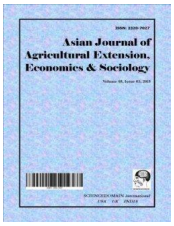

Asian Journal of Agricultural Extension, Economics & Sociology
15(1): 1-10, 2017; Article no.AJAEES.31049
ISSN: 2320-7027

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Component Wise Knowledge of Respondents Regarding Fruits Processing and Preservation Activities

Varsha Hada[1] and Vishakha Bansal[2*]

[1]Research Scholar, College of Home Science, MPUAT, Udaipur, India.
[2]All India Coordinated Research Project – HECM, College of Home Science, MPUAT, Udaipur, India.

Authors' contributions

This work was carried out in collaboration between both authors. Author VH designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript under the guidance of author VB. Both the authors read and approved the final manuscript.

Article Information

DOI: 10.9734/AJAEES/2017/31049
Editor(s):
(1) Jurislav Babic, Faculty of Food technology, University of Osijek, Croatia.
Reviewers:
(1) Md. Zahidul haque, Center for Environmental and Geographic Information Services (CEGIS), Dhaka, Bangladesh.
(2) Isaac Kojo Arah, Ho Polytechnic, Ghana.
Complete Peer review History: http://www.sciencedomain.org/review-history/17983

Original Research Article

Received 17th December 2016
Accepted 16th February 2017
Published 28th February 2017

ABSTRACT

The objective of the present study was to identify the component wise knowledge of respondents regarding fruits processing and preservation activities. The study was conducted in Badgaon and Girwa panchayat samities of Udaipur district of Rajasthan state of India. From each panchayat samiti, two villages were included in the study. The sample consisted of randomly selected 100 rural women, 25 from each village. Interview method was used for data collection. Frequency and percentage were used for analysis of data. Finding of the study reveals that respondents had poor knowledge in fruit processing and preservation activities namely- Fruit selection (70.66 Mean Percent Score), Washing (56.75 Mean Percent Score), grading (36.75 Mean Percent Score), packaging (26.29 Mean Percent Score), marketing (22 Mean Percent Score) and storage (16.30 Mean Percent Score). This might be due to lack of knowledge among respondents regarding these components.

**Corresponding author: E-mail: bvishakha29@yahoo.com;*

Keywords: Knowledge; rural women; processing; preservation and activities.

1. INTRODUCTION

India is known to be a fruit basket of the world. The total production of fruits and vegetables in the world is around 370 metric tonnes. But there is considerable gap between the gross production and net availability of fruits and vegetables due to heavy post-harvest losses.

Fruits are of great importance in human nutrition. Utilization of fruits has been inherent in the Indian way of life since long. It is generally stated that standard of living of the people of a country can be judged by its production and consumption of fruits per capita. It is a fact that fruits and vegetables are extremely good for us and that eating in a diet rich in fruit and vegetables can lower the risk of cancer and prevent number of serious illness and health problems such as high blood pressure and cardio vascular disease. To get maximum health benefits expert recommended eating a variety of fruits and vegetables along with other natural foods. Apart from this, fruits are good appetizers and add flavour and diversity to the diet. We enjoy eating seasonal fruits when the cost is affordable and varieties are available in the market. But we miss the same during off season. There is nothing like consuming fresh foods, they have better taste, appearance, colour etc. but foods, like fruits and vegetables so called perishable foods tends to get spoilt soon. Even under most cautious conditions, we cannot manage to keep them fresh for too long that is why processing and preservation is done to lengthen their shelf life.

India enjoys an enviable position in horticultural map of the world. Dhiman and Parmar [1] today, horticulture alone accounts for 30 per cent of India's agricultural GDP from 8.5 per cent of the cropped areas. A wide range of fruits and vegetables are grown in the country, which is a very rare situation in any county of the world. The total production of fruits has been estimated at 43.11 million tonnes from 4.01 million ha. area, which makes India the second largest producer in the world. Chhada [2] despite the comfortable production of fruits in the country, the per capita consumption of fruits is 85 gm/person/day against the ICMR recommendation of 100/gm/ person/day. Due to short life of horticultural crops, as much as 30-35 per cent of fruits and vegetables perish during harvest, storage, grading, transport, packaging and distribution, amounting to a revenue loss of Rs. 500 billion. In India only 2.2 per cent of fruits and vegetables are processed, whereas in countries like USA 65 per cent, China 23 per cent and Philippines 72 per cent are far ahead of India in reducing the wastage and enhancing the value addition and shelf life of the farm products. Hence there is a need for maximum commercial utilization of fruits and vegetables and to adopt production and marketing activities to the requirements of the world market and to cater to domestic demand which over the past year, has been increasing because of various socioeconomic factors. If the nutritive value of the processed food products could be maintained, this sector will emerge as a major value-added food industry. All the components namely-washing, grading, packaging, marketing, processing and preservation and storage are very much essential for the better utilization of the fruits for long time and also to enhance their shelf life.

Women play a significant and crucial role in agricultural development and allied fields including crop production, livestock production, horticulture, post-harvest operations, agro/social forestry, fisheries etc. Lugman et al. [3] under a small holding system of farming, women play a pivotal role in farming. They actively participate in a range of activities related to crop production and livestock management. Rural women remain busy from dawn to dusk in various agricultural activities, including pre-harvest, post-harvest and livestock management. Yashwant [4] argued the nature and extent of women's involvement in agriculture no doubt varies greatly from region to region. Even within a region, their involvement varies widely among different ecological sub-zones, farming systems, castes, classes and stages in the family cycle. But regardless of these variations, there is hardly any activity in agricultural production, except ploughing in which women are not actively involved. They play major role in animal husbandry, horticulture and poultry which are their main source of income and it is noticed that they always involved in labour and tolerance intensive works like transplantations and weeding operations.

Sirohi [5] in a study women was higher in operation like weeding, grain storage, several storage, several harvests and all post-harvest operations. Goyal [6] stated that majority of farm women were not involved in processing of aonla either at domestic or commercial level and a wide technological gap was seen among 63.05

per cent respondents in cultivation and post-harvest operations of aonla. Nazli et al. [7] reported that the rural women provide most of the labour in post-harvest activities including handling, stocking, processing, packaging and marketing.

Khatri [8] stated that majority of the respondents were not involved in processing either at domestic or commercial level this was due to the lack of knowledge regarding this aspect. Sidhu [9] found that women were found to contribute substantially in drying, storage and cleaning. In other post-harvest activities, majority of the farm women were working with male members. However, least participation was reported in marketing and processing. Rahman and Sharmin [10] involvement of rural women was mostly low to medium in Post-Harvest Activities of vegetables and fruits. Their extent of involvement varied a little bit from vegetable to vegetable and fruit to fruit. Govind and Perumal [11] revealed that generally women in all the activities of seed management either by way of participation or supervision. Women's participation was found to be highest in seed selection, germination of seed, cleaning and storage activities that were traditionally attended by women.

Baba et al. [12] revealed in their study magnitude of gender participation in different activities relating to vegetable cultivation varied from one activity to the other. While some activities are predominantly performed by male others by female yet some activities are performed jointly by both male and female partners of the family. Mehta et al. [13] reported that majority of mango growers (93.00%) were participating in mango cultivation from more than five years. Whereas, in case of market orientation, 72 per cent of mango growers had medium level of market orientation. The probable reason might be that the mango growers produced mango in plenty in the season and due to the improper marketing facility, they have to sale it immediately, as mango is a perishable fruit.

Sahu et al. [14] found that farm women had less knowledge in areas like improved varieties, disease and IPM (Integrated Pest Management), spacing, seed treatment, weed control, cropping system, marketing, package of practices, management of fertilizers, quality improvement and nursery rising in vegetable cultivation practices. Rathore and Dhakar [15] noted that majority of the trainees respondents had high level of knowledge and 40 per cent possessed medium level of knowledge whereas in case of non-trainees, 64 per cent respondents had medium level of knowledge and 12 per cent had high knowledge. It is therefore, concluded that guava growers trainees had high level of knowledge than the non-trainees. Bhatt and Sinha [16] in a study majority of the respondents (75%) used salt and oil as one of the important means to save pickle and sauce from spoilage. Thirty two per cent respondents used citric acid as a preservative in preparing squash whereas, 19 per cent mentioned about the use of acetic acid in preparing apple, peach, pear, apricot and citrus fruit sauce. A very few respondents (4-10 %) used potassium meta bi-sulphite and sodium benzoate in sauce and *chutneys.* It was concluded that though respondents were using chemical preservatives for preservation of fruits and vegetables however, they were unaware about the scientific reasons for using them.

Dubey [17] found that respondents had poor knowledge about improved cultivation and post-harvest practices of *ber* with overall mean per cent score of 14.36. Jadhav et al. [18] majority of the respondents had medium level of knowledge about post-harvest technologies of mangoes. Poonia [19] found that majority of the respondents (65%) had medium level of knowledge of improved kinnow cultivation practices. Respondents found in high and low knowledge category were 18.33 and 16.67 per cent, respectively. Soni et al. [20] more than half of the tribal women had medium level of knowledge about selected nutritional facts. The respondents had good knowledge about consumption of fruits and vegetables in daily diet however, they were unaware about the nutritional facts that fermented foods like *khaman, dhokala* provides vitamin-B and cereals provide carbohydrate.

The result of the research studies indicated that despite the dominance of the labour force, women in India are still facing extreme disadvantages; they have less knowledge, limited access to technology, low capital, low credit facilities etc. Thus, it is imperative that women should be trained in agriculture and allied areas.

2. MATERIALS AND METHODS

The study was conducted in Udaipur district of Rajasthan state (India). There are number of fruits grown in Udaipur district like- Mango, Lime, Banana, Papaya, Guava and Aonla. Out of which

three fruits having highest production were selected purposively for the present study. Udaipur district consists of seventeen panchayat samities out of which two panchayat samities- Badgaon and Girwa were selected purposively on the basis of highest production of the selected fruits. A list of villages was prepared and two villages each from both the panchayat samities namely Badi and Madar from Badgaon panchayat samiti and Sesarma and Bujda from Girwa panchayat samiti were selected for the present study. A village wise list of rural women, who were growing one of the selected fruit in their orchards, was prepared. A sample of 25 rural women was randomly selected from each village making a total sample of 100 rural women from four villages. Data were collected with the help of interview schedule. Frequency, percentage and Mean Weighted Score were used for analysis of the data.

3. RESULTS AND DISCUSSION

3.1 Knowledge of the Respondents Regarding Different Activities of Fruits Processing and Preservation

Knowledge is the most important component of behavior and as such it plays an important role in covert and overt behavior of human beings. Once knowledge is acquired it produces changes in the thinking process of an individual. It helps to develop favorable attitude to take certain action in accepting an innovation. Anshuman and Mistry [21] for making any programme to be effective, it is most important that people should be first aware and informed about it.

To find out knowledge of the respondents about practices of processing and preservation of fruits seven practices were identified and knowledge of the respondents was judged in light of these practices. The results pertaining for the study are presented as under:-

- Component wise knowledge of respondents regarding fruits processing and preservation techniques.
- In depth knowledge of the respondents about different components of fruits processing and preservation.

In depth enquiry into knowledge of the respondents in different components was further made to know in which component they had good knowledge and areas where the knowledge was lacking.

3.2 Fruit Selection

Fruit selection is the first and most important task of fruits processing and preservation practices in which rural women should have appropriate knowledge about importance of selecting of proper fruit, types of fruits selected for processing and preservation and point to be kept in mind during processing and preservation.

With regard to knowledge of the respondents regarding fruit selection, Table 1- depicts that cent percent respondents knew about importance of selecting proper fruits. Data further shows that 77 per cent respondent knew about type of fruits selected for processing and preservation. Regarding point to be kept in mind while fruit selection, all the respondents knew that ripened fruits are best for processing and preservation and that fruits should not be infested with insects, pests and diseases, 34 per cent respondents knew that fruits should be free of fowl smell and a few of them (13 %) knew about bruises and spots on fruits.

From the results it showed complete lack of proper post-harvest knowledge among the farmers, as only 10% of the respondents were found to harvest at an appropriate time of harvesting i.e. morning and evening. Rao [22] found that more than sixty per cent of the respondents had medium level of knowledge by 19.17 per cent of respondents in the category of high knowledge. Harvey [23] only 15.83 per cent respondents possessed poor knowledge about agricultural activities. However harvesting of fruits and vegetables should be done as carefully as possible to minimize mechanical damage such as bruises, scratches and punctures to the crops and should be carried out during the cool part of day i.e. early morning or late evening.

3.3 Washing

Washing of fruits helps to improve the appearance of fruit and to remove dust from it. Regarding washing it is evident from the Table 2 that majority of the respondents knew about necessity of washing fruits (90%) and importance of washing and washing fruits with plain water is known to 83-89 per cent of the respondents.

A similar study conducted by Maulasab [24] revealed that one fourth of the respondents had knowledge about mechanical harvesting and only 12.50 per cent were aware of mechanical means of sorting and cleaning of mangoes.

3.4 Grading

Grading is one of the important fruits processing and preservation practices as it determines the quality, shelf life and price of fruit. Grading is done by grouping of fruits on the basis of size, colour and shape which was reported by 65 per cent respondents respectively.

Data in Table 3 further show that regarding importance of grading 35 per cent of the respondents knew that it is done by removing over ripened fruits, 20 per cent stated that it is helpful in removal of immature fruit which leads to decrease in shelf life and ultimately reduce the cost and earning profit.

Regarding method of grading 60 per cent respondents had knowledge that grading should be done manually so that proper removal of immature and over ripened fruits can take place. Whereas, 5 per cent of the respondents knew that grading should be performed with the help of semi-automatic grading machine which is very effective to save time, energy and money.

Since grading is one of the important steps, some considerations must be followed while grading is performed. In this respect 70 per cent respondents reported that size of the fruits should be appropriate while grading. More than one-third respondents (39%) said that rotten and over ripe fruits should be separated which not only creates unpleasant smell but harmful to other fresh fruits also. One fourth of the respondents (25%) had knowledge that grading of fruits should be done on the basis of color. A very few respondents (10%) knew that immature fruits should be separated while grading is performed.

Table 1. Knowledge of the respondents regarding fruit selection (n=100)

S. no.	Items	f/%
1.	**Importance of fruit selection**	100
2.	**Types of fruits selected for processing and preservation**	77
3.	**Points kept in mind while fruits selection**	
a)	Ripeness	100
b)	Should not be infested with insects, pests and diseases	100
c)	Should not have bruises and spots	13
d)	Should not have fowl smell	34

Table 2. Knowledge of the respondents regarding washing of fruits (n=100)

S. no.	Items	f/%
1.	**Necessity of washing fruits**	90
2.	**Importance of washing**	
a)	To remove dust	83
b)	To remove chemical	0
3.	**Washing of fruits with plain water**	89

Table 3. Knowledge of the respondents regarding grading of fruits (n=100)

S. no.	Items	f/%
1.	**Concept**	65
2.	**Importance**	
a)	To remove immature fruits	20
b)	To remove over ripened fruits	35
3.	**Method of grading**	
a)	Manually	60
b)	Mechanically	5
4.	**Points kept in mind while grading**	
a)	Size should be appropriate	70
b)	Color should be uniform	25
c)	Immature/damaged fruits should be separated	10
d)	Over ripened fruits should be separated	39

Siraj [25] in a similar study on *kinnow* value chain reported that near about half of the respondents (45%) were grading the product before selling. Achuta [26] revealed that all the beetle vine women growers had knowledge of packing beetle vine. The study further indicates that majority of women had knowledge about practice of grading (95%) and harvesting (87.50%).

3.5 Packaging

Packaging of fruits and vegetables is undertaken primarily to assemble the produce in convenient units for marketing and distribution. It is apparent from data presented in the Table 4 that 65 per cent respondents had knowledge about the concept of packaging.

Further it was found that37 per cent respondents knew that packaging protects fruits from mishandling, 52 per cent said that it protects fruits from transport hazards while 21 per cent said that it increases shelf life of fruits. Regarding method of packaging 60 per cent respondents were familiar with manual method of packaging and a very few (5%) had knowledge about packaging of fruits through machines.

Table 4. Knowledge of the respondents regarding packaging (n=100)

S. no.	Items	f/%
1.	**Concept**	65
2.	**Importance of packaging**	
a)	Protect product from miss handling	37
b)	Reduce transport hazards	52
c)	Increase shelf life of product	21
3.	**Method of packaging**	
a)	Manually	60
b)	Mechanically	5
4.	**Material use for packaging**	
	Mango	
a)	Wooden boxes/corrugated fiber boxes (CFB)	35
	Guava	
b)	Corrugated fiber boxes (CFB)	56
	Lime	
c)	Poly bags	52
	Aonla	
d)	Bamboo basket	52
5.	**Packaging of fruits**	
a)	Single layer	10
b)	2-3 layers	33
c)	3-4 layers	32
6.	**Consideration while packaging**	
a)	Never pack loosely	28
b)	Keep proper ventilation	39
c)	Protect from sharp edges of packaging material	45
7.	**Packaging of preserved products**	68
8.	**Types of packaging**	
a)	Jars	75
b)	Containers	5
c)	Pots	21
d)	Cannes	0
9.	**Commercial level packaging of preserved products**	0
10.	**Types of commercial level packaging**	
a)	Vacuum packaging	0
b)	Gas packaging	0
c)	Aseptic packaging (tetra packaging)	0
d)	Modified atmosphere packaging (MAP)	0
e)	Controlled atmosphere packaging (CAP)	0
f)	Active packaging	0

With respect to packaging material it was found that 52-56 per cent of the respondents were familiar with bamboo baskets and corrugated fiber boxes as packaging material for aonla and guava and use of wooden boxes as packaging material for mango was reported by 35 per cent of respondents. Use of poly bags as packaging material for lime is reported by 20 per cent of the respondents. In packaging boxes fruit can be arranged in 2-3 layer and 3-4 layers according to the customer requirement was reported by 32-33 per cent respondents and fruits can be arranged in single layer was reported by only 10 per cent of the respondents respectively.

Less than half of the respondents (39-45%) knew that proper ventilation and protection from sharp edges of packaging material is needed to reduce physiological losses while packing the fruits. Whereas, more than one fourth (28%) of the respondents had knowledge about never pack loosely.

Data further revealed that 68 per cent respondents had knowledge about packaging of preserved products whereas, 36 per cent were not aware about it. Majority of the respondents 75 per cent had knowledge about packaging of preserved products in jars, 21 per cent knew that preserved products should be packed in pots and a very few 5 per cent of the respondents had knowledge that preserved products are packed in containers. None of the respondents had any kind of knowledge about commercial level packaging of preserved products.

A similar study conducted by Maulasab [24] stated that 28.83 per cent respondents had knowledge about scientific packaging.

3.6 Storage

The production of fruits is seasonal but its demand remains for longer time. From Table 5 it was reported by 34 and 30 per cent respondents that storage is very essential for regular supply to market and extend the consumption period of fruits. Data further reveals that 34 per cent respondents had knowledge storing fruits in cool chamber and more than one fourth 28 per cent knew of storing fruits in cupboard with wire gauge. Regarding storage temperature no one possessed knowledge about it.

Regarding precautions to be taken while storing the fruit, 14-32 per cent respondents knew that storage structure should be clean, completely dry, old and new stock should be separately stored to reduce the spoilage and proper air and ventilation be maintained in storage structure. Poor knowledge regarding this aspect was due to low participation of the respondents in this operation.

According to Singh and Agrawal [27] in their study reported that women expressed desire to know more about how to take care of farm produce, method of storage of food grains, precautions in using chemicals for storage and points to be kept in mind before storage of farm produce. Manvar et al. [28] also reported that majority of the mango growers had medium knowledge about mango cultivation technologies. It was also revealed that 97.33 per cent respondents had knowledge about storage of fruits under shade, grading and packaging.

Table 5. Knowledge of the respondents regarding storage (n=100)

S. no.	Items	f/%
1.	**Need of storage**	
a)	Extend the consumption period of fruit	30
b)	Off season availability/make round the year availability	0
c)	Regular supply to market	34
2.	**Storage temperature**	
a)	Storage of fruits in normal temperature	0
b)	Storage of fruits in cold storage	0
3.	**Method of storage**	
a)	Refrigerator/cool chamber	34
b)	Freezer	0
c)	Cupboard with wire gauge	28
d)	Zero Energy Cool Chamber (ZECC)	0
4.	**Point to be kept in mind while storing fruits**	
a)	Clean storage structure	14
b)	Complete dryness of storage structure	20
c)	Separate new and old stock	32
d)	Proper air ventilation in storage structure	20

Table 6. Knowledge of the respondents regarding marketing (n=100)

S. no.	Items	f/%
1.	**Different channels of marketing**	
a)	Direct sale	64
b)	Wholesaler	21
c)	Retailer	0
2.	**Places of selling**	
a)	Local market	10
b)	Outside village	54
c)	Krishi Upaj Mandi	5
d)	Private market chain	0

3.7 Marketing

Data in the (Table 6 above) reveals that majority of the respondents (64%) knew about direct sale as marketing channel and 21 per cent respondents were familiar with the wholesaler as marketing channel and none of the respondent had knowledge regarding retailers as a channel for marketing. Regarding place of marketing 54 per cent of the respondents knew that selling the produce outside the village is best place to get good amount of money for the produce. Whereas, only 5-10 per cent of the respondent knew about the marketing of fruits in local as well as in Krishi Upaj Mandi. None of the respondent had knowledge about marketing of fruits in private market chain.

In many countries urban demand for “traditional crops” such as leafy vegetables and cassava is increasing alongside demand for novel products. Supermarket buyers demand products of consistently high quality, yet small farmers often cannot marshal sufficient working capital to invest in improving product consistency. Smallholders’ understanding of supermarket standards and of consumers also tends to be weak, unlike their knowledge of local markets and unlike the greater knowledge base of large-scale commercial farmers. Improper harvest and postharvest operations lead to short shelf-life, rejection by consumers, and contamination risks. Boselie, Henson, and Weatherspoon [29] it can be difficult for small-scale farmers to deliver desired quantities at short notice or to manage the labour instability involved in “just-in-time” procurement practices.

Mande et al. [30] reported that majority of farm women had low level of Knowledge in storage methods (86 per cent) control measures against Pests (80.67 per cent) storage Pests and their nature of damage (80 per cent), drying period (67.33 per cent) and low cost storage structures (66.66 per cent). Similarly Brar [31] stated that respondents had excellent knowledge about different aspects of post-harvest practices like products prepared by processing. Phiri and Otieno [32] The general trend in most southern African countries is that most agricultural produce is lost soon after production largely because of poor post harvest handling and failure to access the formal markets. This trend is attributed to several factors and barriers in agricultural commodity marketing that discourage smallholder farmers from participating in formal markets. These factors range from household characteristics for instance low education levels, labor shortages, inadequate government services, high transaction costs and lack of physical infrastructure Siziba et al. [33] Jagwe et al. [34]; Pingali et al. [35]. In response to these challenges, most governments in Sub Saharan Africa implemented marke liberalization policies in the 1980s and 1990s which sought to open new market led economic growth opportunities Barrett [36]. It involved the abolition of commodity boards, introduction of free markets and encouragement of private sector participation. According to Jayne and Jones [37], although the overall aim of the liberalization was to improve the functioning and effectiveness of markets, it produced mixed results. In some cases, there was actual retreat to subsistence agriculture while in others there was increased market participation in more remunerative markets, technological progress and improvements in institutions and physical infrastructure.

4. CONCLUSIONS

Based on the findings it can be concluded that respondents having good knowledge about fruit selection and washing with overall mean percent score of 70.66 and 56.75. Data further revealed that respondents possessed poor knowledge in other components namely-grading, packaging, marketing and storage with overall mean percent

score of 36.75, 26.29, 22 and 16.30.This might be due to lack of knowledge of the respondents regarding these components. Hence, it is utmost important to educate and train the women regarding improved fruit processing and preservation practices. So that improvement in the knowledge of rural women for all these aspects can be made.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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