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Research Article

Practices towards Artificial Fruit Ripening Among Fruit Vendors in Rivers State

Eze, E.E[1]. and Prof. Okpako, J.E.F[2].

[1&2]Department of Human Kinetics and Health Education, Faculty of Education, University of Port Harcourt
Corresponding Author Email: akasm29@gmail.com

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Abstract: This study investigated the practice of artificial fruit ripening among fruit vendors of banana, plantain, mango and pawpaw in Rivers State. The study adopted a descriptive cross-sectional survey design. Two objectives, corresponding research questions and null hypotheses guided the study. The population for the study comprised all the accessible 1,810 fruit vendors in Rivers East senatorial district. A sample size of 472 fruit vendors was drawn using multi-stage sampling procedure. A validated self-structured questionnaire titled 'Practice of Artificial Fruit Ripening' with inter-scale reliability co-efficient of 0.896 was used as instrument for data collection. The descriptive statistics of mean and standard deviation were used to answer the research questions, while inferential statistics of Z-test and One-Way Analysis of Variance were used to test the hypotheses at 0.05 alpha level. It was found that fruit vendors in Rivers State sometimes practiced artificial fruit ripening using chemical and non-chemical methods. It was also discovered that regardless of their level of education and years of experience in the fruit business, the fruit vendors sometimes indulged in unhealthy practice of artificial fruit ripening. More so, the study revealed significant difference in practice among the fruit vendors in Rivers State based on level of education and years of experience. Based on the findings, it was concluded that the current practice of artificial fruit ripening in Rivers State is not in tandem with global best practices and therefore portend danger to the wellbeing of Rivers people and other Nigerians. The study therefore recommended among others that; community health workers should carry-out regular and effective health awareness campaigns concerning the dangers of using chemicals to ripen fruits. The Government of Rivers State through the Ministry of Agriculture should organise training programmes for fruit vendors on faster, safer, and economically feasible methods of fruits ripening and other post-harvest management techniques.
Keywords: Knowledge, Artificial Fruit Ripening, calcium carbide, vendors, Rivers State.

Background to the Study

Fruits furnish the body with nutrients such as vitamins (A, C and E), minerals (calcium, magnesium, potassium, zinc, phosphorous), fibre, antioxidants, and phytonutrients (Hewajulige and Premaseela, 2020). Antioxidants present in fruits such as beta carotene, lycopene, and ascorbic acid help to neutralize free radicals produced in the body, which are responsible for heart diseases, blood vessel damage, inflammatory diseases, and cancer. As such, they are an indispensable component of the human diet and should be eaten daily (Eze, 2021). Fruits are best consumed at the edible ripe stage after they have attained the physiological maturity, which takes place at the latter part of the process of fruit growth, development, and senescence (Hewajulige and Premaseela, 2020). Ripening is the last phase in fruit development, and it is a biochemical process through which fruits attain attractive colour, flavor, tissue softening and other physiological changes. It is associated with changes in the composition of a fruit, especially the conversion of starch to sugar, acids to neutral, large organic

compounds to small organic compounds, less soluble pectin to soluble pectin, etc. (Venkatesan, 2016). All these processes are initiated by ethylene, a plant hormone that is naturally produced within the fruits when the fruits have reached their optimum maturity. Hence, fruits are sweet and nutritious when ripened at maturity.

Fruits are grouped into two major classes based on their ripening behaviour during maturation: climacteric and non-climacteric fruits (Eze, 2021). Fruits that continue to ripen even after harvest when ethylene gas is present are climacteric and are known to be ethylene dependent fruits. Examples of climacteric fruits include mango, banana, plantain, papaya, guava, apple, pear, date et cetera. While the non-climacteric fruits do not ripen except attached to the parent plant up to maturity (Maduwanthi and Marapana, 2019). Examples include citrus fruits; fig, olive, pineapple et cetera. They do not ripen after being harvested.

Artificial ripening agents can be used to effect ripening in climacteric fruits much the same way as the naturally occurring ripening agent ethylene. Ripening agents are substances, which accelerate the ripening process, examples include ethylene gas, ethephon, ethylene glycol, ethrel and calcium carbide (Singal, *et al.,* 2012). Fruit vendors often collect fruits at their mature green stage and artificially ripen them before selling to the consumers in order to minimize the economic loss that is usually encountered during the transportation of fruits (Eze, 2021). Transporting and distributing fruits to consumers can take a number of days and during this time the fruits that have ripened naturally may become over ripe, and inedible due to harsh transportation conditions (Hossain, *et al.,* 2015). This indeed is a great economic loss for the fruit sellers and therefore, to minimize the loss, fruit are harvested and transported at their mature green stage then force-ripened with artificial ripening agents (Mursalat, *et al.,* 2013). Fruit vendors also indulge in artificial ripening to make high profit of seasonal fruits and meet the high demand of fruits caused by increased awareness of their health benefits. More so, artificially ripened fruits are usually more attractive than naturally ripened fruits. Under natural conditions, fruits ripen slowly leading to high weight loss, uneven ripening and poor colour development (Subbaiah, *et al.,* 2013).

The most widely used artificial ripening agent is industrial grade calcium carbide (Ismail, *et al.,* 2018). It is the commonly used chemical for ripening of fruits, because it is affordable and readily available in most local markets (Gandhi, *et al.,* 2016). When calcium carbide comes in contact with moisture, it releases acetylene which has the similar ripening effects to the natural ripening agent-ethylene (Ismail, *et al.,* 2018). Treatment with calcium carbide increases the rate at which fruits soften, respire and change in flavour and colour. However, the industrial grade calcium often used by fruits vendors contains traces of impurities in form of calcium arsenide and Calcium phosphide. These impurities interact with water forming phosphine and arsine respectively (Haturusihghe, *et al.,* 2004; Ismail, *et al.,* 2018; Kesse, *et al.,* 2019). These hydrides formed are fat-soluble and can dissolve in the layer of fruits wax, then diffuse from the peel to the flesh which may possibly cause health hazards. Hence, its use as artificial ripening agents has been decreed as illegal in many countries (Hossain, 2018; Igbinaduwa, *et al.,* 2018; Ogundipe, 2018).

There are several alternative chemical and non-chemical agents for hastening ripening process; some chemical methods are use of ethephon, an ethylene releasing compound which has been categorized by appropriate agency as non-carcinogenic to humans. Other non-toxic chemicals are oxytocin (generates ethylene catalytically), ethylene glycol, ethanol, methanol, propylene and methyl jasmonate. Examples of non-chemical methods are the use of smoke, dried or fresh hot pepper, exposure to ethylene gas from already ripe fruits such as apple, avocado and banana or bush mango (Maduwanthi and Marapana, 2019). Despite the available piece of information on the health hazards resulting from the use of calcium carbide in ripening of fruits, some vendors still employ this short practice. There is a rise in reported cases of carbide-ripened fruits in African countries (Oche*,* 2014; Opare, 2016). Although there are supervisory bodies to deal with food safety issues, there is still lack of specific regulations and technical support to control artificial fruit ripening in a good number of

African Countries (Islam, *et al.,* 2016; Stemming-dangers, 2018). In Nigeria, fruits commonly affected by this practice are banana, plantain, mango and pawpaw. Though artificial ripening accelerates the ripening process, nevertheless, it affects the nutritional quality and safety of the fruits if not properly used (Eze, 2021). While it is important to mitigate against economic loss encountered in fruit business, food security should be the primary concern of countries and individuals alike (Okpako, *et al.,* 2016). Therefore, the goal of this research was to evaluate the practices of fruit vendors of banana, plantain, mango and pawpaw towards artificial fruit ripening in Rivers State, Nigeria. Practice in this study refers to the use of chemicals such as calcium carbide in fruit ripening, personal safety while handling the artificial ripening agents as well as other non-chemical methods of artificial fruit ripening.

Statement of the Problem

Under natural process, fruit ripening results in no harm to the consumers as it naturally releases ethylene which catalysis the ripening process. However, to cater for the market demand, different ripening agents are commercially used on fruits to fasten the ripening process. This poses serious problems to the consumption of the fruits. It is difficult to guarantee fruit safety nowadays, as fruits are rarely spared from the unwholesome practice of food adulteration with fruit-ripening chemicals, such as calcium carbide, ethephon and other non-chemical but unsafe ripening techniques for the rapid ripening of immature fruits. For example, calcium carbide, the most prevalent artificial ripening agent in developing countries has been established to be extremely detrimental to human health. More so, the arbitrary increase in the cases of non-communicable diseases such as liver disease, kidney disease, stomach cancer and ulcers in Nigeria has been partly attributed to increase in the consumption of fruits that have been adulterated with fruit-ripening chemicals and unwholesome non-chemical methods by fruit vendors. Thus, the use of fruit-ripening chemicals and unhealthy non-chemical methods in the artificial ripening of fruits is becoming increasingly popular in many Nigerian urban communities, despite the high health risks involved. The increasing population density and increased awareness of the nutritional value of fruits by the inhabitants of Rivers State due to their level of leverage have led to a high demand of fruits and vegetables in the State. In view of the reported cases of ripening of fruits with fruit-ripening chemicals and other unsafe non-chemical methods across the country, artificial ripening practice may not be absent in Rivers State. Although, the consumers bear the bulk effect of ripening agents, the uninformed fruit vendors are also at risk. It is based on these observations that the researchers decided to find out the practice of artificial fruit ripening among fruit vendors of banana, plantain, mango and pawpaw in Rivers State.

Research Questions

The following research questions guided the study.

1) What is the practice of artificial fruit ripening among fruit vendors in Rivers State?
2) What is the practice of artificial fruit ripening among fruit vendors in Rivers State based on level of education and years of experience in fruit business?

Hypotheses

The following null hypotheses were postulated and tested at 0.05 level of significance.

1) There is no significant difference in the practice of artificial fruit ripening practices among fruit vendors in Rivers State based on level of education.
2) There is no significant difference in the practice of artificial fruit ripening practices among fruit vendors in Rivers State based on years of experience in fruit business.

Methodology

A cross-sectional descriptive survey research design was used for this study. The population of the study comprised of all the fruit vendors in major fruit markets in six selected metropolitan Local Government Areas (LGAs) in Rivers East Senatorial district, estimated by the researcher to be 1,810. A multi-stage sampling procedure was used to obtain a sample size of four hundred and seventy-two (472) vendors of banana, mango, pawpaw and plantain from 25 communities in the six selected

metropolitan LGAs. A self-structured questionnaire titled Practice of Artificial Fruit Ripening (PAFR) was used for data collection. The instrument was divided into two sections. Section A consisted of items designed to obtain information on the demographic factors (level of education and years of experience in fruit business) of the participants while Section B consisted of 14 items to assess respondents' practice of artificial fruit ripening. A modified Likert scale with a four-point rating of Always (A) (3 points), Sometimes (S) (2 points), Rarely (R) (1 point) and Never (N) (0 point) was used as response options for practices of artificial fruit ripening. In taking decision on practice, a criterion mean of 0.00 was considered as "never", 1.00–1.59 was considered as "rarely", 1.60–2.59 was considered as "sometimes" while 2.60–3.00 was taken to be "always". The reliability of the instruments was established using split-half method. It yielded an index of 0.896 using Guttman Coefficient. Descriptive statistics of mean and standard deviation were used to analyse data for the research questions. Hypotheses 1 and 2 were tested using One-Way Analysis of Variance (ANOVA) at 0.05 level of significance.

Results and Discussion

Research Question 1: What is the practice of artificial fruit ripening among fruit vendors in Rivers State?

Table 1. Mean and Standard deviation on practice of artificial fruit ripening among fruit vendors in Rivers State

S.No	Items	Fruit Vendors		Remark
		$\bar{x}$	SD	
1	I ripen fruits with fruit-ripening chemicals such as carbide.	2.01	1.25	Sometimes
2	I do not bother protecting myself when applying fruit ripening chemicals.	2.02	1.33	Sometimes
3	I ripen fruits by using large quantity of the ripening chemical so the fruit can ripen quickly.	1.92	1.34	Sometimes
4	I consider the type of fruits in choosing the chemicals to be used.	2.16	1.36	Sometimes
5	I read carefully the information on the labels on the package of the chemicals.	1.96	1.16	Sometimes
6	I follow the information given on the labels	1.70	1.04	Sometimes
7	I ripen fruits by putting them together with apples or avocados in airtight bags.	1.90	0.99	Sometimes
8	I ripen fruits by spreading them as layers over paddy husk or wheat straw.	2.30	0.88	Sometimes
9	I ripen fruits through smoking inside airtight rooms.	2.75	1.07	Always
10	I ripen fruits by placing them in a bowl of rice and ensuring they are completely covered with rice.	2.11	1.21	Sometimes
11	I ripen mangoes by dipping them in a pot of boiled water.	1.87	1.16	Sometimes
12	I ripen bananas and plantains by wrapping them in paper bags or sacks.	2.83	1.09	Always
13	I ripen bananas/plantains by hanging them in dark warm areas.	2.52	0.93	Sometimes
14	I ripen fruits by placing them in paper bags and covering them with flour.	2.28	1.27	Sometimes
Cluster mean		**2.17**	**1.15**	**Sometimes**
Note: x < 1.00 = never, 1.00-1.59 = rarely, 1.60-2.59 = sometimes, 2.6-3.00 =always				

Result in Table 1 revealed that the fruit vendors sometimes practiced artificial fruit ripening with cluster mean score and Standard Deviation of $\bar{X}$ = 2.17 and SD = 1.15.

The table further revealed that they sometimes use fruit-ripening chemicals, such as carbide and other non-chemical methods to ripen fruits for sale.

Research Question 2: What is the practice of artificial fruit ripening among fruit vendors in Rivers State based on level of education and years of experience in fruit business?

Table 2a. Practices of vendors in Rivers State towards artificial fruit ripening based on level of education.

S.No.	Items	No formal education (n=7)		Primary education (n=111)		Secondary education (n=319)		Tertiary education (n=35)		Mean Set	Remark
		$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD		
1	I ripen fruits with chemicals such as carbide.	3.31	1.28	1.83	1.02	1.95	1.25	1.00	0.00	2.02	Sometimes
2	I do not bother protecting myself when applying fruit ripening chemicals.	1.00	0.00	1.59	1.06	1.98	1.31	3.91	0.51	2.12	Sometimes
3	I ripen fruits by using large quantity of the ripening chemical so the fruit can ripen quickly.	1.86	1.46	1.27	0.86	1.91	1.32	4.00	0.00	1.57	Rarely
4	I consider the type of fruits in choosing the chemicals to be used.	3.86	0.38	1.05	0.33	2.51	1.38	2.14	1.31	2.39	Sometimes
5	I read carefully the information on the labels on the package of the chemicals.	3.00	1.41	1.03	0.16	2.27	1.17	1.83	1.18	2.03	Sometimes
6	I follow the information given on the labels	2.14	1.07	1.14	0.53	1.97	1.12	1.00	0.00	1.56	Rarely
7	I ripen fruits by putting them together with apples or avocados in airtight bags.	2.43	0.79	1.81	0.80	2.02	1.04	1.00	0.00	1.82	Sometimes
8	I ripen fruits by spreading them as layers over paddy husk or wheat straw.	1.86	1.46	2.06	0.49	2.47	0.90	1.54	0.95	1.24	Rarely
9	I ripen fruits through smoking inside airtight rooms.	2.71	1.60	1.97	0.77	3.16	0.91	1.46	0.85	2.33	Sometimes
10	I ripen fruits by placing them in a bowl of rice and ensuring they are completely covered with rice.	2.71	1.60	1.69	0.97	2.16	1.20	2.80	1.49	2.34	Sometimes
11	I ripen mangoes by dipping them in a pot of boiled water.	2.57	1.13	1.65	1.05	1.84	1.11	2.63	1.52	2.17	Sometimes
12	I ripen bananas and plantains by wrapping them in paper bags or sacks.	2.57	1.13	2.86	1.09	2.82	1.10	2.97	1.10	2.81	Always
13	I ripen bananas/plantains by hanging them in dark warm areas.	2.00	0.82	2.52	0.92	2.53	0.95	2.54	0.82	2.40	Sometimes
14	I ripen fruits by placing them in paper bags and covering them with flour.	1.29	0.76	2.32	1.28	2.31	1.27	2.09	1.25	2.00	Sometimes
Cluster mean and standard deviation		**2.38**	**1.06**	**1.77**	**0.81**	**2.28**	**1.15**	**2.21**	**0.78**	**2.16**	**Sometimes**
Note: x < 1.00 = never, 1.00 -1.59 = rarely, 1.60-2.59 = sometimes, 2.6-3.00 =always											

Results in Table 2a showed cluster mean scores of 2.38; 1.77; 2.28 and 2.21 as well as cluster standard deviations of 1.06, 0.81, 1.15 and 0.78 for variables of: fruit vendors with no formal education, primary education, secondary education and tertiary education respectively. The results indicated that fruit vendors in Rivers State irrespective of their levels of education sometimes indulged in artificial ripening of fruits using both chemical and non-chemical methods. However, fruit vendors with primary school level of education practiced less of artificial ripening of fruits when compared to others with a cluster mean score of 1.77 and standard deviation of 0.81.

Table 2b. Practice of artificial fruit ripening among fruit vendors in Rivers State based on years of experience in fruit business.

S.No.	Items	Less than 2 years (n=91)		2-5 yrs (n=172)		6yrs & above (n=209)		Mean Set	Remark
		$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD		
1	I ripen fruits with chemicals such as carbide.	2.19	1.20	1.65	1.10	2.22	1.33	2.02	Sometimes
2	I do not bother protecting myself when applying fruit ripening chemicals.	2.55	1.24	1.95	1.29	1.85	1.35	2.12	Sometimes
3	I ripen fruits by using large quantity of the ripening chemical so the fruit can ripen quickly.	1.82	1.35	2.08	1.44	1.82	1.24	1.91	Sometimes
4	I consider the type of fruits in choosing the chemicals to be used.	1.00	0.00	3.17	1.22	1.83	1.19	2.00	Sometimes
5	I read carefully the information on the labels on the package of the chemicals.	1.00	0.00	2.18	1.25	2.19	1.13	1.79	Sometimes
6	I follow the information given on the labels	1.03	0.31	1.62	0.76	2.07	1.27	1.57	Rarely
7	I ripen fruits by putting them together with apples or avocados in airtight bags.	1.35	0.48	2.27	1.24	1.84	0.77	1.82	Sometimes
8	I ripen fruits by spreading them as layers over paddy husk or wheat straw.	1.71	0.45	2.39	0.83	2.47	0.96	2.19	Sometimes
9	I ripen fruits through smoking inside airtight rooms.	1.75	0.51	2.98	1.21	2.99	0.85	2.57	Sometimes
10	I ripen fruits by placing them in a bowl of rice and ensuring they are completely covered with rice.	2.19	1.20	1.80	1.21	2.33	1.16	2.11	Sometimes
11	I ripen mangoes by dipping them in a pot of boiled water.	1.86	1.36	2.15	1.21	1.64	0.96	1.88	Sometimes
12	I ripen bananas and plantains by wrapping them in paper bags or sacks.	2.80	1.17	2.85	1.08	2.84	1.08	2.83	Always
13	I ripen bananas/plantains by hanging them in dark warm areas.	2.69	0.85	2.52	0.93	2.45	0.95	2.55	Sometimes
14	I ripen fruits by placing them in paper bags and covering them with flour.	2.44	1.23	2.30	1.29	2.20	1.26	2.31	Sometimes
Grand mean		**1.88**	**0.81**	**2.28**	**1.15**	**2.19**	**1.11**	**2.12**	**Sometimes**
Note: x < 1.00 = never, 1.00 -1.59 = rarely, 1.60-2.59 = sometimes, 2.6-3.00 =always									

Results in Table 2b showed cluster mean scores of 1.88; 2.28; and 2.19 as well as Standard deviations of 0.81, 1.15, and 1.11 for variables of: fruit vendors with less than 2 years of experience, 2 to 5 years of experience, and fruit vendors with 6 years of experience and above respectively. The results indicated that fruit vendors in Rivers State irrespective of their years of experience sometimes practiced artificial ripening of fruits using both chemical and non-chemical methods. The Table further showed that fruit vendors with less than 2 years of experience in the business practiced less of artificial ripening of fruits when compared with other groups with a cluster mean score of 1.88 and standard deviation of 0.81.

Hypothesis 1: There is no significant difference in the practice of artificial fruit ripening among fruit vendors in Rivers State based on level of education.

Table 3. ANOVA analysis on difference in practice of artificial fruit ripening among fruit vendors in Rivers State based on level of education.

Variable	Sum of Squares	Df	Mean Square	F	Sig.	Decision
Between Groups	2.532	3	.844	2.844	.037	Significant
Within Groups	138.846	468	.297			
Total	141.377	471				

Results in Table 3 showed that the calculated F-value for level of education is 2.844 at degrees of freedom of 3 and 468 and probability level of 0.037 which is less than 0.05 level of probability ($F_{(3/468)}$=2.844; p<.05). The hypothesis was rejected. Therefore, there was a significant difference in the practice of artificial fruit ripening among fruit vendors in Rivers State based the level of education.

Hypothesis 2: There is no significant difference in the practice of artificial fruit ripening among fruit vendors in Rivers State based on years of experience.

Table 4. ANOVA analysis on difference in practice towards artificial fruit ripening among fruit vendors in Rivers State with respect to years of experience

Variable	Sum of Squares	Df	Mean Square	F	Sig.	Decision
Between Groups	9.557	2	4.779	17.002	.000	Significant
Within Groups	131.820	469	.281			
Total	141.377	471				

Results in Table 4 showed that the calculated F-value for years of experience is 17.002 at degrees of freedom of 2 and 469 and probability level of 0.000 which is less than 0.05 level of probability ($F_{(2/469)}$=17.002; p<.05). The hypothesis was rejected, indicating there was a significant difference in the practice of artificial fruit ripening among fruit vendors in Rivers State based on years of experience.

Discussions

The findings of the study were discussed under the following subheadings which represent the major variables that were investigated.

Practice of Artificial Fruit Ripening among Fruit Vendors in Rivers State

The findings in Table 1 showed that the respondents had a grand mean of 2.17 which is from 1.60-2.59. The Table established that the respondents sometimes practiced artificial ripening of fruits. This disagrees with the findings of Adekalu, Fashanu, Olaitan, Ogunsua, Oyebamiji, Ibrahim, Akande and Oyebanji, (2020) which showed that, of the 85 respondents of fruit vendors of banana and plantain, only one fruit vendor admitted using artificial ripening of fruit even though 82.5% of the respondents are aware of the utilization of carbide for plantain/banana ripening. However, it agrees with the findings of Rokonuzaman (2017) which established that litchi and mango growers admitted to be using chemicals such as calcium carbide, ethephon, and sulfur dioxide fumigation to artificially ripen fruits so as to maintain uniform ripening of the fruits and make extra profit.

Relationship between Demographic Factors and Practice of Artificial Fruit Ripening

Tables 2a and 2b showed that all the fruit vendors with no formal education, primary education, secondary education and tertiary education, irrespective of their years of experience in fruit business, sometimes practiced artificial ripening of fruits with a cluster mean set of 2.16 and 2.12 for levels of

education and years of experience respectively. This again resonates with the findings of Rokonuzaman (2017), which established that fruits growers of litchi and mango in some selected areas in Bangladesh use calcium carbide, ethephene and sulphur dioxide fumigants as ripening chemicals regardless of their level of education. This finding is also in tandem with the findings of Ismail *et al.,* (2018) that farmers, farm workers and fruit traders of mango practised artificial fruit ripening in spite of their years of experience.

Table 2a also showed that respondents indicated that they do not bother protecting themselves when applying carbide with the highest mean score of 3.91 for those with tertiary education. This is consistent with the earlier findings of Ismail *et al.,* (2018) which showed that based on protection measures during application of fruit ripening agents only 35% and 37% of the population bother to use face mask and glove respectively when applying calcium carbide. More so, the study revealed significant difference in practice among fruit vendors in Rivers State based on level of education and years of experience. The findings of this research work reflect that respondent's education and experience does have an effect on the utilization of artificial ripening agents and the application of protection measures.

Conclusion

Based upon the findings revealed in this study, it is appropriate to conclude that vendors in Rivers sometimes practice artificial fruit ripening and there was a significant difference in practice of artificial fruit ripening among fruit vendors in Rivers State based on levels of education and years of experience. The findings of the study that fruit vendors indulged in artificial ripening of fruits in Rivers State using both chemical and non-chemical methods portend dangers to public health and should attract public health attention to curtail the practices of artificial ripening of fruits.

Recommendations

Consequent upon the findings and conclusions of this study, the following recommendations were made:

1) Community health workers should organise regular and effective health awareness campaigns concerning the dangers of artificial fruit ripening among fruit vendors in Rivers State.
2) Community health workers should also mobilize market masters or superintendents to disseminate appropriate information on the health implications of artificial ripening and self-police the practices in their various market locations.
3) Rivers State Ministry of Agriculture should organise regular training programmes for fruit vendors on the health consequences of the practice of artificial ripening of fruits especially with chemicals.
4) Rivers State Ministry of Agriculture should organise regular training programmes for fruit vendors on faster, safer and economically feasible methods for fruits ripening and other post-harvest management techniques.
5) Community health workers should advocate for policy makers in Rivers to legislate and enforce laws against artificial fruit ripening in the state.
6) Media agencies in Rivers State should disseminate information about the health hazards of artificial fruit ripening through jingles, shows, programmes and so forth.
7) There should be public and school health education programmes for fruit consumers on how to identify fruits that have artificially ripened with ripening agents and how to avoid them due to their harmful effects.

Conflicts of interest: The authors declare no conflicts of interest.

References

1. Adekalu, O.A., Fashanu, T.A., Olaitan, T.R., Ogunsua, J.M., Oyebamiji, I.T., Ibrahim, A.S., Akande S.A. and Oyebanji, A.O. 2020. Survey on the Use of Calcium Carbide as Ripening Agent in Ilorin Metropolis. European Journal of Agriculture and Food Sciences, 2(6): 1-6.

2. Eze, E.E. 2021. Knowledge, attitude and practice towards artificial fruit ripening among consumers and vendors in Rivers state. Doctoral Thesis, University of Port Harcourt.
3. Gandhi, S., Sharma, M. and Bhatnagar, B. 2016. Comparative study on the ripening ability of banana by artificial ripening agent (calcium carbide) and natural ripening agents. Indian Journal of Nutrition, 3(1): 127.
4. Haturusihghe, L.S., De Silva, D.S.M. and Wimlasena, S. 2004. Quantification of arsenic and phosphorus in calcium carbide treated Mango. Conference paper retrieved from https://www.researchgate.net/publication/26822632.
5. Hossain, M.F., Akhtar, S. and Anwar, M. 2015. Health hazards posed by the consumption of artificially ripened fruits in Bangladesh. International Food Research Journal, 22(5): 1755.
6. Ismail, N.S., Rasdi, I., Pravema, S.M. and Abidni, E.Z. 2018. Knowledge, Attitude and practice associated with calcium carbide used for fruit ripening among mango farmers, farm workers and fruit traders. Malaysian Journal of Medical and Health Science, 14(2): 11–17.
7. Kesse, S., Boakye-Yiadom, K.O., Farooq M.A., Aquib, M.D., Filli, M.S. and Wang B.O. 2019. Analysis of phosphorus as an impurity from the use of calcium carbide as an artificial ripening agent in banana (Musa). Research in Pharmacy and Health Sciences, 5(1): 107-113.
8. Maduwanthi, S.D.T. and Marapana, R.A.U.J. 2019. Induced ripening agents and their effect on fruit quality of banana. International Journal of Food Science, 19: 1–8.
9. Okpako, F.O., Igbinosun, L.I., Okon, E.M. and Chilaka, G.T. 2016. Heavy metal concentrations in some edible vegetables: a case study in Uyo and Ibesikpo Asutan local government areas of Akwa-Ibom State. Recent Patents on Biotechnology, 10(3): 295-303.
10. Shinozaki, Y., Nicolas, P., Fernandez-Pozo, N. et al. 2018. High-resolution spatiotemporal transcriptome mapping of tomato fruit development and ripening. Nature Communications, 9: 364.
11. Singal, S., Kumud, M. and Thakral, S. 2012. Application of apple as ripening agent for banana. Indian Journal of Natural Products and Resources, 3(1): 61-64.
12. Venkatesan, M. 2016. Empowering import regulation through consumer education: an example of mango fruit ripening and calcium carbide. Journal of Food Security, 4(1): 13–17.

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