



Food Risk Perceptions of Women in Rural and Urban Households- A Study in India

**Swetha Boddula¹, Vemula R Sudershan¹, Balakrishna Nagalla¹,
Snehasree Saha¹ and Subba Rao M Gavaravarapu^{1*}**

¹National Institute of Nutrition, Jamai Osmania PO, Hyderabad – 500 007, AP, India.

Authors' contributions

This work was carried out in collaboration between all authors. Author SB developed the study protocol, obtained necessary clearances, collected data and carried out the study. Author VRS helped in fine tuning the protocol, preparation of the questionnaire and interpreting the data. Author BN provided statistical assistance and helped in data analyses. Author SS helped in manuscript writing. Author SRMG contributed to the development of study protocol and supervised the study and prepared the manuscript. All authors read and approved the final manuscript.

Short Research Article

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ABSTRACT

Aims: The current study attempted to examine risk perceptions related to safety of various commonly consumed foods and perceived health hazards associated with such risk perceptions among home food preparers.

Study Design: A cross-sectional study in urban and rural areas. Study locations were selected purposively but the participants were recruited using stratified random sampling technique.

Place and Duration of the Study: This study was conducted in Hyderabad, capital city of the state of Andhra Pradesh in South India and Kothapally Village in Karimnagar District for urban and rural population respectively. The study period was 4 months.

Methodology: Considering size and geographical spread, Hyderabad was divided into 3 natural zones and the village was considered as only one zone. From each zone, 30 households were selected (@ 10 each from lower, middle and upper economic strata in order to capture variations in perceptions, if any), making the total sample 120 with 90 from urban and 30 from rural locations respectively. Women, who were directly involved in food preparation were interviewed using a pre-tested, pre-coded questionnaire.

Results: This study revealed that infestation and adulteration were perceived as major

*Corresponding author: Email: gmsubbarao@yahoo.com;

risks in cereals and pulses. Majority of respondents perceived pesticide residues as risks in vegetables and fruits. About 83% perceived swarming of flies and mosquitoes as the only risk for uncooked non-vegetarian foods like meat and fish. Perceived risks were also linked with food-borne diseases by many of the respondents. We did not find any significant co-relation between income, education or habitat and perceptions related to food risk perception.

Conclusions: This study gives an overview of perceived risks related to commonly consumed foods. These results provide cues and set direction for further research to explore if perceived risks match with actual risks or not.

Keywords: Risk perception; food risks; health hazards; food safety.

1. INTRODUCTION

Food safety deals with ensuring safety in handling, preparation, manufacture and storage of food in order to prevent any harm to health of the consumer. However, consumer perceptions about food safety risk can greatly impact their food choices and consumption. Risk perceptions represent a person's views about the risk inherent in a particular situation. Perceptions about food safety risk are what the individuals believe would be the amount of health risk, if any, they would face from consuming a food product [1]. The perceptions of safety and/or quality of food are based on two dimensions – objective and subjective. Objective dimension strictly refers to physical properties of food, whereas subjective dimension is often the perceived safety/quality of food. Objective quality of food is often based on technical aspects, but subjective quality is often associated with physiological aspects like the perception of risk of selected foods [2]. Food choices are more often influenced by psychological factors including interpretation of product properties and/or risks than the physical properties of products themselves [3]. Therefore, perceptions of risks, especially among home food preparers play a vital role in food choices not just of themselves but also for the entire household. Studies in different countries have tried to explore risk perceptions as a concern for food choice among food preparers and handlers, and a majority of them indeed found food preparers are more concerned regarding the risks from food [3-8]. Habitat and socio-economic status were found to be determinants of food risk perceptions.

In the Indian context, in as many as in 90% of households, it is women who are involved in food preparation [9], but there has been hardly any effort to study their perceptions about food risks, which may in turn affect their food selection vis-à-vis the dietary patterns of the members in the family. In other countries, issues of food risk perception have been considered in formulating important policy agendas [10]. The scenario in India is however different. Although a few nation-wide surveys have attempted to understand the profile of food intakes, food safety knowledge, attitudes and practices, 'risk perceptions' have been largely ignored [9,11-12]. Understanding perceptions of food preparers in India, where centuries-old traditions on one hand and changes brought by globalization on other hand co-exist can be a herculean task. Added to these, the ongoing debate over introduction of new technologies like genetic modification of foods in the country has generated a lot of media attention, public protest by activist groups and resulted in regulatory moratorium [13].

Given this context, we attempted a preliminary study in a Southern state of India with two main objectives - to examine the risk perceptions on food safety issues among households and to understand the perceived health hazards associated with such risk perceptions.

2. METHODOLOGY

2.1 Study Design

It was a cross sectional study in urban and rural areas. Study locations were selected purposively but the participants were recruited using stratified random sampling technique.

2.2 Study Location

The study was conducted in both rural and urban areas in the South Indian state of Andhra Pradesh. Urban population was taken from city of Hyderabad, Andhra Pradesh and rural population was taken from village Kothapally, Jammikunta Mandal in Karimnagar District.

2.3 Subjects

Women of the households, who were engaged in procuring, cooking and serving foods, were the participants in the study.

2.4 Sample

Considering size and geographical spread, Hyderabad was divided into 3 natural zones and the village was considered as only one zone. From each zone, 30 households were randomly selected (@ 10 each from lower, middle and upper economic strata as per NFHS [14] categorization in order to capture variations in perceptions), making the total sample 120 with 90 from urban and 30 from rural locations respectively. Women, who were directly involved in food preparation were interviewed using a pre-tested, pre-coded questionnaire.

2.5 Research Tools

A pre-coded, closed-ended questionnaire was prepared and pre-tested before using it for data collection. The following are the steps involved in development of questionnaire:

2.5.1 Questionnaire development

The questionnaire was developed after a literature review on perceptions on food safety issues. List of commonly consumed foods was collected from the Report of the National Nutrition Monitoring Bureau (NNMB) [11]. There were 2 sections in the questionnaire. They are as follows:

- i. The first part of the questionnaire had questions to elicit socio-demographic details of the respondents. These included name, education, occupation of the respondent and head of the household; general information about the family, religion, caste and the type of house, household assets and drinking water source.
- ii. The second part contained two broad questions. The first question was designed to elicit information on the perceived risk pertaining to each of the commonly consumed food groups. It was a closed ended question depicting the possible perceived risks like pesticide residues, additives, adulteration (addition/substitution of unwanted/wanted item in food), infestation (being invaded by pests or parasites) and microbial contamination (contamination by pathogens), which were derived from thorough review against each food item. The question required the respondents to

rate their risk perception on a three point scale (High risk, medium risk or low risk) or if they did not have any specific perception, they had an option to indicate as 'don't know'. There was yet another column 'remarks', wherein the interviewer would note down subjective perceptions related to the health hazards because of the perceived risks. The next question was about the genetically modified foods and it aimed to assess the perceptions of the respondents about the GM foods. It was an open ended question.

2.5.2 Pre-testing

The questionnaire was pre-tested among 10 women each from randomly chosen households from urban and slum areas of Secunderabad area of the Greater Hyderabad City. Certain changes were made in some of the questions to make them more understandable.

2.6 Ethical Clearance

The study protocol was approved by the Institutional Review Committee of National Institute of Nutrition, Hyderabad, India (Ref: 06/11/M.Sc./13).

2.7 Data Collection

2.7.1 Questionnaire administration

Before administering the questionnaire, written informed consent was taken from the participants. The questionnaire was administered in interview mode.

2.7.2 Data entry

Total 120 households were part of this study. Data from questionnaires were entered into an excel sheet for statistical analysis.

2.8 Statistical Analysis

Statistical analysis was carried out to give descriptive statistics. Chi-square test was conducted to see the associations between education, income and perceived risks of different food groups.

3. RESULTS

3.1 Respondents Profile

The total number of households covered for this study was 120, with 30 from rural and 90 from urban. Over 15% of the respondents were illiterate. About 41.5% of the respondents had studied up to grade X (secondary education) while 12.4% had only primary education (i.e., only up to grade V) and 30.7% studied up to University level. Although a majority (86.3%) of the respondents was homemakers, a fifth of them in rural areas were working as labourers. The details of demographic profile of the respondents are given in Table 1.

Table 1. Socio-demographic profile of the respondents (n = 120)

Parameter	Respondents - Rural (n=30)	Respondents-Urban (n=90)	Total (n=120)
Education			
Illiterate	6 (20%)	12 (13.3%)	18 (15%)
Primary	9 (30%)	6 (6.7%)	15 (12.4%)
Secondary	14 (46.7%)	36 (40%)	50 (41.5%)
University	1 (3.3%)	36 (40%)	37 (30.7%)
Occupation			
Homemaker	22 (73.3%)	82 (91.1%)	104 (86.3%)
Labourer	6 (20%)	0	6 (5%)
Cultivator	1(3.3%)	0	1(0.8%)
Artisans	0	1 (1.1%)	1 (0.8%)
Business	0	3 (3.3%)	3 (2.5%)
Private Service	0	2 (2.2%)	2 (1.6%)
Government Service	1 (3.3%)	2 (2.2%)	3 (2.5%)
Religion			
Hindu	29 (96.7%)	79 (87.8%)	108 (90%)
Muslim	1 (3.3%)	7 (7.8%)	8 (6.7%)
Christian	0	3 (3.3%)	3 (2.5%)
Others	0	1 (1.1%)	1 (0.8%)
Type of family			
Joint	9 (30%)	33 (36.7%)	42 (35%)
Nuclear	21 (70%)	56 (62.3%)	77 (64%)
Extended	0	1 (1.1%)	1 (0.8%)
Type of house			
Pucca	15 (50%)	68 (75.6%)	83 (69%)
Semi pucca	11 (36.7%)	20 (22.2%)	31 (26%)
Kutcha	4 (13.3%)	2 (2.2%)	6 (5%)
Household assets			
Fan	30 (100%)	90 (100%)	120 (100%)
T.V.	28 (93.3%)	82 (91.1%)	110 (91.3%)
Radio	4 (13.3%)	32 (35.6%)	36 (30%)
Clock	30 (100%)	89 (98.9%)	119 (99.2%)
Pressure cooker	26 (86.7%)	86 (95.6%)	112 (93%)
Sewing machine	8 (26.7%)	28 (31.1%)	36 (30%)
Bicycle	24 (80%)	24 (26.7%)	48 (40%)
Motor cycle	11 (36.7%)	61 (67.8%)	72 (60%)
Tractor	1 (3.3%)	7 (7.8%)	8 (6.6%)
Refrigerator	12 (40%)	72 (80%)	84 (70%)
Telephone	29 (96.7%)	89 (98.9%)	118 (98%)
Ration card	30 (100%)	83 (92.2%)	113 (94%)
Source of drinking water			
Tap	28 (93.3%)	90 (100%)	118 (98%)
Hand pump	1 (3.3%)	0	1 (0.8%)
Open well	1 (3.3%)	0	1 (0.8%)

Joint family – A household having two or more married couples with or without their married children

Nuclear family – A household having a married couple and their unmarried children

Extended family – A household having a married couple, with or without their unmarried children and their unmarried or widowed brothers or sisters, father and mother

Pucca house – High-quality materials throughout including roof, walls and floor

Semi-pucca – Partly low-quality, partly high-quality materials

Kutcha – Made from mud, thatch and other low-quality material

3.2 Risk Perceptions Pertaining to Each Food Group

3.2.1 Cereals

Although insect infestation and adulteration were considered as the main risks in case of cereals like rice, wheat and jowar (sorghum), relatively fewer respondents in rural areas were worried about these than their urban counterparts. From the subjective responses provided to the open-ended questions, we inferred that adulteration and infestation were considered not only a financial loss to the consumers (themselves) but also could lead to nutrient losses and would result in diarrhoea, vomiting, stomach pain and fever.

3.2.2 Pulses

About 55.8% of the respondents perceived adulteration as the major risk and infestation is the medium risk for red gram *dal* (split pulse), whereas, 53.3% perceived adulteration as the major risk in green gram *dal*. For, black gram *dal*, over a half of the respondents perceived adulteration as the high risk. When compared to the rural areas, significantly lower proportion of respondents perceived adulteration as risk in case of pulses. The perceived health hazards because of adulteration and infestation of the pulses were reported to be flatulence, diarrhea, and fever.

3.2.3 Vegetables

Almost all the respondents perceived infestation as high risk in case of many vegetables like brinjal (egg plant) (98.3%), ladies finger (100%), cabbage (95%), tomatoes (100%). Over 70% of the respondents considered pesticide residues as the next major risk for all the vegetables. The respondents felt that the possible health hazards that could arise due to insect infested vegetables were ulcers, diarrhea, fever and vomiting.

3.2.4 Roots and Tubers

Over 84% of the respondents perceived infestation as the high risk and about 12.5% of the respondents perceived pesticide residues as a medium risk for onions and potatoes. They were considered as risks by a higher proportion of rural respondents than their urban counterparts.

3.2.5 Green Leafy Vegetables (GLVs)

Even in case of GLVs, infestation was viewed as a risk by almost all the respondents and in addition, almost an equal number (95.8%) perceived pesticide residues are the medium risk for spinach, fenugreek and amaranth leaves. There were minor differences in perceptions related to pesticide residues among urban and rural respondents with a slightly lesser proportion of rural respondents considering pesticide residues in GLVs. Qualitative information from open-ended questions indicated that diarrhoea, vomiting and fever were considered as possible hazards from the infested green leafy vegetables while stomach ache was considered as the major risk from pesticide residues.

3.2.6 Fruits

Although many of the respondents perceived infestation as a possible risk from some of the commonly consumed fruits, a higher proportion of them were worried about the chemicals

used for artificial ripening of bananas/mangoes, pesticides used on grapes and wax used to make apples look shiny. Chemical residues and artificial ripeners were perceived to be the food risks by a significantly higher proportion of urban respondents than their rural counterparts. The perceived health hazards from fruits affected by these risks were vomiting, diarrhea, heat boils on the skin and cough with sputum.

3.2.7 Milk

Over 95% of respondents in both rural and urban areas perceived adulteration as the only major risk in case of milk. Vomiting and nausea were perceived as the health hazards due to consumption of adulterated milk.

3.2.8 Non-vegetarian foods

Only about 64% of the respondents who were non-vegetarians responded to the questions on perceived risks in non-vegetarian foods and most of them selected the option "others" and explained that microbial contamination due to swarming flies and mosquito as the major potential risk. In their subjective perceptions, they explained that flies and mosquitoes could carry disease causing germs/bacteria which might contaminate the non-vegetarian preparations.

3.2.9 Spices

Since red chilli pepper and tamarind are almost ubiquitously used in south Indian households, when we assessed perceptions of the food preparers about these spices, it was observed that over 90% of them about 92.5% of the respondents perceived adulteration as high risk and infestation as medium risk from red chilli powder. 89.2% of the respondents in both rural and urban areas perceived infestation and adulteration as the main risks and similar was the case with tamarind. Qualitative data revealed that the respondents felt consumption of adulterated red chilli powder would result in stomach ulcers, acidity and diarrhea. As regards adulterated tamarind, they felt the health hazard would manifest as stomach ache.

3.2.10 Cooking oils

About 99.2% of the respondents' perceived adulteration is the only major risk in oil. Cardio vascular problems were perceived as greater health hazards from the adulterated oils.

3.2.11 Sugar

Adulteration is perceived as high risk in sugar by 55% of the respondents. In rural areas, significantly higher proportion of respondents perceived adulteration as the risk than their urban counterparts. Although they did not perceive any major health problems with adulteration of the sugar they felt consumption of such sugar would lead to dental problems and loss of taste.

3.2.12 Genetically modified foods

To a question that attempted to assess risk perceptions on GM foods, it was observed that most of them (96.7%) were not even aware of such foods, therefore there were no specific risk perceptions related to them.

Table 2. Risk perceptions of women pertaining to different food groups

Food Group	Perceived risks	Rural (n=30)	Urban (n=90)	Total (n=120)
I. Cereals				
Rice	Infestation	22 (73.3%)	79 (87.8%)	101 (84.2%)
	Adulteration*	21 (70.0%)	79 (87.8%)	100 (83.3%)
Jowar	Infestation*	7 (23.3%)	27 (30.0%)	34 (28.3%)
	Adulteration*	6 (20.0%)	27 (30.0%)	33 (27.5%)
Wheat	Infestation	24 (80.0%)	71 (78.9%)	95 (79.2%)
	Adulteration	22 (73.3%)	71 (78.9%)	93 (77.5%)
II. Pulses				
Red gram <i>dal</i>	Adulteration*	20 (66.7%)	47 (52.2%)	67 (55.8%)
	Infestation	20 (66.7%)	47 (52.2%)	67 (55.8%)
Green gram <i>dal</i> (split pulse)	Adulteration*	18 (60.0%)	46 (51.0%)	64 (53.3%)
	Infestation	18 (60.0%)	46 (51.0%)	64 (53.3%)
Black gram <i>dal</i>	Adulteration*	18 (60.0%)	47 (52.2%)	65 (54.2%)
	Infestation	18 (60.0%)	47 (52.2%)	65 (54.2%)
III. Vegetables – A				
Green chillies	Infestation	30 (100%)	88 (97.8%)	118 (97.8%)
	Pesticide residues	20 (67.7%)	66 (73.3%)	86 (71.7%)
Brinjal (eggplant)	Infestation	30 (100%)	88 (97.8%)	118 (98.3%)
	Pesticide residues	23 (76.7%)	71 (78.9%)	94 (78.3%)
Ladies finger	Infestation	30 (100%)	90 (100%)	120 (100%)
	Pesticide residues	22 (73.3%)	71 (78.9%)	93 (77.5%)
Cabbage	Infestation *	27 (90.0%)	87 (96.7%)	114 (95.0%)
	Pesticide residues*	21 (70.0%)	70 (77.8%)	91 (75.8%)
Tomato	Infestation	30 (100%)	90 (100%)	120 (100%)
	Pesticide residues	24 (80.0%)	71 (78.9%)	95 (79.2%)
IV. Vegetables- B				
Onion	Infestation*	29 (96.7%)	72 (80%)	101 (84.2%)
	Pesticide residues*	13 (43.3%)	2 (2.2%)	15 (12.5%)
Potato	Infestation*	30 (100%)	77 (85.6%)	107 (89.2%)
	Pesticide residues*	13 (43.3%)	2 (2.2%)	15 (12.5%)
V. Green leafy vegetables				
Spinach	Infestation	30 (100%)	90 (100%)	120 (100%)
	Pesticide residues	30 (100%)	85 (94.4%)	115 (95.8%)
Amaranth	Infestation*	27 (90%)	85 (94.4%)	117 (97.5%)
	Pesticide residues*	27 (90%)	85 (94.4%)	112 (93.3%)
Fenugreek	Infestation	30 (100%)	90 (100%)	120 (100%)
	Pesticide residues	30 (100%)	85 (94.4%)	115(95.8%)
VI. FRUITS				
Banana	Infestation*	21 (70%)	49 (54.4%)	70 (58.3%)
	Chemicals *	12 (40%)	60 (75.6%)	80 (66.7%)
Mango	Chemicals	29 (67.7%)	81 (90%)	110 (91.7%)
	Infestation	17 (56.7%)	51 (56.7%)	68 (56.7%)
Grapes	Pesticide residues	29 (96.7%)	82 (91.1%)	111 (92.5%)
	Infestation	18 (60.0%)	51 (56.7%)	69 (57.5%)
Apple	Chemicals	28 (93.3%)	81 (90.0%)	109 (90.8%)
	Infestation	13 (43.3%)	54 (60.0%)	67 (57.8%)
VII. Milk	Adulteration	29 (96.7%)	85 (94.4%)	114 (95.5%)
VII. Non veg				
Egg	Microbial contamination	24 (80.0%)	57 (63.3%)	81 (67.5%)
Chicken	Microbial contamination	24 (80.0%)	54 (60.7%)	78 (65.5%)
Mutton	Microbial contamination	20 (66.7%)	53 (58.9%)	73 (60.8%)
Fish	Microbial contamination	18 (60.0%)	52 (57.8%)	70 (58.3%)
IX. Spices				
Red chilli powder	Adulteration	29 (96.7%)	82 (91.1%)	111 (92.5%)
	Infestation	29 (96.7%)	82 (91.1%)	111 (92.5%)
Tamarind	Infestation	28 (93.3%)	79 (87.8%)	107 (89.2%)
	Adulteration	26 (86.7%)	77 (85.6%)	113 (85.8%)
X. Oil	Adulteration	30 (100%)	89 (98.9%)	119 (99.2%)
XI. Sugar	Adulteration*	30 (100%)	36 (40.0%)	66 (55.0%)

* P value is <0.005

4. DISCUSSION

In the context that food safety has become an important public health concern in India and given the scenario that most Indians consume home prepared foods, many food safety risks are likely to stem from the practices and perceptions of home food preparers [15]. Any attempts to manage food-related risks and to devise risk communication strategies therefore need to be based not only on scientific risk assessments but also on assessment of the perception of risk among them [16]. To our knowledge, this is the only study that looked in to food risk perceptions of home food preparers in India, the only earlier study on food risk perceptions pertained to BT Brinjal and was carried out not among food preparers but farmers [13].

The knowledge and awareness of the possible hazards shapes the risks perceptions of the people. In the current study, we realized that the participants recognized diarrhoea as a symptom of food infestation or adulteration, this observation notably contradicts the findings of a nation-wide Knowledge, Attitudes, Beliefs and Practices (KABP) study on food safety, carried out in 2006, among Indian households, wherein about 54.2% of study participants did not even know diarrhoea as a symptom of food-borne illness [9]. The difference in perceptions in the current study with those reported earlier could be attributed to the fact that the KABP Study was carried out only among rural women, while the current study, though limited by its sample, had both rural and urban respondents. It was also earlier reported adulteration is not generally thought of as a problem and most people remain indifferent even to deliberate adulteration [15]. Adulteration was perceived as greater risk in milk, oil, red chilli powder and sugar. Most of them (over 80%), suggested that red chilli powder is often adulterated with brick powder and/or colours. It was informed that sugar is adulterated with *suji* (semolina). These results were in tune with the findings of some earlier studies conducted among women of Hyderabad and South India, in which women reported these foods as frequently adulterated and listed similar adulterants [9,17-18]. The perceptions about adulteration in the foods listed above are not completely unfounded and they in fact match with reality in India, where in as many as 11% of all foods sold in India are estimated to be adulterated [19]. And some of the foods like milk, oil, chilli powder and semolina are listed as foods highly prone for adulteration by the Food Safety and Standards Authority of India (FSSAI) [20].

This study findings also revealed that the respondents were concerned about artificial ripening of fruits. These could be due to the media coverage about artificial ripening of mangoes in summer, when this study was conducted. This observation is in line with that of Solvic (1987) [21] which says 'hazards tend to come from news media'. This also proves that perception is shaped more by what is felt and heard than known. Thus, microbial contamination which was often unknown to participants got reported as presence of germs, as that is how they are depicted in advertisements.

Effect of food infestation and adulteration is considered to result in health loss, time loss, lifestyle loss, and taste loss by current study population which is in agreement with a study conducted in 2001 by Yeung and Morris among Europeans [22].

In this study, no correlation was observed between income and food risk perception; education and food risk perception; or risk perceptions of rural and urban people excepting some food groups. The results are different compared to findings from earlier studies [23-24]. As Fischhoff [25] and Gavaravarapu et al. [15] argue, theoretical perspectives and risk

perceptions developed in western, industrialized nations may not account for the very different socio-economic and cultural realities in India.

In this study, we also tried to find out not only about their risk perceptions but also the basic awareness of genetically modified foods. It was observed that 96.7% of the respondents (rural and urban) do not even know what GM foods are and hence they did not perceive any specific risk or health hazard from them. In this context, it is pertinent to say that public protest by activist groups or regulatory moratorium imposed on them did not seem to affect the awareness of perception of women.

4.1 Study Limitations

This study was formative in nature with limited sample size constraining the generalizability of results. This study only attempted to categorize perception against food category but did not enquire the effect of such perception on food choice or any prevention measure taken by women in the households to avoid health threat. This study was conducted in interview mode with only one investigator administering the questionnaire, which minimized chances for investigator bias. However, results should be triangulated with qualitative studies and reliability of the questionnaire should be established.

5. CONCLUSION

This study provided an overview of food risk perceptions in a section of women and their perceptions of risk greatly varied by food groups. Infestation and adulteration were perceived as the greater risks in cereals and pulses, infestation and pesticide residues were perceived as major risks in vegetables; while chemicals and pesticide residues were perceived risks in fruits. Almost all of the respondents were not aware of GM foods, hence there were no major risks perceived from these foods.

Although this study tried to explore the perceived food risks and associated health hazards, the scope of the current study did not entail us to explore how these perceptions were formed. Studies using mixed methods of qualitative and quantitative research techniques can help explore the linkages between risk perceptions and the factors that shape them. Despite its limitations and limited generalizability, the study throws light on some important risks that people associate with each category of food; therefore food safety education efforts should address these issues. Moreover, if any of the perceptions are not rational, then appropriate risk communication strategies should be evolved.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Schroeder TC, Tonsor GT, Pennings JM, Mintert J. Consumer food safety risk perceptions and attitudes: Impacts on beef consumption across countries. *The BE Journal of Economic Analysis & Policy*. 2007;7(1). Available at: <http://www.bepress.com/bejeap/vol7/iss1/art65>. Accessed on 06/05/2014
2. Grunert KG. Food quality and safety: Consumer perception and demand. *European Review of Agricultural Economics*. 2005;32(3):369-391.
3. Rozin P, Pelchat ML, Fallon AE. Psychological factors influencing food choice. *The Food Consumer*. 1986;5:85-106.
4. Siegrist M. Perception of gene technology, and food risks: Results of a survey in Switzerland. *Journal of Risk Research*. 2003;6(1):45-60.
5. Knight A, Warland R. The relationship between sociodemographics and concern about food safety issues. *Journal of Consumer Affairs*. 2004;38(1):107-120.
6. Nayga Jr RM. Sociodemographic influences on consumer concern for food safety: The case of irradiation, antibiotics, hormones and pesticides. *Review of Agricultural Economics*. 1996;467-475.
7. Dosman DM, Adamowicz WI, Hrudehy SE. Socioeconomic determinants of health-and food safety-related risk perceptions. *Risk Analysis*. 2001;21(2):307-318.
8. Frewer I. Risk perception, social trust and public participation in strategic decision making: Implications for emerging technologies. *Ambio*. 1999;569-574.
9. Polasa K, Sudershan RV, Subbarao GM, Rao MVV, Rao P, Sivakumar B. KABP study on food and drug safety in India-a report food and drug toxicology research centre. National Institute of Nutrition (NIN) Hyderabad; 2006.
10. Commission of European Communities. White paper on food safety. Com 719 final, 12 January, 2000. Brussels: Commission of European Communities; 1999.
11. National Nutrition Monitoring Bureau (NNMB). Diet and nutritional status of population and prevalence of hypertension among adults in rural areas. Hyderabad: NNMB; 2006. Available:<http://nnmbindia.org/nnmbreport06nov20.pdf>. Accessed on- 10/01/2014
12. National Nutrition Monitoring Bureau. Diet and nutritional status of rural population, prevalence of hypertension and diabetes among adults and infants and young child feeding practices. Hyderabad NNMB; 2012. Available:http://nnmbindia.org/1_nnmb_third_repeat_rural_survey_technical_report_26.pdf. Accessed on- 11 January 2014.
13. Chong M. Perception of the risks and benefits of Bt eggplant by Indian farmers. *Journal of Risk Research*. 2005;8(7-8):617-634.
14. International Institute for Population Sciences (IIPS) and ORC Macro. National Family Health Survey (NFHS-2), 1998–99: India. Mumbai: IIPS; 2000.
15. Gavaravarapu SM, Smith KC, Rimal RN. A case for refining the WHO global strategy on food safety: perspectives from India. *The Lancet Global Health*. 2013;1(5):254-255.
16. Kirk SFL, Greenwood DC, Cade JE, Pearman AD. Public perception of a range of potential food risks in the United Kingdom. *Appetite*, 2002;38(3):189-197.
17. SubbaRao GM, Sudershan RV, Rao P, Vishnu Vardhana Rao M, Polasa K. Food safety knowledge, attitudes and practices of mothers-findings from focus group studies in South India. *Appetite*. 2007;49(2):441-449.
18. Sudershan RV, Rao P, Polasa K. Food safety research in India: A review. *Asian Journal of Food and Agro-industry*. 2009;2(3):412-433.
19. Ministry of Health and Family Welfare. Annual report on working of Prevention of Food Adulteration Act, 1954 for the year 2002. New Delhi: Government of India; 2004.

20. Food Safety and Standards Authority of India (FSSAI). Quick tests for some adulterants in food – Instructional manual-1. New Delhi: FSSAI; 2012. Available: [http://www.fssai.gov.in/Portals/0/Pdf/Final test manual part I\(16-08-2012\).pdf](http://www.fssai.gov.in/Portals/0/Pdf/Final_test_manual_part_I(16-08-2012).pdf) (Accessed on 19th May 2014)
21. Slovic P. Perception of risk. *Science*. 1987;236(4799):280-285.
22. Morris YR. Food safety risk: Consumer perception and purchase behaviour. *British Food Journal*. 2001;103(3):170-187.
23. Lobb AE, Mazzocchi M, Traill WB. Modelling risk perception and trust in food safety information within the theory of planned behaviour. *Food quality and preference*. 2007;18(2):384-395.
24. Angulo AM, Gil JM. Risk perception and consumer willingness to pay for certified beef in Spain. *Food Quality and Preference*. 2007;18(8):1106-1117.
25. Fischhof B. Public values in risk research. *The Annals of the American Academy of Political and Social Science*. 1996;75-84.

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