

# Food safety and quality : A factor analysis approach to consumer perception

■ R. DHIVYA

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## ABSTRACT

Developing countries are paying increased attention to food safety, because of growing recognition of its potential impact on public health, food security, and trade competitiveness. The study focuses on the consumer preferences and perception of food safety and quality with regard to fruits and vegetables and their willingness to pay extra for certified fruits and vegetables. The survey was undertaken in the Coimbatore district of Tamil Nadu State, India during October 2011 – January 2012 covering randomly selected 150 rural and 150 urban households. Vast majority of the urban respondents (47.33%) opined that food safety and quality certifications, grading, packing and labeling and certification of fruits and vegetables were important. While only 21 per cent of the rural respondents considered food safety and quality certification to be important. Freshness and texture were the most important attributes considered by the urban and rural respondents for assessing the quality of fruits and vegetables. Kruskal-Wallis test also confirmed that there was no difference between the urban and rural respondents in choosing the attributes for assessing quality of fruits and vegetables. Consumer perception on food safety and quality when analyzed through factor analysis approach yielded four factors viz., ‘perception on quality’, ‘perception on safety’, ‘sensory perception’ and ‘evaluation based on external appearance’. The rural consumers were not willing to pay extra for graded, packed, labeled and certified fruits and vegetables whereas 46 and 39 per cent of the urban consumers were willing to pay extra for fresh cut and packed and certified fruits and vegetables, respectively. Though the rural and urban consumers did not differ in their choice of attributes for assessing quality of the fruits and vegetables, they did differ on the willingness to pay for minimally processed, graded and branded fruits and vegetables.

**KEY WORDS :** Consumer preference, Consumer perception, Food safety, Quality

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Economic growth, urbanization, modern lifestyles, and globalization have led to a profound change in consumers’ preference from staples towards high-value agricultural products. Rising health consciousness and environmental concerns have bundled nutrition, safety and quality of food and the way the food has been farmed or produced, processed and transported into the decision of consumers to buy or not to buy and how much they might be willing to pay for a food item. This trend has emerged in developed countries and is now increasingly common in

growing urban areas of developing and transitional countries (Pingali, 2007).

### Changing consumer preferences and consumption pattern:

On a global note, there were indications of partial shifts from staple foods towards vegetable oils and sugar in low and lower-middle income countries; towards vegetable oils, sugar and meat in upper-middle income countries, and towards vegetable oils and meat in higher income countries. The relative availability of fruit and vegetables has only increased slightly in most countries and is still well below the recommended level in both developed and the developing countries (FAO/WHO, 2004).

The shift in Asian diet is characterized by increased consumption of temperate fruits and vegetables (Pingali,

### AUTHOR FOR CORRESPONDENCE

R. DHIVYA, Department of Agricultural and Rural Management, Tamil Nadu Agricultural University, COIMBATORE (T.N.) INDIA  
Email: dhivya\_rajaram@yahoo.co.in

2007). Many studies illustrated the emerging food consumption patterns in India (Chatterjee *et al.*, 2006; Bansil, 1999; Rao, 1998; Kumar, 1998; Kumar and Mathur, 1996, Radhakrishna and Ravi, 1992). They noted that there has been a clear shift in recent decades from the grain consumption to non-grain food and animal products consumption.

High and middle-income consumers tend to purchase more packaged fresh produce in the supermarkets rather than raw commodities in the traditional fresh markets (Pingali, 2007). Likewise, an increasing emphasis on quality and safety attributes can create social benefits; grading and standards systems could reduce the negative externalities of poor quality and unsafe food products. Minimally processed fresh fruits and vegetables have become popular, particularly among better educated consumers, young consumers and working women who have less time for preparing food, especially in large cities (Kanlayanarat and McGlasson, 2003).

Alongside the rising middle class in India steering the changes in consumption patterns and driving up demand for quality food, there is a large section of the population dwelling below the poverty line.

#### **Concern about food safety and quality and others factors affecting purchase:**

The role of fresh fruits and vegetables in nutrition and healthy diet is well recognized and in recent years, many countries have undertaken various initiatives to encourage consumers to eat more of these products. Contamination of fresh produce is of special concern, because such produce is likely to be consumed raw posing a potential food safety problem (Sehgal, 2008).

Safety concerns have come to the fore and the dominant modes of competition in many agricultural and food markets are increasingly based around quality. As fruits and vegetables are perishable and susceptible to contamination, the major concern is likely to be related to safety aspects. Pesticide residues and microbial contamination are important hazards in fresh produce (Unnevehr, 2000).

Minimally processed vegetables, which are raw products that are simply trimmed, peeled, sliced/shredded, washed and / or disinfected, are generally considered safe to be eaten by consumers, since their surfaces have been composed mainly of microorganisms that are not of human health significance. Developing countries are paying increased attention to food safety, because of growing recognition of its potential impact on public health, food security, and trade competitiveness (Ryan *et al.*, 2007).

But, there is a need to know what factors is affecting consumer purchase behavior and how much is the demand in short and long run. Therefore, the present study is an exhaustive attempt to analyze the changing consumption pattern for major vegetables among Indian households, in

both the rural and urban areas.

The consumer's decision to purchase begins when the consumer wants something, as clearly explained by Walters (1978). Need recognition occurs when the consumer perceives a complex set of stimuli. The consumer will then start searching for information and solutions to satisfy the need, either internally or externally. An internal search is the knowledge from memory or experience, while an external search is the information collected from others like friends, family and social class members.

#### **Problem focus:**

The global and the national consumption patterns ..... *et al.*, 1995; Bansil, 1999; Bhalla *et al.*, 1999; Rao, 1998; Kumar, 1998; Kumar and Mathur, 1997; Radhakrishna and Ravi, 1992) in consumption of fruits and vegetables. The increasing income levels, urbanization, changing food habits, health consciousness, increasing exposures due to growing educational importance, etc., influenced the consumers' buying behaviour and the consumption pattern towards fresh fruits and vegetables.

Because vegetable consumption in India is growing and is highly income elastic (Mittal, 2006) it can be assumed that there is also an increasing effective demand for safe, uniform, and high quality vegetables in India. For instance, consumer demand for safe vegetables was found to be highly income elastic in urban areas of Vietnam (Mergenthaler *et al.*, 2009). The demand increase directly explains the willingness to pay for safe and quality fresh fruits and vegetables. Consumers concern and awareness of food quality have undoubtedly been fuelled by large increases in real per capita income, development of technology and medicine, as well as food safety scares of recent years (Xia and Zheng, 2005).

Wholesome information pertaining to consumer behaviour towards fresh fruits and vegetables is not easily available. If available, it would be a great source of information to meet out the needs and preferences of changing consumption pattern. In this regard, this study is designed to analyze the trends in the consumption pattern, consumer perception of food safety and quality towards fruits and vegetables and their preferences. The study focuses on the following research objectives:

- To analyze the consumer preferences towards food safety and quality,
- To analyze the consumer perception on food safety and quality aspects,
- To assess the consumers' willingness to pay for safe and quality fresh fruits and vegetables.

#### **METHODOLOGY**

A total of 300 households (150 rural and 150 urban) were covered in Coimbatore district of Tamil Nadu state in India.

These households were randomly selected. The sample size was significant enough for the statistical analysis chosen. The data were collected during October 2011-January 2012. The respondents were contacted in person with a comprehensive pre-tested interview schedule and data were collected from them. The questionnaire was detailed under the sub-heads namely, demographic characteristics of the households, expenditure pattern, purchase behaviour of fruits and vegetables, perception towards food safety and quality and willingness to pay more for value additions. The analysis of the data included descriptive statistics, Kruskal Wallis one way analysis of variance, Garrett's ranking technique and factor analysis.

### ANALYSIS AND DISCUSSION

The findings of the present study as well as relevant discussion have been presented under following heads :

#### Sample profile:

Among the respondents, the major share of respondents from urban areas (60.67%) and 72.00 per cent from rural areas were the female respondents. Major share of urban respondents (50.00%) and 42.00 per cent of rural respondents were in 31-40 years of age category. In case of urban areas, majority of the respondents (42.00%) had completed their graduation. Whereas, in the rural areas almost an equal share of respondents had High School (27.33 %) education and graduate level (26.00%) of education.

About 69 per cent of the sample households had a family size of 2-4 members in the urban area. The major

share of rural sample households (78%) had a family size of 5-7 members. Major share of the urban (50.67%) and rural respondents (62%) were influenced by their family members for purchase of safe and quality fresh fruits and vegetables. Friends had an influence on 41.33 per cent of the urban respondents and it was 34 per cent in the rural area.

#### Association between income and place of purchase:

Income has its own influence in choosing the place of purchase for fruits and vegetables. It is important to study the association between income levels and place of purchase. The households of different annual income categories invariably preferred to buy from weekly markets and farmers shandy in case of rural areas. The sample households in the urban area also preferred to purchase from weekly markets. They were preferring farmers' shandy and nearest grocery stores equally for purchase of fruits and vegetables. The reason for this was that the sample households preferred to buy farm fresh produce that could be bought directly from the farmers which would possess a higher shelf-life than the ones bought from the supermarkets. The Chi-square analysis indicated that there was no significant difference between income class and place of purchase in rural and urban areas (Table 1 and 2).

The prices of fruits and vegetables in weekly markets and farmers shandy are relatively less than the other stores and the produce are also relatively fresh. Besides, one could observe that there was no difference in display or food safety and quality aspects between these two store formats and supermarkets and exclusive fruits and vegetables stores. Only few exotic fruits

**Table 1: Association between income and place of purchase – rural**

Annual income (in Rs.)	Place of purchase						Total
	Street hawkers	Nearest grocery store	Supermarkets	Exclusive fruits and vegetables store	Weekly markets	Farmers shandy	
< 90000	2	3	0	0	19	11	35
90000 - 200000	2	2	0	1	19	8	32
200000 - 500000	1	1	1	2	16	7	28
500000-1000000	1	1	1	1	16	6	26
>1000000	0	0	2	2	20	5	29
Total	6	7	4	6	90	37	150

Calculated  $\chi^2$  value = 13.3; Table  $\chi^2$  value= 31.41; d(f)= 20

**Table 2: Association between income and place of purchase – urban**

Annual income (in Rs.)	Place of purchase						Total
	Street hawkers	Nearest grocery store	Supermarkets	Exclusive fruits and vegetables store	Weekly markets	Farmers shandy	
< 90000	2	5	1	1	15	5	29
90000 - 200000	1	4	1	2	13	5	26
200000 - 500000	1	4	3	4	10	7	29
500000-1000000	1	3	3	3	12	7	29
>1000000	0	2	4	4	13	14	37
Total	5	18	12	14	63	38	150

and vegetables were available in addition in supermarkets and exclusive fruits and vegetables stores. Hence, the households in all the income groups preferred to purchase fruits and vegetables in weekly markets and farmers' shandy.

Coimbatore is listed under the B class cities in India. A study conducted by NABARD (2011) has stated that B class consumers spend about 84 per cent of their monthly fruits and vegetables expenditure at unorganized retail outlets. The most preferred places of purchase were daily wet markets, street vendors and the closest vegetable shops. This substantiates the preference of the urban consumers choosing to purchase from weekly markets, farmers' shandy and nearby grocery stores similar to that of the rural consumers.

### Consumer preferences and willingness to pay more for value additions:

Organically certified, packed and labeled produce have entered the domestic fresh produce market and are gaining momentum. Educational levels, occupational status and the influence of income might have created awareness among the sample households towards their preferences for minimally processed (cut vegetables) and value added

(graded, packed and certified) fruits and vegetables and food safety and quality of fresh produce.

About 47 per cent of urban respondents felt that food safety and quality certifications were an important aspect whereas the 71.33 per cent rural respondents were neutral in their decision. As far the organic certification, it was felt important by 16.67 per cent of the urban while 68 per cent of the rural expressed a neutral condition. Half of the urban respondents (50.00%) and about 75 per cent of rural respondents were neutral in their decisions towards branding. The response of 28.67 per cent urban households regarding grading and packing were towards "important" whereas the rural households (36%) were towards "neutral" (Table 3 and 4).

Table 5 and 6 clearly state that about 29 per cent of urban and 45.33 per cent of rural respondents were indecisive with regard to safety aspect of fresh cut produce. A similar answer was observed from 26.67 per cent of urban and 58 per cent of rural respondents for exotic fruits and vegetables. More than half of the rural respondents were indecisive towards the pre-packed produce but 34.67 per cent of urban respondents were in favour that the pre-packed produce was safe. However, it was different with respect to organically

**Table 3 : Certification, packaging and labeling - Rural**

Statements	HI	I	N	UI	HUI
Food safety and quality certification	12 (8.00)	31(20.67)	107 (71.33)	0 (0.00)	0 (0.00)
Organic certification	19 (12.67)	29 (19.33)	102 (68.00)	0 (0.00)	0 (0.00)
Branding of fruits and vegetables	0 (0.00)	0 (0.00)	112 (74.67)	25(16.67)	13 (8.67)
Grading, packaging and labeling	19 (12.67)	29 (19.33)	54 (36.00)	18 (12.00)	30 (20.00)

HI – Highly Important, I-important, N-Neutral, UI-Un-important, HUI – Highly Un-important (Figures in the parentheses represent percentage to total)

**Table 4 : Certification, packaging and labeling - Urban**

Statements	HI	I	N	UI	HUI
Food safety and quality certification	21(14.00)	71(47.33)	36(24.00)	22(14.67)	0(0.00)
Organic certification	41(27.33)	66(44.00)	25(16.67)	18(12.00)	0(0.00)
Branding of fruits and vegetables	0(0.00)	16(10.67)	75(50.00)	44(29.33)	15(10.00)
Grading, packaging and labeling	39(26.00)	43(28.67)	29(19.33)	25(16.67)	14(9.33)

HI – Highly Important, I-Important, N-Neutral, UI-Un-important, HUI – Highly Un-important (Figures in the parentheses represent percentage to total)

**Table 5 : Fresh cut, exotic, pre-packed and organic fruits and vegetables - Rural**

Statements	HS	S	ID	US	HUS
Fresh cut fruits and vegetables	10 (6.67)	27 (18.00)	68 (45.33)	26(17.33)	19(12.67)
Exotic fruits and vegetables	0 (0.00)	0 (0.00)	87(58.00)	39(26.00)	24(16.00)
Pre-packed fruits and vegetables	21(14.00)	26 (17.33)	83(55.33)	20(13.33)	0(0.00)
Organic fruits and vegetables	36(24.00)	76 (50.67)	38(25.33)	0(0.00)	0(0.00)

HS – Highly safe, S-Safe, ID-Indecisive, US-Unsafe, HUS – Highly unsafe (Figures in the parentheses represent percentage to total)

**Table 6 : Fresh cut, exotic, pre-packed and organic fruits and vegetables - Urban**

Statements	HS	S	ID	US	HUS
Fresh cut fruits and vegetables	22(14.67)	38(25.33)	43(28.67)	35(23.33)	12(8.00)
Exotic fruits and vegetables	31(20.67)	37(24.67)	40(26.67)	27(18.00)	15(10.00)
Pre-packed fruits and vegetables	39(26.00)	52(34.67)	28(18.67)	25(16.67)	6(4.00)
Organic fruits and vegetables	58(38.67)	66(44.00)	26(17.33)	0(0.00)	0(0.00)

HS – Highly safe, S-Safe, ID-Indecisive, US-Unsafe, HUS – Highly unsafe (Figures in the parentheses represent percentage to total)

certified produce, where 44 per cent of urban and 50.67 per cent of rural respondents felt they were safe.

It could be concluded that major share of households in urban areas opined that food safety and quality certification, organic certification and grading, packing and labeling of produce were important and pre-packed produce and organic fruits and vegetables were safe. This reflects the positive attitudes towards these products. The supermarkets and exclusive fruits and vegetables store can concentrate on providing these product types at an affordable price. The rural areas had less awareness towards value additions when compared to urban areas. Also the availability of the value added products were relatively less than the urban areas. These were the reasons for the sample households to stay neutral in their responses towards value additions. But the preferences might change if the awareness and availability levels increased in the near future.

Ali and Kapoor (2008) also stated that with the emergence of organized food retailing, the perception of consumers towards sorted, graded and packaged fruits and vegetables is significantly changing in a positive direction. Labeling, packaging and certifications were least preferred by the consumers of B class city.

**Understanding consumer perception towards food safety and quality:**

The previous section revealed the sample respondents' view towards value additions and safety and quality of the fresh fruits and vegetables. To further understand the consumers' perception towards safety and quality of fruits and vegetables, a set of 23 statements was designed based on a review of the literature, the core importance being given to the visual factors (de Jonge *et al.*, 2008; Miles and Frewer, 2001). The items were analyzed using a five point scale from 'strongly agree' to 'strongly disagree'. An exploratory factor analysis was performed to reduce the 23 statements by grouping them.

From the result of factor analysis of consumer perception towards food safety and quality, four factors were grouped. The identified factors were, (i) perception on quality with four statements loaded under it, (ii) perception on safety with five statements grouped under it, (iii) sensory perception with six statements and (iv) evaluation based on external appearance with eight statements grouped under it and the results are presented in Table 7.

Cronbach's  $\alpha$  co-efficient is used to measure the internal consistency of each variable of the identified

**Table 7 : Statements on consumer understanding of food safety and quality**

Statement No.	Statements	Factor loading	Name of the factor
1.	Freshness indicates the quality and safety of fresh fruits and vegetables	0.928	Perception on quality
2.	Fruits and vegetables with good quality are high in nutritional value	0.886	
3.	Safe and quality fresh fruits and vegetables eliminate health risks	0.801	
4.	The invisible chemical residues and microbes on the fruits and vegetables brings down the quality and safety of fresh fruits and vegetables	0.836	Perception on safety
5.	Ripening methods at retailer affect the quality and safety	0.756	
6.	Fruits and vegetables borne illnesses raise the importance on food safety and quality	0.786	
7.	The safety of fresh fruits and vegetables is highly associated with the handling practices and chemical residues	0.812	
8.	Looking for damage on fresh fruits and vegetables due to handling, packaging and presence of foreign matters are a part of food safety considerations	0.853	
9.	Food safety awareness has imposed the practice of purchase of fresh fruits and vegetables sold under hygienic conditions	0.901	Sensory perception
10.	Cuts and bruises on fruits and vegetables affect quality and safety	0.824	
11.	Visual appearance alone is the predominant factor in the purchase of fresh fruits and vegetables	0.721	
12.	Cuts and bruises will lead to faster decay of fruits and vegetables	0.796	
13.	Edible coating on fruits and vegetables affects safety and quality	0.686	
14.	Fermented/ any disagreeable odour indicates the deteriorated fruits and vegetables	0.728	
15.	Soft portions on certain fruits and vegetables indicate deterioration of safety and quality	0.812	
16.	Insect damage on fruits and vegetables reduces safety and quality	0.756	
17.	Small sized vegetables and fruits are not of good quality	0.601	Evaluation based on external appearance
18.	Any coloured material on top of fruits and vegetables indicate poor quality	0.634	
19.	Fruits and vegetables clean of debris are safe and of good quality	0.723	
20.	Crisp leaves expresses the quality and safety of leafy vegetables	0.765	
21.	Uneven green colouration on fruits and vegetables indicate reduced quality of fruits and vegetables	0.811	
22.	Dry skin and browning indicate deteriorated quality of fruits and vegetables	0.798	
23.	Presence of nodules reduce the quality of fruits and vegetables	0.823	

construct. The reliability of the construct is acceptable if Cronbach's  $\alpha$  exceeds 0.70 (Hair *et al.*, 1998). In order to measure the internal reliability of each factor, Cronbach's alpha, was also calculated for each statement. Cronbach's alphas of all factors of the construct were more than 0.7 which showed that this construct has achieved the high reliability. The value of skewness was less than 2 and kurtosis was less than 7 which meant that the data were normal confirming the normality assumption (Curran *et al.*, 1996).

The Eigen values were examined and all four factors with an Eigen value greater than one were kept for further examination. The factor loadings explain the correlation of each variable with the respective factors. Factors were created from groups of statements that had a factor loading over 0.5.

#### Willingness to pay more for value additions:

New innovation in fruits and vegetables marketing has come up in the kind of value additions. Such marketing activities need the willingness of the consumers to pay more for the new value additions. Hence, it was endeavored to assess the willingness to pay more for value additions like food safety certifications, organic fruits and vegetables, grading, packing and labeling, organic certifications, fresh cut, packed and labeled fruits and vegetables.

About 32 per cent of the urban respondents were not willing to pay extra for graded, packed and labeled fruits and vegetables although there were similar amount of respondents (28.67%) who were willing to pay an extra 5 per cent. More than half of the urban subjects were not willing to pay extra for graded, packed, labeled and certified produce with 21.33 per cent who were willing to pay an extra 5 per cent. Nearly

46 per cent were willing to pay an extra 5 per cent and 25.33 per cent of respondents were willing to pay extra 5-10 per cent for fresh cut and packed produce whereas 47.33 per cent were not willing to pay extra for fresh cut, packed and labeled. Seventy one per cent of the urban samples were not willing to pay extra for graded, packed, labeled and organically certified (Tables 8 and 9).

In the rural responses almost all the categories received an answer of unwillingness to pay extra. There were also people who were willing to pay an extra 5 per cent (12.67 %) for graded and packed produce. Also there were 20 per cent of the rural respondents who were willing to pay an additional 5 per cent for organically certified produce.

With the rising income levels, efforts may be taken to educate the consumers on the advantages of value additions. The increased awareness, accessibility and affordability could increase the willingness of the consumers to pay more. The consumers were willing to pay an extra six per cent for safely produced vegetables and additional 13 per cent for certified vegetables. The major reasons quoted by the respondents for the willingness to pay were that organic vegetables are good for health, they guarantee safety and the consumers can rely on the produce, they are free from chemicals and have a better taste (NABARD, 2011).

#### Conclusion:

The research was framed to analyze the consumer preferences and their perception towards food safety and quality. The households of different income categories preferred to buy from weekly markets and farmers shandy both in cases of rural and urban areas. Vast majority of the urban respondents felt that food safety and quality

**Table 8 : Willingness to pay more – Rural**

Statements	Willingness to pay				Not willing to pay extra
	Up to 5%	5% – 10%	10% - 15%	> 15%	
Graded, packed and labeled	19 (12.67)	12 (8.00)	0 (0.00)	0 (0.00)	119 (79.33)
Graded, packed, labeled and certified	21 (14.00)	15 (10.00)	6 (4.00)	0 (0.00)	108 (72.00)
Fresh cut and packed	10 (6.67)	6 (4.00)	0 (0.00)	0 (0.00)	134 (89.33)
Fresh cut, packed and labeled	5 (3.33)	0 (0.00)	0 (0.00)	0 (0.00)	145 (96.67)
Organically certified	30 (20.00)	18 (12.00)	4 (2.67)	0 (0.00)	98 (65.33)
Graded, packed, labeled and organically certified	11 (7.33)	0 (0.00)	0 (0.00)	0 (0.00)	139 (92.67)

Figures in the parentheses represent percentage to total

**Table 9 : Willingness to pay more – Urban**

Statements	Willingness to pay				Not willing to pay extra
	Up to 5%	5% – 10%	10% - 15%	> 15%	
Graded, packed and labeled	43(28.67)	35(23.33)	24(16.00)	0(0.00)	48(32.00)
Graded, packed, labeled and certified	32(21.33)	23(15.33)	10(6.67)	6(4.00)	79(52.67)
Fresh cut and packed	69(46.00)	38(25.33)	16(10.67)	8(5.33)	19(12.67)
Fresh cut, packed and labeled	38(25.33)	26(17.33)	10(6.67)	5(3.33)	71(47.33)
Organically certified	59(39.33)	34(22.67)	19(12.67)	10(6.67)	28(18.67)
Graded, packed, labeled and organically certified	19(12.67)	14(9.33)	10(6.67)	0(0.00)	107(71.33)

(Figures in the parentheses represent percentage to total)

certifications, grading, packing and labeling and organic certification of fruits and vegetables were important while the rural respondents were neutral towards these aspects. The rural respondents were indecisive towards the safety of fresh cut, pre-packed and exotic fruits and vegetables whereas the urban respondents felt that pre-packed and organic certified fruits and vegetables were safe. The consumer perception on food safety and quality assessed using 23 statements. Four factors namely, perception on quality, perception on safety, sensory perception and evaluation based on external appearance were formed. The consumers perceived the quality as freshness, nutritive value, and health risks associated with chemical residues. The consumers' sensory perception was based on the cuts and bruises, edible coatings, odours and soft external portions. They also perceived that insect damage, crisp leaves, uneven green colouration and dry skin as safety and quality influencing the attributes.

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