Study on Income Effect of Nutrient Intake Structure of Migrant Workers: The Case of China

Zhi-peng HE[1] and Kang YU[2]

[1]Postgraduate Student, College of Economics and Management, Zhejiang Agricultural and Forestry University, Hangzhou, 311300, CHINA

[2]Professor, College of Economics and Management, Zhejiang Agricultural and Forestry University, Hangzhou, 311300, CHINA

[2]Corresponding Author: yukang888@163.com

ABSTRACT

This paper empirically analyzes the income effect of the nutrient intake structure of migrant workers based on the 2014 survey data on the employment and food demand of urban migrant workers in China. The results showed that after controlling for factors such as labor intensity, height and weight, the monthly average income significantly increased the calorie intake of migrant workers, and the income elasticity was 0.052. From the perspective of nutrient intake structure, the average monthly income had no significant effect on the carbohydrate intake of migrant workers, but significantly increased the fat and protein intake of migrant workers, and the income elasticity was 0.222 and 0.075, respectively. Nutrition has not linear relationship between demand and income. The effect of average income on caloric intake of migrant workers in low income group, middle income group and high income group decreases with the increase of income group, until it has no significant effect on high income group, and heat demand income elasticity of low-income as well as middle-income group of migrant workers was 0.182 and 0.092, respectively.

Keywords— Elastic, Migrant Workers, Nutrition Intake

I. INTRODUCTION

Along with the reform and opening up, hundreds of millions of farmers poured into cities, forming a special group, namely migrant workers, and providing sufficient labor force for promoting the development of China's urbanization and industrialization. According to the National Bureau of Statistics, in 2019, the total number of migrant workers in China was 291 million, accounting for 66 percent of the country's urban employment[1]. However, migrant workers are mostly engaged in physical labor, such as construction, with long working hours and high labor intensity. In 2016, migrant workers worked an average of 25.2 days per month, and 84.4% of them worked more than the 44 hours stipulated in the Labor Law[2]. At the same time, the daily food consumption of migrant workers is difficult to meet the nutritional requirements of high-intensity manual labor. Among the sample of migrant workers between the ages of 18 and 49 who are engaged in heavy manual labor, 85% of males and 78% of females consume fewer calories than the recommended intake for heavy manual labor[3], the nutritional intake status is not optimistic. In the long run, it will reduce the healthy human capital of rural migrant workers, and then affect their labor productivity, which is not conducive to the development of economy and society.

Increasing disposable income is the most direct and effective way to improve nutrition status. Since the income elasticity of nutrition demand has obvious policy implications, many studies focus on the income elasticity of nutrition demand, but this issue is still controversial. Some studies have found that nutritional demand has income elasticity, which is much higher than zero, indicating that income growth can promote the improvement of residents' nutrition (Zheng and Henneberry, 2012; Li and Chen, 2017;Li et al., 2018). For example, Zheng and Henneberry (2012) estimated that the income elasticity range of caloric intake of urban households in Jiangsu province of China was 0.936-0.968. Li and Chen (2017) estimated that the income elasticity of caloric intake of urban households in Guangdong province of China was 0.273; Li et al. (2018) estimated that the income elasticity of household calorie intake of migrant workers of China was 0.593.The above studies used data from the National Bureau of Statistics' urban Household Survey of China.

---

[1] Data source: 2019 Statistical Bulletin of National Economic and Social Development.

[2] Data source: 2016 Migrant Workers Monitoring Survey Report

[3] Data source: The recommended intake is from The Reference intake of Dietary nutrients for Chinese residents (revised 2013), in which the level of heavy physical activity for 18-49 years old is 3000 kcal for male and 2400 kcal for female

Other studies have found that nutritional demand has no income elasticity, and its elasticity value tends to zero (Zhang and Cai Fang, 2002; Jensen and Miller, 2011; Zhong et al., 2012; Li, 2012; Liu and Hu, 2013;You et al., 2016).For example, Li (2012) estimated that the income elasticity range of caloric intake of rural residents of China was -0.139~0.138. Liu and Hu (2013) estimated that the income elasticity of urban households' calorie intake of China was 0.039; You et al. (2016) estimated that the income elasticity of caloric intake in rural and urban households of China was 0.051 and 0.097, respectively. Data from the China Nutrition and Health Survey (CHNS) were used in the above literature.

Besides, some studies have found that with the increase of income, the income elasticity of nutritional demand decreases, that is, the relationship between income and nutritional intake is not linear (Meng et al., 2009; Tian and Yu, 2013; Tian and Yu, 2015; Li and Chen, 2017). Tian and Yu (2013) divided the sample into low and high income groups based on the international poverty line standard of $2 per person every day. The income elasticity of caloric intake of middle and low income families was 0.322, while the income elasticity of caloric intake of high income families was close to zero. Based on the threshold model, Li and Chen (2017) estimated that when the per capita income of urban households in Guangdong of China was lower than the threshold value, the income elasticity of calorie intake was 0.7; when it was higher than the threshold value, the income elasticity of calorie intake was 0.201. Meng et al. (2009), Tian and Yu (2015) also showed that there was a nonlinear relationship between household nutrition intake and income.

Throughout the existing studies, there is still no consensus on whether nutrition intake has income elasticity, and most of the studies focus on rural and urban residents' families. It is rare to take migrant workers as the research objects. In addition, the intensity of physical activity and height and weight are non-negligible factors in the study of residents' nutrition intake. CHNS and national urban survey data are mostly used in the study of nutrition intake of Chinese residents. Due to the availability of data, these two factors cannot be effectively controlled, which affects the rigor of the study and the accuracy of the conclusion. For example, the study of Li et al. (2018) fails to control the physical activity intensity and height and weight of residents. The study of You et al. (2016), Li and Chen (2017) did not control the height and weight of residents. However, the research of Zhang and Cai (2002), Liu and Hu (2013) did not control the physical activity intensity of residents.

II. DATA AND MODEL SETTING

2.1 Data Source

In this paper, the data from the research of China agricultural university, migrant workers employment in cities and towns and food demand in 2014, and survey sample included Beijing, Guangdong, Shandong, Sichuan, Zhejiang, These five provinces have a large influx of migrant workers and are geographically dispersed, In 2014, 114 million migrant workers entered these five provinces, accounting for 43.24% of the total number of migrant workers in that year. The stratified and random sampling method were employed in this research. First of all, select capital cities and cities (counties and districts) with more migrant workers from the five confirmed sample provinces (cities). Secondly, according to the industry structure of migrant Workers in cities in the 2012 Migrant Workers Monitoring Survey Report, the number of samples of each industry in each city (county, district) shall be determined. Finally, different sampling methods are adopted according to the characteristics of different industries. For migrant workers in construction industry, manufacturing industry and some wholesale and retail industry with relatively concentrated work and life, contact enterprises, and 10-20 samples are randomly selected by the list provided by the enterprise. The researchers went to the enterprises to investigate the sample farmers and migrant workers. For migrant workers whose work and life are relatively dispersed in transportation, storage, postal service, accommodation and catering industry, resident service industry and other industries, the researcher should go to the corresponding industry cluster to find migrant workers engaged in the corresponding industry for research. Sample a total of 3994 migrant workers, migrant workers (36.9%) for the manufacturing industry, construction industry distribution (25.0%), transportation and warehousing postal service (3.6%), wholesale and retail (10.1%), accommodation, catering industry (9.3%), resident service, repair and other services (15.1%), it has to do with the 2014 migrant workers monitoring survey of migrant workers from rural areas working in cities industry structure. Distribution proportion was consistent, suggests that this sample has good representative.

2.2 Measure of Nutrition Intake

According to the fact of migrant workers' meals in 24 hours, the items of this study included breakfast, lunch, dinner, extra meals and snacks, the number and weight of all kinds of food, the staple food is rice, steamed buns, steamed buns, pies and dumplings, and also the name of the dish, the composition of the ingredients and the type of meat. The meals are divided into rice, noodles, meat (pork, beef, lamb, chicken, duck, etc.), eggs (egg, duck, goose, quail), milk (milk, yogurt), aquatic products (fish, shrimp, crab, shellfish, etc.) and grains (corn, millet, beans, potato, soybean milk, etc.). Then the daily carbohydrate, fat, protein and calorie intake of the migrant workers was

calculated based on the standard conversion coefficient provided by the China Food Composition Table 2002. In this paper, except the samples with daily calorie intake of less than 800 kcal and more than 10,000 kcal (Meng et al., 2009), samples with missing data of breakfast and dinner, and samples of self-employed migrant workers, the valid samples were 3123.

2.3 Model Setting
The model setting is as follows:

$$\ln C_{ji} = \beta_0 + \beta_1 \ln X_{1i} + \sum_{k=2} \beta_k X_{ki} + u_i \quad （1）$$

C_{ji} refers to the j nutritional intake of I migrant workers, including carbohydrates, proteins, fats and calories; X_{1i} is the average monthly income of rural migrant workers; X_{ki} is other control variables: (1) food price. Due to the lack of data on food prices in this survey, this paper used the practice of Meng et al. (2009) for reference and adopted regional dummy variables to control food prices in different regions. Beijing is 1, Guangdong is 2, Shandong is 3, Sichuan is 4 and Zhejiang is 5, while Beijing as the control group. (2) Intensity of labor. light physical labor is 1, Medium physical labor is 2, heavy physical labor is 3, light physical labor as the control group; (3) Mass index (BMI) is the ratio of personal weight (kg) to height (m) squared; (4) Social security. If the migrant worker owns one or more pension insurance, medical insurance, work-related injury insurance and unemployment insurance for urban workers, it is 1; if not, it is 0. (5) Gender. It's 0 for women and 1 for men; (6) Age; (7) Degree of education. junior high school and below is 1, senior high school or junior college is 2, undergraduate and above is 3, while junior high school and below as the control group.

Table 1: Descriptive statistics of variables

Variables	Min	Max	Mean	Std. Err.
Carbohydrate （g/day）	56.64	1096.45	306.18	120.84
Fat （g/day）	2.08	490.29	65.27	53.98
Protein （g/day）	19.24	283.06	67.16	30.11
Calorie （kcal/day）	800	7392.25	2072.60	809.99
Monthly income（RMB）	833	50000	3220.25	2391.61
Gender	0	1	0.59	0.49
Age (year)	18	72	35.75	11.15
BMI	14.61	41.62	22.21	3.06
Middle school and below	0	1	0.66	0.47
High school or junior college	0	1	0.30	0.46
Undergraduate and above	0	1	0.40	0.20
Social insurance	0	1	0.54	0.50
Light manual labor	0	1	0.16	0.37
Moderate manual labor	0	1	0.55	0.50
Heavy manual labor	0	1	0.29	0.45
Beijing	0	1	0.18	0.39
Guangdong	0	1	0.21	0.41
Shandong	0	1	0.20	0.40
Sichuan	0	1	0.19	0.39
Zhejiang	0	1	0.21	0.41
Simple size		3123		

III. EMPIRICAL ANALYSIS

3.1 Estimation Results and Endogeneity Test

In this paper, the heteroscedasticity robust OLS method is used to estimate model (1), and the estimated results are reported in Table 2.

Table 2 Estimated results

Variables	Carbohydrate	Fat	Protein	Calorie
Ln(income)	-0.016(0.018)	0.222[***](0.04)	0.075[***](0.019)	0.052[***](0.016)
Age	0.003[***](0.001)	-0.004[**](0.002)	0.001(0.001)	0.001[**](0.001)
Gender	0.148[***](0.017)	0.117[***](0.037)	0.113[**](0.017)	0.131[***](0.015)
High school or junior college	-0.000(0.017)	0.084[**](0.035)	0.045[***](0.017)	0.021(0.015)
Undergraduate and above	-0.029(0.039)	0.150[*](0.089)	0.087[**](0.041)	0.051(0.034)

BMI	$0.005^{*}(0.002)$	$-0.001(0.005)$	$0.002(0.003)$	$0.003(0.002)$
Moderate manual labor	$0.02(0.021)$	$0.019(0.046)$	$0.019(0.021)$	$0.017(0.018)$
Heavy manual labor	$0.080^{***}(0.025)$	$0.120^{*}(0.057)$	$0.037(0.026)$	$0.066^{***}(0.022)$
Social insurance	$0.064^{***}(0.014)$	$0.169^{***}(0.032)$	$0.088^{***}(0.015)$	$0.083^{***}(0.013)$
Guangdong	$-0.023(0.024)$	$0.578^{***}(0.053)$	$0.139^{***}(0.025)$	$0.139^{***}(0.022)$
Shandong	$-0.005(0.021)$	$-0.229^{***}(0.057)$	$0.010(0.024)$	$-0.035^{*}(0.021)$
Sichuan	$-0.196^{***}(0.024)$	$0.478^{***}(0.053)$	$0.006(0.025)$	$-0.000(0.022)$
Zhejiang	$-0.114^{***}(0.02)$	$0.016(0.053)$	$-0.066^{***}(0.023)$	$-0.089^{***}(0.02)$
Constant term	$5.466^{***}(0.156)$	$1.804^{***}(0.334)$	$3.270^{***}(0.159)$	$6.877^{***}(0.14)$
Simple size	3123	3123	3123	3123
R^2	0.103	0.139	0.072	0.097

Note: ***, ** and * respectively indicate that the regression coefficient is significant at the level of 1%, 5% and 10%.The figures in brackets are standard errors.

There may be a correlation between income and nutritional intake (Zhang and Cai, 2002; Li and Chen, 2017), thus leading to $Cov(X_1, u) \neq 0$, which makes the estimation biased and inconsistent. In this paper, the instrumental variable method is used to test the monthly average income (X_1). The working time in the industry (Z_1) and employment industry (Z_2) of migrant workers were selected as instrumental variables. Employment industries (Z_2) include manufacturing, construction, transportation, warehousing and postal services, wholesale and retail, and accommodation and catering industries, and residential services, repair and other services, with $Z_2=0$ for residential services, repair and other services, and $Z_2=1$ for other industries. The reason for choosing these two variables as instrumental variables is that the length of time migrant workers have been engaged in the industry indicates their working experience, and whether they have rich working experience is closely related to the income level of migrant workers. Second, there are some differences in the salary

levels of different industries, and what industries migrant workers are engaged in is closely related to their income levels. Third, it is unlikely that the time and what kind of industry migrant workers are engaged in will directly affect their nutritional intake.

Table 3 reports the relevant test results. (1) weak instrumental variable test, null hypothesis: all instrumental variables are irrelevant to X_1, F=23.57>19.28, reject null hypothesis at the significance level of 5%.(2) excessive recognition test, Hansen J test, carbohydrate intake model, null hypothesis: instrumental variable is not related to the error term, J (5) =6.44, p=0.27>0.1, therefore, the null hypothesis is accepted. (3) Endogens test, Durbin-Wu-Hausman test, carbohydrate intake model, null hypothesis: the monthly average income variable is not related to the error term, J (1) =0.39, p=0.53>0.1, therefore, null hypothesis is accepted. The fat, protein and calorie intake models showed the same results.

Table 3: Endogenous test of monthly average income variable

	Carbohydrate	Fat	Protein	Calorie
Weak tool variable test.	null hypothesis: the instrumental variables are irrelevant			
	at the 5% significance level, Cragg-Donald F is 23.57 greater than the Stock-Yogo threshold of 19.93. reject null hypothesis			
Over-identification test.	null hypothesis: the instrumental variables are irrelevant			
	J (5) =6.44 p=0.27 accept null hypotheses	J (5) =4.23 p=0.52 accept null hypotheses	J (5) =8.14 p=0.15 accept null hypotheses	J (5) =5.85 p=0.32 accept null hypotheses
Endogenous test	null hypothesis: The monthly income variable is not correlated with the error term			
	J (1) =0.39 p=0.53 accept null hypothesis	J (1) =0.26 p=0.61 accept null hypothesis	J (1) =1.34 p=0.25 accept null hypothesis	J (1) =0.36 p=0.55 accept null hypothesis

3.2 Result Analysis

The second column of Table 2 shows that, after controlling for factors such as labor intensity, height and weight, monthly average income has no significant influence on the intake of carbon hydration compounds of

migrant workers. This result is closely related to the stage of food consumption and nutritional structure of migrant workers. The food consumption and nutrition structure of Chinese residents can be roughly divided into poverty period, transitional period of food and clothing, structural

adjustment period and nutritional health period (Li, 2007). During the transition period, the food-based food structure began to diversify, and the per capita food consumption increased while meat, eggs, aquatic products and other foods also increased. In the structural adjustment period, the food structure continues to be diversified, and the per capita direct food consumption begins to decline (Li, 2007), while the food consumption is the main source of carbohydrates. Migrant workers belong to low and middle income groups, and their food consumption and nutrition structure are still in the period of structural adjustment. Therefore, the increase of income will not increase the food consumption of migrant workers, and therefore will not increase the intake of carbohydrates.

Columns 3 to 5 of Table 2 showed that after controlling for factors such as labor intensity, height and weight, the monthly average income significantly increases the intake of fat, protein and calories of migrant workers, and the income elasticity is 0.222, 0.075 and 0.052, respectively. Li et al. (2018) found that the income elasticity of per capita fat, protein and calorie demand of migrant workers' families was 0.533, 0.610 and 0.593, respectively, which was significantly higher than the conclusion of this paper, and which contributes that they did not control labor intensity, height and weight.

In the structural adjustment period, the food structure continues to be diversified, and the per capita direct food consumption begins to decline (Li, 2007), while the food consumption is the main source of carbohydrates. With rapid growth, the fat provided by animal food exceeds that provided by plant food (Li, 2007). Therefore, the increase in income will promote the consumption of meat, eggs, milk and other foods for migrant workers, thus increasing the intake of fat and protein. Since the average person's demand for protein itself is less than fat, and protein-rich food is usually expensive, it will inhibit the effective demand of migrant workers for such food. Therefore, the effect of income on the increase of fat intake of migrant workers will be greater. Calories mainly come from carbohydrates, fats and proteins in food, among which, carbohydrates are the most economical and the most important source of calories, with 55%-65% of the calories consumed being provided by carbohydrates. Fat is also a major source of calories, accounting for 30 to 35 percent of the calories consumed during physical activity. The main function of protein is not to supply calories, but insufficient protein intake can cause symptoms such as fatigue, weight loss, anemia, decreased immunity and stress ability (Edited by the Chinese Society of Nutrition, 2014). The income increases the intake of fat and protein of migrant workers, thus increasing their intake of calories.

In addition, the intake of calories, carbohydrates and fats of migrant workers with heavy manual labor was significantly higher than that of migrant workers with light manual labor, but there was no significant difference in protein intake. Body mass index had a significant effect on carbohydrate intake, but not on fat, protein and calorie intake.

3.3 Heterogeneity Analysis

In 2014, according to the National Bureau of Statistics released by the per capita disposable income of urban households classification standard, this article will sample farmers based on the average monthly income of migrant workers is divided into three low-income, middle-income and high-income group, the average monthly income less than 2220 yuan for low-income groups, more than 2220 yuan and less than 4000 RMB for middle-income groups, more than 4000 yuan for the high income group. The estimated results are reported in tables 4-7.

Table 4 shows that after controlling for factors such as the intensity of labor and height and weight, average monthly income of the low-income group, middle-income and high-income group of migrant workers calorie intake effect, the influence of the increase of income group, migrant workers calorie intake diminishing the income elasticity of demand, until the high income group had no significant effect, low-income and middle-income group of the demand income elasticity of migrant workers calorie intake was 0.182 and 0.092, respectively. Similar conclusions have been showed in the existing study (Meng et al., 2009; Tian and Yu, 2013).

Based on the nutrition structure, table 5 shows that after controlling for factors such as the intensity of labor and height and weight, for low-income and middle-income group of migrant workers, the average monthly income for migrant workers were no significant influence of carbohydrate intake, but for high income group of migrant workers, monthly income were significantly reduced the carbohydrate intake of rural migrant workers, their income elasticity was 0.111, which means that the food consumption of migrant workers in the high-income group is decreasing.

Table 6 shows that after controlling for factors such as the intensity of labor and height and weight, the influence of fat intake effect on the average monthly income of the low-income group, middle-income and high-income groups of migrant workers decreased gradually until the high income group had no significant effect, low income, middle income group of migrant workers' fat demand income elasticity was 0.623 and 0.418, respectively. Table 7 shows similar conclusions on the impact of monthly average income on protein intake of migrant workers in different income groups.

Table 4: Estimates of calorie intake in different income groups

Variable	Low income	Middle income	High income
Ln(income)	0.182*** （0.065）	0.091* （0.054）	-0.059 （0.042）
Other control variables	control	control	control
Constant term	5.979*** （0.501）	6.533*** （0.429）	7.862*** （0.391）
Simple size	817	1790	516
R^2	0.104	0.104	0.061

Note: ***, ** and * respectively indicate that the regression coefficient is significant at the level of 1%, 5% and 10%. The figures in brackets are standard errors.

Table 5: Estimates of carbohydrate intake in different income groups

Variable	Low income	Middle income	High income
Ln(income)	0.085 （0.068）	-0.022 （0.059）	-0.111** （0.049）
Other control variables	control	control	control
Constant term	4.799*** （0.537）	5.513*** （0.475）	6.155*** （0.457）
Simple size	817	1790	516
R^2	0.082	0.114	0.155

Note: ***, ** and * respectively indicate that the regression coefficient is significant at the level of 1%, 5% and 10%. The figures in brackets are standard errors.

Table 6: Estimates of fat intake in different income groups

Variable	Low income	Middle income	High income
Ln(income)	0.623*** （0.180）	0.418*** （0.129）	-0.055 （0.097）
Other control variables	control	control	control
Constant term	-1.130 （1.381）	0.164 （1.034）	4.467*** （0.902）
Simple size	817	1790	516
R^2	0.161	0.155	0.069

Note: ***, ** and * respectively indicate that the regression coefficient is significant at the level of 1%, 5% and 10%. The figures in brackets are standard errors.

Table 7: Estimates of protein intake in different income groups

Variable	Low income	Middle income	High income
Ln(income)	0.291*** （0.076）	0.134** （0.060）	-0.052 （0.047）
Other control variables	control	control	control
Constant term	1.796*** （0.584）	2.749*** （0.480）	4.391*** （0.445）
Simple size	817	1790	516
R^2	0.081	0.074	0.078

Note: ***, ** and * respectively indicate that the regression coefficient is significant at the level of 1%, 5% and 10%. The figures in brackets are standard errors.

IV. CONCLUSIONS AND POLICY SUGGESTIONS

Urban migrant workers as low-income groups in cities, whether their nutritional needs have income elasticity has obvious policy implications. This paper empirically analyzes the income effect of the nutrient intake structure of migrant workers by using the survey data of "urban migrant workers' employment and food demand" in 2014. The study found that: (1) after controlling for factors such as labor intensity and height and weight, the monthly average income significantly increased the calorie intake of migrant workers, and the income elasticity was 0.052. From the perspective of nutrient intake structure, the average monthly income had no significant effect on the carbohydrate intake of peasant workers, but significantly increased the fat and protein intake of peasant workers, whose income elasticity was 0.222 and 0.075 respectively. (2) There is a non-linear relationship between the nutritional needs of migrant workers and their income. The impact of monthly average

income on the caloric intake of migrant workers in the low-income, middle-income and high-income groups shows a decreasing trend, until it has no significant impact on the high-income group. Based on nutrition structure, average monthly income for low-income and middle-income group of migrant workers have no obvious effect on carbohydrate intake, the high income group is a significant negative impact, and with the increase of income group, the impact of monthly average income on the fat and protein intake of migrant workers showed a decreasing trend, until it had no significant impact on the high-income group.

The above conclusions indicate that: First of all, governments at all levels should strive to optimize the employment environment of migrant workers, avoid the occurrence of unpaid wages of migrant workers, increase investment in vocational skills training for migrant workers, improve their human capital, constantly adjust the standard of minimum wage in cities, and ensure the income level of migrant workers. Second, we should improve the citizenization level of migrant workers, reduce the uncertainty of their income, continuously improve the social security system for migrant workers, remove the obstacles of transfer or availability of social security in different places, reduce precautionary savings, and improve the nutritional consumption level of rural migrant workers. Third, accelerating the reform of household registration system, improve the supply of public services such as medical care and education, and strive to solve the problems of migrant workers' health security and children's education, so as to improve the living standard and the sense of fulfillment of migrant workers in cities.

REFERENCES

[1] Chinese Society of Nutrition. (2014). *Reference intake of dietary nutrients in China (2013)*. Beijing: Science Press.

[2] Li G J & Chen Y F. (2017). The impact of income growth on nutrition demand: Evidence from urban households in Guangdong Province. *Economic Science*, *3*, 60-72.

[3] Li G J, Chen Y F, & Yang C H. (2018). Income growth, differences of residence and nutritional consumption: A Study based on migrant Families in Cities. *Agricultural Technical Economy*, *10*, 66-76.

[4] Li Y S. (2012). The impact of household income risk on the nutritional intake level of Chinese rural residents. *Southern Economy*, *10*, 200-213.

[5] Li Z M. (2007). The changing characteristics of Food consumption and nutrition development in China in the past 50 years. *Resources Science*, *1,* 28-35.

[6] Liu H & Hu X Z. (2013). Study on the impact of income growth on nutrition demand of Chinese urban residents. *Agricultural Technical Economy*, *2,* 95-103.

[7] Jensen, R. T. & Miller N H. (2011). Do consumer price subsidies really improve nutrition?. *Review Economic Statistics, 4*, 1205-1223.

[8] Meng X, Gong X D, & Wang Y J. (2009). Impact of income growth and economic reform on availability in urban China: 1986-2000. *Economic Development and Cultural Change*, *2*, 261-295.

[9] Tian X & Yu X H. (2013). The demand for nutrients in China. *Frontiers of Economics in China*, *2*,186-206.

[10] Tian X, & Yu X H. (2015). Using semi parametric models to study nutrition improvement and dietary change with different indices: The case of China. *Food Policy*, *53*, 67-81.

[11] You J, Imai K S, & Gaiha R. (2016). Declining nutrient intake in a growing China: Does household heterogeneity matter?. *World Development*, *77*, 171-191.

[12] Zhang, C W & Cai F. (2002). Food demand and nutritional resilience in China's poor rural areas. *China Economic Quarterly*, *4*, 199-216.

[13] Zheng Z & Henneberry S R. (2012). Estimating the impacts of rising food prices on nutrient intake in urban China. *China Economic Review*, *4*, 1090-1103.

[14] Zhong F N, Xiang J, & Zhu J. (2012). Impact of demographic dynamics on food consumption- A case study of energy intake in China. *China Economic Review, 4*, 1011-1019.