

Analysis of the Influence Mechanism of Low-Carbon Consumption Behavior in Beijing, China

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Abstract

The daily consumption pattern of residents has an important influence on energy conservation and emission reduction, and tackling climate change. It is an important task for theoretical researchers and policy makers to guide and encourage residents to transform low-carbon consumption pattern. Based on the questionnaire survey, the structural equation model was established to explore the individual psychological factors and external factors which affect residents' low-carbon consumption behavior. Bootstrap method was used to explore and test the mediating effect of pre-variables. The discrepancies of different characteristic groups were analyzed by independent sample T test. The results showed that behavioral intention and low-carbon knowledge directly promoted residents' low-carbon consumption behavior. Psychological variables such as values, subjective norms and perceived behavioral control advanced residents' low-carbon consumption behavior through behavioral intention. Policies and regulations affected residents' low-carbon consumption behavior by individual psychological variables. Publicity and education could directly facilitate residents' low-carbon consumption behavior, and had a significant effect on behavior by improving the knowledge of low-carbon. Groups with different gender, age, educational background, family structure and monthly household income had a prominent discrepancy in low-carbon performance. On this basis, it provided targeted policy ideas for the government to guide residents to convert low-carbon lifestyle and consumption pattern.

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Keywords: Low-carbon consumption behavior, Psychological consciousness, Policies and regulations, Structural equation model, Mediating effect analysis.

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1. Introduction

Coping with climate change is a common concern of the international community. On September, 2020, president Xi Jinping announced that China would "strive to reach the peak of carbon dioxide emissions by 2030 and achieve carbon neutrality by 2060" at the seventy-fifth general debate of the United Nations General Assembly. In China, carbon dioxide emissions caused by household consumption account for about 40% of the total carbon dioxide emissions (Liu et al., 2011). As social terminal consumers, carbon dioxide emissions caused by resident consumption include direct energy consumption such as lighting, cooking, and heating, as well as indirect carbon dioxide emissions resulting in daily commodity consumption. With the continuous improvement of economic development, carbon dioxide emissions brought by household consumption will continue to increase. Paying attention to the carbon emissions caused by household consumption is an important part of China's energy conservation and emission reduction (Mallapaty, 2020), which can guide and force the production field from the consumption side, and further realize the virtuous cycle of China's low-carbon economy. (Dai et al., 2017; Dai et al., 2016).

Lifestyle is the most significant factor on influencing household consumption carbon emissions (Zhang et al., 2020). Positive changes in household consumption structure can promote the reduction of household carbon emissions (Li et al., 2021). It is an important focus to reduce carbon dioxide emissions in the residents' sector by guiding and encouraging residents to change their lifestyles and practicing low-carbon consumption pattern. The improvement of residents' consumption is accompanied by the consumption of more commodities, which may induce more serious carbon dioxide emission problems. Thus, guiding the public to shift to a low-carbon consumption pattern is a crucial part for achieving the goal of Carbon Neutralization and Carbon Peaks of China (Feng et al., 2011). Scholars in different fields have carried out research on the carbon dioxide emission of residents' consumption. The research of sociologists is macroscopic, the carbon emission of residents' consumption was generally researched against the background of the long-term social development process, focusing on social characteristics, government guidance policies, urbanization level and economic development level. This kind of research was mainly based on qualitative analysis which ignored the characteristics of the subject itself, and it was difficult to involve deeper variable relations. For example, Fan et al. (2021) studied the impact of population aging on the carbon emissions of urban and rural households of China and founded that there was a non-linear relationship between population aging and household carbon emissions, and consumption structure and consumption level were mediating factors affecting household carbon emissions. Constructed a regression model for group data of 284 cities of China, Wang et al. (2021) discovered that the level of income had different influences on the carbon dioxide emissions of urban households. Households with upper-middle savings levels contributed to an increase in household carbon emissions, while households with low savings had a

higher demand for government intervention due to difficulties in accessing clean energy. Introducing social psychology theories such as planned behavior theory (Ajzen, 1991), value-belief-norm theory (Stern et al., 1999), behavioral economists regarded subjects as ‘bounded rational economic man’ who influenced by their own characteristics and external environment. Zhang et al. (2018) verified the theory of planned behavior by investigating the environmental responsibility behaviors of tourists in eight Count parks in Beijing. Based on the theory of planned behavior, Justin Paul et al. (2016) investigated the green consumption intention and the influenced factors of 521 consumers in India founded that consumer attitude and perceived behavioral control were the main factors of green consumption intention, while the influence of subjective norms was not significant. This kind of research combines the strengths of psychology and economics (Deng and Wang, 2020). With the establishment of research models more abundant, the conclusions obtained were more diverse and complex, which provided more directional help for the government to formulate policies.

Low-carbon behavior (Barr et al., 2005) includes not only purchasing low-carbon and energy-saving productions (energy-saving household appliances, green energy products), housing investment and other purchasing low-carbon consumption behaviors to reduce long-term (indirect) carbon emissions, but also daily habitual low-carbon consumption behavior (saving electricity, reducing gas use) to reduce immediate (direct) carbon emissions. For the change of residents’ lifestyle and consumption structure, individual psychological factors are the internal motivation, and external factors will also have a certain influence (Wang and He, 2011). The question lies in which psychological variables and external factors act on residents’ low-carbon consumption behavior and the effect of their mechanism, as well as the discrepancy in the performance of groups with different social characteristics in low-carbon consumption behavior, and what further policies and measures can be taken to promote residents to implement low-carbon consumption. Based on this, excavating the psychological and external factors affecting low-carbon consumption behaviors, clarifying the influence mechanism of each factor, and analyzing the discrepancy of different characteristic groups are contributed to formulating policies and measures to promote low-carbon consumption behavior of residents.

2. Research design

2.1 Research hypothesis

Lewin Behavior Model was a widely recognized and applicable behavior model in the field of psychology, which reveals the general rule of individual behavior, and holds that individual characteristics and external environment jointly predict individual behavior under the interaction, which becomes the basic theory to understand individual behavior (Lewin, 1939). Based on psychology and marketing strategy, Hawkins (1991) proposed a consumer behavior model: when influenced by internal (physiological and psychological) and external (political, economic,

socio-cultural, and policy and regulation) factors, consumers could form their own life philosophy and lifestyle, which trigger consumers' needs and aspirations and form final consumption decisions. Individual psychological factors and external influencing factors are two important variables that can predict individual behavioral intention and intensity. Therefore, the influencing factors and mechanism of low-carbon consumption behavior can be explored from the above two aspects.

The key psychological factors affecting individuals' low-carbon consumption behavior and how to predict individuals' low-carbon consumption behavior through psychological variables are important questions. In the field of consumer behavior, behavioral intention is the most ideal factor to predict the occurrence of behavior (Ajzen and Madden, 1986), which can directly measure the probability of behavior occurrence. Behavioral intention is the behavioral motivation produced by the action of individual psychological factors, which refers to the tendency degree or subjective probability of engaging in a certain behavior. And behavioral intention is a psychological manifestation of the prelude of individual behavior, which is inevitable as a stage of behavior (Peng et al., 2016). Behavioral intention can be a good predictor of behavior. Many studies have found that many psychological factors had an impact on behavioral intention to predict and explain the occurrence of behaviors (Wang et al., 2012; Deng, 2012). The more positive low-carbon consumption intention is, the greater the probability of low-carbon consumption behavior occurs, and other psychological variables can significantly affect the intention of low-carbon consumption.

Accordingly, the following hypotheses are proposed:

H1: Low-carbon consumption intention affects low-carbon consumption behavior.

H2: Individual psychological variables affect low-carbon consumption intention.

People are affected by people around them when making decisions. When people perceive that people around them have a positive attitude towards the behavior, they will have a positive behavioral intention. Or in the case of incomplete information, the individual tends to obtain behavioral information from others to promote positive behavioral intentions if they believe that the behavior of members of the group is correct or appropriate. Perceived behavior control refers to people's judgment of possible obstacles in the process of behavior implementation including internal factors such as knowledge and skills, information acquisition ability, and external factors such as convenience, time cost, economic cost, and so on. In the process of behavior implementation, the more obstacles to the implementation of specific behavior, the more uncontrollable factors individuals perceive, the weaker their behavior intention will be (Qin et al., 2020). Perceptual effectiveness is defined as a belief in a specific domain, which is an individual believe their efforts can produce and the possibility of the occurrence of target events (Ellen et al., 1991). Perceptual Effectiveness is also a psychological expectation for the environmental

protection effect that people can achieve by participating in low-carbon consumption.

Accordingly, the following hypotheses are proposed:

H2a: Subjective norms affects low-carbon behavioral intention.

H2b: Perceived behavioral control affects low-carbon behavioral intention.

H2c: Perception effectiveness affects low-carbon behavioral intention.

Values is an important factor affecting the cognitive process in the process of individual behavior. Values is the basic stand in dealing with the value relationship and the inner guiding principle of human social life. Their influence on individual behavior is persistent and far-reaching (Schwartz and Boehnke, 2004). Schwartz (2010) proposed the value theory that differences in values would lead to differences in behaviors. From this, Stern P.C (1999) proposed the classic theory—value-belief-norm theory, which holds that values are the deep-seated psychological factors of environmental behavior. Environmental values are the basis of low-carbon behavioral intention (Liao and Ke, 2020), as well as the cognitive basis and judgment criteria of individual for events. The influence of values on low-carbon consumption intention will be further explored.

The following hypotheses are proposed:

H2d: Environmental values affects low-carbon behavioral intention.

In the field of environmental education, knowledge and skills related to environmental problems are considered to be important factors affecting the occurrence of relevant behaviors. Environmental knowledge is an important variable to predict environmental behavior in environmental literacy model (Sia et al., 1986), and environmental knowledge has significant influence on environmental behavior through psychological variables (Hines et al., 1987). From the perspective of economics, knowledge is the main resources possessed by individuals. The more knowledge and skills of low carbon consumption, the more likely to implement low carbon consumption behavior. Accordingly, the following hypotheses are proposed:
H3: low carbon knowledge affects low-carbon consumption behavior

External factors are important variables to predict individual behavior. The influence mechanism of external factors on individual behavior was explored from three aspects: policies and regulations, social consumption culture and publicity and education. According to the PRECEDE-PROCEED theory, proceed factors (such as policies and regulations) affect individual behavior through precede factors (psychological variables). From the economic perspective, low-carbon consumption behavior has obvious externality. The environmental benefits generated by low-carbon consumption pattern could be shared by all members of the society. In this case, policies and regulations are important measures to solve the imbalance between costs and benefits. In the field of psychology, policy intervention as an important part of the external environment which plays an important role in the process of individual cognition. The government formulates

policies to cultivate social models, provide external conditions and guide social and cultural atmosphere. Thus, policies and regulations can influence low carbon consumption behavior through individual psychological variables.

Accordingly, the following hypotheses are proposed:

H4: Policies and regulations affects individual psychological variables.

H4a: Policies and regulations affects subjective norms.

H4b: Policies and regulations affects perceived behavior control.

H4c: Policies and regulations affects perceived effectiveness.

Social culture is the cultural standard that guides and restricts all social activities (including consumer behavior) of consumers. Social consumption culture is a social environment formed in a certain period relative to the political, economic, and cultural environment at that time, which can be seen as the consensus of social members in terms of consumption concept and consumption mode, and is also a standard and belief for social members to judge whether the behavior is good or bad, right or wrong in a specific period (Chen et al., 2014). The values and behavior choices of most social members come from the cultural environment at that time. The cognitive behavior theory of social psychology believes that individuals will acquire information and knowledge from the surrounding environment to learn and solve the problems encountered. In this process, publicity and education will play an important role in individual cognition. Environmental education is a means of disseminating environmental science to all members of society through publicity and education. It is a common measure to improve individual relevant knowledge. The more effective the publicity and education measures, the better the individual's low-carbon knowledge level, and the greater the probability of low-carbon consumption behavior.

Accordingly, the following hypotheses are proposed:

H6: Consumer culture affects environmental values.

H7: Publicity and education affects low-carbon consumption behavior.

H8: Publicity and education affects knowledge of low-carbon.

2.2 Research preparation

2.2.1 Scale design

The questionnaire mainly adopts Likert 5-level scale to measure variables. The scale was developed by combing relevant literature and policy and referring to existing scales. According to the behaviors related to residents' clothing, housing, use and transportation in the "National Energy Conservation and Emission Reduction Manual", residents' carbon emission and energy consumption behavioral are selected. The low-carbon consumption behavior was divided into two aspects: purchasing low-carbon consumption behavior and habitual low-carbon consumption behavior. The scales of behavior intention, subjective norms, perceived behavior control and values were revised with reference to previous

studies (Dunlap et al., 2000).

To test the scale, multiple pre-surveys were conducted from August to September 2021. There were 3-5 observation items for each variable. SPSS.26 was used to test the reliability of all variables in the scale, and exploratory test validity of factor analysis. The unreasonable items in the initial scale were modified and deleted, and the formal scale containing 39 items was finally formed. The scale included two parts: personal basic information and variable measurement items. Basic personal information included gender, age, education background, family composition and monthly income. The 34 items of variable measurement included environmental values, perceived effectiveness, perceived behavior control, subjective norms, low-carbon knowledge, consumption culture, publicity and education, policies and regulations and low-carbon consumption intention.

2.2.2 Data collections and samples

From August to October 2021, a random sampling survey was conducted among Beijing residents, and used both online and offline research methods. In order to ensure the quality of the questionnaire, the electronic questionnaire is distributed online, and one-to-one interviews were used for offline questionnaires. The questionnaire was distributed in Songyuli community, Shuanglong community, Park Street, Beijing University of technology and other public places in Beijing. Finally, a total of 758 questionnaires were obtained. A total of 758 questionnaires were obtained, and 523 questionnaires were included in this research after excluding those containing missing values and short answer time. The socio-demographic composition of the sample is shown in Table 1.

Table 1: Summary of sample demography

	Background	Frequency	Percentage (%)
Gender	Male	274	52.39
	Female	249	47.61
Age	18-30	191	36.52
	31-40	235	44.93
	41-50	61	11.66
	51-60	18	3.44
	>60	18	3.44
Education	Junior/senior high school	37	7.07
	Junior college	239	47.70
	College or above	247	47.23
Family Composition	No elderly / child	243	46.46
	With elderly/child	280	53.54%
Monthly Income	<5000	108	20.65
	5000-10000	151	28.87
	10000-20000	135	25.81
	>20000	129	24.67

2.2.3 Research methods

Residents' low-carbon consumption behavior is influenced by multiple psychological and external factors. A simple and clear conclusion can be drawn by discussing the factors and behaviors one by one, but the logical relationship between the factors cannot be clarified. In addition, since behavioral intention, subjective norms, values, perceived behavioral control and other factors cannot be directly observed, we needed to transform these factors through measurement indicators, and considered the existence of measurement errors. Structural equation model (SEM) was used to analyze the interactions of multiple constructs through covariance matrix which allowed for measurement errors. SEM combined the advantages of confirmatory factor analysis and path analysis which could test the measured variables, and incorporate the multiple dependent variables and multiple intermediary variables into the model to comprehensively consider the variable information. Therefore, the structural equation model fits this research.

3. Results

3.1 Reliability and validity test

Maximum likelihood estimation was used for confirmatory factor analysis to test the reliability and validity of the scale, and the results were shown in Table 2. The factor load of each item of latent variable was between 0.605 and 0.963, greater than 0.5, which was within the acceptable range. The composite reliability (CR) value was between 0.727 and 0.937, which was greater than the recommended value of 0.6 by Fornell and Larcker (1981), indicating good internal consistency of the scale. The average variance extracted (AVE) value was between 0.473 and 0.799, and more than 0.36 was the acceptable range, indicating that the latent variable had a good ability to explain the variance of each measurement variable. The reliability and convergence validity of the scale were good.

Table 2: Test results of reliability and convergence validity

Diml	Items	Item Reliability	Composite Reliability	Convergence Validity
		STD.LOADING	CR	AVE
Purchasing low-carbon behavior, PLCB	3	0.701~0.827	0.814	0.595
Habitual low-carbon behavior, HLCB	3	0.636~0.774	0.727	0.473
Perceived effectiveness, PE	3	0.714~0.917	0.863	0.680
Environmental values, EV	4	0.856~0.936	0.937	0.789
Perceived behavioral control, PBC	3	0.675~0.859	0.800	0.574
Knowledge of low-carbon, KLC	3	0.764~0.931	0.865	0.683
Subjective norm, SN	3	0.743~0.963	0.869	0.692
Consumption culture, CC	3	0.605~0.802	0.752	0.505
Publicity and education, EDU	3	0.750~0.915	0.866	0.684
Policies and regulations, PR	3	0.648~0.828	0.808	0.586
Behavior intention of low-carbon, BIL	3	0.886~0.908	0.923	0.799

In order to ensure the discriminant validity of scale variables, the discriminant validity of each variable was tested. The test results are shown in Table 3. If the correlation coefficient between the latent variable and other latent variables was less than the square root of the AVE value corresponding to the latent variable, it could be indicated that there were differences in connotation and demonstration among various variables. According to the test results, all variables met that condition. The Pearson correlation coefficient between purchasing low-carbon consumption behavior and habitual low-carbon consumption behavior was 0.707, indicating a strong correlation. Therefore, this paper tried to conduct second-order factor analysis on purchasing low-carbon consumption behavior and habitual low-carbon consumption behavior. The target coefficient was 97.72%, closing to 1, indicating that the second-order factor model could effectively explain the structural relations of the first-order factor model. The second-order model had good fitting and the target coefficient met the requirements. According to the principle of model simplification, the second-order structural equation model was used for analysis.

Table 3: Correlation coefficient matrix and square root of average refined variance

DIML	PLCB	HLCB	PE	EV	PBC	KLC	SN	CC	EDU	PR	BIL
PLCB	0.771										
HLCB	0.707	0.688									
PE	0.103	0.168	0.825								
EV	0.257	0.376	0.291	0.888							
PBC	0.445	0.441	0.331	0.505	0.758						
KLC	0.462	0.320	0.022	0.172	0.348	0.826					
SN	0.499	0.443	0.267	0.421	0.672	0.385	0.832				
CC	0.485	0.499	0.263	0.428	0.593	0.370	0.821	0.711			
EDU	0.406	0.350	0.162	0.315	0.497	0.407	0.569	0.670	0.827		
PR	0.515	0.508	0.130	0.308	0.538	0.324	0.596	0.704	0.666	0.766	
BIL	0.322	0.364	0.288	0.496	0.611	0.226	0.559	0.633	0.466	0.519	0.894

Note: The lower half of the matrix is the correlation coefficient , and the diagonal is the square root of the AVE value

3.2 Results of direct effects

The model was established according to the research hypothesis. The fitting index of structural equation model were shown in Table 4. X^2 value was 959.039, Df value was 511, X^2/Df was 1.869, in the range 1 to 3; CFI and TLI values were 0.943 and 0.938, both greater than 0.9. RMSEA value was 0.041, less than 0.08; The SRMR value was 0.072, less than 0.08. All of them were in reasonable range, and the model fitted well. The testing of research hypotheses could begin.

Table 4: Model fit index

Fit index	Criteria	Model	Result
X^2	Smaller is better	959.039	Ideal
Df	Larger is better	511.000	Ideal
X^2/Df	$1 < X^2/Df < 3$	1.869	Ideal
CFI	> 0.9	0.943	Ideal
TLI	> 0.9	0.938	Ideal
RMSEA	< 0.08	0.041	Ideal
SRMR	< 0.08	0.072	Ideal

The hypothesis relationships among latent variables of the structural equation model were tested, and the results were shown in Table 5 and Figure 1. The effect value of low-carbon consumption intention on low-carbon consumption behavior was 0.201 at the significance level of 1%, and H1 was supported. The effect values of subjective norms, perceived behavioral control and environmental values on low-carbon behavioral intention were 0.253, 0.350 and 0.239 at the significance level of 1%, and H2a, H2b and H2d were valid. The standardized effect value of perceived effectiveness on low-carbon behavior intention was only 0.069, and the p-value value is 0.051, showing that it failed to pass the test, and H2c was not tenable. The effect value of low-carbon knowledge on low-carbon consumption behavior was 0.321 at the significance level of 1%, indicating that low-carbon knowledge had a significant positive impact on behavior, and H3 was established. The effect values of policies and regulations on subjective norms, perceived behavior control and perceived effectiveness were 0.797, 0.704 and 0.258 at the significant level of 1%. The results were significant, and H4a, H4b and H4c were established. The effect value of policies and regulations on consumer culture was 0.894 at the significant level of 1%, and H5 was established, showing that policies and regulations not only had a significant positive impact on most individual psychological variables, but also played an important role in guiding consumer culture. The effect value of consumer culture on values was 0.463 at the significant level of 1%, indicating that consumer culture had a significant positive impact on values, and H6 was established. The effect value of consumption culture on values was 0.463 at the significance level of 1%, declaring that consumption culture had a significant positive impact on values, and H6 was valid. The effect value of low-carbon education on low-carbon consumption behavior was 0.268 at the significance level of 1%, and H7 was valid. The effect value of low-carbon education on low-carbon knowledge was 0.428 at the significance level of 1%, and H8 was valid, indicating that low-carbon education had a significant positive impact on low-carbon consumption behavior and a significant effect on improving individual low-carbon knowledge.

Table 5: Hypothesis analysis of research model

Relationships		Estimate	S.E.	Est./S.E.	P-Value	Hypothesis
H1	BIL→LCB	0.201	0.048	4.185	***	Support
H2a	SN→BIL	0.253	0.044	5.770	***	Support
H2b	PBC→BIL	0.350	0.044	7.915	***	Support
H2c	PE→BIL	0.069	0.035	1.955	0.051	Not Support
H2d	EV→BIL	0.239	0.040	5.958	***	Support
H3	KLC→LCB	0.321	0.047	6.807	***	Support
H4a	PR→SN	0.797	0.025	32.307	***	Support
H4b	PR→PBC	0.704	0.035	20.109	***	Support
H4c	PR→PE	0.258	0.048	5.421	***	Support
H5	PR→CC	0.894	0.022	41.463	***	Support
H6	CC→EV	0.463	0.046	10.062	***	Support
H7	EDU→LCB	0.268	0.055	4.866	***	Support
H8	EDU→KLC	0.428	0.043	9.905	***	Support

Note: ***p<0.001

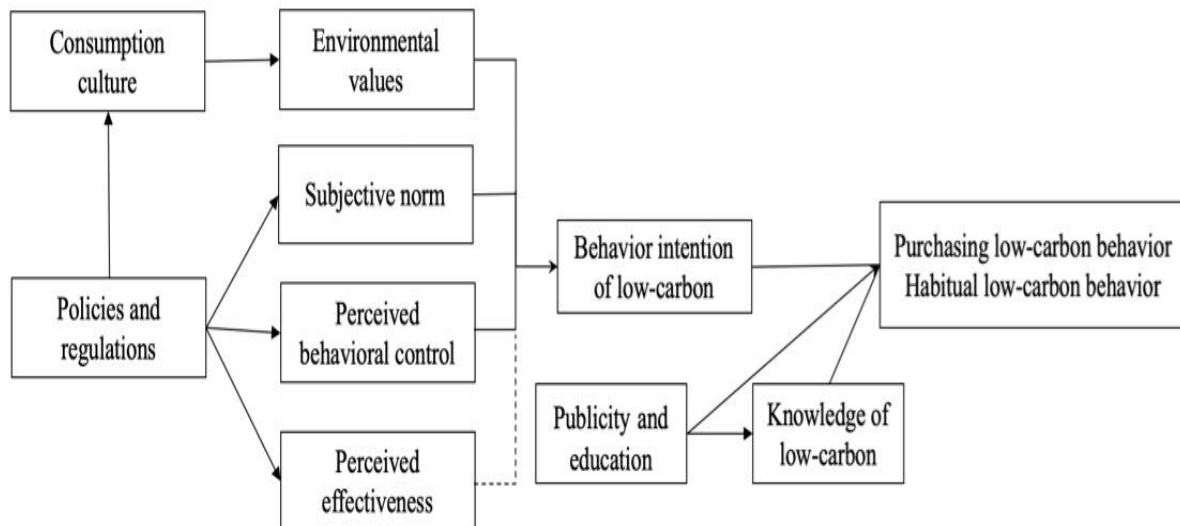


Figure 1: Model of influencing factors of low-carbon consumption behavior

3.3 Mediation analysis

In order to clarify the indirect influence of independent variables through mediating variables, based on Bootstrap method, structural equation model was used to analyze the mediating effect. Compared with the stepwise test and Sobel test, the Bootstrap method was more accurate in estimation, more effective in statistical inference, and more effective in multi-mediation models. The bootstrap sample was obtained by using 5000 repeated sampling with return for the original sample through Mplus.8 software. The mediating effect was tested by using the confidence interval estimation method of Bias Corrected Bootstrap and Bootstrap. Based on the suggestion of Preacher and Hayes (2008), the mediating effect would be significant if the 95 % confidence interval for the mediating effect did not contain zero values. The mediating effect recommendations were shown in Table 6. X^2 value was 1080.618, Df value was 511, X^2/Df value was 2.115, CFI value was 0.933, TLI value was 0.926, RMSEA value was 0.053, SRMR value was 0.078. The model fitted well and could be used to analyze the mediating effect.

The results of Bootstrap test confirmed that the effect coefficients of values, subjective norms, perceived behavioral control and other psychological variables indirectly affecting behaviors through behavioral intention were 0.062, 0.099, and 0.068, with P values less than 0.05. There was no zero value in the confidence interval of 95% mediation effect, indicating that the mediation effect was established. The effect coefficients of policies and regulations indirectly affected behaviors through psychological variables which were 0.054 and 0.065, $P < 0.05$, and the confidence interval did not contain zero value, declaring that the mediation effect was established. The mediating effect included two paths: one was that policies and regulations affected behaviors by influencing subjective norms and behavioral intentions; the other was that policies and regulations affect behaviors by influencing perceived behavioral control and behavioral intentions. As mediating variables, the effect coefficient of policies and regulations with consumer culture and psychological variables on behaviors was 0.026, $P < 0.05$, and the confidence interval did not contain zero value, showing that the mediating effect was valid. The effect coefficient of indirect influence of publicity and education on behavior through low-carbon knowledge was 0.15, $P < 0.05$, and the confidence interval did not contain zero value, indicating that the mediation effect was valid.

Table 6: Mediating effect analysis

Path	Point Estimate	Product of coefficients			Bootstrap 5000 TIMES 95%CI			
		S.E.	Est./SE.	P-Value	Percentile		Bias corrected	
					Lower	Upper	Lower	Upper
EDU→KLC→LCB	0.150	0.035	4.272	0.000	0.089	0.226	0.093	0.234
PR→PBC→BIL→LCB	0.065	0.028	2.337	0.019	0.021	0.127	0.025	0.143
PR→SN→BIL→LCB	0.054	0.023	2.279	0.023	0.016	0.107	0.019	0.113
PR→CC→EV→BIL→LCB	0.026	0.013	2.039	0.041	0.008	0.057	0.009	0.062
CC→EV→BIL→LCB	0.032	0.015	2.186	0.029	0.010	0.065	0.012	0.070
EV→BIL→LCB	0.062	0.026	2.376	0.017	0.021	0.121	0.024	0.129
PBC→BIL→LCB	0.099	0.038	2.651	0.008	0.034	0.179	0.041	0.195
SN→BIL→LCB	0.068	0.029	2.393	0.017	0.021	0.132	0.023	0.138
Model fit index	$X^2=1276.961$ Df=511 $X^2/Df=2.499$							
	SRMR=0.072				TLI=0.922			
	RMSEA=0.054				CFI=0.929			

3.4 Difference Analysis

In order to explore the similarities and discrepancies between different types of groups in low-carbon consumption behavior and its determinants, variables were divided into five groups according to gender, age, educational background, family composition and monthly income. Difference analysis were conducted by independent sample T test. If Sig. 2-tailed value was less than 0.05, there was a significant difference between groups. The results were shown in Table 7. Sig.2-tailed values of the independent sample T test of values less than 0.05, perceived behavioral control, subjective norms, low-carbon knowledge and behavioral intention of male and female groups were 0.001, 0.008, 0.005, 0.020 and 0.000 respectively, showing that there were significant differences between male and female groups in the performance of the above variables. The mean values of values, perceived behavioral control, subjective norms and behavioral intention of male were 4.570, 4.197, 3.989 and 4.483, and those of female were 4.766, 4.359, 4.145 and 4.697. The female group had a better performance than the male group in this aspect. The mean values of low carbon knowledge for men and women were 3.545 and 3.285, indicating that the mastery of low carbon consumption knowledge for men was better than that for women. Independent sample T test for different age groups declared that only the sig.2-tailed values of purchasing-type low-carbon consumption behavior and low-carbon knowledge were less than 0.05, which were 0.040 and 0.001. The mean values of the young group were 3.764 and 3.616, and the mean values of the older group were 3.570 and 3.309, showing that the young

group had more implementation of purchasing low-carbon consumption behavior and know about low-carbon knowledge. Groups with different education background had significant differences in values, perceived behavioral control, consumer culture and policies and regulations. Sig.2-tailed values were 0.030, 0.010, 0.017 and 0.018. And the average values of the groups with higher education were higher than those with lower education, indicating that the groups with higher education performed better in the above aspects. The group with the elderly or children in the family had more purchasing low-carbon consumption behavior and more knowledge about low-carbon. Groups with different incomes had significant discrepancy only in policies and regulations, while groups with lower incomes were more sensitive to policies and regulations.

Table 7: Results of independent sample T test of different types of population

		PLCB	HLCB	EV	PBC	KLC	SN	CC	EDU	PR	BIL
Gender	Male	3.652	3.918	4.570	4.197	3.545	3.989	4.036	3.891	3.903	4.483
	Female	3.629	3.934	4.766	4.359	3.285	4.145	4.123	3.930	4.024	4.673
	Sig. 2-tailed	0.802	0.839	0.001	0.008	0.005	0.020	0.154	0.589	0.093	0.000
Age	18-30 years old	3.764	3.928	4.651	4.293	3.616	4.127	4.117	3.909	3.972	4.639
	Over 30 years old	3.570	3.925	4.671	4.263	3.309	4.026	4.055	3.910	3.954	4.536
	Sig. 2-tailed	0.040	0.963	0.746	0.635	0.001	0.145	0.328	0.996	0.810	0.057
Education	Below bachelor degree	3.546	3.861	4.620	4.185	3.339	4.005	4.013	3.850	3.856	4.556
	Bachelor degree or above	3.748	3.999	4.713	4.374	3.513	4.128	4.150	3.976	4.077	4.594
	Sig. 2-tailed	0.027	0.078	0.125	0.002	0.061	0.066	0.024	0.089	0.002	0.463
Family composition	No elderly / child	3.490	3.868	4.613	4.213	3.269	3.979	4.040	3.907	3.919	4.542
	With elderly/child	3.773	3.976	4.707	4.327	3.554	4.136	4.111	3.912	3.996	4.601
	Sig. 2-tailed	0.002	0.168	0.121	0.061	0.002	0.020	0.244	0.944	0.290	0.255
Family monthly income	≤10000	3.685	3.988	4.642	4.243	3.435	4.059	4.112	3.970	4.053	4.592
	> 10000	3.598	3.865	4.685	4.304	3.408	4.067	4.044	3.850	3.870	4.556
	Sig. 2-tailed	0.345	0.113	0.480	0.318	0.769	0.908	0.264	0.102	0.012	0.483

4. Discussion

Behavioral intention, low-carbon knowledge and publicity and education were the direct influencing factors of individual low-carbon consumption behavior, which was the same as the research result of Liang Hao (2015). To improve the enthusiasm of residents' low-carbon consumption behavior, stimulate residents' low-carbon consumption will, and improve residents' knowledge of low-carbon and strengthening publicity and education were the key measures. Among them, the direct effect of low carbon knowledge was the largest, and it was also an important

focus to promote low carbon consumption of residents. As a pre-influencing variable of low-carbon knowledge, publicity and education could not only directly increase residents' low-carbon consumption behavior, but also indirectly enhance the occurrence of low-carbon consumption behavior by improving residents' knowledge of low-carbon. Thus, the significance of low-carbon publicity and education should be taken seriously. The government deepens residents' cognition and provides residents with specific behavior guidance for low-carbon consumption to improve residents' specific behavior knowledge by using short videos, public accounts, official media, and other publicity channels to a specific unit, such as schools, communities, and other subjects. At the same time, as the internal influence variable of low-carbon consumption behavior, individual psychological variables predicted the occurrence of individual low-carbon consumption behavior through individual low-carbon consumption intention, which answered how to stimulate residents' low-carbon consumption intention. Like values, subjective norms and perceived behavioral control, psychological variables had significant positive effects on individual low-carbon consumption intention, and further positively affected low-carbon consumption behavior through behavioral intention. Therefore, establishing the correct values of residents, cultivating the leading group of low-carbon consumption and providing a convenient external environment for low-carbon consumption were the main ideas to stimulate the willingness of low-carbon consumption.

Policies and regulations affected low-carbon consumption behavior through individual psychological factors such as values, subjective norms and perceived behavior control. There was the same result as the research results of Shen et al. (2016). Formulating policies and regulations were feasible measures to stimulate low-carbon consumption intention and promoted low-carbon consumption behavior. Individuals were not only the role of consumers, but also complete individuals with independent thinking and judgment ability. Only consumption that resonates with individual values will be accepted and adopted. Therefore, it was an important way to promote residents' low-carbon consumption behavior to shape residents' positive and healthy ecological values and guide residents from the pursuit of consumption quantity to the pursuit of consumption quality, from the material life to the pursuit of non-material (climate change, ecological civilization) life. The government could strengthen the behavioral constraints on government officials and public figures with high social status and greater influence, and cultivate them to become a leading group of low-carbon consumption. This would play a group consciousness that makes residents accept, identify and internalize the image of low-carbon consumption behavior. From the perspective of individual perceived behavior control, the formulation of policy intervention mechanisms on low-carbon consumption, such as economic incentives, low-carbon product supply, supporting facilities and product technology, can reduce the obstacles to the implementation of low-carbon consumption behavior by consumers, guide residents to start simple, convenient, low-cost and high-feasibility low-carbon consumption behavior, and gradually guide residents to implement more low-carbon consumption behavior.

The impact of perceived effectiveness was not significant, which might be due to the significant external effects of environmental impact caused by low-carbon consumption behavior. Rational individuals always pursued the maximization of income, but the asymmetry of responsibility and right of low-carbon behavior made individuals less enthusiastic, so that the perceived effectiveness does not show obvious effectiveness in the influencing factor model of individual low-carbon consumption behavior. The government could formulate low-carbon consumption incentive mechanism, reward low-carbon consumers for their environmental protection behavior, and improve the tax system for carbon emissions, internalize the negative external cost of high carbon consumers, make consumers perceive the realistic utility of low-carbon consumption. So as to open the impact path of individual perceived effectiveness on low-carbon consumption behavior.

Social consumption culture had a significant direct impact on individual values, and a significant indirect impact on individual behavior. Social consumption culture could shape individual values and guide consumers to develop positive low-carbon values. At present, people still pay more attention to social status. People who held the concept of consumerism and conspicuous consumption motivation believed that high-carbon consumption can make them praised and respected by others, and tend to show a higher social status through high-carbon consumption. There was still much room for consumption culture to improve. It showed that policies and regulations had a significant impact on consumption culture. The government could formulate some policies and regulations, provide a good low-carbon consumption environment, guide residents to dilute luxury, show off and other bad consumption, and make residents pay attention to climate change and the quality of living environment. The formation of a cultural atmosphere of low-carbon and moderate consumption in the whole society could make the low-carbon consumption culture become the mainstream consumption culture of the society and guide the implementation of residents' low-carbon consumption behavior.

Groups with different gender, age, educational background, family composition and monthly income showed significant differences in low-carbon consumption. Women with strong empathy, delicate emotion, and careful observation performed better in values and perceived behavior control, and behavior intention, while men with rational information collection and analysis had a deep understanding of low-carbon knowledge. In the guidance of low-carbon consumption, it is better to guide women from emotion and perception and men from rationality and knowledge. Young people had a stronger interest in and acceptance of emerging things. They were more active in purchasing low-carbon consumption and knew more about low-carbon knowledge, as well as they were more likely to become action models of low-carbon consumption. The group with higher education had better performance in values, perceived behavioral control, consumer culture and policies and regulations. Rich knowledge reserves enabled them to have a deeper understanding of positive consumer culture and hold more correct values than others. Strong learning and thinking ability made them have strong action motivation and high acceptance and recognition of policies and regulations. Groups with higher monthly

household income were less sensitive to prices and less aware of policies and regulations. Policies and regulations had a more effective effect on low-income groups. In order to encourage or restrain high-income groups, non-policy and regulation methods such as publicity and education could be used preferentially.

5. Conclusion

Based on relevant theories and research results, this paper analyzed the influencing factors of individual low-carbon consumption behavior. Psychological variables and external variables were included into the influencing mechanism model of individual low-carbon consumption behavior. At the same time, structural equation model was used to verify the research hypothesis, and the method of mediation effect analysis was applied to clarify the influence path and effect of variables. The action path of each influencing variable was clarified, and the different character groups were explored by discrepancy analysis. The following conclusions are drawn: (1) Residents' low-carbon consumption behavior is an individual behavior generated by the comprehensive decision-making of internal and external factors. It is the result of the combined effects of behavioral intention, values, subjective norms, perceived behavioral control, low-carbon knowledge, publicity and education, policies and regulations, consumer culture and other factors. (2) Individual psychological variables are the internal influencing factors of low-carbon consumption behavior. Psychological variables such as values, subjective norms and perceived behavior control affect individual low-carbon consumption behavior through behavior intention, and low-carbon knowledge can directly affect individual low-carbon consumption behavior. (3) The influence of policies and regulations, publicity and education can actively promote individual low-carbon consumption behavior by improving individual psychological factors. Publicity and education can also directly promote individual low-carbon consumption behavior. (4) Groups with different characteristics, such as gender, age, education background, family composition and monthly income, have significant differences in low-carbon consumption behavior and its determinants. The mechanism of each factor influencing behavior is clarified, and the generation process of individual low-carbon consumption behavior is further clarified. In particular, external factors such as policies and regulations, publicity and education were added into the behavioral influencing factor model. The influencing mechanism of influencing factors controllable by the government such as policies and regulations, publicity and education on Residents' low-carbon consumption behavior had been clarified. The differences of different characteristic groups were analyzed. It had explored how to guide people to a low-carbon and healthy lifestyle and consumption mode. It can be used as a reference for the government to formulate relevant policies and regulations and to publicize and educate the residents.

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