



Analysis of Consumers' Perception of Insecticidal Preservatives and Its Residues in Cucumber and Tomato from Selected Markets in Port Harcourt

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Article History

Received: 02.05.2024

Accepted: 08.06.2024

Published: 27.06.2024

Abstract: A market survey involving 100 fruit sellers/consumers who were randomly selected in Fruit garden, Rumuokoro, Mile 3 and Oil Mill markets was conducted to examine their awareness of chemical preservatives, residual and dietary effects on their body. The study utilizes primary data which was collected through the use of questionnaire from the respondents and personal observation by the researchers. A semi structured standardized questionnaire was administered to the respondents to gather information about their socio demographic characteristics, knowledge, and attitude of the traders/consumers on nutrition and food preservation. Only 150 copies of the questionnaire were distributed by the researcher with the help of researches assistance. Data were analyzed using descriptive statistics such as frequency distributions, percentages, mean score and correlation coefficient. In this survey, the seller/consumers above 35 years old consumes more of the fruits (35%) and those of 70kg weight recorded above 52%. Only 29% of respondents are aware that fruits bought are usually preserved with banned chemicals (gammalin 20, carbide etc.) by the traders. The hazard index recorded by tomato (1.2 - 1.3) and cucumber (1.8 - 2.2) was high in both markets under study. The consumption of tomato and cucumber is correlated positively with Weight (0.091) (0.019), Height (0.086) (0.178) and Body mass index (0.016) (0.043).

Keywords: Body mass index, Hazard index, pesticides, residues, markets, fruits.

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INTRODUCTION

Tomato (*Solanum lycopersicum*) is the second most important vegetable crop after potato (*Solanum tuberosum*). Based on the FAO world data (2004), the total acreage is approximately 2.8 million hectares with yearly worldwide fruit production of 84.7 million metric tons. Fresh tomatoes and other processed tomato products make a significant contribution to human nutrition owing to the

concentration and availability of several nutrients in these products and to their widespread consumption. Composition tables show that ripe tomato contains 93-95% water and low levels of solid matter. Tomato varieties are divided into several categories, based mostly on shape and size. The most cultivated varieties in Africa are 'Floradel', 'Marglobe', 'Heinz 1370', 'Rio Grande', 'Roma VF', 'Moneymaker', 'Anna F1', 'Marmande', etc. Factors influencing selection of

tomato varieties include market demands, resistance to disease pathogens, suitability to production systems, and regional adaptability (Diver *et al*, 1999). Tomatoes are adapted to a wide range of environmental conditions, but in temperate areas low temperatures and short growing seasons can limit growth. Tomatoes prefer slightly acidic soils with a pH of 6.0 to 6.8 (Cox and Tilth, 2009). The tomato plant requires significant quantities of water, but not in excess, since tomato roots will not function under water-logged (anaerobic) conditions.

The consumption of tomatoes and cucumbers may be important in prostate and pancreatic cancer prevention. These vegetables contain all four major carotenoids (alpha- and beta-carotene, lutein and lycopene) and all three high powered antioxidants (beta-carotene which has vitamin A activity in the body, vitamin E and vitamin C), may have individual benefits and display synergy as a group (that is, they interact to provide health benefits).

In the findings of Aktar *et al*, (2009), it is reported that pesticide is an estimated sixty billion dollars' industry accounting for more than 2.8 million tons of chemicals deposited which is being deposited in to the environment annually. Pesticide residue is the amount of pesticide that remains on the harvested part of the plant and farm produce at crop maturity.

Oerke (2006) reported that more than 80% of the global pesticide production is being mostly used in farming to protect seeds, crops and products as some kind of pest control is necessary to avoid losses of 50% or more.

Rahman and Chima (2018) posited agriculture as the largest user of these pesticides, consuming 85% of world production, to chemically control various pests that are known for the reduction of food crops, vegetables and fruits quantity and Quality.

Pretty and Bharucha (2015); Schreinemachers and Tipraqsa (2012) opined that the use of pesticides has grown steadily and has now reached 3.5 billion kg of active ingredient per year of which 70% is used by China, Argentina and USA. Farmers in high- and higher-middle-income countries are known to use more than farmers from lower-middle and low-income countries both in total amounts and in amounts to be able to reach the same yield per ha (Pretty and Bharucha, 2015). Jørs (2016) posited average use of pesticide to be around 3.2 kg of active ingredients per ha of crop. Garcia *et al*, (2012); Borş *et al*, (2012) posited that some of the most used pesticides ranges from insecticides,

acaricides, herbicides, fungicides, plant growth regulators, rodenticides and biocides. Some of these aforementioned pesticides are known to have active ingredients upon their application to plant and can break down in a reaction generally to produce chemicals commonly classified as metabolites (Zacharia, 2011).

Rivers state is undoubtedly a business hub in Nigeria. A survey of literature has shown that data on pesticide residues of farm produce such as fruits sold in the city's markets metropolis are limited and scarce. This calls for concern as the toxicological effects of the chemicals which humans and animals are exposed to are increasing daily. One of the avenues for human exposure to these compounds is through the consumption of these agricultural produce that might have been treated with pesticides (Cserhádi and Szógyi, 2012). Moreover, there has been reported cases of food poisoning and deaths related pesticide remnants in food materials bought from markets in Nigeria (Shaibu, 2008). Since food safety generally is related to health, the obtained results will enlighten the public and policy makers on the danger associated with pesticides residues in fruits and vegetables and the need for precaution. Therefore, it is on this premise to assess pesticide residue in watermelon, cucumber, cabbage and tomato being one of the major fruits and vegetable consumed from eight selected markets in Port Harcourt, Rivers State.

- Consumption of agricultural produce treated with pesticides whose safety limit exceeded EU-MRLs (Cserhádi and Szógyi, 2012).
- Reported cases of food poisoning and deaths in food materials bought from markets in Nigeria (Shaibu, 2008).

The broad objective of the study is to assess pesticide residue in Tomato and cucumber from four selected markets in Port Harcourt.

While the specifics were to:

- To examine socio-economic characteristic of the respondents
- To examine the chemical substances and its inherent hazard on the preserved cucumber and tomato.
- To evaluate the dietary exposure of pesticide residues in preserved fruits.
- To investigate the relationship between effect of preservatives on the body traits and fruit consumption

MATERIALS AND METHODS

Sample Collection and Preparation

A total of 24 samples of tomato and cucumber (twelve each) consisting of three each from four different markets in Port Harcourt were

randomly collected from Fruit garden(4.7988° N, 7.0009° E) Oil mill(4.8585° N, 7.0648° E),Rumuokoro(4.8664° N, 6.9991° E) and Mile 3(4.8042° N, 6.9924° E) Markets in June, 2021. Tomato and cucumber sample collections were made at these wholesale markets that are popularly patronized.

- Sources of selected vegetables (Rumuokoro, Mile 3, Fruit Garden and Oil Mill Markets).
- Thereafter, Survey and distribution of questionnaires were done among consumers
- Research work and Laboratory analyses were carried out

Research Instrument

The study utilizes primary data which was collected through the use of questionnaire from the respondents and personal observation by the researchers. A semi structured standardized questionnaire was administered to the respondents to gather information about their socio demographic characteristics, knowledge, and attitude of the students on nutrition and food preservation. Respondents were informed about the study and provided consent, mostly verbal but sometimes signed, before interviews were conducted;

A semi-structured self-developed questionnaire was used as the survey instrument. The questionnaire includes the socio-demographic characteristics, knowledge about nutritional status, food preservation and assessment of associated factors.

Data Collection Methods

The questionnaires were self-administered and carried out by the Researchers.

Statistical Analysis

All data will be subjected to Analysis of variance (ANOVA). Significant means will be separated using New Duncan multiple test (Using SPSS, Version 2.0)

Dietary estimate was calculated using this formula:

$$\text{Dietary exposure} = \frac{\sum (\text{residue} \times \text{food consumption per market})}{\text{Body weight (Kg)}}$$

$$\text{Hazard index (HI)} = \text{EDI/ADI}$$

Correlation analysis will be carried out to determine the relationship between the residues from different open markets.

RESULTS AND DISCUSSION

Table 1 showed that 35% of the respondents were between the age group 30 and 35 years, closely followed by 25% of respondents who were between the group of 20 and 25 years; then 23% of respondents were between 25 and 30 while, few (3%) were between the group of 15 and 20 years. It could be seen that middle aged and youths consumed more of this fruits in the markets. Therefore majority of the consumers were observed to be predominantly youths and this contributes to their high consumption. However, the preservation of fruits involves all stakeholders both strong and feeble because this part of production is invariably less tedious or challenging/tasking. This is in line with the study of Bhosle *et al*, (2012) who reported that the use pesticides as seed/fruit treatment are easy to apply by the young ones to maximize high productivity. The study reveals that majority of the respondents were in the age range of 35 and above years which indicates that they are still active in fruit trading and consumption. The distribution based on gender classification revealed there was a balance ratio between the male and females consumers (50%). The table also showed that 50% of the respondents were married, closely by single 44%, only 6% were divorcee. The respondents are mostly young men and women who are still in youthful age. However, the marriage cut across board irrespective of religion or tribe. This connotes that marriage is highly cherished by the people in the study area and could lead to increase in household size. The respondents are predominantly Christians (86%) while Muslims were 14% though none was recorded as traditional believer (0). The implication here is that consumption is based on choice rather than religion, tribe nor marital status.

The table also revealed that 25.0% were students, while 43.0% of the respondents were government workers while traders were 23%, only 6% were retiree. The 23% traders solely involved in buying and selling of fruits, which implies fruit trading is a major means of livelihood for the traders. Also the distribution favoured the study since most of the respondents were literate and choose their diets based on their body requirements. This is in consonance with Okunola (2006) who stated that education influences various human activities among buyers/users. However, education is a major factor that could influence consumers' eating habit and they could easily adopt better technologies transferred in fruit preservation of their choices which increase their income for carrying out insect pest control.

Table 1: Demographic characteristics assessment of respondents

Variable	Frequency	Percentage
Age		
15-20	3	3.0
20-25	25	25.0
25-30	23	23.0
30-35	14	14.0
35 and above	35	35.0
Total	100	100.0
Sex		
Male	50	50.0
Female	50	50.0
Total	100	100.0
Religion		
Christianity	86	86.0
Islam	14	14.0
Traditional	0	0.00
Total	100	100.0
Tribe		
Yoruba	23	23.0
Igbo	26	26.0
Hausa	10	10.0
Others	41	41.0
Total	100	100.0
Marital status		
Married	47	47.0
Single	47	47.0
Divorcee	6	6.0
Total	100	100.0
Class		
Student	28	28.0
Working	43	43.0
Trader	23	23.0
Retiree	6	6.0
Total	100	100.0

Table 2 showed the respondents' distribution based on physical requirements of the respondents, 52% of the respondents recorded highest percentage of above 70kg weight followed by 16% for 60-65kg, 12% for 55-60kg, 9% for 65-70kg, 5% for 45-50kg, 4% for 40-45kg and the least was 2% for 50-55kg. However, 93% of respondents recorded 1.5-2.0m height and the least obtained was 7% for 1.0-1.5m. In terms of BMI, 47% respondents recorded 20-25kg/m, followed by 29% for 25-30kg/m, 13% for 15-29kg/m and the least (11%) for 30kg/m and

above. Most of the respondents were in the normal category, they are neither underweight nor overweight because none of the respondents was obese. However, there has been greater interest in knowing the prevalence of overweight and obesity, thus establishing the prevalence of hypertension at an early age (Chen, 2008). Sorof *et al.*, (2004) however reported three times higher prevalence of hypertension in obese compared to non obese adolescents in a similar research work.

Table 2: Physical measurements characteristics assessment of respondents

Variable	Frequency	Percentage
Weight(Kg)		
40-45	4	4.0
45-50	5	5.0
50-55	2	2.0
55-60	12	12.0
60-65	16	16.0
65-70	9	9.0
70 and above	52	52.0
Total	100	100.0

Variable	Frequency	Percentage
Height(m)		
1.0-1.5	7	7.0
1.5-2.0	93	93.0
Total	100	100.0
BMI(kg/m)		
15-20	13	13.0
20-25	47	47.0
25-30	29	29.0
30 and above	11	11.0
Total	100	100.0

Table 3 showed that 50% of the respondents used improvised chemical, carbide for quick ripening of the fruits in the storage while some used gammalin 20 banned insecticide for the preservation the fruits against the attack of storage insect pest. However some traders used gammalin 20 despite the snag/inadequacy associated with the use of the chemical insecticide. Only 12.5% respondents used Aldrex 20 and other local concursion to prolong the shelve life of the fruits.

The results in Table 4 showed that only 21.9% of the respondents are aware of approved insecticide, while majority of the respondents

(78.1%) claimed ignorance of the policy. Also, majority of the respondents (93.7) is not aware of banned insecticide either, whereas only 6.3 of the respondents claimed to have knowledge of banned insecticide. However, the majority of the respondents (84.4%) were not aware of health hazard inherent in banned insecticide, while just 15.6% respondents aware of the risk associated with the over-dependence on insecticide as a means of control. This implies that traders did not follow proper channel for the right insecticide to use. Traders make do with what is available irrespective of the authenticity and originality.

Table 3: Distribution based on chemical used for fruit preservation

Type of Chemical used	Frequency	Percentage
Gammalin 20	40	25.0
Carbide	80	50.0
Aldrex	20	12.5
Other	20	12.5
Total	160	100

Table 4: Awareness of approved/banned insecticides and hazard inherent

Approved insecticide	Frequency	Percentage
Yes	35	21.9
No	125	78.1
Total	160	100
Banned insecticide	Frequency	Percentage
Yes	10	6.3
No	150	93.7
Total	160	100
Health hazard	Frequency	Percentage
Yes	8	5
No	152	95
Total	160	100

Based on dietary pattern in a day, 51% of respondents consumed tomato and cucumber twice in a day while 49% eats tomato and cucumber thrice in a day. However, 56% of respondents agreed to have skipped meals while 44% were not. Furthermore, 28% respondents indicated they skip meals because of breakfast while 21% indicated launch as the major reason they skip meals and 7% indicate dinner as the main reason (Table 5).

However, 42% of the respondents indicated they skip meal because they are fasting, 25% for low appetite, 9% for drug adverse effect, 4% for weight watching and 2% indicated habits. The result further shows that 100% of the respondents indicated they like snacking, while 18% respondents indicated that they don't take snack as fruit while 14% indicates yes they take fruit as snack while 11% of the respondents never gave an answer to this.

Table 5: Dietary Pattern assessment of respondents

Variable	Frequency	Percentage
How often do you eat in a day?		
1	0	0.00
2	51	51.0
3	49	49.0
Total	100	100.0
Do you skip meals?		
Yes	56	56.0
No	44	44.0
Total	100	100.0
If yes, which meal(s) do you skip?		
0	44	28.0
Breakfast	21	21.0
Lunch	7	7.0
Dinner	28	44.0
Total	100	100.0
Why do you skip meals?		
0	42	42.0
I don't like the food	2	2.0
I am fasting	9	9.0
No time to eat	25	25.0
Just an habit	4	4.0
Drug adverse effect	1	1.0
No/low appetite	7	7.0
Weight watching	10	10.0
Total	100	100.0
Do you like snacking?		
0	2	2.0
Yes	56	56.0
No	42	42.0
Total	100	100.0
Why do you like snacking?		
0	42	42.0
I like them	15	15.0
Hunger	11	11.0
Habit	14	14.0
Making up for skipped meals	18	18.0
Total	100	100.0
Do you take fruits daily as snack?		
0	26	26.0
Yes	20	20.0
No	54	54.0
Total	100	100.0
If no, do you take it as a meal?		
0	36	36.0
Yes	48	48.0
No	16	16.0
Total	100	100.0
Do you buy organic fruits?		
0	8	8.0
Yes	58	58.0
No	34	34.0
Total	100	100.0
If Yes, from which market?		
0	42	42.0
Oil mill	17	17.0

Variable	Frequency	Percentage
Fruit garden	14	14.0
Rumuokoro	10	10.0
Mile3	17	17.0
Total	100	100.0
If no, are you aware that the fruits are protected against insect infestation or ripened quickly with banned chemical like gamaline 20, carbide, etc. by traders.		
0		
Yes		
No		
Total		

Based on what is an adequate balance diet, the result shows that 12% of the respondents believed balanced diet as the supplication of nutrients the body needs to work while 44% posited

balanced diet to consist of different classes of food which provide adequate amount of nutrients necessary for good health.

Table 6: Balance/adequate diet assessment of respondents

Variable	Frequency	Percentage
What is an adequate/balance diet?		
0	30	30.0
A balance diet supplies the nutrients the body needs to work effectively.	12	12.0
A balance/adequate diet consist of different classes of food and provide adequate amounts of nutrients necessary for good health.	44	44.0
A balance/adequate nutrient is an healthy diet	11	11.0
An adequate and balanced diet contributes to achieve or maintain a good state of health	3	3.0
Total	100	100.0
Are you satisfied with your dietary/eating pattern?		
0	1	1.0
Yes	55	55.0
No	20	20.0
I don't know	24	24.0
Total	100	100.0

Table 7 showed that there was significant higher danger in eaten tomato treated with the banned organochlorine compound like Lindane or gammalin 20 etc. Low estimate was observed in cucumber because more of organophosphorus compound were used in the protection against pest

across the markets surveyed. From the table, traders in Rumuokoro and Mile 3 used more chemical compound than other markets. The hazard index recorded the highest ranging from 1.2-1.3 and 1.8 – 2.2 in tomato and cucumber in all the markets monitored.

Table 7: Dietary Exposure of Pesticide Residues in Tomato and Cucumber

Markets	Dietary Estimate	Cucumber	Tomato
OIL MILL	DE	0.454a	1.1a
	EDI	0.454a	1.1a
	ADI	0.571a	0.33b
	HI	0.8b	3.3c
FRUIT GARDEN	DE	0.489a	1.2a
	EDI	0.489a	1.2a
	ADI	0.626a	0.34b
	HI	0.8b	3.5c
RUMOKORO	DE	0.663a	0.6a
	EDI	0.663a	0.6a
	ADI	0.516a	0.5a
	HI	1.3b	1.2b

Markets	Dietary Estimate	Cucumber	Tomato
MILE 3	DE	0.995a	0.6a
	EDI	0.995a	0.6a
	ADI	0.452b	0.34a
	HI	2.2b	1.8b

Means are separated by Tukey’s Honest Significant Difference Test at 5%. Means followed by the same letter in the same column are not significantly different from one another.

DE- Dietary estimates, * EDI-Estimated daily intake, * ADI- Acceptable daily intake, *HI-Hazard Index

Table 8 Tomato correlated positively with body index like weight (0.091) BMI (0.016) and height (0.086). Likewise, there is positive correlation between the cucumber and body morphology weight (0.019) BMI (0.043) and height (0.178). Cucumber recorded higher correlation with these parameters than tomato across the four markets under study

Table 8: Correlation coefficient of body traits and fruit consumption

Fruit	Weight	BMI	Height
Tomato	0.091	0.016	0.086
Cucumber	0.019	0.043	0.178

CONCLUSION

This study established the presence of different group of pesticides residues in tomato and cucumber samples from the selected markets in Port Harcourt, South South, Nigeria. This implicated regular use of common all purpose insecticides that still available in the markets despite outlawed by the government. Therefore contamination may pose a danger to human since fruit contamination is the main route of exposure to all groups of pesticides. Consequently, dietary intake estimates from the pesticide levels gave an insight into likely health risks to livestock and humans. Only 29% of respondents are aware that fruits bought are usually preserved with banned chemicals (gammalin 20, carbide etc) by the traders.

RECOMMENDATIONS

- Sparingly use of pesticide should be encouraged in insect pest management
- More emphasis should be laid on the practice of organic Agriculture
- Further studies for effects on humans should be conducted.
- Education, training and information on pesticide safety and management should be strengthened.
- Farmers should be sensitized to better pesticide safety practices and the need for continuous pesticide residue monitoring is highly recommended
- More emphasis should be laid on the practice of organic agriculture.
- Legislation to control the indiscriminate use of pesticides should be enforced.

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