

## China's Potential Market of Tropical Fruits and its Influencing Factors An Empirical Research Based on Survey Data of Guangdong Province, China\*

Shan-Ni CHEN<sup>1</sup> Yan-Wen TAN<sup>1</sup> Monzur MORSHED<sup>1</sup>

**ABSTRACT:** As the main consumable fruit, Tropical fruit has a large market in southern part of China. Since the inception of "Early Harvest Program" of China - ASEAN Free Trade Area, the importation of tropical fruits from the ASEAN countries to China increases every year. At the same time, tropical fruit production in China is also showing the trend of growth, which indicates that market demand of tropical fruit, has risen in China. Therefore, in-depth analysis of the potential market of tropical fruit, and discussion of the factors influencing tropical fruit consumption of urban and rural residents, has great practical significance for the promotion of tropical fruit industry in China. Based on the field survey on consumer behavior of Guangdong residents, which have a large consumption of tropical fruits, this paper uses Ordered Multi-Variable Discrete Choice Model to analyze the main factors impacting the consumer behavior of urban and rural residents in Guangdong province while consuming tropical fruit. The results show that income, economic development level and educational background influence consumption of tropical fruit. Along with the rapid development of China's national economy, the consumption of tropical fruit will increase by large margins in the foreseeable future.

**Keywords:** Tropical fruits, household consumption, Ordered multi-variable discrete choice model, influencing factors

## Guangdong Şehri Anket Verilerine Dayalı Olarak Yapılan Çin'in Tropik Meyvelerde Pazar Potansiyeli ve Bunu Etkileyen Faktörler Konusunda Ampirik Bir Araştırma

**ÖZET:** Ana tüketilir meyve olarak, tropikal meyve Çin'in güney kesiminde büyük bir pazara sahiptir. Çin - ASEAN Serbest Ticaret Bölgesi "Erken Hasat Programı"na başladığından bu yana Güneydoğu Asya Milletleri Birliği'nden Çin'e yapılan tropikal meyve ithalatı her yıl artmaktadır. Aynı zamanda, Çin'de tropikal meyve üretiminin de büyüme eğilimi göstermesi Çin'de tropikal meyvelerde pazar talebinin arttığını göstermektedir. Bu nedenle, tropikal meyve potansiyel pazarının derinlemesine analizi, kentsel ve kırsal kesimlerin tropikal meyve tüketimini etkileyen faktörlerin tartışılması, Çin'de tropikal meyve endüstrisinin tanıtımı için büyük pratik öneme sahiptir. Tropikal meyvelerde büyük bir tüketime sahip Guangdong şehrinde oturanların tüketici davranışları konusunda yapılan anket verilerinin temel alındığı bu çalışmada, Guangdong şehrinde oturan kentsel ve kırsal kesimin tropikal meyve tüketirken tüketici davranışlarını etkileyen ana faktörlerin analizi için sıralı çok değişkenli kesikli tercih modeli kullanılmıştır. Araştırma sonuçları gelir, ekonomik gelişmişlik düzeyi ve eğitim durumunun tropikal meyve tüketimini etkilediğini göstermektedir. Çin'in ulusal ekonomisinin hızlı gelişimi ile birlikte, tropikal meyve tüketimi yakın gelecekte büyük oranda artacaktır.

**Anahtar kelimeler:** Tropikal meyveler, evsel tüketim, sıralı çok değişkenli kesikli tercih modeli, etkileyici faktörler

<sup>1</sup> College of Economics and Management, South China Agricultural University, Guangzhou, China

\* This paper is initial results of China National Social Science Fund Project (08 & ZD030), Guangdong Provincial Social Science Fund Project (09E-17), Project of Guangdong Department of Education (11ZGXM79003)(09JDXM79005)

Sorumlu yazar/Corresponding Author:: Yan-Wen TAN, tanyw@scau.edu.cn

## INTRODUCTION

Tropical fruit is one of the main varieties of fruit in China, and occupies an important economic position. The production of tropical and subtropical fruits in China in 2009 was 14.459 million tons, accounting for fruit production (122.464.000 tons) of 11.8%. After joining WTO, particularly after the implementation of "Early Harvest Program" in China - ASEAN Free Trade Area, the tropical fruit imports increased sharply. In 2004, China imported 495,900 tons of major tropical fruits, such as banana, litchi, longan, pineapple. In 2009, the importation reached 796.500 tons, as an increase of 60.6%. At the same time, the tropical fruit industry in China has made rapid development. In 2004, China's major tropical and subtropical fruit production was 10.344 million tons, and reached 14.459 million tons in 2009, raised by about 39.8%, showing tropical fruit consumption in China has a promising future.

October 11, 2010, China's State Council issued "Commission on promoting industrial development of the tropical crops", promoting the construction of tropical crops industry development zones in a comprehensive way, with the industries of banana, litchi and mango as the priority. Against this background, along with overall implementation of zero tariff in China-ASEAN Free Trade Area, in-depth analysis of the potential market of tropical fruits in China and the main factors affecting tropical fruit consumption is undoubtedly of great practical significance. Furthermore, the industrial development strategic measures for tropical fruit on the demand side are also discussed.

At present, the Chinese domestic scholars' research on the tropical fruit focused on production and trade. Xiao-tao (2004) argued that China's tropical fruit consumption preferred to fresh fruits, and export market is relatively concentrated. The study of Yong-hua (2008) concluded that the tropical fruit had no international competitiveness through the International Comparative Analysis of Competitiveness of China with relevant countries, and put forward corresponding countermeasures. You-peng et al., (2008) also believed that the international competitiveness of the banana industry was relatively weak, trade deficit of pineapple industry showed a trend of further expansion. Li-feng (2004), Jun-ping (2005), Ping and Xiao-qing (2010), and many other scholars in China studied interaction and influences of Tropical fruits industry between China and Main ASEAN Countries. The results indicated that tropical fruits trade between China and ASEAN had complementary effects and competitive effects, which had an important influence on the tropical fruit

industry in China. Although the existing literature on tropical fruits were studied from different angles, but researches on potential market for tropical fruits and the influencing factors are scarce. This paper plans to explore the potentiality of tropical fruit market consumption and analyze the main influencing factors of tropical fruit consumption of urban and rural residents in Guangdong, by field research on the tropical fruit consumption in Guangdong Province, to provide more reliable reference to market expectations while promoting the rapid development of the tropical fruit industry.

### The Main Factors and Mechanism of Consumption of Tropical Fruits and Processed Products

**Data and models:** Guangdong Province, as coastal areas, has a high degree of openness of economy and large amount of population from other places, which lead to strong purchasing power, concentrated population, and representative consumer behavior. Guangzhou and Shenzhen, on behalf of the highly developed areas, have more developed economy, whose population from other places accounting for a high proportion of the total population, and the composition of population is relatively complex. Foshan is on behalf of middle-developed areas, while Meizhou represents the less economically developed regions. Each city divides into urban and rural, and selects a number of settlements on behalf of high, medium, low income. Each city carries on 160 questionnaires; the urban-rural ratio is about 5:3. 640 survey questionnaires were distributed and the response rate was 100%, of which 620 questionnaires were available, the effective rate was 96.88%, the survey results are representative with the effectiveness.

The survey respondents constitute a basic balance of gender. There are 290 men (accounting for 46.77%) and 330 females (accounting for 53.23%) surveyed. Young, as the key decision makers in household consumption, accounts for more than 50% of the survey, which is reasonable. There are 48.23% of respondents with education level of Tertiary or above. Family size of 3 accounts for 27.10%, while 4 accounts for 26.61% of respondents, indicating small families as the primary structure. This result is in line with China's current family structure characteristics. In the model,  $y_1$  represents consumption of fresh tropical fruits; meanwhile  $y_2$  represents consumption of processed tropical fruits. A represents age of the respondents, and Gender is expressed by  $S$ .  $L_1$ , said city, while  $L_2$  stands for Urban or Rural.  $P$  said family size of respondents,  $INC$  that the household income of respondents, and  $EDUC$  respondents

**Table 1.** Variables and statistical properties

Variable	Variable Meaning	Sample Mean (Standard deviation)
$y_1$	Family Tropical Fruit Consumption Per Week: 1 for not more than 10 yuan, 2 for 11-25 yuan, 3 for 26-50yuan, 4 for 51-100 yuan, 5 for at least 100 yuan	2.39 (1.17)
$y_2$	Family Processed Tropical Fruits Consumption Per Week: 1 for not more than 10 yuan, 2 for 11-25 yuan, 3 for 26-50yuan, 4 for 51-100 yuan, 5 for at least 100 yuan	1.65 (0.95)
$L_1$	City arranged by the level of regional economic development, using 0, 1, 2, 3 represent Meizhou, Foshan, Guangzhou, Shenzhen	1.51 (1.11)
$L_2$	Urban-Rural Divide: 1 for Urban, 2 for rural	1.55 (0.50)
P	Family Size of Respondents: using 1-6 for the household number, 7 for the household number of 7 or over	3.87 (1.47)
S	Gender: 1 for male, 2 for female	1.53 (0.50)
AGE	Age: 1 for not more than 25, 2 for 26-35, 3 for 36-45, 4 for 46-55, 5 for at least 55	2.44 (1.18)
EDUC	Education Level: 1 for below the junior secondary school level, 2 for middle school level (Including secondary school, technical school), 3 for Tertiary level, 4 for College level, 5 for Master's degree or above	2.63 (1.13)
INC	Monthly family income: 1 for not more than 3000 yuan, 2 for 3001-5000 yuan, 3 for 5001-8000 yuan, 4 for 8001-10000 yuan, 5 for more than 10000 yuan	2.63 (1.31)

the level of education. The specific nature and statistics properties of the variable are shown in Table 1.

To study the impact of basic information, such as age, gender, location, family size, income, education level on the consumption of tropical fruits and processed, this paper uses Ordered Multi-Variable Discrete Choice Model to conduct quantitative analysis. The models used are as follows:

$$Y_1 = \alpha + \beta X_i + \varepsilon_i$$

$$Y_2 = \alpha + \beta X_i + \varepsilon_i$$

Suppose  $c_1 < c_2 < c_3 < c_4$  as the four critical points, and make the following definition:

$$Y=1 \text{ if } 10 \leq c_1$$

$$Y=2 \text{ if } 10 < Y^* \leq 25$$

$$Y=3 \text{ if } 25 < Y^* \leq 50$$

$$Y=4 \text{ if } 50 < Y^* \leq 100$$

$$Y=5 \text{ if } Y^* > 100$$

$Y_i$  is the latent variable,  $Y_1, Y_2$  represent the consumption level of fresh tropical fruits and the processed,  $X_i$  is variable that influences the consumption level, including statistics and economic characteristics such as gender, age, education level and income. Other

characteristics which have not been observed will be included in the error term, so it does the measurement errors. This article used the maximum likelihood method (MLE) to estimate via Stata 11.0 software. Estimated results are as follows:

By neglecting the explanatory variables which did not pass the significance test and rebuild model. Estimation model is as follows:

Although the estimated model goodness of fit is not high, but from the likelihood ratio statistic point of view, its P-value is very low, indicating that the explanatory variables from the two models have significant explanatory ability for the independent variable on the overall as Ordered Multi-Variable Discrete Choice Model used here. So the two models can be used in this analysis.

Model 1 shows that income level, urban economic development, education level and family size are the main factors of tropical fruit consumption. Furthermore, finding in the model 2, in addition to income and education level, the regional economic level and the family size have no effect on consumption of processed tropical fruits. Model 2 also shows that men like tropical fruit processed products more than women do, such as fruit juice, canned fruit, which should be of particular concern.

**Table 2.** Ordered multi-variable discrete choice model of factors influencing tropical fruit and processed consumption in guangdong (1)

Dependent Variables	Y <sub>1</sub>		Dependent Variables	Y <sub>2</sub>	
Independent Variables	Coefficient	Z-statistic	Independent Variables	Coefficient	Z-statistic
A	0.042	0.61	A	-0.057	-0.68
S	0.043	0.29	S	-0.397	-2.43
L <sub>1</sub>	0.247	3.49	L <sub>1</sub>	0.125	1.64
L <sub>2</sub>	0.1462	0.97	L <sub>2</sub>	0.070	0.42
P	0.18	3.39	P	0.067	1.16
INC	0.421	6.37	INC	0.227	3.24
EDU	0.212	2.82	EDU	0.179	2.19
PseudoR <sup>2</sup> =0.0619 Log likelihood = -857.29 LR=113.14 Prob.(> $\chi^2$ )=0.000			PseudoR <sup>2</sup> =0.0264 Log likelihood = -660.83 LR=35.9 Prob.(> $\chi^2$ )=0.000		

**Table 3.** Ordered multi-variable discrete choice model of factors influencing tropical fruit and processed consumption in guangdong(2)

Model 1			Model 2		
Dependent variables	Y <sub>1</sub>		Dependent variables	Y <sub>2</sub>	
Independent variables	Coefficient	Z-statistic	Independent variables	Coefficient	Z-statistic
L <sub>1</sub>	0.232	3.33	S	-0.397	-2.42
P	0.179	3.37	INC	0.227	2.68
INC	0.427	6.67	EDU	0.179	3.88
EDU	0.207	2.99			
PseudoR <sup>2</sup> =0.0610 Log likelihood = -858.08 LR=113.57 Prob.(> $\chi^2$ )=0.000			PseudoR <sup>2</sup> = 0.0231 Log likelihood = -663.09 LR=31.37 Prob.(> $\chi^2$ )=0.000		

**Guangdong Tropical Fruit Consumption Factors Analysis**

**Marginal probability analysis of various factors on tropical fruit consumption:**In order to investigate the impact degree of factors on the tropical fruit consumption, y<sub>1</sub> were set at different levels, computing the marginal probability of tropical fruit consumption from changes in income, economic development level, education and family sizes (Table 4). The results shows that the improvement in income, economic development level and education will raise the tropical fruit consumption of residents to a higher level, of course, the increase in household number will also increase the consumption of tropical fruits.

From studying the economic factors, when economic development level of the district move to higher level, the probability of consumers spending less than 10 yuan<sup>1</sup> on tropical fruit per week reduces 3.96%, as the probability of spending 51-100 yuan on tropical fruit per week increases 1.96%. But the probability of other consumer segments changes small in amount.

1 Yuan is the Chinese Currency. It's also called RMB.

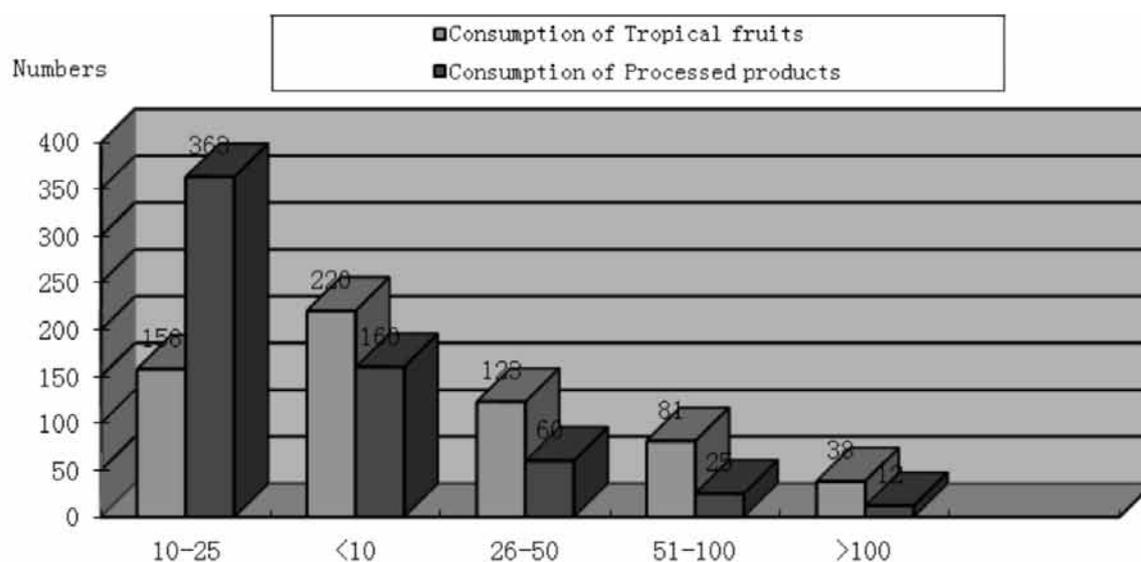
When family income increased by one grade, the probability of tropical fruit consumption of less than 10 yuan per week reduces by 7.30%, the probability of choosing 11-25 yuan reduces by 1.51%, while the probability of spending 26-50 yuan on tropical fruit per week increases by 2.86 %, the probability of 51-100 yuan increases by 3.62%, and the probability of above 100 yuan increases by 2.32%.

Figure 1 gives an important message that when the tropical fruit consumption level is 51-100 yuan per week, the marginal probability impact of the various factors have the greatest influence on tropical fruit consumption, followed by the level of 26 - 50 yuan weekly. Therefore, through China's rapid economic development, the consumption of tropical fruits will be increases from the current 20 yuan per week to about 50 yuan every week.

**The marginal probability analysis of various factors on processed tropical fruits consumption:**Table 5 shows that the marginal impact of family income levels on processed tropical fruits consumption every

**Table 4.** The marginal probability response of tropical fruit consumption to various factors at different consumption levels

Variables	$y_1=1$ marginal probability	$y_1=2$ marginal probability	$y_1=3$ marginal probability	$y_1=4$ marginal probability	$y_1=5$ marginal probability
Inc	-0.0730 (-6.76)	-0.0151 (-3.94)	0.0286 (6.49)	0.0362 (6.25)	0.0232 (4.90)
$L_1$	-0.0396 (-3.36)	-0.0082 (-2.66)	0.0155 (3.25)	0.0196 (3.28)	0.0126 (3.04)
Edu	-0.0353 (-3.01)	-0.0073 (-2.48)	0.0139 (2.96)	0.0175 (2.93)	0.0113 (2.77)
p	-0.0306 (-3.40)	-0.0063 (-2.65)	0.0120 (3.28)	0.0152 (3.30)	0.0097 (3.07)



**Figure 1.** Households consumption of tropical fruits and processed products per week

week is significant. When the family income increases to the next level, the probability of weekly tropical fruits processed products consumption of less than 10 yuan reduces by 5.73%, the probability of 11-25 yuan increases by 2.50%, the probability of 26-50 yuan increases by 1.82%, the probability of 51-100 yuan increases by 0.93%. And the probability to consume more than 100 yuan processed tropical fruit per week increases 0.48%. Education Level is of a significant effect on the probability of spending less than 10 yuan on processed tropical fruits weekly. When the education level improves, the probability of weekly consumption of processed tropical fruits of less than 10 yuan reduces by 4.57%, the probability of spending 11-25 yuan a week on that will increase by 1.99%, but other stages of the selection probability was less affected. The above analysis shows that when the processed tropical fruit consumption fixed at 11-25 yuan per week, the marginal selection probability will be affected by indicated factors significantly, showing that, as China's rapid

economic development, the consumption amount of processed tropical fruits in a given period would maintained at 11-25 yuan per week.

The study also found that men are more likely to buy processed tropical fruits products. Table 5 shows that the consumption level from the second level to the fifth level, the marginal probability impact of women is negative, only at the consumption level of less than 10 yuan per week, the probability of the marginal consumption of processed tropical fruits for women is positive, which indicates that the study of processed tropical fruits consumption should pay more attention to male groups.

**Regional Differences Analysis of Tropical Fruit Consumption:** Survey results shows that weekly consumption of fruit of Shenzhen residents is mostly in the 26-50 yuan level (Figure 2), reaching the share of 30.92%, and spending 10-25yuan weekly are of a large

**Table 5.** The marginal probability response of various factors to different consumption levels of processed tropical fruit

Variables	y <sub>2</sub> =1 marginal probability	y <sub>2</sub> =2 marginal probability	y <sub>2</sub> =3 marginal probability	y <sub>2</sub> =4 marginal probability	y <sub>2</sub> =5 marginal probability
Edu	-0.0457 (-2.74)	0.0199 (2.73)	0.0145 (2.61)	0.0074 (2.39)	0.0038 (2.13)
Sex	0.0902 (2.46)	-0.0394 (-2.46)	-0.0287 (-2.37)	-0.0147 (-2.19)	-0.0075 (-1.99)
Inc	-0.0573 (-4.07)	0.0250 (4.02)	0.0182 (3.68)	0.0093 (3.13)	0.0048 (2.61)

proportion of tropical fruit consumption by residents of Guangzhou, Foshan, Meizhou, respectively, accounted for 34.59%, 48.13% and 36.91% (Table 6). The influence of regional economic development on processed tropical fruit is relatively small.

In order to analyze the marginal probability effects of various factors on tropical fruit consumption in different regions, this article has the inter-district variables controlled, respectively for Shenzhen, Guangzhou, Foshan, Meizhou, and analyzes influence of factors, such as income, education level and family size, on the tropical fruit consumption and processed tropical fruit consumption.

**The marginal probability response of tropical fruit consumption to different factors in each region:** Estimation results (Table 7) show that areas with higher economic development level, such as Shenzhen, Guangzhou, Foshan, in y<sub>1</sub>=4 level, said consumption amount is 51-100 yuan per week, income, education level and family size has large impact on the marginal probability of tropical fruit consumption most. On the other hand, Meizhou, a relatively less economic-developed region, consumer spending level amounted to 26-50 yuan per week; the variables have the greatest impact on the marginal probability of tropical fruit consumption. These show that, in the economically

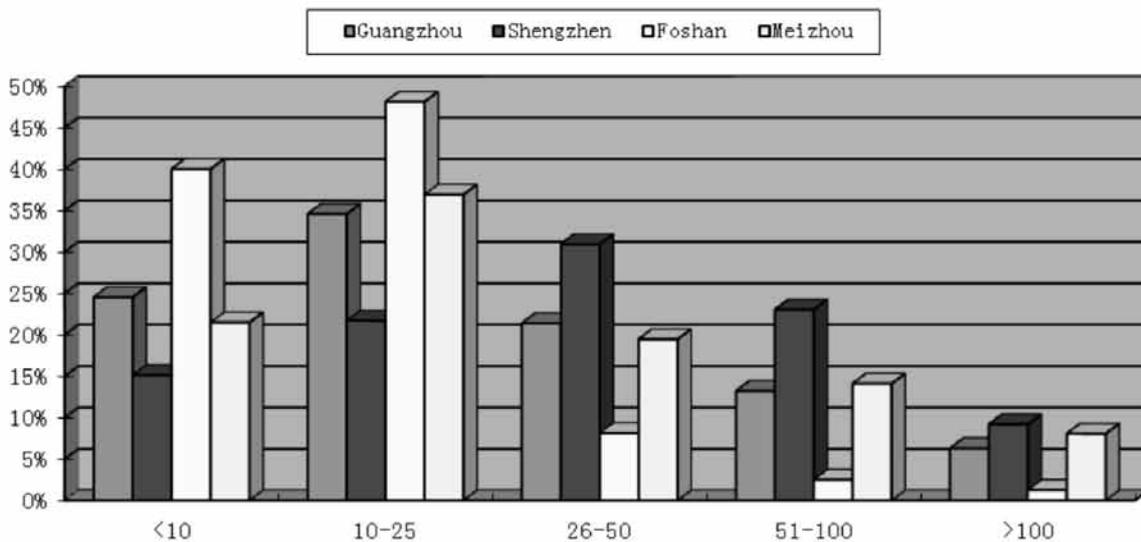


Figure 2. Regional differences in the consuming level proportion of weekly tropical fruits consumption

**Table 6.** Tropical fruit consumption statistics

Region consumption level	Meizhou		Foshan		Guangzhou		Shenzhen	
	Frequency	Proportion (%)						
1	32	21.48	64	40	39	24.53	23	15.13
2	55	36.91	77	48.13	55	34.59	33	21.71
3	29	19.46	13	8.13	34	21.38	47	30.92
4	21	14.09	4	2.5	21	13.21	35	23.03
5	12	8.05	2	1.25	10	6.29	14	9.21
Total	149	100	160	100	159	100	152	100

developed areas, accompanied by income growth and improvement in education, consumers will increase the consumption of tropical fruits more significantly, while in relatively underdeveloped areas, albeit not as developed areas, but level of tropical fruits consumption will upgrade as income and education levels are improving.

**The marginal probability response of processed tropical fruit consumption to different factors in each region:** Four regions were selected for different fresh fruits, at the weekly consumption level of 11-25 yuan, the various factors has largest effect on the marginal probability of processed tropical fruit consump-

**Table 7.** The marginal probability of different factors on the choice of tropical fruit consumption in each region

Dependent variable	Independent variable	Shenzhen $\partial y/\partial x$	Guangzhou $\partial y/\partial x$	Foshan $\partial y/\partial x$	Meizhou $\partial y/\partial x$
Pr( $y_1=1$ )	Educ	-0.0301	-0.0338	-0.0353	-0.0403
	p	-0.0261	-0.0292	-0.0306	-0.0349
	Inc	-0.0621	-0.0697	-0.0730	-0.0832
Pr( $y_1=2$ )	Educ	-0.0154	-0.0107	-0.0073	0.0002
	p	-0.0133	-0.0092	-0.0063	0.0001
	Inc	-0.0318	-0.0220	-0.0151	0.0003
Pr( $y_1=3$ )	Educ	0.0115	0.0139	0.0139	0.0165
	p	0.0099	0.0120	0.0120	0.0143
	Inc	0.0237	0.0286	0.0286	0.0342
Pr( $y_1=4$ )	Educ	0.0197	0.0186	0.0175	0.0155
	p	0.0171	0.0161	0.0152	0.0134
	Inc	0.0407	0.0385	0.0362	0.0320
Pr( $y_1=5$ )	Educ	0.0143	0.0119	0.0113	0.0081
	p	0.0124	0.0103	0.0097	0.0070
	Inc	0.0296	0.0246	0.0232	0.0167

**Table 8.** The marginal probability of different factors on the choice of processed tropical fruit consumption in each region

Dependent variable	Independent variable	Shenzhen $\partial y/\partial x$	Guangzhou $\partial y/\partial x$	Foshan $\partial y/\partial x$	Meizhou $\partial y/\partial x$
pr( $y_2=1$ )	Educ	-0.0447	-0.0442	-0.0434	-0.0423
	Sex	0.0906	0.0895	0.0879	0.0858
	Inc	-0.0552	-0.0546	-0.0536	-0.0523
pr( $y_2=2$ )	Educ	0.0175	0.0188	0.0198	0.0206
	Sex	-0.0354	-0.0381	-0.0402	-0.0418
	Inc	0.0216	0.0232	0.0245	0.0254
pr( $y_2=3$ )	Educ	0.0150	0.0143	0.0135	0.0127
	Sex	-0.0304	-0.0289	-0.0273	-0.0257
	Inc	0.0186	0.0176	0.0167	0.0157
pr( $y_2=4$ )	Educ	0.0080	0.0073	0.0067	0.0061
	Sex	-0.0163	-0.0148	-0.0135	-0.0123
	Inc	0.0099	0.0090	0.0082	0.0075
pr( $y_2=5$ )	Educ	0.0042	0.0037	0.0034	0.0030
	Sex	-0.0085	-0.0076	-0.0068	-0.0061
	Inc	0.0052	0.0046	0.0041	0.0037

**Table 9.** Statistics of the processed tropical fruits consumption

Region Consumption level	Meizhou		Foshan		Guangzhou		Shenzhen	
	Frequency	Proportion (%)						
1	80	53.69	114	71.25	104	65.41	65	42.76
2	39	26.17	41	25.63	37	23.27	43	28.29
3	19	12.75	2	1.25	11	6.92	28	18.42
4	7	4.7	1	0.63	5	3.14	12	7.89
5	4	2.68	2	1.25	2	1.26	4	2.63
Total	149	100	160	100	159	100	152	100

tion (Table 8). Meanwhile, the study also finds that, at that consumption level, the lower economic development, and the greater marginal probability response to the income improvement. Statistics from the survey (Table 9), all regions, on behalf of developed areas or on behalf of underdeveloped regions, the spending of processed tropical fruits are mostly less than 10 yuan in a week, so a basic assessment is that China's economic development would not significantly increase the consumption of tropical fruits and processed products, at least in the near future. But relative to developed regions, the processed tropical fruit in less developed regions will have a better market prospects.

### Varieties Consumption of Tropical Fruits and Processed Products

In the survey of 620 valid questionnaires, a total of 523 people, or 84.35% of respondents prefer fresh tropical fruit. Only 154 people (24.84% of total surveyed) believe that eating fresh fruit is not convenient. On the varieties of tropical fruit consumption, although slightly different in four regions, but the main purchase of all varieties includes banana, citrus, litchi, longan, etc.; mangosteen, durian, papaya, guava and other fruits are also very popular in the four areas, which are selected as the daily purchase of fruit by more than 30% respondents, and only less than 10% of respondents choose jackfruit, rambutan and wax apples as they daily purchased. The most popular fruit is banana, followed by citrus, durian is also very popular among consumers, litchi and longan are chosen as the favorite tropical fruits by about 7% of respondents each. Seasonal consumption of common tropical fruit was shown as in Table 10.

Based on the findings of seasonal consumption of common tropical fruits, set 1jin as the consumption is less than 2 jin, 2-5 jin takes the middle value of 3.5 jin, 6-10 jin takes the middle value of 8 jin, and more than 10 jin takes 15 jin. By the weighted average method, per capita tropical fruit consumption of each variety is calculated, and then tropical fruit consumption of Guangdong in general is estimated according to the total population (household registration) of 8,365.98 million in Guangdong Province in late 2009. Its found that banana's total consumption of Guangdong in season is estimated up to 192,400 tons, litchi, longan estimates consumption of 16million tons, mango and papaya has slightly lower of total consumption, but also up to 11 million tons.

Based on the findings of seasonal consumption of common tropical fruits, set 1jin as the consumption is less than 2 jin, 2-5 jin takes the middle value of 3.5 jin, 6-10 jin takes the middle value of 8 jin, and more than 10 jin takes 15 jin. By the weighted average method, per capita tropical fruit consumption of each variety is calculated, and then tropical fruit consumption of Guangdong in general is estimated according to the total population (household registration) of 8,365.98 million in Guangdong Province in late 2009. Its found that banana's total consumption of Guangdong in season is estimated up to 192,400 tons, litchi, longan estimates consumption of 16million tons, mango and papaya has slightly lower of total consumption, but also up to 11 million tons.

Purchases of Processed tropical fruits are shown in Figure 3. Consumer spending less on processed tropical fruits compared with fresh fruit, the proportion of respondents spending less than 20 yuan on processed products monthly were over 60%, among which includ-

**Table 10.** Seasonal Consumption of Common Tropical Fruit

<b>Banana consumption</b>	<b>Less than 2 jin<sup>1</sup></b>	<b>2-5 jin</b>	<b>6-10 jin</b>	<b>More than10 jin</b>
Respondents(number)	188	252	131	49
Proportion	30.32%	40.65%	21.13%	7.90%
<b>Litchi consumption</b>	<b>Less than 2 jin</b>	<b>2-5 jin</b>	<b>6-10 jin</b>	<b>More than10 jin</b>
Respondents(number)	286	203	87	44
Proportion	46.13%	32.74%	14.03%	7.10%
<b>Longan consumption</b>	<b>Less than 2 jin</b>	<b>2-5 jin</b>	<b>6-10 jin</b>	<b>More than10 jin</b>
Respondents(number)	289	198	87	46
Proportion	46.61%	31.94%	14.03%	7.42%
<b>Mango consumption</b>	<b>Less than 2 jin</b>	<b>2-5 jin</b>	<b>6-10 jin</b>	<b>More than10 jin</b>
Respondents(number)	391	148	60	21
Proportion	63.06%	23.87%	9.68%	3.39%
<b>Papaya consumption</b>	<b>Less than 2 jin</b>	<b>2-5 jin</b>	<b>6-10 jin</b>	<b>More than10 jin</b>
Respondents(number)	389	158	50	23
Proportion	62.74%	25.48%	8.06%	3.71%

<sup>1</sup> Jin is the Chinese Measuring unit. Where 1 Jin = 500gm

**Table 11.** Per capita tropical fruit consumption of each variety in season

	<b>Banana</b>	<b>Litchi</b>	<b>Longan</b>	<b>Mango</b>	<b>Papaya</b>
per capita consumption estimator(jin)	4.6	3.79	3.82	2.75	2.72
Total consumption estimator of Guangdong (10 thousand tons)	19.24	15.85	15.98	11.50	11.38

ing 86.77% (538 people) of the total respondents consuming canned tropical fruits less than 20 yuan monthly, and only 0.81% of respondents spend more than 60 yuan on canned tropical fruits every month. Consumption of tropical fruit juice processed slightly higher relative to other processed tropical fruits, more accepted by consumers. The number of respondents tends to choose fruit juice is 418, accounting for 67.42%; 168 respondents prefer dried fruit products, accounting for 27.10%; only 3.87% of the respondents tend to choose canned tropical fruits, among the respondents choosing juice, there are 47.42% of respondents prefer coconut milk, 22.42% prefer mango juice, 13.71% prefer oranges juice, 15.16% like apple juice.

**Tropical fruit consumption market in China's guangdong has a greater potential:** Survey data show that average consumption of tropical fruits in Guangdong is 11-25 yuan per week (Table 1, Table 12), and measurement results show that when the level of weekly fruit consumption is 51-100 yuan ( $y_1 = 4$ ), the marginal probability of residents income, education level and family size on tropical fruit consumption has the greatest impact, followed by tropical fruits consumption in the 26-50 yuan per week level, the marginal probability of each factor influenced. Therefore, as China's economic develops, tropical fruit consumption will have a more significant improvement-which is expected to be raised to 50 yuan per week level. Currently, people have increasingly strong demand on nutrition

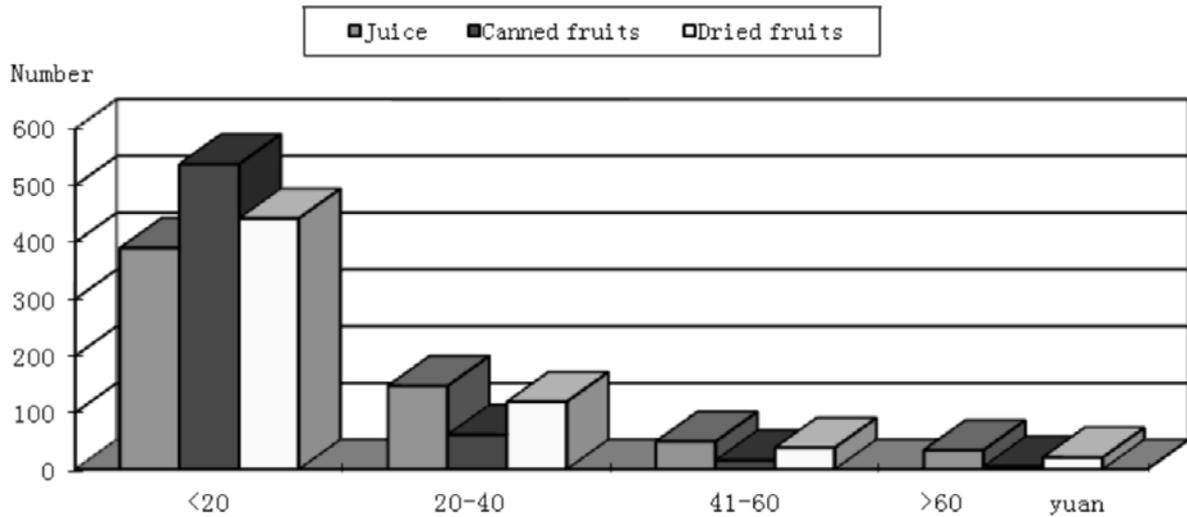


Figure 3. Monthly expenditures on processed products

Table 12. Statistics of guangdong tropical fruit consumption

Level of tropical fruits consumption	Frequency	Proportion
1	158	25.48
2	220	35.48
3	123	19.84
4	81	13.06
5	38	6.13
Total	620	100

and healthy fruits and vegetables. With the health and safety awareness of urban and rural residents further enhance, demand of high-quality fruit, pollution-free fruit, green fruit will have further growth. Tropical fruit market prospect in China is cheerful.

**Consumption market of processed tropical fruits in China’s guangdong has obvious regional and gender differences:** The results of this study show that, despite the market potential for processed tropical fruits in Guangdong is less than that of fresh fruits, but the measurement model analysis proves that the higher the consumption of processed tropical fruits, the market prospects of region with relative less development are better than that developed ones. Moreover, the male population much more than women prefers to buy processed tropical fruits, says fruit juice, canned tropical fruit. Thus, the marketing of processed tropical fruits should focus on the areas with low-income and middle-income economies, but also to develop more targeted marketing strategies on male consumer groups.

**The structure of varieties of tropical fruit consumption in China’s guangdong has difference:** The survey shows that the consumers in Guangdong prefer bananas and citrus more than other fruit. In addition, among processed tropical fruits, people generally like to buy fruit juice, dried fruits, and less like to buy canned fruits, which have a great relationship with Guangdong’s consumption habits that people like fresh fruit. The analysis concluded that, bananas, oranges, pineapple, durian and other fruits, and coconut juice, orange juice and other fruit juice consumption in Guangdong will have more room to grow, and market potential of lichi, longan and canned fruit is relatively small.

**Policy Implications**

**China should establish a modern management system of the tropical fruit industry:** With China’s economic development and the accelerated pace of urbanization, the tropical fruit consumption will have a more substantial increase, and the tropical fruits market

in China is very promising. Seizing market opportunities and accelerating the establishment of a modern management system of the tropical fruit industry is the developing strategic focus of the tropical fruit industry currently. Industrialization is the momentum of sustainable, stable and healthy development of tropical fruit production industry. The Chinese Government should combine the marketing system with tropical fruit plantation, processing and storage services and related technology through the establishment of modern industrial management system.

Tropical fruit production should be market-oriented, based on local natural resources, in accordance with the laws of market economy development, targeted to adjust the layout of China's fruit production and variety structure. Farmers and agricultural enterprises should be encouraged to apply science and technology to improve the quality of fruit and increase the yield of per unit area. On this basis, mass production should be implemented to gain economies of scale. Secondly, governments at all levels should organize the information collection and analysis of tropical fruit industry's production, supply, etc., and announce to related industries, associations, producers, so that the market information can be understood in time. Thus provide scientific basis for the government to policy formulation, corporate strategic decision-making, fruit production plans. It should build the market systems with various types and different levels by majorly offering technology, capital and equipment supports for tropical fruit industry development. Then ultimately provide a good economic environment for the successful realization of fruit production, processing and marketing operations.

**Supply structure of tropical fruits and processed products should be adjusted in China:** Compared with developed countries, China's fruit market has been in a relatively backward level. The domestic fruit producers pay no attention to brand development, neglect of market segmentation, and lack of targeted marketing. In fact, according to the results of field surveys, the demand for tropical fruits' species and quality is quite different in different market areas. Different gender also has different consumption habits of tropical fruits. Ignoring market research to conduct production and sales blindly often lead to losses. Therefore, the production and sales process of tropical fruits and processed products should focus on market segments, market research, and developing different marketing strategies to improve the marketing level.

Consumers prefer varieties of bananas and citrus in this field survey, and litchi and longan of usually thought are of lower proportion. Supply structure unfit with changes in consumption structure of tropical fruits on the market often leads to the appearance of oversupply. Therefore the structure of varieties of fruit must be adjusted to enhance the quality of the fruit. On one hand, the production of high-quality fruit varieties should be increased, on the other hand the production should be concentrated in suitable areas for fruits to achieve high yield. Optimizing the reasonable structure of varieties of fruit by paying attention to the different maturity of seasonal fruits to meet the urban resident's consumption demand for season fruits. In addition, people generally like to buy fruit juice, dried fruits, and less like to buy canned while considers processed tropical fruits. The marketing of processed tropical fruits should focuses on the middle-income and less developed economies, but also to develop more marketing for men consumer groups.

**China's tropical fruit processing industries should be accelerated for development:** The results show that China's economic development at least in the near future would not significantly increase the consumption of tropical fruits and processed products, but according to the development experience of developed countries, the consumption of tropical fruits will be processed with the economic development, changes in consumer attitudes gradually expanded. The U.S., Japan and other developed countries, steady growth in demand for the juice market, the world volume of 7 liters per capita consumption is about, and our demand for tropical fruits and processed by the concept of consumption, income and other factors, far below the world average the level of processed tropical fruits in China, especially fruit juice, dried fruit products, there is a large increase in spending power for growth. At the same time, many developed countries, a huge demand for processed tropical fruits, a bright future urge us to speed up the development of tropical fruit processing industry in order to comprehensively promote the development of the tropical fruit industry.

Processing industry of fruit storage should be developed and raw material processing base should be established, so as processes improved, costs reduced, research and production of fruit drinks, fruit juice and wine developed. The Government should increase investment in tropical fruit processing industry, develop deep-processing tropical fruit products, and extend the industrial chain of tropical fruit, to achieve a reasonable

division of labor among tropical fruits industrial chain, on the way to go to industrial upgrading stimulating by deep-processing tropical fruit products.

## REFERENCES

- Anna, H.B., Wardle, J., 2003. Sex differences in fruit and vegetable intake in older adults. *Appetite*, 40: 269-275.
- Bogers, R.P., Brug, J., Van Assem, P., Dagneliea, P.C., 2004. Explaining fruit and vegetable consumption: The theory of planned behavior and misconception of personal intake levels. *Appetite*, 42: 157-166.
- Daniel, J.K., Ericc, J.H., 2003. Brief validated survey instruments for the measurement of fruit and vegetable intakes in adults: A review. *Preventive Medicine*, 36: 440-447.
- Kitagawa, H., Matsui, T., Kawada, K., Agravante, J.U., 1990. Japan as a market of tropical Fruit. *Acta Hort*, 41-46.
- Keyou, P., Jian-chun, G., Jia, F., Chaoxia, M., Huijian, Z., 2008. China's pineapple production and trade development trend analysis. *China Tropical Agriculture*, 2.
- Keyou, P., Jian-chun, G., Jia, F., Chaoxia, M., Huijian, Z., 2008. China's development of banana production and trade trends. *Tropical Agriculture in China*, 01.
- Feng, L.L., 2004. China - ASEAN fruit trade situation and Outlook. *China's rural economy*, No: 6.
- Proctor, F.J., 1990. The European Community market for tropical fruit and factors limiting growth. *Acta Hort*, 29-40.
- Subhadrabandhu, S., 1992. Status of the tropical fruit industry in Thailand, *Acta Hort*, 13-24.
- Junping, S., 2005. ASEAN is the impact of the tropical fruit industry. *Tropical Agriculture*, 4.
- Jia-shao, W., 2006. The world's major tropical fruit production, trade and trend Analysis. *World Agriculture*, 1.
- Ping, W., Xiaoqing, Z., 2010. China - ASEAN free trade of the effect of fruit. *Foreign trade practices*, 7.
- Huarong, Y., Fang, Z., Zhong, W., Yang L., HouBin, C., 2010. 2009 Guangdong Litchi and Longan industry analysis. *Guangdong Agricultural Sciences*, 4.
- Jijun, Z., Yonghua, H., 2008. China's major tropical fruits and the development potential of the international competitiveness of research. *Taiwan Agricultural Research*, 1.
- Xiaotao, Z., 2004. The tropical fruit industry, the basic situation and prospects. *China's rural economy*, 7.