

Heavy Metals Contamination Awareness Among Leafy Vegetables Consumers in Kano, Nigeria

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Abstract

The toxicity and accumulation behaviour of heavy metals (HMs) make them a potential danger not only to plants but also to humans. Heavy metals can have their way into humans through the consumption of contaminated foods. Understanding public perception of HM contamination will guide the concerned authorities in curtailing the risks associated with their consumption in foods. The research aim to assess the level of consumers' awareness of the presence of heavy metals (HMs) in commonly consumed leafy vegetables (amaranth, lettuce and cabbage) in Kano and the dangers associated with the consumption of HM-contaminated leafy vegetables. Data was gathered through oral interviews; 86 leafy vegetable habitual consumers were interviewed in the Kano metropolis. Information gathered includes demography of the respondents, vegetable sources, HM contamination awareness in irrigation water and vegetables, awareness of dangers associated with the consumption of HM-contaminated vegetables, awareness of possible contamination from other foods and activities that can worsen HM-related health problems in humans. The results revealed that over 91 % of the respondents consume all three types of vegetables (amaranth, lettuce and cabbage). The level of HMs contamination awareness among vegetable consumers in Kano is poor, the possibility of having HMs contamination in vegetables is known by only 23.26 % and only 5.58 % know that HMs contamination can cause health problems such as kidney failure and cancers. Education level does not influence the consumers' awareness of vegetable-heavy metal contamination

Keywords: food safety, vegetable, heavy metal, awareness

INTRODUCTION

Heavy metals consist of all elements found in trace amounts in the Earth's crust or biological tissues. Many of these elements, such as Cd, Pb, or Zn are potentially toxic (Sumiahadi and Acar, 2018). Life has evolved to cope with the low trace element concentrations found in nature. However, human activity has released large amounts of these elements into the environment, creating situations that can be hazardous for both ecosystems and human health (Foucher and William, 2010). The toxicity and accumulation behaviour of heavy metals makes them a potential danger not only to plants but also to humans (Sanda *et al.*, 2016). Consumption of HM-contaminated foods continues to increase HM toxicity consistently, the menace tends to affect children more than adults (Gajbhiye and Wadnerwar, 2021).

The awareness level of HM contamination among food consumers ranges from poor (Okareh *et al.*, 2023; Shafiei *et al.*, 2016) to moderate (Javier, 2023), depending on the location. The findings of Anantha (2016) and Kayısoğlu and Coşkun (2016) revealed a positive relationship between education level and HM contamination awareness. Javier (2023) also reported that education level, income and age can influence awareness of HM contamination in food. Lack of adequate awareness of the ideal sources of HM and the safety status of staple foods can increase the risk of HM contamination and subsequently lead to chronic toxicity (Gajbhiye and Wadnerwar, 2021). The objective of the research is to assess the level of consumers' awareness of the presence of heavy metals (HMs) in commonly consumed leafy vegetables (amaranth, lettuce and cabbage) in Kano and the dangers associated with the consumption of HM-contaminated leafy vegetables.

METHODOLOGY

Study area

Kano city is an ancient city with unique human and physical settings due its dynamic nature and influence on West African economy (Mustapha *et al.*, 2014). The city is one of the largest cities in Nigeria and second to the largest traditional city in the West African sub-region. Kano city is located on latitude 12° 25' N to 12° 40' N and longitude 8°35' E to 8°45' E (Mustapha & Aris, 2011).

Sampling/Sample Size

Simple random sampling was employed to interview 86 respondents. The respondents were chosen from the eight metropolitan local governments. At least ten persons were interviewed from each of the eight local governments. No less than one person was interviewed in each of the political wards in the eight local governments.

Data Collection and Analysis

An oral interview was used to ascertain leafy vegetable consumers' knowledge of the presence of heavy metals in lettuce, amaranth and cabbage and their awareness of the dangers associated with HMs contamination in these vegetables. Information gathered includes demography of the respondents, vegetable sources, HM contamination awareness in irrigation water and vegetables, awareness of dangers associated with the consumption of HM-contaminated vegetables, awareness of possible HM contamination from other foods and activities that can worsen HM-related health problems in humans.

The survey was conducted between November and December 2023 in Kano metropolis, Nigeria. Interview locations were chosen carefully to ensure adequate representation. Data was collected by face-to-face interviews using Kobo Collect; an android application controlled

by Kobo Toolbox and used for digital data collection. The survey data analysis was conducted using Microsoft Excel (Version 2019).

RESULTS AND DISCUSSION

Demography of the Respondents

The result for the demography of the respondents is presented in Table 1. A total of 86 respondents were interviewed, 74.42 % were male and 25.58 % were female. The age of the respondents ranged from less than 20 years to above 60 years. The percentages of the respondents with the age of less than 20 years, 20-30 years, 31-40 years, 41-50 years, 51- 60 years and above 60 years are 4.65, 37.21, 34.88, 14.12, 6.98 and 1.16 respectively.

Table 1: Background Characteristics of Vegetable Consumers in Kano (N=86)

Demography of the Respondents		
		N (%)
Gender	Male	64 (74.42)
	Female	22 (25.58)
Age	Less than 20	4 (4.65)
	20-30	32 (37.21)
	31-40	30 (34.88)
	41-50	13 (15.12)
	51-60	6 (6.98)
	Above 60	1 (1.16)
Educational level	Non-Formal Education	16 (18.60)
	Primary school	5 (5.81)
	Secondary school	36 (41.86)
	Tertiary Institution	29 (33.72)
Occupation	Public sector	4 (4.65)
	Private Sector	10 (11.63)
	Self-employed	72 (83.72)
Marital status	Married	52 (60.47)
	Single	33 (38.37)
	Widowed	1 (1.16)
	Divorce	0 (0.00)
Length of stay in Kano	5 years or less	4 (4.65)
	6-10 years	9 (10.47)
	Above 10 years	73 (84.88)

The results for the education status of the respondents show that 18.60 % possessed non-formal education, 5.81 % attended primary school, 41.86 % attended secondary school, and 33.72 % attended tertiary institutions. The findings revealed that the majority (75.58 %) of the respondents have at least secondary education.

The majority (83.72 %) of the respondents are self-employed, 11.63 % of them work with private organisations and only 4.65 % are public servants. More than 60 % were married, 38.37 % were single and 1.16 % were widows. No divorcee among the respondents. Most of the respondents (84.88 %) live in Kano for more than 10 years, 10.47 % live for 6-10 years and 4.65 % live for less than 5 years.

Table 2: Heavy Metals Awareness Among Vegetable Consumers in Kano (N=86)

HEAVY METALS AWARENESS	N (%)
Do you consume all three types of vegetables?	
Yes	79 (91.86)
No	3 (3.49)
Not sure	4 (4.65)
Most prefer vegetable	
I consume Amaranth more than Lettuce and Cabbage	15 (17.44)
I consume Lettuce more than Amaranth and Cabbage	48 (55.81)
I consume Cabbage more than Amaranth and Lettuce	23 (26.74)
My preference for a particular vegetable over the other two is due to:*	
Convenience	49 (56.98)
Availability	48 (55.81)
Affordability	30 (34.88)
Health concern	32 (37.21)
Taste	56 (65.12)
What is/are the source(s) of the vegetable you consume? *	
Market	76 (88.37)
Garden	11 (12.79)
Local retailers	60 (69.77)
Mobile hawkers	14 (16.28)
Name of the garden and/or market*	
Nearby Market	49 (56.98)
Urban Gardens (Sharada, Samegu, Airpot Road, K/Ruwa)	6 (6.98)
Backyard Garden	2 (2.33)
What is their irrigation water source? *	
Potable water	10 (11.63)
Wastewater	18 (20.93)
Tube well	38 (44.18)
Local well	15 (17.44)
Bore hall	0 (0.00)
Others	0 (0.00)
Are you satisfied with the quality and safety of the irrigation water?	
Yes	50 (58.14)
No	15 (17.44)
Not Sure	21 (24.42)
Do you know contaminated water can pass contamination to crops?	
Yes	60 (69.77)
No	5 (5.81)
Not Sure	21 (24.42)
Do you know heavy metals?	
Yes	20 (23.26)
No	66 (76.74)
Are you aware that consumption of heavy metals-contaminated vegetables can cause health problems?	

Yes	36 (41.86)
No	7 (8.14)
Not sure	43 (50.00)
If yes mention some	
Kidney failure and cancer	5 (5.81)
Do you do/have any of the following (tick all that apply) *	
Smoking cigarette	10 (11.63)
Smoking Shisha	4 (4.65)
Alcohol consumption	0 (0.00)
High BP/Stroke	6 (6.98)
Heart disease(s)	0 (0.00)
Diabetes	4 (4.65)
Obesity	1 (1.16)
Consumption of commercial local drinks such as Zobo, Kunun Aya, Tsimi etc.	81 (94.19)
frequent consumption of commercial fried, roasted or smoked foods	83 (96.51)

The survey results for Heavy metals contamination awareness among vegetable consumers in Kano are presented in Table 2. The results revealed that Over 91 % of the respondents consume all three types of vegetables (amaranth, lettuce and cabbage). The results for consumption preference show that the respondents prefer lettuce more than amaranth and cabbage. Percentage distribution of the reasons for vegetable preference are convenience (56.98 %), availability (55.81 %), affordability (34.88 %), health concern (37.21 %) and taste (65.12 %).

The majority of the respondents are getting their vegetables from either market (88.37 %) or from local retailers (69.77 %). Only a few respondents obtained their vegetables from urban gardens (6.98 %) and backyard gardens (2.33 %). Knowing the actual source and the quality of the irrigation used in the production of vegetables by urban farmers in Kano will be difficult for the respondents since they are majorly getting their vegetables from markets.

The majority (58.14 %) of the respondents ignorantly believed that the irrigation water used in the production of vegetables by urban farmers in Kano is safe. A much bigger percentage of them (69.77 %) are passionately faithful that contaminated irrigation water cannot pass contamination to thriving crops.

Most of the respondents (76.74 %) do not know heavy metals much less know their persistent nature and the scientifically proven tendencies to cause complicated health problems including cancers. A significant proportion (50.00 %) are not even sure whether contaminated crops can pass contamination to consumers. Nevertheless, 41.86 % agreed that consumption of contaminated crops can cause health problems. About 34 % of the respondents attended tertiary institutions but only 5.81 % of them are aware that HMs contamination can cause cancers and kidney failure in humans. This is slightly above the 4 % reported by Shafiei *et al.* (2016) on awareness of the adverse effect of HM contamination through rice consumption in Iran. The results of this study contradict the findings of Anantha (2016) who reported a positive correlation between food safety awareness and education level. Likewise, the findings of Kayışoğlu and Coşkun (2016) which reported an increase in food safety consciousness with an increase in education level. Javier (2023) also reported moderate awareness of HM contamination among fishermen in the Philippines.

Consumer awareness of HM contamination is generally poor not only in Nigeria or Africa but also in other parts of the globe. The results of a survey conducted by Shafiei *et al.* (2016) in Sanandaj, Iran show that more than 78 % of women living in the study area have a low level of awareness of HM contamination in rice.

In this computer era, where tonnes of information are readily available online, awareness of the appropriate utilisation of smartphones can influence the food safety awareness status of Kano consumers. Research conducted by many researchers (Amole *et al.*, 2021; Garba *et al.*, 2018; Musa *et al.*, 2023) shows that Kano youths are heavily using smartphones but mostly for social purposes, educating them on how to get vital and highly educational resources using their smartphone can bust their safety awareness not only on food but also on other contemporary issues like environmental safety and chemical utilisation that are indirectly affecting the wholesomeness of our foods.

The respondent's reply to the supplementary question on the contemporary potential cancer risk factors shows that 94.19 % are frequently consuming commercial traditional drinks that are massively prepared using unregulated quantities of synthetic additives with compromised qualities and standards, 96.51 % are habitual consumers of commercial fried, roasted and smoked foods with high chance of having acrylamides, 16.28 % are smoking either cigarette or shisha, 6.98 % have high blood pressure, 4.65 % are diabetic patient and 1.16 % are obese.

The level of HMs contamination awareness among vegetable consumers in Kano is inferior, the possibility of having HMs contamination in vegetables is known by only 23.26 % and only 5.58 % know that HMs contamination can cause health problems such as kidney failure and cancers. Most of the respondents are also prone to other cancer-causing factors through consumption of traditional drinks, locally processed meat products and smoking. These are in addition to other factors, such as exposure through skin and inhalation, aflatoxins in contaminated food, radioactive compounds, automobile exhaust, pesticide residues, etc., that are outside the scope of this research.

Anantha (2016) opined that understanding consumer attitudes on the safety awareness of what they are consuming is generally confusing and research in this sphere continues to yield conflicting results with insignificant empirical data.

CONCLUSION

The majority of the respondents (72.09 %) are young men aged between 20 and 40 years, 75.58 % of them have at least secondary education, 83.72 % are self-employed, 60 % are married and 84.88 % of them reside in Kano for more than 10 years. The level of HMs contamination awareness among vegetable consumers in Kano is poor, the possibility of having HMs contamination in vegetables is known by only 23.26 % and only 5.58 % know that HMs contamination can cause health problems such as kidney failure and cancers. Most of the respondents are also prone to other cancer-causing factors through consumption of traditional drinks, locally processed meat products and smoking. These are in addition to other factors, such as exposure through skin and inhalation, aflatoxins in contaminated food, radioactive compounds, automobile exhaust, pesticide residues, etc.

With the current industrialisation, ensuring HM-free food chain is virtually impossible; however, measures must be initiated by the concerned stakeholders to ensure safe levels of HMs in the environment, water bodies, agricultural lands, foods, food ingredients and

processing equipment and utensils. There is a need to establish a workable system for educating consumers on the importance of understanding the safety status of whatever they are consuming. In this computer era, where tonnes of information are readily available online, awareness of the appropriate utilisation of smartphones can influence the food safety awareness status of Kano consumers. Mass media campaigns through radio, television, magazines, newspapers, social media platforms and public gatherings will educate consumers and expose the dangers of HM contamination. Campaigns through social media platforms should be given utmost priority since findings from many researches disclose that the majority of smartphone users are addicted to social media. Organising debates and quiz on food toxicity among primary and secondary school students will augment their understanding of food safety and upsurge their curiosity about food contamination. It would be more apt if basic topics on food safety will be included in these schools' curricula.

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