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An Impact of Threshold Heat Level on Local Garri Producers in Osun State, Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Garri production stands as a vital economic endeavor in Nigeria, with the well-being of local producers raising concerns regarding health and safety. This study focused on evaluating the prevalence of heat stress among Omoboriowo local garri processing producers in Ifon Osun, Orolu Local Government. Employing a descriptive survey research design, the study included a sample size of 30 garri processing producers, and data were collected through a questionnaire. Results indicated that all respondents (100%) recognized the potential for high temperatures to induce heat stress, leading to heat stroke. Furthermore, a majority of participants (93.3%) reported observing

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symptoms of heat stress during garri processing, encompassing fatigue, headaches, dizziness, muscle cramps, and nausea. Access to personal protective equipment (PPE) varied, with only 33.3% consistently having access to items like hats, gloves, or cooling vests to alleviate heat stress. Although 70% had received some training on heat stress prevention, only 30% had undergone comprehensive training. The study recommends enhancing the availability and consistent use of appropriate PPE among garri processing producers. Moreover, comprehensive training programs focusing on heat stress prevention and management should be provided to all workers. Introducing regular breaks and rest periods into the work schedule, allowing for cooling down and hydration, and improving ventilation systems in the garri processing area are also recommended.

Keywords: Garri; heat; stress; heat stress prevention; PPE; garri processing; training; ventilation.

1. INTRODUCTION

Garri, a staple food in Nigeria, holds significant economic importance and is a dietary mainstay for many communities across the country. The production of garri involves a series of labor-intensive processes, including peeling, washing, grinding, fermentation, and roasting. These activities are often carried out in local settings, with producers working under conditions that expose them to various occupational hazards. One critical concern that has received limited attention is the potential health risks associated with heat stress among garri processing producers.

Heat stress is a physiological response to high temperatures, and it occurs when the body's cooling mechanisms cannot effectively dissipate the heat generated during physical exertion or exposure to hot environments [1]. Nigeria, characterized by a tropical climate, frequently experiences high ambient temperatures, especially in regions where garri production is a prevalent economic activity. The combination of elevated temperatures and strenuous physical work during garri processing poses a considerable health risk to workers.

Heat stress occurs when the body absorbs more heat than it can dissipate, leading to an elevated core body temperature (Kenny et al., 2016). This physiological response is triggered by exposure to high temperatures, humidity, or a combination of both, challenging the body's thermoregulation mechanisms [2]. Environmental factors, including limited air circulation, contribute to the impact of heat stress [3]. The heat index, considering both air temperature and humidity, reflects how the human body perceives these conditions and correlates with the risk of heat-related illnesses [4]. Prolonged exposure to heat stress can result in symptoms like excessive sweating, weakness, and nausea, progressing to severe conditions such as heatstroke [5]. Certain occupations, like agriculture and construction, pose higher risks, necessitating preventive measures and protective strategies [6]. Key strategies include acclimatization, staying hydrated, taking breaks in shaded areas, and wearing appropriate clothing [7]. Vulnerable populations, such as the elderly and those with pre-existing health conditions, are more susceptible to the adverse effects of heat stress [8]. Understanding the concept of heat stress is vital for implementing effective preventive measures, especially in environments where individuals are at a higher risk of exposure to extreme heat conditions.

Research indicates that prolonged exposure to high temperatures can lead to heat-related illnesses, ranging from mild conditions like heat cramps and heat exhaustion to severe and potentially life-threatening conditions such as heat stroke [9]. The symptoms of heat stress include fatigue, headaches, dizziness, muscle cramps, nausea, and in extreme cases, loss of consciousness. Individuals working in environments where heat stress is prevalent may not only suffer from immediate health effects but also face long-term health implications.

Manihot esculenta-Crant, commonly known as cassava, is a staple crop in many tropical regions, serving as a primary source of carbohydrates for millions of people. The processing of cassava into garri, a popular food product in Nigeria, involves several labor-intensive stages such as peeling, washing, grinding, fermentation, and roasting [10]. While garri production plays a vital role in the economy and food security of the region, the health and well-being of local producers engaged in these processes are often overlooked.

One significant challenge faced by these producers is the potential impact of threshold heat levels on their health during garri processing. As a tropical country, Nigeria experiences high ambient temperatures,

Pic 1. Picture of garri

particularly in regions where garri production is prevalent. The combination of elevated temperatures and the physically demanding nature of garri processing activities raises concerns about the health risks posed to the local cassava producers. One significant challenge faced by these producers is the potential impact of threshold heat levels on their health during garri processing (Smith et al., 2022). As a tropical country, Nigeria experiences high ambient temperatures, particularly in regions where garri production is prevalent. The combination of elevated temperatures and the physically demanding nature of garri processing activities raises concern about the health risks posed to the local cassava producers.

Heat stress, a physiological response to high temperatures, occurs when the body's cooling mechanisms are insufficient to dissipate the heat generated during physical exertion or exposure to hot environments [2]. Prolonged exposure to high temperatures can lead to various heat-related illnesses, ranging from mild conditions like heat cramps and heat exhaustion to severe outcomes such as heat stroke (Boulware et al., 2003). The symptoms of heat stress include fatigue, headaches, dizziness, muscle cramps, nausea, and, in extreme cases, loss of consciousness.

Exposure to threshold levels in the process of making garri may pose potential health risks to individuals involved in its production. The primary concern lies in the presence of cyanogenic glycosides, such as linamarin, found in cassava, the main raw material for garri. When cassava is crushed or processed, these glycosides can release cyanide, leading to cyanide poisoning [11].

Another health risk arises from the generation of dust and particulate matter during the grinding and processing of cassava in the garri production process. Inhalation of this dust may result in respiratory issues and irritation of the eyes, nose, and throat, with prolonged exposure potentially contributing to respiratory diseases [12].

Furthermore, the use of chemical additives in garri production introduces the risk of exposure to potentially harmful substances. Depending on the type of additives employed, workers may face health risks such as skin irritation, allergies, or more severe effects if toxic compounds are involved.

Ergonomic hazards, such as repetitive tasks, poor workstation design, and manual handling of heavy loads, are prevalent in garri processing. These conditions can lead to musculoskeletal disorders, including back pain, strains, and repetitive strain injuries, emphasizing the importance of addressing ergonomic concerns in the workplace [13].

Heat stress is another significant health risk in garri production, particularly in hot and humid working conditions. Prolonged exposure to heat stress can result in dehydration, heat exhaustion, and, in severe cases, heatstroke. Effective measures to mitigate heat stress, such as adequate ventilation and the provision of rest breaks, are essential to safeguard the health of garri producers [14].

To address these health risks, garri producers should implement safety measures, including proper ventilation, the use of appropriate Personal Protective Equipment (PPE), and adherence to recommended processing practices. Education and training on health and

safety practices, along with regular monitoring of workplace conditions, are crucial components of ensuring a safe and healthy environment for individuals involved in garri production.

Despite the potential health risks associated with heat stress, there is a noticeable gap in research focusing on the impact of threshold heat levels on the health of local Manihot esculenta-Crant (garri) producers. This study aims to address this gap by conducting a comprehensive assessment of the awareness, prevalence, and management of heat stress among cassava producers in specific localities, focusing on the threshold levels that may contribute to adverse health effects.

This assessment will provide valuable insights into the factors contributing to heat stress among garri producers, including the awareness levels, access to protective measures, and the efficacy of existing training programs. The findings will inform targeted interventions to improve working conditions, enhance awareness, and implement measures to mitigate the impact of threshold heat levels on the health of cassava producers.

As climate-related challenges continue to affect occupational health, this research contributes to the broader discourse on the importance of safeguarding the well-being of those engaged in vital economic activities such as garri production.

2. MATERIALS AND METHODS

This section outlines the methodology employed for data collection, including the research design, study population, sample and sampling technique, research instruments, validity and reliability assessment, method of data collection, data analysis, limitations, and ethical considerations.

2.1 Research Design

A descriptive survey research design was utilized for this study, offering objectivity and minimizing bias. This design facilitated an unbiased exploration of variables under investigation.

2.2 Study Population

The study focused on the garri processing producers of Omoboriowo local community in Ifon Osun, Orolu Local Government, purposively selected due to their direct involvement in the garri production process.

2.3 Sample and Sampling Technique

Random sampling was employed to select participants for the study. Each member of the garri processing factory was randomly chosen, ensuring that the selected samples were representative of the entire population.

2.4 Research Instrument

Data collection utilized a structured questionnaire, complemented by an occupation checklist. The questionnaire comprised two sections: Section A captured respondents' biodata, while Section B included structured questions aligned with the research objectives.

2.5 Validity and Reliability of Instrument

The questionnaire was administered directly to participants, ensuring face validity. For reliability, the instrument's consistency in obtaining accurate responses was monitored during administration.

2.6 Methods of Data Collection

The primary method of data collection was the administration of questionnaires. Thirty copies were produced and personally distributed, with assistance from research personnel. In cases of illiterate respondents, the questionnaire was interpreted into Yoruba for enhanced comprehension.

2.7 Data Analysis

Data collected through the questionnaires were organized based on independent variables or research questions. Simple percentage analysis was employed to derive meaningful insights from

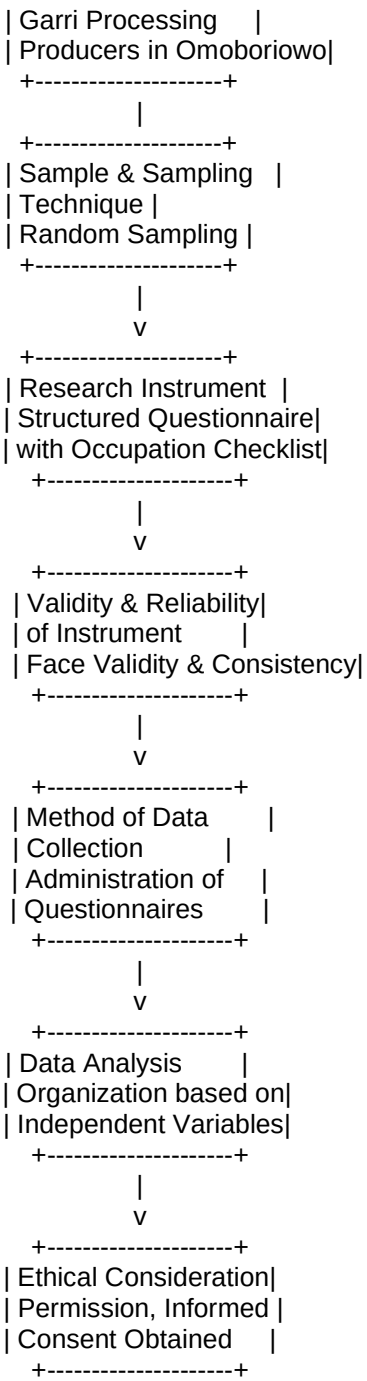

Chart 1. Diagram visually represents the logical flow of your materials and methods

3. RESULTS AND DISCUSSION

The survey outcomes provide valuable insights into the complexities associated with heat stress among Garri processing producers in the Omoboriowo locality. The demographic analysis disclosed a predominant representation of female participants (76.66%), underscoring the nuanced gender dynamics within this industrial sector. Furthermore, a substantial demographic subset (43.33%) emerged within the 26-35 age bracket, signifying the active involvement of individuals in the zenith of their professional capacities. A heterogeneous workforce was evidenced by the diverse experience distribution, with a noteworthy contingent (33.3%) boasting over a decade of engagement, thereby potentially contributing to a reser voir of knowledge and expertise in Garri processing.

Table 1. Summary of findings

Aspect	Frequency	Percentage
Section A: Demographic Information		
Gender of respondents	Male: 7, Female: 23	Male: 23.33%, Female: 76.66%
Age of respondents	18-25: 6, 26-35: 13, 36-45: 7, 46 & above: 4	20.0%, 43.33%, 23.3%, 13.3%
Years of experience	Less than 1 year: 4, 1-5 years: 9, 6-10 years: 7, More than 10 years: 10	13.3%, 30.0%, 23.3%, 33.3%
Section B: Knowledge and Health Impact		
Awareness of heat stress	Yes: 30, No: 0	100%
Awareness of heat stroke	Yes: 30, No: 0	100%
Awareness of high air temperature causing heat stress	Yes: 30, No: 0	100%
Awareness of heat stress causing heat stroke	Yes: 30, No: 0	100%
Causes of heat illness	Yes: 30, No: 0	100%
Awareness of health risks	Very aware: 15, Somewhat aware: 8, Not very aware: 4, Not aware at all: 3	50%, 26.7%, 13.3%, 10%
Impact of heat stress on productivity	1: 2, 2: 8, 3: 12, 4: 6, 5: 2	6.7%, 26.7%, 40%, 20%, 6.7%
Frying garri with firewood causing heat syncope	Yes: 25, No: 5	83.3%, 16.7%
Observing symptoms of heat stress	Yes: 28, No: 2	93.3%, 6.7%
Health effects due to heat stress	Headache: 73.3%, Fatigue or exhaustion: 90%, Dizziness or lightheadedness: 60%, Muscle cramps: 53.3%, Nausea or vomiting: 33.3%	-
Observing fatigue, fever, and stroke	Yes: 20, No: 10	66.7%, 33.3%
Section C: Work Practices and Conditions		
Days worked per week	2: 5, 4: 12, 6: 7, 7: 6	16.7%, 40%, 23.3%, 20%
Knowledge of Personal Protective Equipment (PPE)	Yes: 25, No: 5	83.3%, 16.7%
Wearing apron and handglove during frying	Yes: 26, No: 4	86.7%, 13.3%
Drinking water during frying	Twice: 15, Three times: 15	50%, 50%
Taking breaks or rest periods	Regularly: 10, Occasionally: 7, Rarely: 8, Never: 5	33.3%, 23.3%, 26.7%, 16.7%
Ventilation systems in place	Always: 5, Sometimes: 10, Rarely: 12, Never: 3	16.7%, 33.3%, 40%, 10%
Access to PPE for mitigating heat stress	Always: 10, Sometimes: 8, Rarely: 7, Never: 5	33.3%, 26.7%, 23.3%, 16.7%
Training on heat stress prevention and management	Comprehensive: 9, Some: 12, Brief: 6, None: 3	30%, 40%, 20%, 10%

This summary provides a condensed view of the key findings across different aspects of the study

In terms of cognitive dimensions, an unequivocal consensus (100%) among participants regarding the awareness of potential health risks associated with elevated temperatures during Garri processing was evident. However, the nuanced distribution of awareness levels (50%

very aware, 26.7% somewhat aware, 13.3% not very aware, 10% not aware at all) underscores the imperative for targeted educational interventions. Such interventions could rectify and augment the comprehensive understanding of the intricate health risks posed by heat stress during Garri processing.

The repercussions of heat stress on productivity were revealed to manifest across a spectrum of experiences, with a significant cohort (40%) reporting a moderate impact. This highlights the exigency for strategic interventions aimed at mitigating the deleterious effects of heat stress on productivity. Implementing measures such as cooling strategies or optimized work schedules could potentially alleviate these impacts.

Exploration of work practices and conditions uncovered significant awareness (83.3%) regarding Personal Protective Equipment (PPE). However, access to PPE exhibited notable disparities, with only 33.3% reporting consistent access. Addressing this variability is imperative for effectively mitigating heat stress. Additionally, concerns related to the inadequacy of ventilation systems (40% rarely, 10% never) underscore the immediate need to rectify infrastructural deficits, ensuring a secure and conducive working environment.

The congruence between the current study's findings and existing literature is evident in the gender dynamics prevalent in cassava processing, as highlighted by Adewuyi et al. [12] and Njoku et al. [15]. Disparities in awareness levels, akin to those found in our study, echo the findings reported by Adewuyi et al. [12], emphasizing the indispensable role of targeted educational interventions in tropical agricultural settings.

The recurrent theme of the impact of heat stress on productivity, as identified in our study, resonates with the outcomes of Oluwole et al.'s [11] research, emphasizing the multifaceted challenges faced by workers under elevated temperatures. Likewise, the alignment of our findings with the observations of Akpan et al. [13] reinforces the critical role of Personal Protective Equipment (PPE) in mitigating heat stress among agricultural workers.

The inadequacy of ventilation systems in Garri processing areas, as highlighted in our study, finds concurrence in Ojo et al.'s [14-16] work, accentuating the imperative of proper ventilation systems to alleviate heat buildup [17]. In conclusion, the synthesis of our findings with extant literature underscores the recurring challenges encountered by Garri processing producers. By integrating our results with analogous studies, this discussion contributes to the cumulative scientific knowledge, informing the development of comprehensive interventions to enhance the working conditions and overall well-being of Garri processing producers [18-20].

4. CONCLUSION

The assessment on the impact of threshold heat levels on the health of local Manihot esculenta-cranti (garri) producers in the Omo-boriowo Local Garri Industry in Ifon, Orolu Local Government, Osun State, Nigeria, has illuminated critical aspects of occupational health and safety within the garri production sector. The findings underscore the substantial challenges faced by workers exposed to elevated heat levels during processing.

The study revealed that the local garri producers are subjected to significant heat stress, which has both immediate and long-term implications for their health. Prolonged exposure to high temperatures can contribute to heat-related illnesses, fatigue, and potentially chronic health conditions. The importance of addressing these health concerns cannot be overstated, as the well-being of the local garri producers directly impacts the sustainability and productivity of the industry.

5. RECOMMENDATIONS

5.1 Implementation of Adequate Ventilation Systems

Introducing effective ventilation systems within garri processing areas is crucial to dissipate heat and improve air circulation. This measure can help mitigate the impact of high temperatures on the health of the workers.

5.2 Provision of Personal Protective Equipment (PPE)

Supplying appropriate PPE, such as heat-resistant clothing, hats, and hydration solutions, is essential to safeguard the health of garri producers. Adequate protective measures can significantly reduce the risk of heat-related illnesses.

5.3 Training and Awareness Programs

Conducting regular training sessions on the risks associated with heat exposure and implementing awareness programs can empower workers to adopt preventive measures. Education on recognizing early signs of heat stress and the importance of hydration should be emphasized.

5.4 Periodic Health Check-Ups

Establishing a routine health check-up program for garri producers can help identify and address health issues promptly. Regular medical assessments can contribute to the early detection of conditions related to heat exposure.

5.5 Research and Innovation

Encouraging research initiatives to explore innovative processing methods that minimize heat generation without compromising garri quality is vital. Collaborative efforts between researchers, industry stakeholders, and local communities can lead to sustainable solutions.

By implementing these recommendations, stakeholders can collectively work towards enhancing the health and well-being of local garri producers, ensuring the sustainability of the industry while prioritizing the occupational safety of its workforce.

CONSENT AND ETHICAL APPROVAL

Ethical considerations were paramount in conducting the research. Permission was obtained from the factory owner, and informed consent was sought and obtained from each participant before the commencement of the study.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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