The Influencing Factors and Inter-Group Differences for Urban Residents' Behavior of Consuming Edible Vegetable Oil

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Abstract To clarify the determinant factors and inter-group differences of Chinese urban residents' edible vegetable oil consuming behavior is very important for us to understand their consumption features of edible vegetable oil，so as to guide their consuming behavior and improve China's vegetable oil industry security. In this article，urban residents of China's three traditional vegetable oil main production areas have been chosen as study objects，and multiple linear regression and one-way ANOVA have been used to do empirical analysis on the determinant factors and inter-group differences of their edible vegetable oil consuming behavior. The results indicate that the edible vegetable oil consuming behavior of urban residents from China's three traditional vegetable oil main production areas show a trend of diversification；"publicity measures"，"preference evaluation"，"personal characteristics" and "family characteristics" remarkably affect urban residents' edible vegetable oil consuming behavior and show obvious provincial characteristics. In addition，urban residents from different groups show differences in terms of "publicity measures" and "preference evaluation".

Key words Urban residents，Edible vegetable oil，Consuming behavior，Factor analysis，Inter-group differences

1 Introduction

Edible vegetable oil is a major component of human diet，and it provides essential nutrients and energy for human life. Since 2000，the living standards of Chinese residents have been improved steadily；the edible vegetable oil consumption has continued to grow；the demand gap has been widening. The self-sufficiency rate of edible vegetable oil dropped from 65% in 2000 to 40% in 2014，and the supply security of edible vegetable oil is facing a serious threat. The edible vegetable oil consumption in urban areas has long been higher than in rural areas，and the quick China's urbanization process in recent years also prefigures the transition of rural areas to urban areas，so the analysis of the Chinese urban residents' behavior of consuming edible vegetable oil is not only of practical significance，but also of guiding significance to industrial development in rural areas. Therefore，this paper selects the urban residents in main producing areas of three types of traditional vegetable oil（rapeseed oil，soybean oil and peanut oil） as the objects of study，to perform a comparative analysis of differences in urban residents' behavior of consuming edible vegetable oil in different regions，in order to provide a reference for the government to formulate relevant industrial policies and domestic oil production companies to develop production and marketing plan.

2 Literature review

Many scholars have carried out extensive and in-depth researches on China's edible vegetable oil consumption. There are differences in the edible vegetable oil consumption between urban and rural areas. On the whole，the income elasticity of demand and price elasticity of demand about China's edible vegetable oil are at a low level，and show a gradual decreasing trend；there is a large difference in the elasticity of demand between urban and rural areas [1]. Peng Kemao et al. measure the elasticity of demand of various varieties of edible vegetable oil from an urban-rural perspective，and the results show that for both income elasticity of demand and price elasticity of demand，the elasticity of various varieties in urban market is significantly less than in rural areas；compared with the rural market，the relative consumption proportion of soybean oil and rapeseed oil in the urban market declines，while the consumption proportion of palm oil and peanut oil is increased [2]. Based on the residents' vegetable oil consumption habits in different regions，Cheng Fang and John Beghin divide the entire country into three areas，and estimate the elasticity of demand concerning the main edible oil and other types of vegetable oil. As opposed to non-primary oil，the price elasticity and income elasticity of primary oil in various regions are small，and the oil consumption in different regions shows strong regional preferences [3]. There is a difference in the variety and brand of edible vegetable oil. Shen Qiong analyzes the substitutional relation between imported varieties of vegetable oil in China after joining WTO，and believes that soybean oil and palm oil have a strong replacing effect on rapeseed oil，and considerable imports of palm oil will affect the changes in the domestic vegetable oil consumption structure [4]. The study results of Wei Dan et al. show that the international palm oil prices Granger cause price changes of domestic rapeseed oil，and there is Granger causality between the domestic peanut oil price and international palm oil price；there is Granger causality for various types of domestic vegetable oil due to the substitutional relation [5]. Shen Qiong further analyzes the substitutional relation between va-

rious types of domestic vegetable oil, and points out that there is the most significant substitutional relation between soybean oil and other types of oil such as sesame oil, and there is also a significant substitutional relation between rapeseed oil and peanut oil or soybean oil [6]. Shi Shuai and Zhang Dahong analyze the Shanghai consumers' preferences when purchasing high-end and general edible oil; they focus on brand when purchasing high-end edible oil and pay more attention to nutritional value and efficacy when purchasing general edible oil [7]. Kevin Chen, Shi Minjun, Zhong Funing and Chen Xi carry out relevant research on genetically modified oil consumption, and find that consumers are affected by price factors, education level, household income, food safety risk awareness and other factors when buying non-transgenic or genetically modified edible oil [8-9]. Through the analysis of the existing literature, it can be found that the academic circles have reached a consensus on consumption differences of edible vegetable oil between urban and rural areas in China, and also performed some studies on the substitutional relation between various types of edible vegetable oil. However, previous studies are primarily based on statistical data before 2006, lacking the first-hand large sample data support; in addition, with the rapid progress of China's urbanization and impact of food safety incidents, urban residents' consumption concept on edible oil is also undergoing changes. In this paper, we use the empirical research based on large samples for analysis and comparison of the differences in behavior of consuming edible vegetable oil between different regions and different types of urban residents, in order to fully grasp the consumer behavior and regional features of urban residents in the main producing areas of vegetable oil, and provide basis and policy options for the government to formulate relevant industrial policies.

3   Data and research methods

3.1   Data sources   Through random sampling method, we select one province from the three main vegetable oil producing areas as the survey object, respectively. Hubei Province is the representative of main rapeseed producing areas; Shandong Province is the representative of main peanut producing areas; Liaoning Province is the representative of main soybean producing areas. On this basis, we further randomly select Wuhan and Xianning in Hubei Province, Shenyang and Dalian in Liaoning Province, Rizhao and Qingdao in Shandong Province. The survey selects stratified sampling method to randomly select 2 districts in each city, randomly select 2 residential areas from each district, and select 20 residents in each residential area for home visit. 480 questionnaires were distributed, and 419 valid questionnaires were taken back after removing the invalid questionnaires (Hubei: 141; Liaoning 147; Shandong 131). The questionnaire consists of three parts. The first part is the current situation of edible vegetable oil consumption, aimed at understanding urban residents' edible vegetable oil consumption types, choice reasons and consumption in recent years; the second part is the factor affecting edible vegetable oil consumption, and it is used for the measurement of the

model data; the third part is the basic situation, including gender, age, education level, occupation, family per capita monthly income, and family structure. In terms of gender, male respondents account for 27.92% and female respondents account for 70.08%; in terms of age, 21 – 30 years old respondents account for 22.91% and 31 – 40 years old respondents account for 29.36%; in terms of education level, the respondents mainly received junior high school education and below (31.26%) and senior high school (34.37%); in terms of the career, students account for 3.10% and the rest account for about 20%; in terms of the family per capita monthly income, the cumulative percentage of samples with family per capita monthly income of less than 5000 yuan reaches 79%; from the family structure, 5.49% of respondents have limited choice on edible vegetable oil due to three factors (children under 14 in the family; the elderly aged more than 60 years; health problems in some family members), 25.06% of respondents are affected by two of the factors, 44.63% of respondents are affected by one of the factors, and 24.82% are not affected by the three factors.

3.2   Data characteristics   Through the preliminary analysis of the survey data, we can conclude the general characteristics of urban residents' edible vegetable oil consumption types in China's three traditional main producing areas of vegetable oil (Table 1). First, the urban residents in Liaoning Province and Shandong Province show a clear preference for the locally produced vegetable oil. About 60% of urban residents in Liaoning choose the locally produced soybean oil while more than 83% of urban residents in Shandong choose the locally produced peanut oil, but the urban residents in Hubei show no clear preference for the locally produced rapeseed oil and only 26.24% of respondents choose the rapeseed oil. Second, 60.54% of urban households in Liaoning have changed the commonly used vegetable oil type in the past two years; 46.1% of urban households in Hubei have changed the commonly used vegetable oil type in the past two years; 22.9% of urban households in Shandong have changed the commonly used vegetable oil type in the past two years. Finally, over the past two years, the proportion of edible soybean oil has declined for the urban residents in Liaoning, while the proportion of edible rapeseed oil, peanut oil and other edible vegetable oil types has increased to different degree, and the consumption patterns have shown a trend of diversification; the proportion of edible rapeseed oil for the urban residents in Hubei has remained unchanged, the proportion of edible blended oil has declined by 8.51%, and the proportion of edible peanut oil, soybean oil and other types of edible vegetable oil has increased to different degree; the proportion of edible peanut oil for the urban residents in Shandong has increased by 0.76%, the proportion of edible rapeseed oil and soybean oil has declined, and the proportion of edible blended oil, maize oil, sunflower seed oil, olive oil and other types of edible vegetable oil has also increased to different degree. Overall, there is little change in the proportion of three main types of vegetable oil consumed by the urban residents in the three regions, but the consumption of maize

oil, sunflower seed oil and other types of vegetable oil is increased.

Table 1 Proportion of urban residents' edible vegetable oil consumption types Unit:%

	Liaoning		Shandong		Hubei		Total	
	2013 – 2015	Before 2013	2013 – 2015	Before 2013	2013 – 2015	Before 2013	2013 – 2015	Before 2013
Rapeseed oil	8.16	3.40	1.53	2.29	26.24	26.24	12.17	10.74
Soybean oil	58.50	60.54	4.58	9.16	14.89	12.77	26.97	28.40
Peanut oil	28.57	27.21	83.97	83.21	19.15	16.31	42.72	41.05
Blended oil	14.29	18.37	4.58	3.82	26.95	35.46	15.51	19.57
Maize oil	8.16	6.80	10.69	7.63	16.31	10.64	11.69	8.35
Sunflower seed oil	2.72	0.68	0.76	0.00	6.38	3.55	3.34	1.43
Olive oil	2.72	4.08	4.58	3.82	3.55	2.13	3.58	3.34
Others	8.84	9.52	3.82	1.53	17.73	23.40	10.26	11.69
Number of respondents	147		131		141		419	

3.3 Research methods Firstly, using SPSS 22.0 software, we first employ principal component factor analysis to explore whether the items affecting the dimensions of urban residents' behavior of consuming edible vegetable oil can truly reflect the significance of various dimensions. Secondly, we use the ordinary linear regression model [15] to determine the factors that may influence the consumers' behavior of consuming edible vegetable oil. Finally, in order to clarify the inter-group differences in consumer behavior between different types of urban residents and help the government and enterprises to develop relevant policies, this paper uses one-way ANOVA to analyze the inter-group differences in the factors influencing Chinese urban residents' behavior of consuming edible vegetable oil.

4 Analysis of the factors that affect edible vegetable oil consumption and inter-group differences

4.1 Reliability and validity of questionnaire Based on the theory of planned behavior, this paper believes that demographic factors, subjective evaluation factors and objective environmental factors will affect urban residents' behavior of consuming edible vegetable oil. According to the studies of Dai Yingchun [10], Jin Ming [11], Xiao Qi [12], Chai Junwen [13] and Yang Jing [14], taking into account people's wide attention to genetically modified vegetable oil and blended oil in recent years, this paper selects 21 indicators (Table 2) to measure the factors influencing the Chinese urban residents' behavior of consuming edible vegetable oil. The above 21 indicators are evaluated using the Likert scale except the data obtained directly. This paper uses the most commonly used Cronbach's α coefficient to test the reliability of the scale and uses factor analysis to verify the construct validity of the measurement scale. Firstly, we test the suitability prerequisite of factor analysis to conclude that KMO value is 0.716 and Bartlett's Test of Sphericity is significant ($p = 0.000$), so the data in this paper are suitable for factor analysis and meaningful [16]. Through the factor analysis of the above-mentioned 21 factors affecting urban residents' edible vegetable oil consumption, we can extract six common factors (see Table 2), and two common factors can be extracted from the three aspects that affect vegetable oil consumer

behavior. Specifically, demographic factors can be extracted as two factors (personal characteristics and family characteristics); subjective evaluation factors can be extracted as two factors (preference evaluation and purchase evaluation); objective environmental factors can be extracted as two factors (publicity measures and processing means). From the factor analysis results, it can be found that the cumulative validity of six factors is 58.035%, and in general, this cumulative validity is at a moderate level, so the original model hypothesis is verified. The indicators contained by each common factor and the reflected content are basically consistent with the hypothesis, but the load factor on "gender" and "family population structure" in demographic factors is too small, so they are not clustered into the corresponding common factors. We use SPSS software to calculate the Cronbach's α coefficient of scale, and get the scale reliability index value of each factor (Table 3). The reliability of "publicity measures", "preference evaluation", "purchase means" and "processing means" is passable and the overall reliability of four factors is high. Based on the foregoing analysis, it is considered that the scale designed in this paper has good validity and reliability, so it can be used to measure the Chinese urban residents' behavior of consuming edible vegetable oil.

4.2 Determinants of urban residents' behavior of consuming edible vegetable oil This paper uses the principal component regression method to explore the determinants of the Chinese urban residents' behavior of consuming edible vegetable oil. Specifically, we take urban residents' per capita annual consumption of edible vegetable oil as the dependent variable, and six factors obtained by factor analysis as the independent variable. The regression model is as follows:

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \varepsilon$$

where Y is the per capita annual family consumption of edible vegetable oil; X_1, X_2, $\cdots$, X_6 denote publicity measures, preference evaluation, purchase evaluation, processing tools, personal characteristics and family characteristics, respectively; α is the regression constant; β_i represents the regression coefficient for each corresponding factor; ε is the error term.

Table 2   Factor analysis of the factors that affect edible vegetable oil consumption

	Common factors						
	Publicity measures	Preference evaluation	Purchase evaluation	Processing means	Personal characteristics	Family characteristics	Common degree
Advertising recommendation	0.832						0.715
Promotion	0.795						0.677
Salesman's recommendation	0.652						0.576
Price	0.425						0.297
Personal consumption habits		0.728					0.563
Nutritional value		0.691					0.559
Family members' preferences		0.679					0.528
Taste		0.652					0.512
Package			0.739				0.624
Brand public praise			0.729				0.563
Easy purchase			0.559				0.508
Whether it is genetically modified				0.779			0.634
Whether it is blended oil				0.761			0.628
Processing technology				0.577			0.549
Per capita monthly income					0.694		0.628
Occupation					−0.686		0.516
Education level					0.631		0.600
Responsibility for oil purchase						0.838	0.717
Age						−0.612	0.633
Validity of single factor(%)	18.448	10.416	9.077	7.865	6.387	5.842	
Cumulative validity(%)	18.448	28.864	37.941	45.806	52.193	58.035	

Table 3   Reliability analysis of the factors that affect edible vegetable oil

Factors	Reliability	Overall reliability	Conclusions	Note
Publicity measures	0.686		High reliability	Cronbach's α value ≥ 0.7, high
Preference evaluation	0.674		High reliability	reliability; 0.35 ≤ Cronbach's α value < 0.7,
Purchase evaluation	0.612	0.730	High reliability	acceptable reliability; Cronbach's α value < 0.35,
Processing means	0.590		High reliability	low reliability (Gilford, 1954) [11].

The analysis results are shown in Table 4, and the adjusted model coefficient of determination is 0.199, indicating that the selected variables have some explanatory power on the model. Through further analysis of the estimated results, it can be found that both "publicity measures" and "preference evaluation" are significant at the 1% level, and the coefficients are positive, indicating that both "publicity measures" and "preference evaluation" have a significant positive effect on the Chinese urban residents' edible vegetable oil consumption; "personal characteristics" and "family characteristics" are significant at the 1% level, and the coefficients are negative, indicating that both "personal characteristics" and "family characteristics" have a significant negative effect on the Chinese urban residents' edible vegetable oil consumption; "purchase evaluation" and "processing tools" do not pass the significance test, indicating that the two factors do not have a significant impact on the Chinese urban residents' per capita family edible vegetable oil consumption. Based on this, this paper will use one-way ANOVA to test the differences in the factors that affect consumer behavior of edible vegetable oil between the urban residents in China's three major producing areas of vegetable oil, as well as the differences due to different personal characteristics and family characteristics.

Table 4   Estimation results

Predictive variable	Coefficient	Standard error	T value
Intercept	18.863	0.637	29.624 ***
Publicity measures	2.754	0.638	4.306 ***
Preference evaluation	4.349	0.638	6.821 ***
Purchase evaluation	0.262	0.638	0.411
Processing means	−1.091	0.638	−1.711
Personal characteristics	−3.701	0.638	−5.806 ***
Family characteristics	−1.804	0.638	−2.830 ***

Note: Adjusted R^2 = 0.199; * indicates that the variable is significant at the 5% level; *** indicates that the variable is significant at the 1% level.

4.3   Inter-group differences in the factors that affect urban residents' behavior of consuming edible vegetable oil

4.3.1   Comparative analysis of regional differences. We perform ANOVA analysis of urban resident samples in different regions, and the results are shown in Table 5. The multiple comparison results using Scheffe method are shown in the last column in the table; A, B and C represent the urban residents in Hubei, Liaoning and Shandong, respectively; B > A indicates that the influence of one factor on the urban residents in Liaoning is greater than in Hubei. ANOVA analysis results show that salesman's recommendation, promotion and prices in "publicity measures" affect urban

residents' behavior of consuming edible vegetable oil in varying degrees in different regions. The influence of salesman's recommendation on the urban residents in Liaoning is greater than in Hubei, the influence of promotion on the urban residents in Shandong is also greater than in Hubei, and the influence of prices on the urban residents in Liaoning is greater than in Hubei and Shandong. The four factors in "preference evaluation" have different degrees of impact on the urban residents' behavior of consuming edible vegetable oil in three main producing areas of vegetable oil. Specifically, taste, eating habits and family members' preferences have the greatest influence on the urban residents' vegetable oil consumer behavior in Liaoning, and it is followed by Shandong and Hubei. The influence of nutritional value on the urban residents' behavior of consuming edible vegetable oil in Liaoning and Shandong is greater than in Hubei. Only the factor of education level in "personal characteristics" has different degrees of impact on urban residents' behavior of consuming edible vegetable oil in three regions, that is, the influence on the urban residents in Shandong is greater than in the other two provinces. Two factors in "family characteristics" also have different degrees of impact on urban residents' behavior of consuming edible vegetable oil in the three main producing areas of vegetable oil. The influence of age on the urban residents in Hubei is greater than in Shandong, while the influence of responsibility for purchasing edible oil on the urban residents in Shandong is greater than in the other two provinces.

Table 5 ANOVA analysis results of regional groups and influencing factors

			Sum of square	df	Mean square	F value	Scheffe post hoc method	
Publicity measures	Salesman's recommendation	Between the groups	9.185	2	4.592	4.592	3.946^*	$B>A$
		Within the groups	482.911	415	1.164			
		Total	492.096	417				
	Advertising recommendation	Between the groups	4.477	2	2.238	1.770	.	
		Within the groups	525.939	416	1.264			
		Total	530.415	418				
	Promotion	Between the groups	8.272	2	4.136	3.342^*	$C>A$	
		Within the groups	514.774	416	1.237			
		Total	523.045	418				
	Prices	Between the groups	20.458	2	10.229	9.939^{***}	$B>A$ $B>C$	
		Within the groups	428.125	416	1.029			
		Total	448.582	418				
Preference evaluation	Taste	Between the groups	31.652	2	15.826	25.242^{***}	$B>A$ $B>C$ $C>A$	
		Within the groups	260.825	416	0.627			
		Total	292.477	418				
	Nutritional value	Between the groups	22.820	2	11.410	20.292^{***}	$B>A$ $C>A$	
		Within the groups	233.915	416	0.562			
		Total	256.735	418				
	Personal consumption habits	Between the groups	56.893	2	28.446	31.990^{***}	$B>A$ $B>C$ $C>A$	
		Within the groups	369.914	416	0.889			
		Total	426.807	418				
	Family members' preferences	Between the groups	40.109	2	20.055	23.383^{***}	$B>A$ $B>C$ $C>A$	
		Within the groups	356.783	416	0.858			
		Total	396.893	418				
Personal characteristics	Per capita monthly income	Between the groups	3.950	2	1.975	1.335	.	
		Within the groups	615.482	416	1.480			
		Total	619.432	418				
	Occupation	Between the groups	10.412	2	5.206	1.735		
		Within the groups	1247.899	416	3.000			
		Total	1258.310	418				
	Education level	Between the groups	11.430	2	5.715	7.474^{***}	$C>A$ $C>B$	
		Within the groups	318.126	416	0.765			
		Total	329.556	418				
Family characteristics	Age	Between the groups	17.470	2	8.735	5.031^*	$A>C$	
		Within the groups	685.432	416	1.648			
		Total	702.902	418				
	Responsibility for oil purchase	Between the groups	4.140	2	2.070	9.432^{***}	$C>A$ $C>B$	
		Within the groups	91.288	416	0.219			
		Total	95.427	418				

Note: A, B and C represent the urban residents in Hubei, Liaoning and Shandong, respectively; * indicates that the variable is significant at the 5% level; *** indicates that the variable is significant at the 1% level.

4.3.2 Comparative analysis of occupational differences. We perform ANOVA analysis of urban resident samples of different occu-

pations, and the results are shown in Table 6. $B > A$ means that the influence of one factor on business service personnel is greater than on the clerks. The results show that except the price factor, there are significant differences in the influence of other factors in "publicity measures" and "preference evaluation" on the urban residents of different occupations; in the variance analysis of personal eating habits and family members' preferences, F value of the overall test is significant, but the Scheffe post hoc comparison is not significant. The Scheffe method is the most stringent among all post hoc comparison methods, and it is relatively conservative, so sometimes F value of the overall test is significant but post hoc comparison is not significant [16]. Specifically, the students are easily affected by salesman's recommendation and advertising recommendation, indicating that student groups are more susceptible to publicity measures; the professional and technical personnel are greatly affected by promotion, while the clerks lay greater empha-

sis on taste and nutritional value, which may be related to the income level and education level of the two groups.

4.3.3 Comparative analysis of educational differences. We perform the ANOVA analysis of the urban resident samples with different education levels, and the results are shown in Table 7. $B > A$ indicates that the influence of one factor on the urban residents with the education level of senior high school is greater than on the urban residents with the education level of junior high school and below. The results show that there are significant differences in advertising recommendation, taste and family members' preferences between the urban residents with different education levels, and only the taste difference can be tested using the strict Scheffe method. The difference indicates that the influence of taste on the urban residents with the education level of senior high school is greater than on the urban residents with the education level of junior high school and below in the choice of edible vegetable oil.

Table 6   ANOVA analysis results of occupation groups and influencing factors

			Sum of square	df	Mean square	F value	Scheffe post hoc method
Publicity measures	Salesman's recommendation	Between the groups	17.927	5	3.585	3.115*	E > D
		Within the groups	474.168	412	1.151		
		Total	192.096	417			
	Advertising recommendation	Between the groups	19.482	5	3.896	3.150*	E > B
		Within the groups	510.933	413	1.237		
		Total	530.415	418			
	Promotion	Between the groups	18.094	5	3.619	2.960*	C > B
		Within the groups	504.951	413	1.223		
		Total	523.045	418			
	Prices	Between the groups	10.640	5	2.128	2.007	
		Within the groups	437.942	413	1.060		
		Total	448.582	418			
Preference evaluation	Taste	Between the groups	12.442	5	2.488	3.670*	A > D
		Within the groups	280.035	413	0.678		
		Total	292.477	418			
	Nutritional value	Between the groups	12.566	5	2.398	2.387*	A > B
		Within the groups	244.169	413	1.004		
		Total	256.735	418			
	Personal consumption habits	Between the groups	11.988	5	2.398	2.387*	
		Within the groups	414.818	413	1.004		
		Total	426.807	418			
	Family members' preferences	Between the groups	16.315	5	3.263	3.541*	
		Within the groups	380.577	413	0.921		
		Total	396.893	418			

Note: A, B, C, D and E denote clerks, business service personnel, professional and technical personnel, retirees and students, respectively; * indicates that the variable is significant at the 5% level; *** indicates that the variable is significant at the 1% level.

4.3.4 Comparative analysis of age differences. We perform the ANOVA analysis of the urban resident samples at different age levels, and the results are shown in Table 8. $B > A$ indicates that the influence of one factor on the urban residents aged $31 - 40$ years is greater than on the urban residents aged 30 years and below. The results show that there are significant differences in salesman's recommendation and advertising recommendation in "publicity measures" between the urban residents at different age

levels. The influence of salesman's recommendation on the urban residents aged 30 years and below is greater than on the urban residents aged 61 years and above, and the advertising recommendation differences can not be tested by strict Scheffe method. In terms of "preference evaluation", there are significant differences in four factors between the urban residents at different age levels. Overall, there are no significant differences in the influence of various factors on the urban residents aged $41 - 50$ years and other

age groups; the influence of most factors on the urban residents aged 40 years and below is significantly greater than on the urban residents aged 50 years and above.

Table 7 ANOVA analysis results of education level and influencing factors

			Sum of square	df	Mean square	F value	Scheffe post hoc method
Publicity measures	Salesman's recommendation	Between the groups	5.710	3	1.903	1.620	
		Within the groups	486.386	414	1.175		
		Total	492.096	417			
	Advertising recommendation	Between the groups	10.860	3	3.620	2.892*	
		Within the groups	519.555	415	1.252		
		Total	530.415	418			
	Promotion	Between the groups	7.050	3	2.350	1.890	
		Within the groups	515.995	415	1.243		
		Total	523.045	418			
	Prices	Between the groups	7.000	3	2.333	2.193	
		Within the groups	441.583	415	1.064		
		Total	448.582	418			
Preference evaluation	Taste	Between the groups	8.108	3	2.703	3.944*	$B > A$
		Within the groups	284.370	415	0.685		
		Total	292.477	418			
	Nutritional value	Between the groups	3.004	3	1.001	1.638	
		Within the groups	253.731	415	0.611		
		Total	256.735	418			
	Personal consumption habits	Between the groups	3.907	3	1.302	1.278	
		Within the groups	422.900	415	1.019		
		Total	426.807	418			
	Family members' preferences	Between the groups	3.907	3	2.760	2.947*	
		Within the groups	422.900	415	0.936		
		Total	426.807	418			

Note: *A*, *B*, *C* and *D* signify the education level of junior high school and below, senior high school, college, graduate and above, respectively; * indicates that the variable is significant at the 5% level; *** indicates that the variable is significant at the 1% level.

Table 8 ANOVA analysis results of different age groups and influencing factors

			Sum of square	df	Mean square	F value	Scheffe post hoc method
Publicity measures	Salesman's recommendation	Between the groups	13.099	4	3.275	2.824*	$A > E$
		Within the groups	478.997	413	1.160		
		Total	492.096	417			
	Advertising recommendation	Between the groups	16.017	4	4.004	3.223*	
		Within the groups	514.399	414	1.243		
		Total	530.415	418			
	Promotion	Between the groups	3.813	4	0.953	0.760	
		Within the groups	519.232	414	1.254		
		Total	523.045	418			
	Prices	Between the groups	4.913	4	1.228	1.146	.
		Within the groups	443.669	414	1.072		
		Total	448.582	418			
Preference evaluation	Taste	Between the groups	17.114	4	4.279	6.433***	$A > D$ $B > D$ $B > E$
		Within the groups	275.363	414	0.665		
		Total	292.477	418			
	Nutritional value	Between the groups	9.945	4	2.486	4.171*	$A > D$ $B > D$
		Within the groups	246.790	414	0.596		
		Total	256.735	418			
	Personal consumption habits	Between the groups	14.822	4	3.460	3.740*	$B > E$
		Within the groups	411.984	414	0.925		
		Total	426.807	418			
	Family members' preferences	Between the groups	13.840	4	3.460	3.465*	$A > D$ $B > D$
		Within the groups	383.053	414	1.006		
		Total	396.893	418			

Note: *A*, *B*, *C*, *D*, *E* represent the urban residents aged 30 years and below, 31 − 40 years, 41 − 50 years, 51 − 60 years and 61 years and above, respectively; * indicates that the variable is significant at the 5% level; *** indicates that the variable is significant at the 1% level.

5 Conclusions and discussions

5.1 Conclusions To clarify the determinant factors and inter-group differences of Chinese urban residents' edible vegetable oil consuming behavior is very important for us to understand their consumption features of edible vegetable oil, so as to guide their consuming behavior and improve China's vegetable oil industry se-

curity. In this article, urban residents of China's three traditional vegetable oil main production areas have been chosen as study objects, and multiple linear regression and one-way ANOVA have been used to do empirical analysis on the determinant factors and inter-group differences of their edible vegetable oil consuming behavior. The results indicate that the edible vegetable oil consuming behavior of urban residents from China's three traditional vegetable oil main production areas show a trend of diversification; "publicity measures", "preference evaluation", "personal characteristics" and "family characteristics" remarkably affect urban residents' edible vegetable oil consuming behavior and show obvious provincial characteristics. In addition, urban residents from different groups show differences in terms of "publicity measures" and "preference evaluation".

5.2 Discussions In this paper, the findings show the Chinese urban residents' edible vegetable oil consumption trends, influencing factors and inter-group differences. Given the results of this study, the domestic oil production enterprises need to develop production and sales plans, and take into account the sales regions, buying group characteristics and other factors. In addition, the development potential of small vegetable oil varieties can not be ignored. In the development of industrial policy, the relevant departments need to consider regional preferences and development trends of small vegetable oil varieties, which is beneficial to the sound development of the vegetable oil industry. To further understand the characteristics of Chinese urban residents' behavior of consuming edible vegetable oil, we can take the reasons for the inter-group differences in consumer behavior as the next research goal.

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