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Meat Processors and Consumers Perception of Toxic Heavy Metal Residues in Meat and Meat Products

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Target Audience*: Farmers, Consumers, Meat processors*

Abstract

The study was carried out to examine the awareness of meat processors and consumers pertaining toxic heavy metal residues in meat and meat products in parts of Jigawa State Nigeria. A cross-sectional survey was carried out using structured questionnaires. A sample size of 180, 90 meat processors (45 Gwaram and 45 Kafin Hausa) and 90 consumers (45 Gwaram and 45 Kafin Hausa) from Gwaram and Kafin Hausa Local Government Areas were randomly surveyed in Gwaram and Kafin Hausa Local Government Areas (LGAs) of the State. Information on meat processing consumption and pattern, awareness of toxic heavy metal residues and their health implication were examined. The results were analyzed using SPSS software version 25 and mean values presented in frequencies and percentages. Majority (77.8% and 85.6%) of the meat processors and consumers were unaware of the negative impact of toxic heavy metals on human health. Most of them (88.9 and 80.0%) were however not aware of the possibility of the occurrence of toxic heavy metals in meat and meat products. It was concluded that consumers and meat processors were not aware of the health implication of toxic heavy metal residues on human health. It is recommended that campaigns to create public awareness on the negative impact of toxic heavy metals and the banning of illegal mining activities and grazing of animals around contaminated areas be intensified.

Key words: Awareness, Campaigns, Heavy metals, consumers, meat processors, Food safety

Description of Problem

Environmental pollution with heavy metals is now considered as a threat to food safety (1). Heavy metals occur naturally in the earth's crust, and are persistent environmental contaminants that are not biodegradable (2). Animals might come into direct contact with the metals in water, soil or through grazing and subsequently passes to their meat and to meat products as well (3). Indigenous meat products such as *Balangu, Kilishi*, *Dambun nama, Tsire and Kamsa* are predominant in Northern Nigeria (4, 5, 6, 7). Heavy metal contamination in meat and meat products has been reported, and is a major source of concern to food safety (8). Heavy

metals bio-accumulate over time to cause serious health challenges such as kidney and bone damage, cancer, elevated blood pressure, intrauterine growth retardation, impaired psycho-social behaviour and decrease immunological defences (9). The most disturbing first signs of heavy metal toxicity are neurological and behavioural abnormalities which occur even before any physical damage is noticed (10). Laya village of Fagam, Gwaram Jigawa State is one of the mining areas known for mining Kaolin, tourmaline, white quartz, fine clay, tantalite and lead ore . Many years after mining operations were closed, villagers continue to illegally mine lead in the area exposing grazing animals to danger. Similarly, Kafin Hausa is another Local Government Area of Jigawa State that experience seasonal flooding from river Kafin Hausa. The river supplies the grazing animals with drinking water that could have been contaminated with toxic heavy metals. It is reported that the river contains high level of toxic heavy metals which may likely be transferred to the animals via feed and water (12). The animals usually raised on a free range system may consume contaminated pasture and water which may become deposited on the animal tissue and organs and subsequently transferring to consumers posing public health risk. The objectives of the study are to assess the perception of consumers and the level of awareness of meat processors on the effect of toxic heavy metals in raw and processed mutton in Gwaram and Kafin Hausa Local Government Area of Jigawa State.

Materials and Methods

The study was conducted in Gwaram and Kafin Hausa Local Government Areas of Jigawa State, Nigeria. Gwaram is located between latitude 11° 4' 0" North and longitude 9° 58' 0" East , Gwaram is one of the Local Government Area in Jigawa State that is known for mining Kaolin, tourmaline, white quartz, fine clay, tantalite and lead ore (11), While Kafin Hausa is situated at latitude 12° 68'N and longitude 10° 26'E . Kafin Hausa has a river which is among the largest river in Jigawa State receiving input from both natural and anthropogenic activities and reported to be contaminated with heavy metals (12)

A total of 180 structured questionnaires covering 90 meat processors (45 Gwaram and 45 Kafin Hausa) and 90 consumers (45 Gwaram and 45 Kafin Hausa) from Gwaram and Kafin Hausa Local Government Areas were administered that covers the bio-data of the respondents, meat consumption, awareness on heavy metal residues and health implication of the heavy metals.

Purposive sampling design was used to select the locations based on predominant activities. Gwaram is known for its mining activities (11) and Kafin Hausa receives seasonal flooding from a river Kafin Hausa resulting in contamination with toxic heavy metals (12).

Results and Discussion

Socio-economic characteristics of the consumers

Table 1 presents the socio-economic characteristics of the consumers. In terms of gender, majority (51.1%) of the respondents are males who are more willing to fill the questionnaire than the female (15). The result of the analysis of their age distribution revealed that those within 21-40 years are the majority (64.4%) who dominate the Nigerian population (16). The result in respect of the

marital status of the respondents indicated that almost all of them (81.1%) are married; the widowed ones had the lowest percentage. The number of respondents that had secondary school education was highest (50.0%). The National Bureau of statistics reported that the highest percentage of the Nigerian population has at least secondary school education (16).

Table 1: Socio Economic Characteristic of the Consumers

Variables	Frequency	Percentage
Gender		
Male	46	51.10
Female	44	48.90
Age		
<20	09	10.00
21-40	58	64.40
41-60	19	21.10
>61	04	04.50
Marital Status		
Single	10	11.10
Married	73	81.10
Divorced	05	05.60
Widowed	02	02.20
Level of Education		
Primary	19	21.10
Secondary	45	50.00
Tertiary	19	21.10
Islamic School	07	07.80

Meat preference and its consumption pattern in Gwaram and Kafin Hausa

The trend in the preference for meat types and consumption pattern in the study are presented in Table 2. The choice for meat types did not reveal clear cut trend as the consumer preference was not different as almost all population consume all the categories of meat (Beef, Chevon, Mutton and Chicken) (17). With respect to meat products, *Balangu* was most preferred in comparison to others for its acceptability by all age groups and economic class as well as its delicacy (18). Meat vending is popular in developing countries and making great contributions to the socio-economic development of the countries source. The pattern of meat consumption indicated that majority (50.0%) of the respondents purchased and used meat on weekly basis because of their financial status and its high cost (15). The results further revealed that majority of the respondents consumed meat products at the outdoor selling points because meat entrepreneurs have special skills and expertise in the preparation of the products (19).

Table 2: Meat Preference and Consumption Pattern in Gwaram and Kafin Hausa

Variables	Frequency	Percentage
Meat type consumed		
Beef	10	11.10
Chevon	09	10.00
Mutton	10	11.10
Chicken	09	10.00
All of the above	52	57.80
Preferred meat product		
Kilishi	24	26.70
Balangu	30	33.30
Tsire	26	28.90
Dambunnama	09	10.00
Ganda	01	01.10
Meat consumption Frequency		
Daily	19	21.10
Weekly	45	50.00
Monthly	19	21.10
Occasionally	07	07.80
Meat consumption outlet		
Indoor	32	35.60
Outdoor	58	64.40

The result of the analysis of consumer awareness to toxic heavy metals in meat and meat products is presented in Table 3. Majority of the respondents are unaware of the occurrence of toxic heavy metals as most of them are more concerned with meat spoilage and microbial contamination (20). It was reported by (21) that consumers have low awareness to chemical residues in meat. With regards to the impact of the toxic heavy metals on human health, it was revealed that majority of them are also unaware of their negative effects (22). Furthermore, the respondents believed that proper cooking can destroy the toxic heavy metals in meat and meat products and this is in agreement with the finding of (21). The result also indicated that almost all the respondents (98.9%) were not allergic to meat and meat products. Despite the fact that some animal products contain food allergens, such as milk and eggs, allergy to meat itself has historically been considered to be quite rare (23).

The socio economic characteristic of the meat processors is presented in Table 4. In terms of gender, the result showed that all the meat entrepreneurs were males as traditionally meat processing and selling is undertaken by men usually at night in northern Nigeria (24). The trend in age distribution of the respondents revealed that, majority of them are within the range of 21-40 years. With respect to the marital status of the meat entrepreneurs, majority of them are

Table 3: Consumer Awareness to toxic Heavy Metal Occurrence in Meat and Meat Products

	Frequency	Percentage
Awareness on heavy metal residue in meat and meat product		
Yes	10	11.10
No	80	88.90
Awareness on the negative impact of heavy metals to human health		
Yes	13	14.40
No	77	85.60
Effect of cooking on destruction of toxic heavy metals		
Yes	70	77.80
No	20	22.20
Allergic to meat product?		
Yes	01	01.10
No	89	98.90

married as meat vending is profitable business to enable them caters for their families. The level of education of the respondents revealed that a great number (36.7%) of the meat entrepreneurs had primary school certificate and the least are those with tertiary education.

Table 4: Socio Economic Characteristics of the Meat Processors

Variables	Frequency	Percentage
Gender		
Male	90	100.00
Age		
<20	04	04.40
21-40	46	51.10
41-60	33	36.70
>61	07	07.80
Marital status		
Single	13	14.40
Married	75	83.30
Divorced	02	02.30
Level of education		
Primary	33	36.70
Secondary	29	32.20
Tertiary	02	02.20
Islamic education	26	28.90

Presented in Table 5 is information on the sources and hygiene of water and raw meat used by the meat processors in Gwaram and Kafin Hausa LGA. Abattoir serve as the main source of meat (54.4%), as the State provides urban and local abattoir facilities (25). Most of the respondents (61.1%) are satisfied with the hygiene condition of the meat source. This could be attributed to the fact that the State always provides sanitary and protective items to aide hygiene at all the slaughter facilities (25). Borehole is the most common source of water (36.7%) for the animals before slaughter.

Table 5: Hygiene Practices on Meat and Water source

Variable	Frequency	Percentage
Meat source		
Abattoir	49	54.40
Farm	12	13.30
Local Market	19	21.10
Wholesale	10	11.20
Hygiene condition of meat source		
Good	32	35.60
Satisfactory	55	61.10
Poor	03	03.30
Water source		
River	16	17.80
Borehole	33	36.70
Well	18	20.00
Tap	23	25.50

Table 6 presents the result on the analysis of meat processors awareness regarding toxic heavy metals. It was indicated that most (80.0%) of the respondents were unaware of the possibility of the occurrence of toxic heavy metals in meat and meat products. Most of them (77.8%) were also not aware of the negative impact of these metals on human health. Subsequently, majority of the entrepreneurs were of the opinion that proper cooking can destroy the toxic heavy metals in meat and meat products which is in agreement with the work of (21).

Conclusion and Application

1. Most of the meat processors were male and married and had at least primary school education.
2. The most preferred meat product by the consumers in the study area is *Balangu* followed by *Tsire*, while most of the consumers consumed meat on a weekly basis.
3. The meat processors source their meat from at least a local abattoir where they rate the hygiene condition of the meat as satisfactory.

Table 6: Meat Processors Awareness towards Toxic Heavy Metals

Variable	Frequency	Percentage
Awareness on heavy metal residue in meat and meat product		
Yes	18	20.00
No	72	80.00
Awareness on the negative impact of heavy metals		
Yes	20	22.20
No	70	77.80
Do you think proper cooking can destroy heavy metals?		
Yes	75	83.30
No	15	16.70

4. By application, there is need to embark on massive public health awareness campaigns on the need to reduce illegal mining activities near grazing areas.

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