary adjustment in construction of the juice extractor.
ii. Blanching of fresh ripe cashew apples
iii. Extraction of juice from blanched cashew apples.
iv. Pasteurization of cashew apple juice produced by the juice extractor
v. Laboratory analysis of the extracted cashew apple juice
vi. Acceptance test of the extracted cashew apple juice among the populace of selected communities.
vii. Analysis of data collected from the listed tests above.

Justification/Rationale

Nigeria produces enormous quantity of cashew apples of about 2.5 metric tonnes by estimate, but about 6-10% portion of this production is consumed as raw apples while around 90 percent is wasted. The apples also contain very high content of about 85% juice having around 300mg/ml

Vitamin C content and a lot beneficial minerals. Proper extraction of juice from these apples through sustainable technologies resulting in quality acceptable products will promote Vit C and minerals intake of Nigerians, increase cashew apple utilization, increase farmers` income and assist in job creation. Promotion of job creation in line with Agricultural Transformation Agenda (ATA) of the Federal Government of Nigeria for economic diversity. Turning waste to wealth through reduction of pollution and environmental hazards due to cashew apples decomposition during the season

Target Beneficiaries

- Cashew farmers – It will improve the quality of their beans and consequently give them market advantage and better livelihood
- Nigeria Government – National production will increase
- Female gender – Job creation for women
- Consumers – Good quality product for their money
- Processors – Knowledge on proper juice processing will increase
- CRIN – Research achievement and more opportunities for further research
- NCAM – Research achievement and more opportunities for further research

Key Performance Indicators (KPI)

i. Considerably high functional performance efficiency of about 85% will be achieved.
ii. Acceptable quality juice based on international requirements will be produced.
iii. High percentage of acceptance of the extracted juice by consumers in selected towns is expected.

Hypothesis

Quality juice produced by the constructed extractor will be considerably accepted by consumers in selected locations which will promote cashew apple juice consumption among Nigerians.

Collaborators

i. National Centre for Agricultural Mechanization (NCAM), Idofia, Kwara State, Nigeria.
ii. Cashew Farmers Association of Nigeria
iii. Cashew juice processors

Juice Extraction and Acceptability

Juice will be extracted from freshly harvested cashew apples after the appropriate process of boiling in water at temperature range of 90^0C for 10 minutes as reported by Adou *et al*. (2019) and Preethi *et al*. (2020). An appropriate mechanical extractor assisted with muslin bag will be used to produce acceptable quality juice. These samples will be tested for acceptability by serving them at random to consumers in strategically selected communities in major

towns/cities located in different geo-political zones of Nigeria. Data will be obtained through organized questionnaire and analyzed properly to determine level of acceptance in those communities for further research.

Material Requirement and Budget

- Motorized mechanical cashew apple juice extractor
- Cashew apple boiler (charcoal powered, medium sized)
- Pasteurizer (Electrically powered, medium sized)

Budget: A budget estimate of Thirty six million naira (₦36,000,000.00) is needed to carry out this project

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