



## **Consumption Pattern of Organic Foods among Urban Consumers of Punjab State, India**

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### **Authors' contributions**

*This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.*

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### **ABSTRACT**

The present study was carried out to assess the consumption pattern of organic foods among urban consumers of Punjab. A total of 120 selected respondents belonging to middle (MIG) and high income group (HIG) from two cities of Punjab namely Ludhiana and Patiala were selected. Data were collected using questionnaire and were subjected to appropriate statistical analysis using various descriptive tools and tests such as mean, frequency, percentages and z-test. The results of the study showed that the age of the respondents varied from 35 to 45 years and 50% of the selected respondents were found to be graduates in both cities. Majority of the respondents in MIG of both cities were familiar with organic foods. A good number of the respondents i.e. 35% reported that they purchased organic foods because they were healthier and more nutritious while 27.5% reported that organic foods were safer than conventional foods. No significant difference ( $p \leq 0.05$ ) was observed between the number of respondents belonging to MIG and HIG who were using organic foods within last three years. More subjects in the HIG (63.3%) practised kitchen gardening compared to their MIG (43.3%) counterpart. The most preferred organic foods were vegetables (73.3%), fruits (59.1%), cereals (37.5%) and pulses (37.5%). Supermarkets were found to be the main source for purchase of organic foods among all the respondents. A good number of the respondents (36.7%) agreed that organic foods were very good. There was a significant difference ( $p \leq 0.05$ ) in the middle and high income group regarding monthly expenditure on organic fruits and

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vegetables, the values being 8.75 and 14.7% respectively. The purchase of organic food had a positive but non-significant relation with age. However, a significant positive correlation ( $p \leq 0.05$ ) was observed with education and income, indicating that with the increase in education and income frequency of purchase of organic foods also increases.

*Keywords: Consumption pattern; organic foods; Ludhiana; Patiala.*

## 1. INTRODUCTION

Food consumption patterns are changing these days due to changes in environmental conditions which are affecting people's health. Organic foods are known to be free from pesticides and chemical residues and their quality and safety create more consumer interest [1]. Organic food can be defined in various ways, because different countries have different standards for product to be certified as "organic". In simple words organic foods can be defined as food which is produced by using organic agricultural practices. Organic agricultural practices are those which largely eliminate the use of chemical fertilisers made with synthetic ingredients or sewage sludge, pesticides, growth regulators and ionising radiation [2]. Organic foods are minimally processed food and are produced by the processes which are friendly to the environment. According to the Codex Alimentarius Commission [3], organic agriculture promotes and enhances agro eco system, health, biodiversity, biological cycles and soil activities as a holistic management production system.

Organically produced foods have been found to have excellent nutritional properties with the higher amount of vitamins and mineral content. It has also been observed that organic diets result in decreased proliferation of cancer cells [4]. The consumers' interest in organic foods is increasing because of the growing demand for foods that are free from pesticides and chemical residues [5]. The cultivation techniques to obtain the organic products are environmental friendly considering both the final product and production methods [6]. So, there is hope that the organic foods demand will continue to grow in future.

It is well known that organic foods cost more than standard or conventional foods, so the consumers in high income group tend to purchase them more than lower income groups. Besides this, there are surely other factors which influence their consumption. Healthy lifestyle has become a global trend and has been underlined by the slogan 'back to nature'. A balance

between human and nature is maintained by this movement and is supported by the fact that everything coming from nature is good and beneficial. The agricultural production and productivity has increased extensively in the past few years. However, this extensive increase has been achieved at the cost of excessive use of chemicals and fertilisers. Keeping these problems in view, a need for appropriate and sustainable method arose. Organic farming was found as the best solution to these problems, which is one of the best agricultural practices inherited from the ancestors.

Though the organic product originated in the developed countries like US, UK and European countries, due to increasing awareness about the environmental issues and their alarming effects on the health of people, the consumers of Asia are also accepting the notion of "Go organic". The foods that have been produced in accordance with the principles and practices of organic agriculture are termed as organically grown foods. According to International Federation of Organic Agriculture Movement, organic agriculture is a production system in which the health of soil, ecosystem and the people are sustained. It relies on ecological processes, biodiversity and cycles suitable to local conditions rather than the use of inputs with adverse effects. Organic farming is a system of farm management which can achieve sustainable productivity without the use of external inputs like chemo- synthetic fertilisers and pesticides to create an eco-system [7]. Organic farming also saves the cost of external inputs as it utilises the inputs present in the farm itself so it is more economical to the farmers and also fetches a higher premium in the market [8].

Though 50% of organically produced foods in India are targeted for export, their consumption is on the rise in the country. A survey conducted by a leading research firm ACNielsen in 2007 revealed that India was among the top ten countries where health food including organic food was demanded for by the consumers. The concern for the health of children was the most important reason for buying organic food, with

over 66 per cent parents preferring organic food to non-organic food.

Following the worldwide trend, Indian population is becoming increasingly health conscious and tend to consume more nutritious and healthier food. The present study was undertaken to study the relationship between various demographic factors and consumption pattern of organic foods among the urban population of Punjab State.

## 2. MATERIALS AND METHODS

Two cities namely Ludhiana and Patiala were selected representing two out of 5 different zones of Punjab. Ludhiana represents Central Zone, whereas Patiala represents Southeastern Zone of Punjab. From each city two localities were selected on the basis of socio- economic status of the families. A total of 120 subjects cities were selected from both cities, out of which 60 were from MIG (30 from Ludhiana and 30 from Patiala) and 60 were from MIG (30 from Ludhiana and 30 from Patiala). The criteria for selection of MIG respondents were that they belonged to the

families having monthly income more than Rs. 1 lakh per month. However, the criteria for selection of MIG respondents was that their family income varied between Rs. 50,000-1,00,000 per month. The selection of subjects is depicted in the figure below.

A detailed questionnaire containing demographic profile and consumption pattern of organic foods was developed and pretested on 20 respondents who were excluded from the main study. The questionnaire was used to collect information on gender (M/F), age, marital status, education, total family income, religion, type of family, number of family members and locality by using personal interview method. Apart from this, other information related to consumption pattern of organic foods which included food habits, purchase, use, type, place of buying, money spent on organic foods and barriers to purchase of organic foods was also collected. Means, frequency and percentages were calculated from the collected data and z-test was used to compare the categories of the respondents.

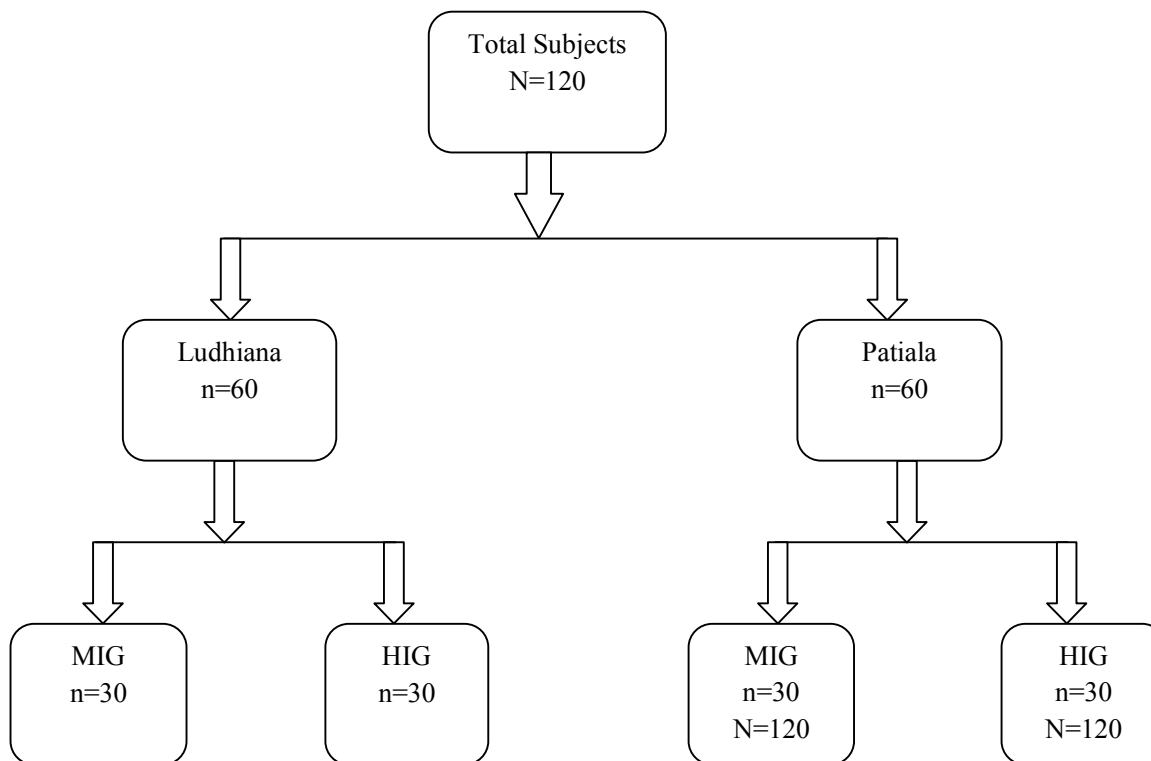


Fig. 1. Selection of subjects

### 3. RESULTS AND DISCUSSION

#### 3.1 General Information

As evident from Table 1, the age of majority of the respondents of both cities belonging to MIG as well as HIG ranged between 35-45 years. Gender distribution showed that 90% of the MIG respondents and 86.7% of HIG respondents were females. Majority of the respondents were married (95% and 91.7% of MIG and HIG respectively). In both income group from both the cities 50% of the selected respondents were found to be graduates while 45% of the HIG respondents and 36.7% of the MIG respondents were educated up to a postgraduate level indicating the good educational level of the respondents. Majority of the respondents in both cities from both the income groups were Hindus/Sikhs, while only 1.7% in both the income groups belonged to other religions. Majority of the selected respondents i.e. 78.3% in MIG and 71.7% in HIG belonged to the nuclear family.

All the respondents in the HIG had their own houses compared to 75% of MIG. It was found out that 71.7% of the respondents in MIG were working as against 90% of the respondents in HIG.

#### 3.2 Food Habits

As indicated in Table 2 regarding food habits of the selected respondents, it was found out that 30% of the respondents in MIG and 23.3% in HIG belonged to non vegetarian category. Majority of the selected subjects i.e. 68.3% in MIG and 76.7% in HIG were vegetarians.

#### 3.3 Frequency of Purchase of Organic Foods

As shown in Table 3 majority of the respondents in middle income group of both cities were familiar with organic foods i.e. 96.7 and 93.33% in Ludhiana and Patiala cities, respectively. Similarly, in high income group, all the respondents (100%) were familiar with organic foods. A higher number(96.7%) of the respondents in middle income group in Ludhiana city were purchasing organic foods while in Patiala city the value was 83.3%.The observed difference was not statistically significant ( $p \leq 0.05$ ). Similar results were also found in the high income group in both cities.

When the respondents were asked about frequency of purchasing organic foods it was

found out that 23.3% in the middle group in both cities purchased organic foods at least once a month. Those who purchased organic foods at least once a week in middle income group of both cities were 20.0 and 16.7%, respectively. There was a significant difference ( $p \leq 0.05$ ) in the number of respondents who never purchased organic foods in middle income group of both cities. The values being 3.3 and 16.7% in Ludhiana and Patiala city respectively. However, the corresponding values in high income group of both cities was 3.3 and 10% respectively, so it can be concluded that the respondents in upper income group were purchasing organic foods more.

#### 3.4 Practice of Kitchen Gardening

The data regarding practice of kitchen gardening indicated that it was practiced more among the HIG (63.3%) as compared to MIG (43.3%). Forty five percent (45%) of the respondents in HIG reported that the available land for kitchen garden could fulfill their daily requirement of the vegetables while in MIG a lesser number (25%) responded the same (Table 4). The reason for this difference might be that the HIG respondents had more space in their houses available for kitchen gardens while MIG respondents had comparatively smaller size houses and therefore, lesser space could be used for kitchen gardening. Very few respondents in MIG (13.3%) and HIG (5%) agreed that they were spraying some kind of pesticides in their kitchen gardens.

Among the middle-income group in both cities, 51.6% of the respondents have been purchasing organic foods since last 3 years as against 55 % of the respondents in high income group (Fig. 2). The number of respondents who have been purchasing organic foods since last 2 years was higher in upper income group (30%) of both cities when compared to the middle income group (26.7%). According to Chandrashekar [9] more (30%) respondents were purchasing organic products since last 3 years while 25 and 19% were have been purchasing them since the last two and one year, respectively.

According to majority of the respondents the reason of purchasing organic foods was that they were healthier/ nutritious (Table 5). Some respondents in MIG (23.3%) and HIG (25%) reported that the reason for buying organic foods was that they were safer and not contaminated. The taste was also found to be one of the

**Table 1. General profile of the selected respondents (N=120)**

		MIG			HIG		
		Ludhiana (n=30)	Patiala (n=30)	Total (n=60)	Ludhiana (n=30)	Patiala (n=30)	Total (n=60)
Age	35-45	18 (60.0)	23 (76.7)	41 (68.3)	16 (53.3)	19 (63.3)	35 (58.3)
	>45	12 (40.0)	7 (23.3)	19 (31.7)	14 (46.7)	11 (18.3)	25 (41.7)
Gender	Female	26 (86.7)	28 (93.3)	54 (90.0)	26 (86.7)	26 (86.7)	52 (86.7)
	Male	4 (13.3)	2 (6.7)	6 (10.0)	4 (13.3)	4 (13.3)	8 (13.3)
Marital Status	Married	28 (93.3)	29 (96.7)	57 (95.0)	27 (90.0)	28 (93.3)	55 (91.7)
	Unmarried	2 (6.7)	1 (3.3)	3 (5.0)	3 (10.0)	2 (6.7)	5 (8.3)
Education	Primary	1 (3.3)	0 (0.0)	1 (1.7)	0 (0.0)	0 (0.0)	0 (0.0)
	High school	5 (16.7)	2 (6.7)	7 (11.7)	2 (6.7)	0 (0.0)	2 (3.3)
	Graduate	15 (50.0)	15 (50.0)	30 (50.0)	18 (60.0)	12 (40.0)	30 (50.0)
	Post graduate	9 (30.0)	13 (43.3)	22 (36.7)	10 (33.3)	17 (56.7)	27 (45.0)
Religion	Hindu	18 (60.0)	13 (43.3)	31 (51.7)	14 (46.7)	13 (43.3)	27 (45.0)
	Sikh	11 (36.7)	17 (56.7)	28 (46.7)	16 (53.3)	16 (53.3)	32 (53.3)
	Others	1 (3.3)	0 (0.0)	1 (1.7)	0 (0.0)	1 (3.3)	1 (1.7)
Type of family	Joint	7 (23.3)	6 (20.0)	13 (21.7)	4 (20.0)	10 (33.3)	14 (23.3)
	Nuclear	23 (76.7)	24 (80.0)	47 (78.3)	26 (80.0)	20 (66.7)	46 (76.7)
Type of residence	Owned	18 (60.0)	27 (90.0)	45 (75.0)	30 (100.0)	30 (100.0)	60 (100.0)
	On rent	12 (40.0)	3 (10.0)	15 (25.0)	0 (0.0)	0 (0.0)	0 (0.0)
Occupation	Working	22 (73.3)	21 (70.0)	43 (71.7)	28 (93.3)	26 (86.7)	54 (90.0)
	Non- working	8 (26.7)	9 (30.0)	17 (28.3)	2 (6.7)	4 (13.3)	6 (10.0)
Total monthly income	50,000-1,00,000	30 (100)	30 (100)	60 (100)	0 (0.0)	0 (0.0)	0 (0.0)
	>1,00,000	0 (0.0)	0 (0.0)	0 (0.0)	30 (100)	30 (100)	60 (100)

*Figures in parenthesis indicate %age***Table 2. Food habits of the middle and high-income group respondents in selected cities (N=120)**

Food habits	MIG			HIG		
	Ludhiana (n=30)	Patiala (n=30)	Total (n=60)	Ludhiana (n=30)	Patiala (n=30)	Total (n=60)
Non-vegetarian	12(40.0)	6(20.0)	18(30.0)	7(23.3)	7(23.3)	14(23.3)
Ova- lacto vegetarian	1(3.33)	0(0.0)	1(1.7)	0(0.0)	0(0.0)	0(0.0)
Vegetarian	17(56.7)	24(80.0)	41(68.3)	23(76.7)	23(76.7)	46(76.7)

*Figures in parenthesis indicate %age*

**Table 3. Frequency of purchase of organic foods in middle and high income group of selected cities (N=120)**

	MIG				HIG			
	Ludhiana (n=30)	Patiala (n=30)	z-value	Total (n=60)	Ludhiana (n=30)	Patiala (n=30)	z-value	Total (n=60)
Familiarity with organic food	29(96.7)	28(93.3)	0.59	57(95)	30(100)	30(100)	NA	60(100)
Purchase of organic foods	29(96.7)	25(83.3)	1.72	54(90)	28(93.3)	27(90)	0.22	55(91.6)
<b>Frequency of purchasing organic foods</b>								
At least once/week	6(20)	5(16.7)	0.33	11(18.3)	13(43.3)	10(33.3)	0.31	23(38.3)
At least once/month	7(23.3)	7(23.3)	0.00	14(23.3)	10(33.3)	8(26.7)	0.24	18(30)
Once half a year	16(53.3)	13(43.3)	0.61	29(48.3)	6(20)	9(30)	0.33	15(25)
Never	1(3.3)	5(16.7)	2.01*	6(10)	1(3.3)	3(10)	0.30	4(6.7)

Figures in parenthesis indicate %age

\*Significant at 5% level

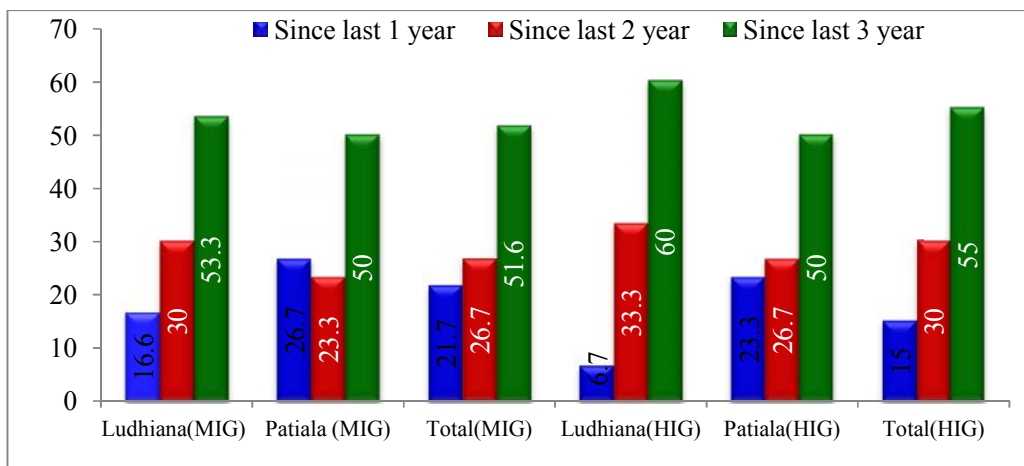
**Table 4. Practice of kitchen gardening in middle and high income group of selected cities (N=120)**

Kitchen gardening	MIG				HIG			
	Ludhiana (n=30)	Patiala (n=30)	z- value	Total (n=60)	Ludhiana (n=30)	Patiala (n=30)	z- value	Total (n=60)
Practice of kitchen gardening	11(36.7)	15(50)	0.52	26(43.3)	16(53.3)	22(73.3)	1.61	38(63.3)
Land fulfill your requirements	8(26.7)	7(23.3)	0.30	15(25)	12(40.0)	15(50.0)	1.35	27(45)
Spray of pesticides	6(20)	2(6.7)	1.52	8(13.3)	1(3.3)	2(6.7)	0.59	3(5.0)

Figures in parenthesis indicate %age

**Table 5. Reasons for purchase of organic foods among middle and high-income group of selected cities (N=120)**

Reasons for purchase	MIG (n=60)				HIG (n=60)			
	Ludhiana	Patiala	z-value	Total	Ludhiana	Patiala	z- value	Total
Healthier	8(26.7)	7(23.3)	0.21	15(25)	12(40)	13(43.3)	0.25	25(41.7)
Safer/not contaminated	7(23.3)	7(23.3)	0.00	14(23.3)	8(26.7)	7(23.3)	0.21	15(25)
Tasty	6(20)	7(23.3)	0.22	13(21.7)	5(16.7)	6(20)	0.23	11(18.3)
Readily available	5(16.7)	4(13.3)	0.25	9(15)	3(10)	3(10)	0.00	6(10)
Environment friendly	3(10)	3(10)	0.00	3(10)	2(6.7)	1(3.3)	0.20	3(5)
No specific reason	1(3.3)	2(6.7)	0.23	3(5)	0(0)	0(0)	0.0	0(0)



**Fig. 2. Duration of consumption of organic foods in middle and high-income group of selected cities**

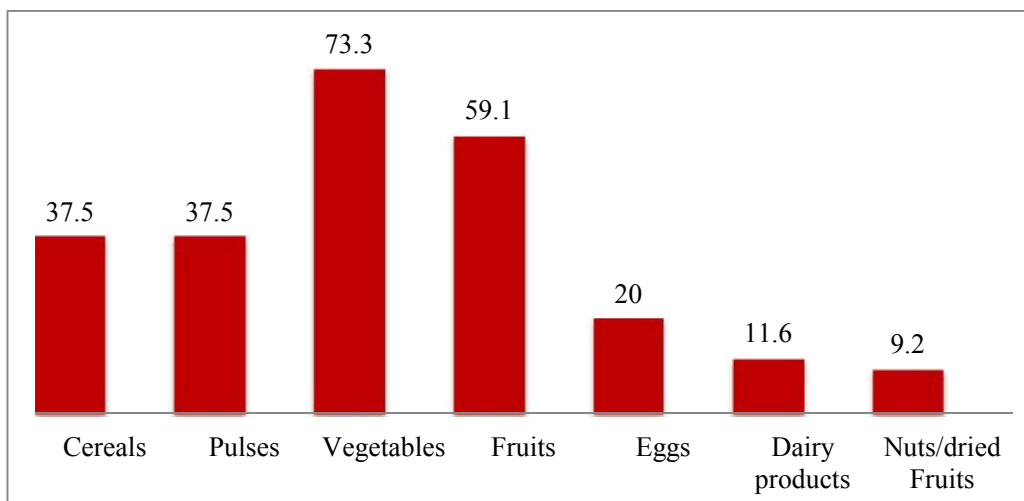
reasons for the purchase of organic foods. Ergin and Ozsacmaci [10] also reported that majority of the Turkish consumers found health to be the major factor for the purchase of organic foods (65.1%) followed by 'more natural', taste and that they do not contain preservatives.

### 3.5 Preferred Organic Foods

Among the various food groups the most preferred organic foods was found to be vegetables (73.3%), followed by fruits( 59.1%), cereals (37.5%) , pulses (37.5%), eggs (20%) dairy and its products (11.6 %) and nuts/ dry fruits (9.2%) [Fig. 2]. Similarly, in studies conducted by Ergin and Ozsacmaci [10] and

Omar et al. [11] the most preferred organic foods were found to be fruits and vegetables.

As evident Fig 3, supermarkets were found to be the main source for purchase of organic foods in both cities among all the respondents because 100% of the respondents preferred to purchase organic foods from supermarkets. The number of respondents from both income groups in Ludhiana city who preferred kitchen garden as a source of organic foods was lesser when compared to the respondents in Patiala city. Mukherjee [12] had also reported that fifty % of respondents purchased organic foods from the stores specialised in organic foods.



**Fig. 3. Rate of preference of organic foods by the respondents**

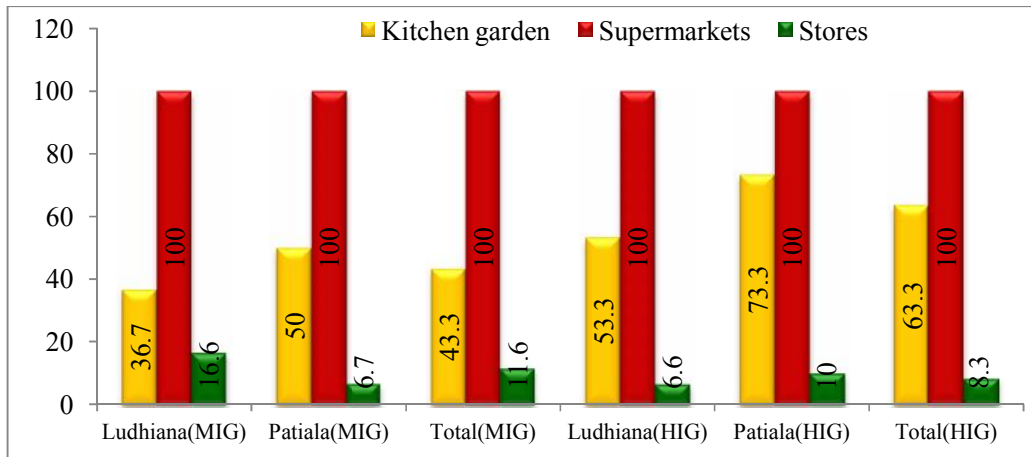


Fig. 4. Preferred source of organic foods among middle and high-income groups in selected cities

### 3.6 Source of Authentication of Organic Foods

As shown in Table 6, in middle income group, 43.3% of the respondents farmed their organic foods as against 63.3% in HIG. The difference was statistically significant ( $p \leq 0.05$ ). In HIG, 41.7% of respondents were buying from the farmers who practice organic farming. Fifteen percent (15%) of the respondents in MIG and 38.3% respondents in HIG purchased organic foods from specific shops. Other method of procurement among both groups were 'purchasing specific brands' followed by checking labels.

### 3.7 Ranking of Organic Foods

The selected respondents were asked to rank the organic foods in comparison to conventional foods according to their own perception whether they found them very good, good, fair or same as

conventional foods and results are presented in Fig. 5.

The Fig. 4 shows that 41.7% respondents in HIG and 31.7% respondents in MIG highly preferred organic foods when compared to conventional foods in all aspects. The 33.3% of respondents of HIG and 28.3% respondents in MIG moderately preferred. Remaining 13.3% respondents from MIG and 8.3% in HIG preferred slightly organic foods. Chandrashekar [9] had reported that in Mysore city majority of the respondents i.e. 66% found organic foods as very good followed by 18% of respondents who found them as good.

The respondents in middle income group spent only 8.75% of their total money on organic fruits and vegetables. However, high income group respondents spent 14.7% of their total money on organic fruits and vegetables (Table 7). The difference was statistically significant ( $p \leq 0.05$ ).

Table 6. Source of procurement of organic foods among the middle and high income groups in selected cities (N=120)

S. No.	Procurement method	MIG (n=60)	HIG (n=60)	z- value
1.	Practicing own organic farming	26(43.3)	38(63.3)	2.20*
2.	Buying from specific farmers who practice organic farming	20(33.3)	25(41.7)	1.66
3.	Purchasing from specific shops that are known to sell organic food products	15(25)	23(38.3)	1.57
4.	Purchasing specific brands known to be organic	12(20)	30(50)	3.45**
5.	Checking labels	12(20)	17(28.3)	1.47

Figures in parenthesis indicate %age

\*Significant at 5% level

\*\* Significant at 1% level



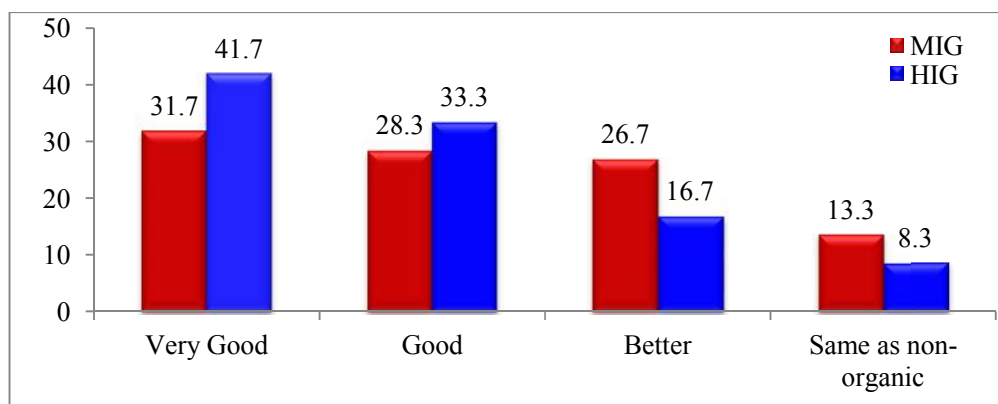


Fig. 5. Ranking of organic foods by respondents

Table 7. Total monthly expenditure on fruits and vegetables by the middle and high income groups in selected cities (N=120)

Income group	Total expenditure on fruits and vegetables(Rs.)	Total expenditure on organic fruits and vegetables(Rs.)	% expenditure on organic fruits and vegetables	z-value
MIG	Range	3000-5000	300-400	8.75
	Mean	4000	350	
HIG	Range	7000-10,000	1000-1500	14.7
	Mean	8500	1250	

\*Significant at 5% level

There was a non-significant ( $p \leq 0.05$ ) difference in the purchase of organic foods by the respondents in both income groups when they were cheaper when compared to conventional foods (Fig 6). In middle income group, lesser number (28.3%) compared to 45% in the high-income group preferred to purchase organic foods when they were costing a quarter higher than conventional foods. A significantly higher ( $p \leq 0.01$ ) number of respondents from upper

income group in both t cities purchased organic foods even if they were priced 50% higher than the conventional foods. Chandrashekar [9] had reported that in Mysore city only 5% of the respondents were ready to purchase organic foods when they were costing comparatively 80% higher than conventional products and 18% were ready to purchase when cost was 0-20% higher.

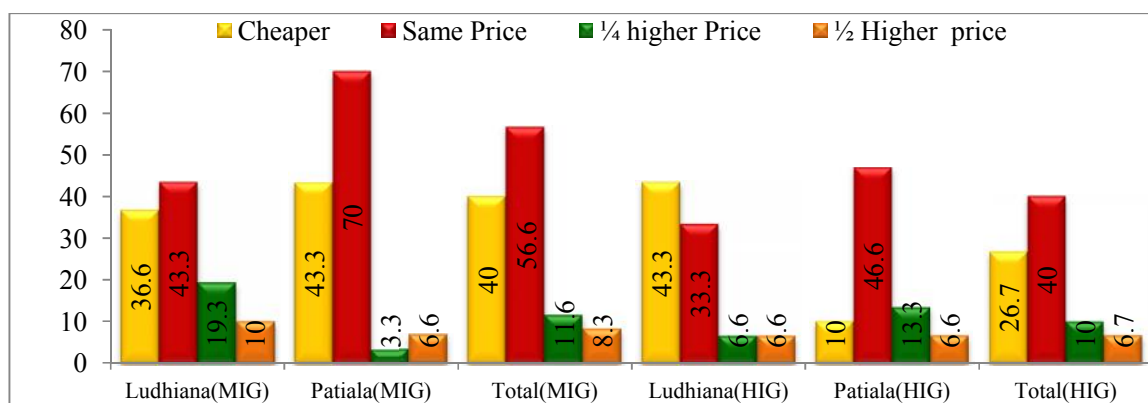


Fig. 6. Cost factor in purchase of organic foods among middle and high income groups in selected cities

**Table 8. Barriers to purchase of organic foods among the middle and high income groups in selected cities (N=120)**

Factors	MIG (n=60)	HIG(n=60)	z-value	Total(N=120)
Cost	10(16.7)	8(13.3)	0.52	18(15)
Appearance and taste	8(13.3)	7(11.7)	0.26	15(12.5)
Shelf life	5(8.3)	12(20)	1.84	17(14.1)
Availability	12(20)	11(18.3)	0.24	23(19.1)
Accessibility to market	10(16.7)	9(15)	0.25	19(15.8)
Less information available	8(13.3)	7(11.7)	0.26	15(12.5)
Trust to production and origin	7(11.7)	6(10)	0.30	13(10.8)

Figures in parenthesis indicate %age

**Table 9. Correlation coefficients (r) of purchase of organic foods and KAP score with other factors**

Factor I	Age	Education	Income
Purchase of organic foods	0.11 <sup>NS</sup>	0.15*	0.18*
Monthly expenditure on organic foods	0.02 <sup>NS</sup>	0.12 <sup>NS</sup>	0.25**
Practice of kitchen gardening	0.04	0.09	0.17*

\*. Correlation is significant at the 0.05 level (2-tailed)

\*\* . Correlation is significant at the 0.01 level (1-tailed)

NS. Non-significant

### 3.8 Cost Factor in Purchase of Organic Foods

As evident from the literature cost factor is one of the major factor for purchase of organic foods. In the present study it was found that majority of the respondents from middle and high-income group (93.3% and 90%, respectively) preferred to purchase organic foods when they were priced same as conventional foods.

As depicted in Table 8 in MIG, accessibility to market was the major factor that prevented the respondents from purchasing organics foods whereas in HIG shelf life was a major barrier. For 13.3% respondents in MIG and 11.7% respondents in HIG, taste was the barrier hindering organic foods purchase. Lack of information was another barrier for 13.3% respondents in MIG and 11.7% respondents in HIG. Mishra and Kaushik [13] reported that major barriers in purchase of organic foods were low access to market followed by unavailability and lack of media information.

### 3.9 Correlations between Various Factors and Purchase of Organic Foods

As depicted in Table 9, purchase of organic food had a positive but non-significant relation with age. However, a positive significant correlation ( $p \leq 0.05$ ) was observed with education and income, indicating that with the increase in

education and income frequency of purchase of organic foods also increases. Omar et al. 2016 had reported that purchase intention towards organic foods and the level of income had a positive but insignificant relationship. Similarly, the monthly expenditure on organic foods had a positive but non-significant relation with age and education but it has a positive and significant ( $p \leq 0.01$ ) correlation with income. As a result, it can be concluded that as the income of the consumers increases the money spent on organic foods also increases. The practice of kitchen gardening had a positive (though not significant) correlation with age and education as well as a significant correlation with income, indicating that with the increase in income the practice of kitchen gardening also increases.

## 4. CONCLUSIONS

It can be concluded that the major reason for the preference of organic foods over the conventional foods was that they were perceived as healthier and safer. However, their cost, availability, accessibility to market, trust to production and origin were found to be the most dominant barriers. The purchase of organic foods had a positively significant co-relation ( $p \leq 0.05$ ) with education and income. Similarly, the monthly expenditure on organic foods and practice of kitchen gardening had a positive and significant ( $p \leq 0.01$ ) correlation with income.

It can be recommended that consumers will be more interested in purchasing organic foods if they are provided with more information, product choice, timely availability and affordable prices. The data obtained through the present study can be used by policy makers in organic farming at the regional level.

### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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