Tianjin Consumer Study: With Special Attention to Food Safety

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1 INTRODUCTION

The study was carried out within the framework of a project titled *'Strengthening Research and Extension on Sustainable Vegetable Production and Marketing in Tianjin'*. This project was conducted between 2000-2002 by Wageningen University and Research Centre, in co-operation with their Chinese counterpart Tianjin Academy of Agricultural Sciences and together with a number of Dutch companies. During the implementation of this project, the consumer's awareness over food safety became very apparent to us. At the same time, the government of Tianjin Municipality was heavily promoting a pollution-free vegetable programme aiming at safer food. The purpose of this study was to gain insight into the consumer's knowledge and awareness over food safety, in order to be able to advise private sectors and suggest governmental policies. At the same time, we wanted to analyse consumer awareness of newly introduced Dutch vegetable varieties in the markets, namely mini-cucumbers, cherry tomatoes, coloured sweet peppers, and long oval-shaped eggplants.

Figure 2.1 Location of Tianjin in China

2 FOOD SAFETY: AN EMERGING CONTEMPORARY ISSUE

Food safety, together with globalisation and technological revolution, is one of the key emerging issues in food policy research (Pinstrup-Andersen, 1999). After the break out of a series of food-borne pathogens, such as E.Coli, BSE, and Salmonella in the 1980s, consumer confidence in food came to an all-time low. As a result, a group of researchers began to focus on consumer perception of food safety and their willingness to pay for safe foods. (Henson and North. 2000; Latouche, et al. 1998; Nayga, 1996; Wessells and Anderson, 1995, Caswell, 1995, etc.). Shin et al. (1992) developed an experimental method to measure consumer willingness to pay (WTP). The results indicated that for each meal that might have been contaminated with Salmonella, Iowa State University students would be willing to pay an extra 55 cents to upgrade it to a safer product. In a pesticide-residue risk reduction study, Buzby et al.(1995) found that consumers' WTP for safer grapefruit was significantly related to the consumer's age, income and attitude. The results indicated that WTP was lower for older respondents. They argued that older people on a fixed budget were not able to pay more even if they wanted to. They argued that the findings of an inversed relationship between WTP and income was due to concerns over a decrease in food safety when consumer income increased as a result of better access to information. The study also found that consumers' WTP increased with consumer concern over pesticide risks and a firm belief that the government should ban all pesticides. By using a contingent valuation method, Fu et al. (1999) found that consumers who were particularly concerned about health risks, such as those who purchase hydroponic vegetables, were more WTP to reduce the chance of cancer associated with pesticide residues. The results furthermore showed that the most significant factors determining the WTP for risk reduction were the respondent's health condition and concern about the cost and quality of vegetables.

As far as international trade is concerned, food safety issues are becoming more intensively used as non-tariff barriers to hinder international trade due to a decline in existing tariff trade barriers (Hooker, 1999; Hooker and Caswell 1999). Some countries in particular, mostly developed ones, have been adopting different/higher regulatory standards than those recommended by the three international agencies under the WTO Sanitary and Phytosanitary (SPS) Agreement. The scientific rationale of the SPS Agreement is embedded within the framework of risk analysis (risk assessment, risk management and risk communication). The SPS Agreement highly recommends member nations to strengthen their rapprochement efforts based on three international standard advisory organisations. They are the Codex Alimentarius Commission (Codex), the International Plant Protection Convention (IPPC) and the International Office of Epizootics (OIE). In order to assure consumer trust, private sectors have also been playing an important role in food safety issues by certifying their products and demanding stricter requirements than the national government's ones. Such initiatives include Eurep GAP, BRC, GFSI, etc. Eurep GAP is a European standard for the production of fresh produce and horticultural products. BRC stands for British Retailers' Consortium. Global Food Safety Initiative (GFSI) is an initiative of European retailers and food service companies worldwide. It is foreseeable that trade disputes will arise in the future as a result of these technical trade barriers.

3 CHINESE FOOD QUALITY AND SAFETY

Until some years ago, the Chinese government had not put food safety on their agenda. The priority had been to produce enough food for the whole nation and to maintain a high level of grain self-sufficiency. The issue of Chinese food security has been widely studied by a group of scholars. For an overview, consult Huang, et al. (1999).

Food quality and safety have only recently become a hot issue in China. Two factors account for this new challenge. First, with the rising level of living standards, Chinese consumers are no longer satisfied with quantity alone. They are demanding better quality assurance. However, a series of food scandals in recent years shocked consumers and reduced consumer confidence.

Secondly, the rapid development of international trade in China should be taken into account. As China is now a WTO member, the number of disputes over tariff trade barriers is gradually decreasing. Technical trade barriers, however, such as food safety issues, prevail. Export products that do not comply with the standards of importing countries, have been rejected or dumped in ports and have caused tremendous losses for China. The Chinese government has become aware of the new challenge and has taken action on it. The government has listed food safety as one of the top programmes in their 10^{th} Five-Year National Planning(2001-2005).

In 2001, the Ministry of Agriculture (MoA) announced the 'Pollution-Free Food Action Plan'. The main objective of this plan is to establish a sound food quality and safety standard system in China within the next ten years. Based on the references of other internationally recognised food safety standards, China will adopt and enact its own standard system whilst at the same time aiming at harmonising with the Codex Alimentarius. The government strongly supports setting up advanced monitoring and testing laboratory centres at every level. These authorized centres will be responsible for testing pollution-free products. The certified products will have to meet three criteria: production environment (air, water, soil, etc.), production technique procedure (how and when to use which pesticides, etc.), and product quality and safety (residue level, etc.). Apart from pollution-free certification, enterprises are encouraged to comply with the internationally recommended quality assurance schemes, such as GMP, HACCP, ISO 9000, ISO 1400, etc. The Chinese government is also in the process of ratifying the 'Agrifood Quality and Safety Law'.

Beijing, Shanghai, Tianjin, and Shenzhen were chosen as pilot cities for the implementation of the 2001 Pollution-Free Food Action Plan. The emphasis of the first phase (2001-2005) will be on agro-chemicals and residues of vegetables, fruits and teas. By 2005, the product category will have been expanded to include grains, meats, eggs, milk and fish.

Before the introduction of PFF in China, there were two other certification schemes involving green foods and organic foods. If the Pollution-Free Food Programme is to ensure safe, basic food for the people of China, the target for green food and organic food must be food of a higher quality. The MoA promotes green food which is classified at A-level and AA-level. AA-level products are of a higher standard than A-level products and correspond with organic products. Of the 2000 certified green food products in China, only 10% are qualified at AA-level. The State Bureau for Environmental Protection is in charge of organic product certification and

co-operates with other international organic organisations. Organic products are mainly for the exporting markets.

Another hot dispute concerning food safety is the character of genetically modified (GM) products. China is developing the largest capacity for plant biotechnology besides North America. Bt cotton accounts for 30% of China's cotton area, and other GM crops, such as rice, maize, wheat, soybeans and peanuts are either in a research trial stage or ready for commercialisation (Huang, et al.2002, a and b). In January 2002, the MoA announced two GM food regulations for GM food import and labelling, in addition to previously published regulations for general GM food management. These regulations require all GM product importers to apply for safety verification from the MoA, and all GM products, or products processed from GM materials, to be labelled implicitly. The new regulations took effect on March 20, 2002. So far, around two dozen trade companies have been granted GM product import and labelling permission.

4 SURVEY DESIGN

Survey data were obtained by using structured questionnaires (Appendix 1). The questionnaire was first designed in English and discussed with sector experts and consumer researchers. It was then translated into Chinese. After instructions, 30 college students conducted the survey in October 2001. 8 interviews were held to test the questionnaires, after which some small changes were made. The students were instructed to select the interviewees from different locations like supermarkets, open markets, residential areas, streets etc. Only 10 out of 308 people refused to be interviewed.

The first part of the questionnaire covers demographic variables. The results are presented in Table 1. It seems that the category 'college or higher level' scores very high. However, it should be pointed out that the level of education refers to the highest level within the interviewee's household, not necessarily to the interviewee her/himself. The remaining part of the questionnaire is related to consumer awareness of food safety. Selected consumer foods include pork, beef, chicken, fish, fresh milk and vegetables. The questions are about consumers' general concerns over the safety of selected products. Selected consumer concerns include details like gaining weight, falling ill, pesticides, hormones, harmful bacteria, and nutritional levels of the purchased products.

Table 1 The demographic variables of the survey

Demographic variables	Category	Frequency
Age	<30	104
	30-40	60
	40-50	74
	50>	60
Income	<1000	47
	1000-2000	126
	2000-3000	92
	3000 >	33
Education	Elementary and Secondary	31
	High school	103
	College and Higher	164
Gender	Female	133
	Male	165

The consumer's knowledge, purchasing experiences and willingness to pay for pollution-free vegetables, green food, organic food and GMO food were also measured. Ten items of the EBBT sub-scale were carried out to measure the consumer's variety-seeking tendencies and were measured against the five-point Likert scale. (Baugartner and Steenkamp, 1996). We assumed consumers to have

exploratory behaviour, such as variety-seeking, and risk-taking. Variety-seeking is a form of behaviour resulting from, for instance, boredom or curiosity. Food and vegetable consumption may easily become boring and could be a motivation for variety-seeking behaviour (van Trijp, 1996).

In addition, consumers were asked about their purchasing and consumption experiences regarding four Dutch products (mini-cucumbers, cherry tomatoes, coloured sweet peppers and long oval-shaped eggplants) and their perception about product attributes.

5 RESULTS

5.1 General concerns about food safety

From the six selected products, a four-point rating scale was used to assess concerns ranging from “not at all concerned” to “very much concerned”. The results in Table 2 show that Tianjin’s consumers are most concerned about vegetables and milk. 70% and 73% of the consumers indicate that they are "very much concerned" about milk and vegetable products respectively. Consumers are relatively confident about the quality of chicken and fish as only 40% claim to be "very much concerned". Beef and pork have an average score of 54% and 64% respectively with regard to serious concerns.

Table 2 Consumers’ General Concerns about Selected Food Products (%)

Degree of Concern	Pork	Beef	Chicken	Fish	Milk	Vegetables
Very much	63.9	54.2	44.1	46.5	69.9	72.9
Generally	23.1	30.1	42.5	33.8	17.1	20.4
A little bit	7	11.7	9.7	14.0	5.7	5.4
Not at all	6	4.0	3.7	5.7	7.4	1.3

We asked consumers how important issues like gaining weight, falling ill, hormones, pesticides, harmful bacteria and nutritional levels were when purchasing different products. Again, the four-point rating scale was applied here ranging from "not al all concerned" to "very much concerned". The results (Table 3-5) indicate that consumers have different concerns about different types of food. Consumers’ major concerns about pork are falling ill and harmful bacteria, whilst being least concerned about gaining weight. With regard to fish , consumers find nutrition more important than anything else whilst being least concerned about gaining weight . Their main concerns about vegetables are pesticides followed by harmful bacteria. Not surprisingly, gaining weight comes last in their concerns about vegetable consumption.

Table 3 Degree of consumers’ care about pork consumption (%)

Degree	Not at all	A little bit	General care	Care very much
Getting fat	22	18.3	23	35.7
Falling ill	2.3	8.4	24.8	64.4
Pesticides	19	21.6	19.7	39.8
Hormones	9.9	17.1	24.3	48.6
Harmful bacteria	5.1	9.9	21.9	63
Nutrition	7.1	14.1	27.3	51.5

Table 4 Degree of consumers' care about fish consumption (%)

Degree	Not at all	A little bit	General care	Care very much
Getting fat	36.5	23.0	22.6	17.9
Falling ill	8.8	20.3	24	47
Pesticides	19.2	22.9	21.4	36.5
Hormones	13.8	22.1	26.6	37.4
Harmful bacteria	8.5	15.4	24.2	51.9
Nutrition	6.7	10.4	24.9	57.9

Table 5 Degree of consumers' care about vegetable consumption (%)

Degree	Not at all	A little bit	General care	Care very much
Getting fat	42.2	19.4	14.3	24.1
Falling ill	5.1	15.3	17.6	62
Pesticides	1	5.4	12.2	81.4
Hormones	14.3	18.7	23.1	44
Harmful bacteria	5.1	11	18.8	65.1
Nutrition	3.4	10.8	23	62.8

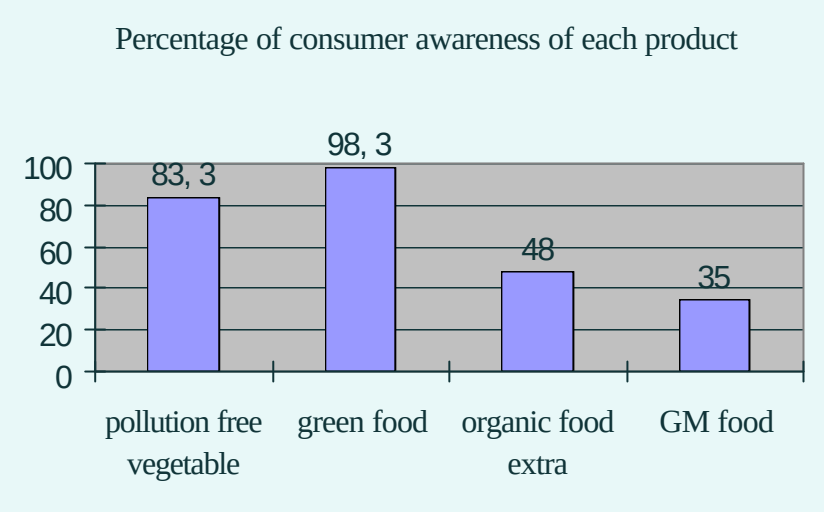
5.2 Awareness and Experiences of pollution-free, green, organic and GM foods

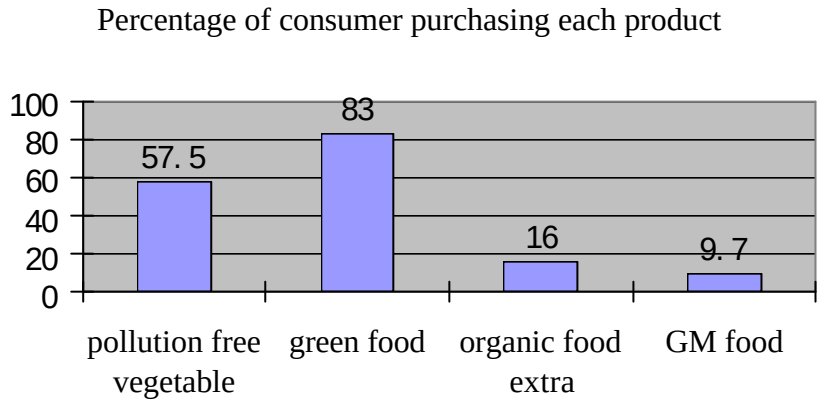
Different quality products with various labels are available in the markets. Four types of products (pollution-free vegetables, green food, organic food and GM food) were listed and the consumer was asked about product awareness, purchasing experiences and willingness to pay. Awareness means whether he/she had ever heard about these products before; any purchasing experiences in the past were measured.

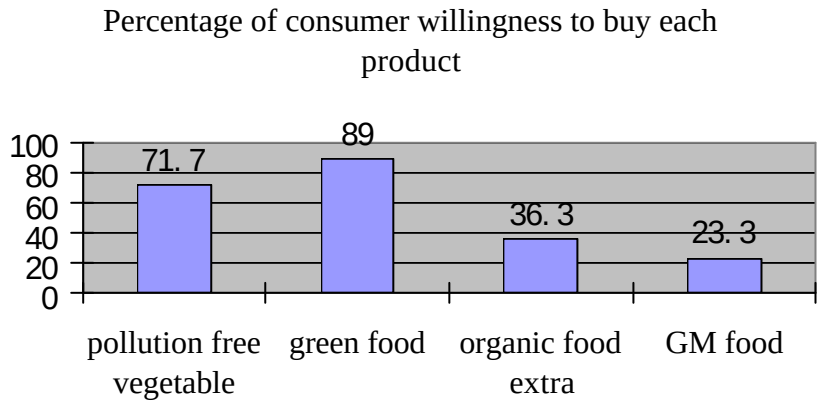
The results in Figure 1 show that from the four selected categories Tianjin consumers know green food best followed by pollution-free vegetables. Less than half the consumers have heard of organic and GM food. In terms of purchasing experience, green food has the highest purchase rate followed by pollution-free vegetables. Around 10% and 16% of the consumers claim that they have tried GM food and organic food respectively. This result contradicts reality because the survey was carried out in 2001 when labelled GM foods were not for sale in Chinese markets. A follow-up interview showed that consumers believed some functional food products, such as fortified calcium in milk, to be GM food.

Consumers intend to expand their food consumption to all four categories. Particularly future consumption of organic and GM foods (to a certain degree functional food) will be doubled if consumers are to follow their intentions.

Figure 1. Consumers' Awareness and Experiences of Pollution-free, Green, Organic and GM foods







5.3 Willingness to pay (WTP) extra

We focused on consumers' intentions only and did not carry out a WTP study on an experimental basis. Consumers were asked how much extra they would be willing to

pay for each product category. The results (Table 6) show that 262 out of 298 consumers are willing to pay extra for Green food compared to normal food even though GM food accounts for the lowest WTP (only 98 respondents). The amount they are willing to pay extra is limited. The majority are only willing to pay up to 20% extra and a negligible percentage are willing to pay more than half.

Table 6 Consumers' Willingness to pay for different types of food (% in brackets)

Pay extra	Pollution-free vegetables		Green food		Organic food		GM food	
Less than 20%	156	(52)	163	(54)	89	(30)	71	(24)
20% - 40%	42	(14)	64	(21)	15	(5)	13	(4)
40% - 60%	19	(6)	25	(8)	12	(4)	13	(4)
60% - 80%	1	(0)	2	(1)	1	(0)	1	(0)
More than 80%	6	(2)	8	(2)	0	(0)	0	(0)
Zero	76	(26)	38	(14)	173	(61)	202	(68)

5.4 What kind of consumer would purchase PFV?

It is interesting to find out what kind of consumer would be more likely to purchase PFV, since the Chinese government is heavily promoting its pollution-free food programme. Given consumers' behaviour 'purchased or not' to be a dichotomous dependent variable, such situations cannot be studied under the assumption of ordinary regression due to the absence of normal distribution. Furthermore, several demographic variables have more than two categories. Logistic regression was applied here to estimate model coefficients by using the maximum-likelihood method.

The dependent variable is the consumers' purchasing experience of PFV. If purchased before, this is coded as '0' in the model. If not '1' is coded as the internal value. Four categorically explanatory variables, the interviewee's age and gender, household income, and highest education within the household, are coded in Table 7.

Table 7 Categorical Variables Coding

Variables		Frequency	Parametre coding		
			(1)	(2)	(3)
Age	<30	104	.000	.000	.000
	30-40	60	1.000	.000	.000
	40-50	74	.000	1.000	.000
	50>	60	.000	.000	1.000
Income	<1000	47	1.000	.000	.000
	1000-2000	126	.000	1.000	.000
	2000-3000	92	.000	.000	1.000
	3000 >	33	.000	.000	.000
Education	Elementary and Secondary	31	.000	.000	
	High school	103	1.000	.000	
	College and University	164	.000	1.000	
Gender	Female	133	.000		
	Male	165	1.000		

Other explanatory variables include the total EBBT score and the degree of consumer's general concerns about vegetables 'VEGE' (measured at four levels). Forward Stepwise (Likelihood Ratio) was used as automated model building. The estimation terminated after four variables entered the model. Both Omnibus tests of the model's coefficients and the Hosmer and Lemeshow test are significant and indicate that the model fits the data quite well. The estimated coefficients Bs are measures of the changes in odds ratio. A positive coefficient increases the probability of an event occurring, whilst a negative value decreases the predicted probability. Since the internal code for 'purchased' is '0' in this model, Bs should be explained as follows: a negative coefficient sign increases the probability of consumer purchasing and a positive sign decreases it. The final result (Table 8) of the Forward Selection method indicates four significant variables: VEGE, Gender, Age and Education.

The results show that the more consumers are concerned about the safety of vegetables, the higher the probability that they will purchase PFV. Men are more likely to buy PFV than women. The variable 'age' as a whole is significant. When we look at the different categories, it becomes obvious that the two younger age groups are significant groups whereas the older group (50 years and older) is not. This indicates that younger consumers are more likely to purchase PFV. As far as the education category is concerned, the highest education category (college and higher) is significant, indicating the willingness of higher educated people to buy PFV. It is somewhat surprising to see that men are more likely to buy PFV than women given the fact that women usually look after their families. This could be explained by the fact that nowadays more and more Chinese men are becoming involved in household issues and that they are more cautious about their families' health than their wives.

The insignificant variables are the EBBT scores and incomes. It is reasonable to believe that variety-seeking consumers are not in the same category as food-safety consumers. Nevertheless, the insignificance of income contradicts the general expectation that higher-income consumers would pay more attention to food safety. This may be explained by the fact that the reported income data are not a real reflection of the interviewee's living standards.

Table 8 Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 4	AGE			13.768	3	.003	
	AGE(1)	-1.150	.363	10.011	1	.002	.317
	AGE(2)	-.974	.333	8.545	1	.003	.377
	AGE(3)	-.391	.352	1.237	1	.266	.676
	GENDER(1)	-.777	.256	9.252	1	.002	.460
	EDUMERGE			5.984	2	.050	
	EDUMERGE(1)	-.387	.454	.728	1	.393	.679
	EDUMERGE(2)	-.877	.429	4.179	1	.041	.416
	VEGE	-.532	.196	7.363	1	.007	.587
	Constant	3.198	.852	14.084	1	.000	24.488

a. Variable(s) entered in step 1: VEGE.
b. Variable(s) entered in step 2: GENDER.
c. Variable(s) entered in step 3: AGE.
d. Variable(s) entered in step 4: EDUMERGE.

Model Summary:

-2LL=370.65

Omnibus tests: Chi-square = 35.33, df. =7 , sig. = .000

Hosmer and Lemeshow test: Chi-square =14.202, df.=8, sig.=.077

5.5 Who will buy GM Food?

As mentioned in the beginning of this paper, China ratified the regulations on GM food in the beginning of 2002, requiring food markets to label all their GM foodstuffs. Little research has been done on consumers' attitudes toward GM foods in China and we were therefore interested to find out what kind of future consumers would be most likely to buy GM food. As we had already discovered some consumers' confusion about GM food and functional food, we assumed that in order to continue our analysis that this type of confused consumer would not dominate our samples.

We applied logistic regression here for the same reason because of the dichotomous dependent variable and multiple categorical explanatory variables. If willing to purchase GM food, the internal code was '0' in the model. If not, '1' was coded as the internal value. The same categorically explanatory variables as in the previous section were included. They are coded in Table 9 as follows. Additional explanatory variables include the total EBBT score and the consumer's attitude towards GM food. The attitude is measured by the statement 'I think GM food is harmful to human beings'. Consumers were asked to give their opinion according to the five-point Likert scale ranging from "total disagreement" to "total agreement". We expected the attitude to positively influence consumers' willingness to buy.

Forward Stepwise (Likelihood Ratio) was again used as automated model building. The estimation terminated after two variables entered the model. The Omnibus tests of the model coefficients were significant. However, the Hosmer and Lemeshow test were not . This may have been caused by the small size of the sample which made the test unsuitable.

Table 9 Categorical Variables Coding

Variables		Frequency	Parameter coding		
			(1)	(2)	(3)
Age	<30	104	.000	.000	.000
	30-40	60	1.000	.000	.000
	40-50	74	.000	1.000	.000
	50>	60	.000	.000	1.000
Income	<1000	47	1.000	.000	.000
	1000-2000	125	.000	1.000	.000
	2000-3000	92	.000	.000	1.000
	3000 >	33	.000	.000	.000
Education	Primary and Secondary	31	.000	.000	
	High school	102	1.000	.000	
	College and University	164	.000	1.000	
Gender	Female	132	1.000		
	Male	165	.000		

Table 10 Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 2	EDUMERGE			6.715	2	035	
	EDUMERGE(1)	-1.186	782	2.298	1	130	305
	EDUMERGE(2)	-1.689	759	4.950	1	026	185
	EBBT	107	033	10.350	1	001	1.113
	Constant	-684	1.245	.302	1	583	505

a.Variable(s) entered in step 1: EBBT.
b.Variable(s) entered in step 2: EDUMERGE.
Model summary
-2LL = 300.351
Ominbus test: chi-square = 21.637, df.=3, sig.=.000
Hosmer and Lemeshow test: chi-square=11.941, df.=8, sig.=.154

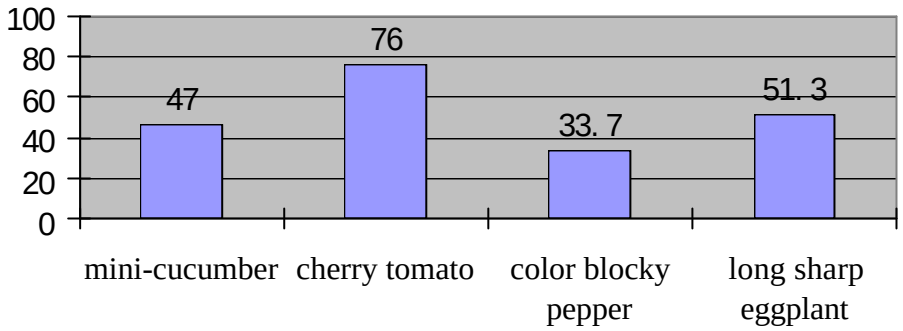
The results show two significant variables: EBBT score and Education (Table 10). This implies that the higher the consumer's EBBT score, the more likely he/she will be to buy GM food in future. We may conduct from this that consumers who have a higher variety seeking tendency are more likely to purchase GM food. The significance of the highest education category indicates that the higher consumers are educated, the more likely they will be to buy GM food. This could be explained either by the fact that higher educated consumers are better informed about GM food and therefore less negative in their reactions to GM food, or that higher educated consumers are more quality conscious consumers. Their perception that GM food is high quality food is the main driving force for their willingness to buy. Both explanations need further research to examine the consumers' knowledge about the precise meaning of GM food.

5.6 Tianjin Consumers' Acceptance of Dutch Novel Vegetables

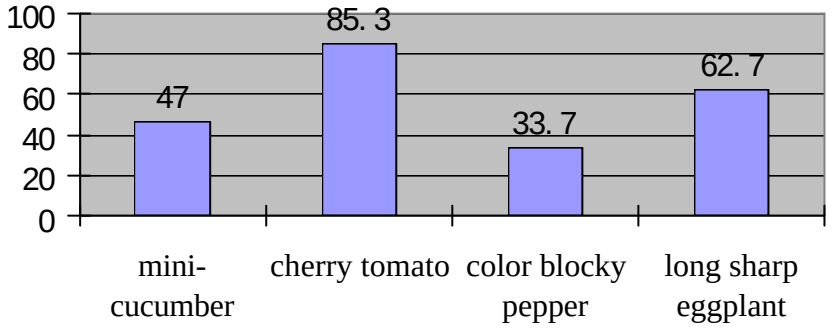
At the time of this project, four types of Dutch vegetables were introduced in Tianjin: mini-cucumbers, cherry tomatoes, coloured sweet peppers, long oval-shaped eggplants. They were novel vegetables in the markets. In this survey we intended to test consumer acceptance and consumer perception regarding these four products. The results show that cherry tomatoes are the most popular vegetables among the four in Tianjin; 94% of Tianjin's consumers spotted them in markets or shops, followed by eggplants, mini-cucumbers and peppers. Cherry tomatoes are also the most consumed products, followed by eggplants, mini-cucumbers and peppers. Regarding future predictions, it is again the cherry tomatoes that will have the brightest future and peppers the least optimistic future. More than half the consumers intend to buy eggplants and mini-cucumbers in future. Figure 2 presents the degree of Tianjin consumers' awareness of the four novel vegetables.

Figure 2 Awareness of Tianjin Consumers of four new vegetables (%)

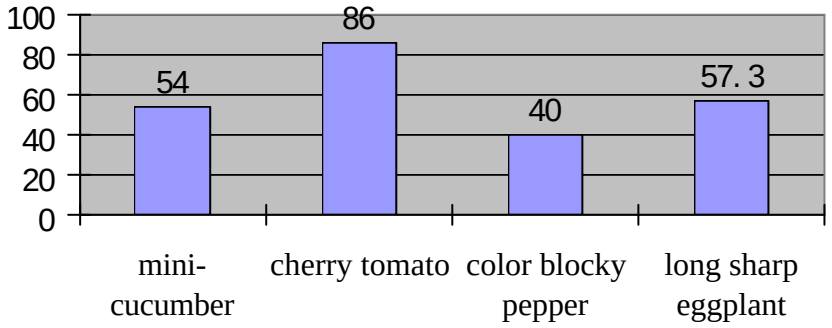
Eaten by Tianjin consumers away from home



Bought by Tianjin consumers for home consumption



To be bought by Tianjin consumers in the future



5.7 Tianjin Consumer Perception of Four Novel Vegetables

Six attributes (taste, size, shape, appearance, convenience of kitchen use, and price), which may be relevant to explanatory variables of the novel vegetable consumption, were chosen to measure consumer perception of the four products. Factor analysis was chosen to analyse consumer perception. We followed three steps (data evaluation, factor extraction, factor interpreting) for each new vegetable (mini-cucumber, cherry tomato, coloured sweet pepper, long oval-shaped eggplant).

Mini-cucumber

In general, the minimum sampling size is to have at least five times the number of variables. A more appropriate range would be a higher case-to-variable ratio. In case of mini-cucumbers the 50-to-1 ratio (300/6) is within the acceptable range. We must also assess the factorability of the correlation matrix. Bartlett's test of sphericity value is 306.365, which is significant at a 0.001 level. But this test only accounts for the presence of non-zero correlation, not the pattern of these correlations. The value of Kaiser-Meyer-Olkin (KMO) test is .724 KMO, falling within the range of middling. Examination of the values for each variable identifies all variables with values over .50. All tests stated above indicate that the set of variables is appropriate for a factor analysis.
The Principal Components Analysis (PCA), in which linear combinations of the variables are formed, was selected for factor extraction. We retained six mini-cucumber-related attributes. PCA tries to explain the total variance as well as possible by a minimum number of factors. Several criteria can be used to determine the number of factors. The Eigenvalue is the variance explained by a factor. Only factors having Eigenvalues larger than 1 were selected. The results of PCA are presented in Table 11. 2 factors should be derived since their values are larger than 1; they represent 62% of the variance of the 6 variables. If we look for an elbow in the plot of Eigenvalues in Figure 3, 2 factors should be retained as well.

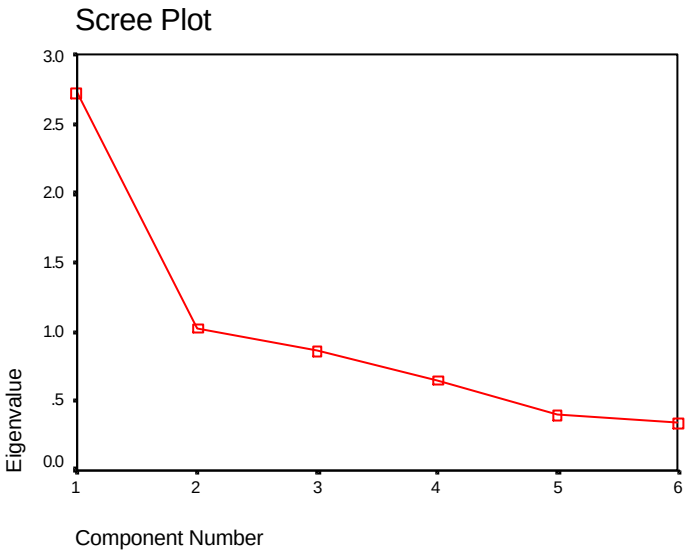
Table 11 The result of factor extraction of 6 mini-cucumber attributes (N=300)

Total Variance Explained

	Initial Eigenvalues		
Component	Total	% of Variance	Cumulative %
1	2.726	45.428	45.428
2	1.029	17.145	62.572
3	.865	14.412	76.985
4	.647	10.788	87.773
5	.397	6.612	94.385
6	.337	5.615	100.000

Extraction Method: Principal Component Analysis.

Figure 3 Scree plot of 6 mini-cucumber attributes



PCA extracted two factors. In order to identify the meaningful factors, an Orthogonal rotation (Varimax) method, which makes each variable loading high on one factor only, was applied. Table 12 shows the rotated factor matrix with the loading sorted by size for each factor.

Table 12 Rotated factor (component) matrix of 6 mini-cucumber attributes

Varimax-Rotated Loading

	Factor 1	Factor 2
Given names	Product	Price
Size	.818	.220
Shape	.770	-.181
Appearance	.750	-.306
Kitchen use	.689	-.281
Taste	.595	.255
Price	.273	.843

The five variables loading on factor 1 are size, shape, appearance, kitchen use and taste. These variables are dominated by the outlook for mini-cucumbers. Therefore, we named factor 1 “appearance”. Price is the only variable significantly loading on factor 2. We labelled factor 2 “price”. This indicates that the strongest consumer perception about mini-cucumbers is their special appearance and price.

Cherry tomato

The same methodology was used for other products. In order to avoid repetition, we only reported the differences.

Bartlett’s test of sphericity value is 286.550, which is significant at a 0.001 level. The .733 KMO value of the result falls within the range of middling. All tests above indicate that the set of variables is appropriate for a factor analysis.

The results of PCA are presented in Table 13. 2 factors should be derived since their Eigenvalues are larger than 1. 2 factors should be retained if we look for an elbow in the plot of Eigenvalues in Figure 4.

Table 13 The result of factor extraction of 6 cherry tomato attributes (N=300)

Total Variance Explained

Component	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	2.427	40.452	40.452
2	1.035	17.250	57.702
3	.812	13.530	71.231
4	.774	12.898	84.129
5	.498	8.308	92.437
6	.454	7.563	100.000

Extraction Method: Principal Component Analysis.

Figure 4 Scree plot of 6 cherry tomato attributes

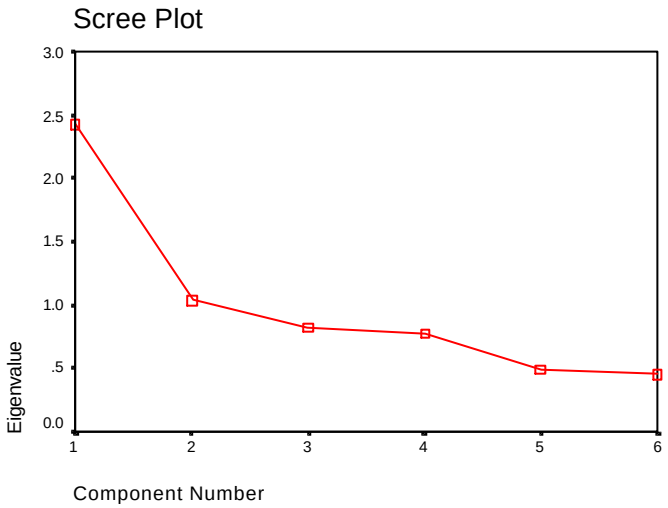


Table 14 shows the rotated factor matrix with the loading sorted by size for each factor. The three variables loading on factor 1 are appearance, shape and size. We named factor 1 “exterior”. Variables of price, taste and kitchen use loading on factor 2. We labelled factor 2 “price” as the first loading with the highest loading value. These results indicate that consumer perception of cherry tomatoes has two factors that are most important: shape and price.

Table 14. Rotated factor (component) matrix of 6 cherry tomato attributes

Varimax-Rotated Loading

	Factor 1	Factor 2
Given names	Exterior	Price
Appearance	.828	-.073
Shape	.786	.200
Size	.673	.342
Price	-.108	.829
Taste	.361	.606
Kitchen use	.386	.461

Coloured sweet pepper

Bartlett's test of sphericity value is 211.314, which is significant at 0.001 level. But the KMO value (.673) falls within the range of mediocrity and indicates that these group variables are not very suitable for a factor analysis. Therefore, we did not carry out a factor analysis sweet peppers.

Long oval shaped-eggplants

Bartlett's test of sphericity value comes to 124.144, which is significant at a 0.001 level. The .725 KMO value of the result falls within the range of middling. All tests stated above indicate that the set of variables is appropriate for a factor analysis. The results of PCA are presented in Table 15. 2 factors should be derived since their values are larger than 1. The two factors represent 88% of the variance of the 6 variables. A Scree plot is presented in Figure 5.

Table 15 The result of factor extraction of 6 long oval-shaped eggplants attributes

Total Variance Explained

		Initial Eigenvalues		
	Component	Total	% of Variance	Cumulative %
Raw	1	14.630	80.779	80.779
	2	1.361	7.512	88.291
	3	.674	3.722	92.013
	4	.550	3.035	95.048
	5	.454	2.505	97.553
	6	.443	2.447	100.000

Extraction Method: Principal Component Analysis.

Figure 5 Scree plot of 6 long oval-shaped eggplant attributes

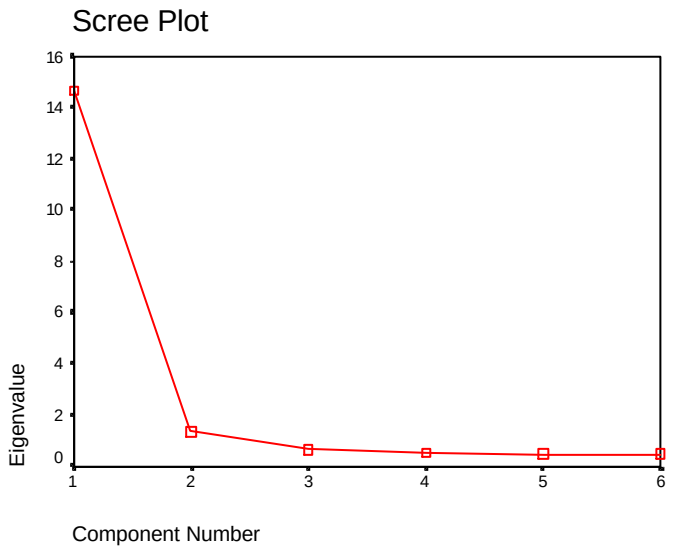


Table 16 shows the rotated factor matrix with the loading sorted by size for each factor. The three variables loading on factor 1 were taste, appearance, size, kitchen

use and price. We named factor 1 “intrinsic quality”. The variable of shape loads on factor 2. We labelled factor 2 “shape”. The higher loading of taste in the factor of ‘intrinsic quality’ indicates consumers’ appreciation of the product's natural taste. The attribute ‘Shape’ that stands out accounting for one factor, confirms that the long oval -shaped eggplant has made a strong impression among Tianjin consumers.

Table 16 Rotated factor (component) matrix of 6 cherry tomato attributes

Varimax-Rotated Loading

	Factor 1	Factor 2
Given names	Intrinsic quality	Shape
Taste	726	015
Appearance	658	176
Size	644	145
Kitchen use	628	034
Price	298	008
Shape	096	.995

6 POLICY RECOMMENDATIONS AND MANAGERIAL IMPLICATIONS

Food safety has been widely studied in developed countries but little in developing countries. It could be argued that the reason for this is food security, and not food safety, the main concern in developing countries. However, our research results show that a majority of our surveyed consumers are very much concerned about the safety of their food, particularly vegetables and dairy products, but at a low extra WTP. Our convenient sampling method is, of course, by no means representative of the whole Chinese population.

During the last decades, developed countries have put a lot of effort into rebuilding consumer trust in food by adopting stricter laws and setting up independent food safety authorities. This development produced spillover effects outside the developed countries as the international trade intensified. China's announcement of the Pollution-Free Food Action Plan is an illustration of this strategic approach. Our results indicate that this initiative will be greeted by young, male and higher educated consumers. This implies that the government's promotion policy on this Plan should pay special attention to older and female consumers. The use of easy language when explaining the benefits of this Action Plan is desirable, especially for less well educated consumers.

Among the four quality schemes available in China, Green food has been the best received. There may be two explanations for this. First of all, Green food is the oldest quality label in China; the other three are relatively new on the market. Secondly, Certified Green food is easily available on the markets; this is not the case for the other three. The real battle for quality products has only just started in China. It is hard to predict at this moment which ones are going to dominate the market.

At the moment a widespread debate about the ethics of GM food is going on. In spite of this, our results indicate that quite a number of Chinese consumers are prepared to buy GM Food in future. These consumers have been characterized as higher educated and variety-seeking consumers. One of the efficient ways to educate consumers about GM food would be to offer more information, since some consumers confuse GM food with other high-tech foods, such as functional food. Variety-seeking consumers may think of GM food as a new, innovative, novel product and would like to become pilot consumers.

Future research in China related to food safety issues should focus on several aspects. First of all, more elaborate research should be done on the impact of perceived risks and benefits on consumers' attitudes towards PFF and GM Food . It will also be worthwhile to gain insight into the trust consumers have in sources of information, like information from scientists, the government, the media, etc. Furthermore, there seems to be a need for research on benefits and costs for private sectors when adopting food safety and quality assurances (e.g. PFV, GM labelling) as they proceed with their compliance processes, since consumers are not willing to pay too much. It is predictable that economic implications for companies will vary, particularly when it concerns small enterprises.

As far as managerial implications are concerned, generally speaking, the four Dutch novel vegetables have been well accepted among Tianjin consumers given the consumers' high awareness and consumption experiences. Among these four, cherry tomatoes are the most successful followed by eggplants. In fact, mini-cucumbers too

have a good market in Tianjin. However, their popularity was affected by availability due to a limited production in the early stage of this project. The most problematic one are coloured peppers, starting with their difficult cultivation technique compared to other vegetables. Market promotion, such as information on kitchen use, are also needed to help consumers' adoption. Factory analysis indicates that the appearance of these novel products is the most important factor for consumers. Seed companies and breeders should be oriented towards innovation and should continuously introduce attractive products to the markets, whilst at the same time producing marketable products at a reasonable cost as "price" appears to be the second most important factor.

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APPENDIX 1. QUESTIONNAIRE OF TIANJIN FOOD SAFETY SURVEY

Code: --------

Tianjin Food Safety Survey

Dear Sir/Madam,

We are interviewers of the Tianjin Academy of Agricultural Sciences and are carrying out a consumer survey in Tianjin. We would like to know your opinion about new vegetables in the markets and how much you are aware of food safety. We would appreciate it very much if you could spend about 15 minutes on answering the questions.
If you have any comments or suggestions regarding our work, please feel free to call this telephone number: 020….

Thank you for your co-operation.

Interviewer's name:	
Interview time:	
Date (month/day)	
Time	from till

1. PLEASE, INDICATE WITH AN 'X' WHETHER YOU HAVE SEEN, BOUGHT OR EATEN THE FOLLOWING PRODUCTS.

(markets are supermarkets, grocery stores, open markets, etc.)

Statements	**Mini-cucumber**	**Cherry tomato**	**Coloured sweet pepper**	**Long oval shaped eggplants**
I have seen it in the market/shop				
I have eaten it off-home				
I have bought it for home consumption				
In the future I will buy it (again)				

2. PLEASE, INDICATE WITH A NUMBER YOUR OPINION ABOUT THE FEATURES OF THE FOLLOWING PRODUCTS

1	***2***	***3***	***4***	***5***
Very bad	*Bad*	*Indifferent*	*Good*	*Very good*

	Mini-cucumber	**Cherry tomato**	**Colour sweet pepper**	**Long oval shaped eggplants**
Taste				
Size				
Shape				
Appearance				
Kitchen use				
Price				

3. PLEASE, INDICATE WITH AN 'X' HOW MUCH YOU ARE CONCERNED ABOUT THE SAFETY OF THE FOLLOWING PRODUCTS

Products	**Not at all Concerned**	**a little bit concerned**	**generally concerned**	**very much concerned**
Pork				
Beef				
Chicken				
Fish				
Fresh milk				
Vegetables				

4. PLEASE, INDICATE WITH A NUMBER YOUR MAJOR CONCERNS WHEN YOU PURCHASE THE FOLLOWING PRODUCT

1	***2***	***3***	***4***
not at all concerned	*a little bit concerned*	*generally concerned*	*very much concerned*

Concerns	**Pork**	**Fish**	**Dairy products**	**Vegetables**
Getting fat				
Getting ill				
Pesticides				
Hormones				
Harmful bacteria				
Others (please describe)				

5. PLEASE, INDICATE WITH AN 'X' IN CASE YOUR ANSWER IS "YES"

Statement	**Pollution free vegetable**	**Green Food**	**Organic Food Extra**	**GM food**
Have you ever heard of the following products?				
Have you ever bought them?				
Are you (still) willing to buy them?				
If 'yes', How much extra are you willing to pay, compared to traditional products?	.....%	.....%	.....%	.....%

6. PLEASE, GIVE YOUR OPINION BY USING ANUMBER FROM 1 TO 5 AS INDICATED IN THE FOLLOWING BOX FOR EACH SENTENCE

1	***2***	***3***	***4***	***5***
Strongly disagree	*Disagree*	*Neutral*	*agree*	*strongly agree*

	Statements	***number***
1	Even though certain food products are available in a number of different flavours, I tend to buy the same flavour.	
2	I would rather stick with a brand(product) I prefer buying something I know to trying something I am not very sure of.	
3	I think of myself as a brand(product)-loyal consumer.	
4	When I see a new brand(product) on the shelf, I'm not afraid of giving it a try.	
5	When I go to a restaurant, I feel it is safer to order dishes I am familiar with.	
6	If I like a brand(product), I rarely switch from it just to try something different.	
7	I am very cautious when trying new or different products.	
8	I enjoy taking chances in buying unfamiliar brands just to get some variety in my purchases	
9	I rarely buy brands (product) about which I am uncertain how they will turn out.	
10	I usually eat the same kind of food on a regular basis.	

7. PLEASE, INDICATE THE AGE AND SEX OF YOUR FAMILY/HOUSEHOLD MEMBERS (ONLY COUNT THE ONES WHO ACTUALLY LIVE AT HOME).

Member	Age	Gender: *1. Female 2. male*
Yourself		
Member 2		
Member 3		
Member 4		
Member 5		

8. PLEASE, INDICATE WITH AN 'X' THE HIGHEST EDUCATIONAL LEVEL THAT (ONE MEMBER OF) YOUR FAMILY/HOUSEHOLD HAS ENJOYED?

Elementary school	
Secondary school	
High school	
College or higher	

9. WHAT IS YOUR OCCUPATION?

---

10. PLEASE, INDICATE WITH AN 'X' THE COMBINED MONTHLY INCOME OF YOUR FAMILY/HOUSEHOLD. (*THESE DATA WILL BE KEPT STRICTLY CONFIDENTIAL)*

1	less than 800 yuan.	
2	800 -- 1,500 yuan.	
3	1,501 -- 3,000 yuan	
4	3,000 --- 5,000 yuan	
5	5,000 yuan and over	