Does social class affect nutrition knowledge and food preferences among Chinese urban adults?*

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Abstract:

The purpose of this article is to analyse the influence of social class on nutrition knowledge and food preferences among Chinese urban adults with an emphasis on the middle class. First, we propose a multidimensional definition of social class that combines income, occupation and education. We highlight the heterogeneity of the Chinese middle class with four distinct groups: the *elderly and inactive middle class*, the *old middle class*, the *lower middle class* and the *new middle class*. In a second step, we assess the influence of social class on nutrition knowledge and food preference indices. Our results shed light on the specific role of the middle class in the diffusion of nutrition knowledge and healthy food preferences. Adults belonging to the elderly and inactive middle class and to the new middle class have better nutrition knowledge and healthier food preferences than their poorer counterparts.

Key Words: Nutrition knowledge, Food preferences, Social stratification, Middle class, Urban China

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1. INTRODUCTION

One of the consequences of the striking economic development that China has experienced since the 1980s has been a strong and extremely rapid change in eating behaviour and dietary patterns. The nutrition transition framework predicts such changes. The concept of nutrition transition refers to the change in diet and activity patterns that has occurred recently in developing countries concomitantly with economic development, globalization and urbanization. More precisely, it describes the shift from traditional diets (high in cereals and fibre) and a high level of physical activity to "Western" diets (high in fats and sugar) and sedentary lifestyles (Popkin, 2003). In China, a growing literature provides evidence of the multiple changes associated with the nutrition transition such as the increasing consumption of animal foods and fats, the development of sedentary lifestyles, the increasing prevalence of overweight and obese individuals, and the emergence of diet-related non communicable diseases (Du et al., 2002; Zhai et al., 2009). Among the factors explaining those changes, the role of socioeconomic status (SES) has been a specific focus. For instance, the empirical literature on the social gradient of overweight and obese individuals in China indicates that groups of high SES are more concerned with such nutritional problems (Du et al., 2004; Zhang et al., 2008). However, recent evidence is more ambiguous. Ma (2012) shows that the association between SES and being overweight is positive for adult males but negative for adult females.

To obtain a better understanding of the causes of diet change and the increase in the number of overweight individuals requires the underlying mechanisms to be addressed. Nutrition knowledge and food preferences can be seen as potential mediators between SES and dietary patterns. Nutrition knowledge and food preferences are often considered as important determinants of diet and obesity, especially in the context of the nutrition transition. Popkin (1993) argues that "dietary change is associated with changes in the public's knowledge concerning the role of diet in health promotion and disease prevention" (Popkin, 1993: 144) and Blaylock et al. (1999: 277) explain that "nutrition knowledge arms the consumer with tools for instituting change". In other words, knowledge is crucial for consumers to make informed choices (Ippolito, 1999). The role of food preferences is no less important. According to Asp (1999), food likes play an important role in food selection because they translate the degree of satisfaction that an individual anticipates from eating specific foods.

Investigating the association between SES, food preferences and nutrition knowledge is particularly relevant in the Chinese context. A burgeoning literature focuses on the growing urban middle class and its potential role in socioeconomic development. The development of a large middle class is considered to be an engine for consumption (Banerjee and Duflo, 2008). The extension of the middle class and the subsequent reduction in poverty tend to increase households' expenditure but also lead to a change in consumption patterns. Compared to poor people, middle class individuals are thought to spend proportionally less on basic necessities and low-quality goods and more on discretionary, luxury and high-quality goods as well as on all categories of

equipment (Matsuyama, 2002). Senauer and Goetz (2003) emphasize the role of the expanding middle class in fast-growing economies in the increasing consumption of high-value food products (fresh fruit, red meat, and food consumed away from home). Using this perspective, it can be argued that the Chinese middle class vehicles specific knowledge, values and preferences regarding food consumption. Epidemiological studies examining the association between SES and nutrition quasi-systematically measure SES using occupation, education and income (Liberatos et al., 1988), but those components are included separately in econometric analyses of the determinants of obesity and dietary patterns. In line with Bonnefond et al. (2015), we suggest that information on income, occupation and education can be combined to propose a multidimensional identification of social class. We have chosen to concentrate on the middle class that we assume to be strongly heterogeneous in the Chinese context regarding employment and education.

This article aims to identify the impact of social class (with a focus on the middle class) on the formation of nutrition knowledge and healthy food preferences in China. We choose to focus chiefly on urban China and use household and individual-level data from the China Health and Nutrition Survey (CHNS) for 2009 that are specifically designed to analyse health and nutrition issues. The article is structured as follows. The second section establishes the potential links between social class and food knowledge and preferences and gives some evidence relating to China. The third section describes the data and the variables. The fourth section focuses on the identification of social classes and analyses the heterogeneity of the Chinese urban middle class. The fifth section presents the results from the econometric analysis, while the final section discusses the implications of our findings for the design of nutrition policies and for further research.

2. LITERATURE REVIEW

2.1 The influence of social class on nutrition knowledge

In their seminal article, Link and Phelan (1995) explain that social context is a fundamental cause of disease because it "involves direct access to resources that can be used to avoid risks or to minimize the consequences of disease once it occurs" (Link and Phelan, 1995: 87). Resources are broadly defined "to include money, knowledge, power, prestige and the kinds of interpersonal resources embodied in the concepts of social support and social networks" (Link and Phelan, 1995: 87). Therefore, according to the theory of the fundamental causes of disease, access to health knowledge is socially determined. Applying this framework to nutrition issues leads us to consider that the formation of nutrition knowledge is mediated by socioeconomic position and can affect diet and obesity patterns. The main idea is that groups with high SES have better access to information (and particularly to nutrition information) through multiple channels (media, internet, family, social networks, education, etc.) which could result in healthier eating habits and thus better nutrition.

The empirical literature examining the relationship between nutrition knowledge and SES in high-income countries confirms such a positive association (McLeod et al., 2011; Parmenter et al., 2000) However, there is very little evidence for the link between SES and nutritional knowledge in developing countries and particularly in China. Several studies examine the level of nutrition knowledge in specific Chinese student populations and conclude that there is a lack of nutrition knowledge among these young populations (Sakamaki et al., 2005; Xiao et al., 2011). Even if these studies provide some pieces of evidence (gender differences for instance), their primary objective is not to investigate the potential determinants of nutrition knowledge and thus they do not directly examine the association between SES and nutritional knowledge. The study by Tan et al. (2010) better meets that objective. It compares the level of nutrition knowledge between non-parent and parent care-providers of children under 7 years old in rural areas and shows that nutrition knowledge is lower in the parent group. The study also highlights a positive association between care-providers' family income and nutrition knowledge, confirming the idea that groups with higher SES have better access to nutrition knowledge.

2.2 The influence of social class on food preferences

As for nutrition knowledge, food preferences are also considered to be a mediator between socioeconomic position and food behaviour. Food likes are above all explained by physiological, psychological and cultural factors that are connected to sensory attributes of food such as taste, texture or colour (Asp, 1999). The role of SES and the social functions of food have also been emphasized (Fieldhouse, 1986; Beardsworth and Keil, 1998). In his seminal work, Bourdieu (1984) shows that taste is socially determined and suggests that food is one means of distinguishing between the upper classes and the working class. Food preferences should thus be seen as a social marker, as a means to distinguish social class membership, to establish class identity. In China, the preference for western-style convenience food or for foreign fast food is often seen as a symbol of modernity (Watson, 1997; Curtis et al., 2007) and can be considered as a marker of social class membership. However, a non-negligible proportion of urban consumers remain attached to the traditional diet. Veeck and Burns (2005) explain that "traditional food shopping, preparation, and consumption are deeply rooted in Chinese self-identity" and that "the adoption of new consumption habits (…) may engender a great deal of deliberation" (Veeck & Burns, 2005: 651).

There is strong evidence for the influence of SES on actual food consumption in China but less regarding food preferences. A few studies have analysed food preferences among adolescent populations. For instance, Shi et al. (2005) show that for a sample of school adolescents in Jiangsu province, there are few significant differences with respect to food preferences between adolescents from different SES (low, medium and high) . However, boys from high SES tend to have a greater preference for ice cream and soft drinks (that can be considered as unhealthy preferences). Deng (2011) focuses on a large sample of adolescents in nine Chinese provinces. Food preferences are measured by a composite index of healthy food likes. The SES is defined at household level with household income and household registration type (urban and rural). Both

SES variables have a significant and negative effect on the index of food preferences. In other words, adolescents from households of higher SES have food preferences that are significantly unhealthier. However, the study does not find any significant effect of education.

3. DATA AND METHODS

3.1 Data

Data used in this paper come from the China Health and Nutrition Survey (CHNS), a collaborative project between the Carolina Population Centre (University of North Carolina) and the Chinese Centre for Disease Control and Prevention. The CHNS survey consists of a multi-wave longitudinal survey that provides detailed information on income, labour market, education, health, nutrition, migration, etc. The survey covers nine provinces including coastal (Shandong and Jiangsu), North-Eastern (Heilongjiang and Liaoning) and inland provinces (Henan, Hubei, Hunan, Guangxi and Guizhou). Even if the survey is not nationally representative, these provinces have been selected to provide a highly-diversified picture of Chinese provinces in terms of geography, economic development and health and nutritional outcomes. The sample was selected through a multistage random cluster procedure[1] and CHNS data are representative of rural and urban areas. For the purpose of our study, we consider the urban sub-sample from 2009 that covers 1,320 households and 2,841 adults aged 18 and over after checking for missing values.[2]

3.1.1 Nutrition knowledge and food preferences indices

In the CHNS survey, information on knowledge of principles is collected. More precisely, surveyed adults express their opinion on a five-point Likert scale (strongly disagree, disagree, neutral, agree and strongly agree) about twelve diet- and activity-related statements (Table A.1 in the Appendix). We only consider the ten nutrition-related items. For each answer, we have constructed a score ranging from 0 to 4, with a higher score indicating better knowledge. It is worth noting that for "wrong" statements we have reversed the scale. The nutrition knowledge index is the sum of the ten scores divided by two, and thus ranges from 0 to 20.

CHNS also collects information on preferences for five food categories: fast foods, salty snack foods, fruit, vegetables and soft drinks and sugary fruit drinks. Each adult expresses his preference on a five-point Likert scale (dislike very much, dislike, neutral, like, like very much). On this basis, we have created a score for each category ranging from 0 to 4, with a higher score indicating a healthier preference. The food preference index is the sum of the five scores and thus ranges from 0 to 20. Moreover, for each of the five categories, we create a dummy that is equal to one for an

[1] For a description of the sample scheme, see Popkin et al. (2009).

[2] The main reason why we do not use other waves of CHNS data is that the method implemented to identify social classes gives a 'picture' of social stratification at a specific moment of time. If we carry out the same analysis for another wave of CHNS, the social class structure could be completely different and could not be compared with the 2009 one.

individual who likes this item (like and like very much) and zero otherwise (neutral, dislike and dislike very much).

3.1.2 Social class variables

Although CHNS data are primarily designed to analyze health and nutrition issues, they also include basic information on income, occupation and education that are the three dimensions that we take into account to identify social classes. The first variable that interests us is household income which is expressed in Yuan per capita and per annum and is composed of wages, retirement income, business income, subsidies, agricultural income and other income (private transfers and rent). At the individual level, CHNS data include detailed information on employment and education. Because our analysis of social class is at the household level, we have selected information on occupation and education for heads of households. Four classification variables are taken into account: primary occupation (professional or technical worker, skilled or non-skilled worker, service worker, inactive, etc.), employment position in the occupation (self-employed, paid-employee, etc.), the type of work unit (government department, state-owned or collective enterprise, etc.) and education level (highest level of education completed).

3.1.3 Control variables

The purpose of our econometric analysis is to identify the effect of social class on nutrition knowledge and food preferences. Such an analysis necessitates additional control variables that are seen as important determinants of nutrition knowledge and food preferences. We include demographic characteristics of adults (age, gender, and matrimonial status) and their household (household size, hukou status of head of household). We also include the province of residence that can be considered as a proxy for regional food identities. We try to control for the information environment. First, we use an index of urbanization. Based on community-level data, this index is a composite measure synthesizing the information on twelve dimensions of urbanicity: population density, economic activity, traditional markets, modern markets, transportation infrastructure, sanitation, communications, housing, education, diversity (in education and income levels), health infrastructure, and social services.[3] Second, two individual variables are taken into account to describe media exposure: the daily time spent watching TV (in minutes) and a dummy indicating if a person is active in surfing the Internet.

3.2 Methods

3.2.1 The identification of social class

While the preferred method for identifying the middle class in the economic literature is a strictly monetary approach, we propose to strengthen this purely income-based definition by considering occupation and education, which are the chief focus of sociological literature on class structure. To do this, and in line with Bonnefond et al. (2015), we adopt a two-step statistical methodology.

[3] For each component, a score varying from 0 to 10 is calculated. The global index is the sum of the twelve component scores. A higher urbanization score indicates higher urbanicity. See Jones-Smith and Popkin (2010) for more details.

For the first step, we have chosen to prioritize a monetary criterion and thus refer to an income-based definition of the middle class. In the empirical literature, there is absolutely no consensus on the lower and upper boundaries for defining the middle class. Following Birdsall (2010), we propose to identify the Chinese urban middle income class by combining an absolute lower boundary and a relative upper boundary. The lower boundary is set at 10,000 Yuan in order to ensure that people whose income is above have reached a certain level of economic security (Wang and Davis, 2010).[4] As for the upper limit, we use the 95th percentile of the income distribution (Birdsall, 2010).

For the second step, we use information on employment (primary occupation, employment position and work unit) and education (highest level completed) to analyze the structure of the middle income class previously identified. To implement this second step, we carry out a mixed classification procedure in order to establish homogeneous and meaningful clusters of households with respect to their multidimensional "middle-class status". A mixed classification procedure involves conducting hierarchical cluster analysis and consolidating the relevant partition through some k-means-like iterations aiming at increasing inter-cluster variance while minimizing intra-cluster variance (Jain et al., 1999).[5] We finally compare the distributions of each active (classification) variable in order to give a precise description of each cluster. We also consider additional variables (the hukou status of the head of the household and the annual per capita household income) that can help to improve our description of social classes.

3.2.2 Econometric framework

Because the acquisition of nutrition knowledge and the formation of food preferences are possibly non-independent processes, we have chosen to use multivariate regression procedures. Multivariate regressions are an extension of multiple regressions that allow for multiple dependent variables. In this article, the nutrition knowledge index and the healthy food preferences index are jointly regressed on the same independent variables, including social class dummies and control variables. In order to deepen our analysis, we use the same set of independent variables to estimate multivariate probit regressions for the five kinds of food preferences (fast-food, snacks, fruits, vegetables and soft drinks). For each food preference, the dependent variable equals one for adults who like this item and zero otherwise. As for the previous multivariate regressions, the five probit equations are jointly regressed. The underlying idea is that individual food tastes and preferences are shaped in a non-independent way. For all regression estimates, the non-independence between equations is checked for using a Breusch-Pagan test of independence of residuals.

4. RESULTS

[4] This implies that a household belonging to the middle class earns at least 8.36 times as much as the Chinese poverty line (set at 1196 Yuan per annum in 2009).

[5] The relevant number of clusters is derived from the analysis of the provided dendrogram and the analysis of two indicators that respectively (i) maximize the marginal improvement of the inter to intra-cluster variance ratio from a given partition to another and (ii) minimize the impact of k-means consolidation on that ratio.

4.1 The heterogeneity of the Chinese urban middle class

The income criterion [10,000 Yuan; 95th income percentile] leads us to distinguish three main income classes in our sample: (i) the poor, whose annual per capita household income falls below 10,000 Yuan (43.4% of households); (ii) the middle class, earning between 10,000 and 36,285 Yuan (51.6% of households); and (iii) the rich with an income above 36,285 Yuan (5% of households).[6] In the next step, we carry out a cluster analysis to analyse the structure of the middle income class regarding employment and education variables.

Results from the mixed classification procedure are presented in Table 1. Generally speaking, and in line with Chunling (2010), this cluster analysis confirms the strong heterogeneity of the urban middle class by identifying four distinct clusters within it. Our results also indicate that those four middle class components display specific features compared to the poor and the rich.[7] The first cluster, referred to as the *elderly and inactive middle class*, is mainly composed of households whose head is poorly-educated and retired. From our point of view, the identification of an *elderly and inactive middle class* in urban China is a new finding, particularly since the share of this group in the middle class as a whole is approximately 50 per cent. The chief focus of sociological research on the Chinese middle class is the working-age population. In other words, sociological studies do not consider the possibility of an elderly middle class. Conducting an investigation at a household level helps to broaden the scope of the analysis. Another interesting result is that, with a mean income significantly higher than in the other three groups put together, those elderly households are located at the top of the income distribution within the middle class. The second cluster is composed of self-employed people and wage-earners, who are quasi-exclusively employed in collective and private enterprises. This small business community is often referred to as the *old middle class* in the literature on social stratification (Chunling, 2010), and represents only 12% of the whole middle class. This class (not to be confused with the capitalist class composed of managers and owners of large export-oriented firms) is composed of moderately well-off households. Moreover, approximately 20% of household heads in the *old middle class* are rural-to-urban migrants with rural hukou. The third cluster describes a working class which consists of skilled and non-skilled workers. On average, households in this group have a significantly lower annual per capita income than the rest of the middle class. The proportion of this *lower middle class* in the whole middle class is quite limited with no more than 12%.

Table 1: Socioeconomic characteristics of middle-classes (four clusters derived from mixed classification procedure), poor and rich (urban households, 2009).

	Poor N=573	**Elderly and inactive Middle Class N=338**	**Old Middle Class N=83**	**Lower Middle Class N=79**	**New Middle Class N=181**	**Rich N=66**	**All N=1320**
Education							
No school	**19.7%**	**17.2%**	10.8%	*0%*	*0.6%*	10.6%	14.2%
Primary school	**19.7%**	**14.2%**	7.2%	3.8%	*0.6%*	6.1%	13.3%

[6] For a comparison with other income criteria, see Bonnefond et al. (2015).

[7] A more detailed description of the four middle class clusters can be found in Bonnefond et al. (2015).

Secondary school	48.0%	42.6%	**69.9%**	**73.4%**	*27.1%*	37.9%	46.1%
Technical /Vocational degree	*7.5%*	*13.0%*	*9.6%*	20.3%	**29.8%**	**21.2%**	13.6%
Superior	*5.1%*	*13.0%*	*2.4%*	*2.5%*	**42.0%**	**24.2%**	12.8%
Total	100%	100%	100%	100%	100%	100%	100%
Occupation							
Inactive / Seeking work	**36.3%**	**13.0%**	*0%*	*0%*	*0%*	*1.5%*	19.2%
Professional / Technical worker	*5.1%*	*0%*	8.4%	11.4%	**50.3%**	**24.2%**	11.5%
Administrator / Executive	*2.8%*	*0%*	4.8%	8.3%	**24.3%**	7.6%	5.8%
Office staff	*2.4%*	*0%*	1.2%	2.5%	**19.3%**	3.0%	4.1%
Skilled worker	4.7%	*0%*	2.4%	**44.3%**	*0%*	3.0%	5.0%
Non-skilled worker	**5.4%**	*0%*	1.2%	**26.6%**	*0%*	3.0%	4.2%
Service worker	**12.0%**	*0%*	**51.8%**	5.1%	*2.2%*	**18.2%**	10.0%
Other	**8.0%**	*0%*	**30.1%**	1.3%	3.9%	3.0%	6.1%
Retired	*23.2%*	**87.0%**	*0%*	*0%*	*0%*	36.4%	34.2%
Total	100%	100%	100%	100%	100%	100%	100%
Employment status							
No job	**59.5%**	**100.0%**	*0%*	*0%*	*0%*	*37.9%*	53.3%
Self-employed with employees	2.3%	*0%*	**16.9%**	0%	*0%*	**9.1%**	2.5%
Self-employed with no employees	**12.4%**	*0%*	**53.0%**	*0%*	*0%*	9.1%	9.2%
Paid employee	*24.8%*	*0%*	*26.5%*	**100.0%**	**100.0%**	43.9%	34.3%
Other status	1.0%	*0%*	**3.6%**	0%	0%	0%	0.7%
Total	100%	100%	100%	100%	100%	100%	100%
Work unit							
No job	**59.5%**	**100.0%**	*0%*	*0%*	*0%*	*37.9%*	53.3%
Government / State service	*8.9%*	*0%*	*1.2%*	*12.7%*	**90.1%**	25.8%	18.3%
State-owned enterprise	*3.8%*	*0%*	*0%*	**58.2%**	*1.1%*	6.1%	5.6%
Collective / Private / Individual enterprise	**27.7%**	*0%*	**98.8%**	**29.1%**	*8.8%*	30.3%	22.7%
Total	100%	100%	100%	100%	100%	100%	100%
Characterization variables							
Annual per capita income (mean)	*5,063*	**18,571**	16,818	*16,266*	**18,874**	**66,299**	14,887
Rural hukou	**12.7%**	3.8%	**19.7%**	4.0%	*1.1%*	9.2%	8.4%

Notes: For the poor and the rich, bold characters denote the fact that the value is significantly higher in the group than in the rest of the population (excluding the group concerned), and italic characters do the same for values significantly lower in the group than in the rest of the population. For the four components of the middle class, bold characters denote the fact that the value is significantly higher in the group than in the rest of the middle class (excluding the component concerned), and italic characters do the same for values significantly lower in the group than in the rest of the middle class. Adjusted standardized residuals of khi ² for categorical variables ($p<0.05$) and independent samples t-test for continuous variables ($p<0.10$). Source: CHNS (2009).

The fourth and last cluster accounts for approximately 26% of the middle class as a whole and is composed of the highest-earning and best-educated individuals (mainly professional or technical workers, administrators, executives and office workers). Members of this group are almost exclusively employed in the public sector as state employees. Based on Chunling (2010), this salaried upper middle class may be described as the *new middle class*. It is the richest component of the Chinese urban middle class, with a mean annual per capita household income that is significantly higher than the other middle class groups (particularly the *old* and the *lower middle class* groups). Following Bonnefond et al. (2015) and Elfick (2011), we argue that the *new middle class* is the most westernized component of the Chinese urban middle class and should be considered as a class that drives the spread of new consumption patterns.

4.2 The effect of social class on nutrition knowledge and food preferences

Table 2 presents the estimates of multivariate regressions for the nutrition knowledge and food preference indices with income class dummies and social class dummies respectively included as covariates. The mean values of nutrition knowledge and food preference indices for income classes and social classes are presented in Table A.2 in the Appendix. Table 3 presents the multivariate probit regression estimates for the five categories of food preferences. For these latter estimates, we do not report the coefficients and t-statistics for control variables. The Breusch-Pagan tests are significant in all regressions, thus confirming the non-independence (i) between the formation of nutrition knowledge and food preferences (Tables 2) and (ii) between the five food preference categories (Table 3).

4.2.1 The influence of control variables

Results reported in Tables 2 and 3 reflect the diversity of factors affecting nutrition knowledge and food preferences. It is worth noting that the determinants of the nutrition knowledge and healthy food preference indices are not clearly gender-specific. The coefficient associated with gender is not statistically significant in any of the regressions.[8]

Table 2 emphasizes a U-inverted association between age and nutrition knowledge and healthy food preferences. This result is consistent with other empirical work on samples of adult populations which show that people of middle years tend to have a better nutrition knowledge score than the youngest or the oldest (Wardle et al., 2000).

Another demographic characteristic that has a significant impact on nutrition knowledge is the household registration type. According to our results, having a rural hukou is significantly associated with a lower nutrition knowledge score across the whole sample but also for men and women separately. In general, migrants earn higher incomes in cities than in rural areas. However, the rural hukou of migrants implies employment and wage discriminations and restrictions in access to education or health care (Liu, 2005). Perhaps such restrictions result in a lack of knowledge of the health benefits of good nutrition.

Household size has a significant negative influence on food preferences. Since household size is closely linked to the presence of children, this result may be partially explained by children's preferences for unhealthy food, such as fast food or sodas. In the literature on children's obesity in China, the role of the one-child policy has often been highlighted (Jing, 2000; Yang, 2007). The expression "little emperor" has been increasingly employed to describe the Chinese only child who has become the centre of attention of his family.

Table 2: Multivariate regressions for nutrition knowledge and food preferences with income classes.

	With income classes		With social classes	
	Nutrition knowledge	**Healthy food preferences**	**Nutrition knowledge**	**Healthy food preferences**
Demographic characteristics				
Age	0.0271**	0.1761***	0.0257**	0.1770***

[8] We have also estimated this multivariate regression for men and women separately. For the majority of variables, the associations observed for men are not radically different from those observed for women.

	(2.53)	(11.90)	(2.39)	(11.91)
Age squared	-0.0003***	-0.0012***	-0.0003***	-0.0012***
	(-2.83)	(-8.85)	(-2.68)	(-8.90)
Male	0.0338	0.0218	0.0374	0.0277
	(0.62)	(0.29)	(0.69)	(0.37)
Married	0.1370	0.1027	0.1441	0.1105
	(1.27)	(0.69)	(1.34)	(0.74)
Household size	-0.0148	-0.0643*	-0.0147	-0.070**
	(-0.61)	(-1.92)	(-0.60)	(-2.08)
Rural hukou	-0.3517***	-0.1532	-0.3356***	-0.1302
	(-3.26)	(-1.03)	(-3.10)	(-0.87)
Living environment				
Surfing internet	0.2821***	-0.2352**	0.2567***	-0.2552**
	(3.82)	(-2.30)	(3.44)	(-2.47)
TV time	-0.0005*	0.0002	-0.0006*	0.0001
	(-1.84)	(0.38)	(-1.93)	(0.29)
Urbanization index	-0.0001	-0.0097**	-0.0010	-0.0103**
	(-0.03)	(-2.00)	(-0.28)	(-2.11)
Province (ref. = Guizhou)				
Liaoning	0.3477***	-0.0844	0.3628***	-0.0754
	(2.83)	(-0.50)	(2.95)	(-0.44)
Heilongjiang	0.3063***	0.2747*	0.2851**	0.2572
	(2.57)	(-1.67)	(2.38)	(1.55)
Jiangsu	0.4573***	0.0978	0.4875***	0.1223
	(3.78)	(0.59)	(4.01)	(0.73)
Shandong	0.0508	-0.1532	0.0580	-0.1522
	(0.43)	(-0.93)	(0.49)	(-0.93)
Henan	0.0939	-0.3103*	0.1036	-0.2961*
	(0.76)	(-1.81)	(0.84)	(-1.73)
Hubei	0.3805***	0.5683***	0.3874***	0.5813***
	(3.04)	(3.29)	(3.09)	(3.36)
Hunan	0.1718	0.0310	0.1701	0.0279
	(1.39)	(0.18)	(1.37)	(0.16)
Guangxi	0.2125*	0.0948	0.2411*	0.1280
	(1.68)	(0.54)	(1.90)	(0.73)
Social Class (Ref. = Poor)				
Middle Class	0.2514***	0.2030**		
	(4.06)	(2.37)		
Elderly and inactive MC			0.2590***	0.2952***
			(3.56)	(2.93)
Old middle class			0.0955	-0.0905
			(0.82)	(-0.56)
Lower middle class			0.1867	0.1222
			(1.56)	(0.74)
New middle class			0.3839***	0.2343*
			(4.07)	(1.80)
Rich	0.0948	0.1397	0.1065	0.1513
	(0.71)	(0.76)	(0.80)	(0.82)
Constant	12.6791***	8.9945***	12.7755***	9.0741***
	(29.38)	(15.07)	(29.47)	(15.14)
Nb. Obs.	2325	2325	2325	2325
R-squared	0.0553	0.2188	0.0575	0.2206
Independence of residuals (Breusch-Pagan test)	55.849		54.929	
(p. value)	(0.000)		(0.000)	

Notes: t-statistics into brackets. Levels of statistical significance. Levels of statistical significance: *** p<0.001, ** p<0.05, *p<0.1. Source: CHNS (2009).

Table 3: Multivariate probit regressions for five food likes with income classes and social classes.

	Fast- food	**Snacks**	**Fruits**	**Vegetables**	**Drinks**
Income class (Ref.= Poor)					
Middle class	-0.1178	-0.2248***	0.0930	0.2212***	-0.0927
	(-1.23)	(-2.67)	(1.45)	(2.94)	(-1.33)
Rich	-0.9030**	-0.2009	-0.0368	-0.2139	0.0272
	(-2.53)	(-1.11)	(-0.27)	(-1.43)	(0.18)
Independence of residuals (Breusch-Pagan test)	644.747 (p. value = 0.000)				

Social class (Ref.= Poor)					
Elderly and inactive MC	-0.0204	-0.3003***	0.1644**	0.3247***	-0.1946**
	(-0.18)	(-2.83)	(2.16)	(3.46)	(-2.26)
Old middle class	-0.4676**	-0.3202*	-0.0855	-0.1030	0.1401
	(-2.22)	(-1.89)	(-0.72)	(-0.80)	(1.17)
Lower middle class	-0.1449	-0.1220	0.0272	0.0116	-0.1645
	(-0.81)	(-0.76)	(0.21)	(0.08)	(-1.18)
New middle class	-0.1097	-0.0983	0.0916	0.4699***	-0.0476
	(-0.79)	(-0.82)	(0.90)	(3.54)	(-0.45)
Rich	-0.8944**	-0.1832	-0.297	-0.1872	0.0249
	(-2.53)	(-1.01)	(-0.22)	(-1.25)	(0.16)
Independence of residuals (Breusch-Pagan test)			645.055 (p. value = 0.000)		

Notes: z-statistics into brackets. Levels of statistical significance: *** p<0.001, ** p<0.05, * p<0.1. Only the coefficients on income and social classes are reported. Source: CHNS (2009).

Several variables related to the living environment also significantly affect nutrition knowledge and food preferences. Among this, surfing the Internet has an ambiguous impact since it is significantly associated with a higher level of nutrition knowledge, but also tends to significantly increase the preference for unhealthy food. Watching TV is significantly associated with lower nutrition knowledge. Another important finding is that living in a more urbanized city is significantly associated with unhealthier food preferences. A possible explanation may be linked to the fact that more fast food can be found in highly urbanized cities, resulting in a greater exposure to an obesogenic environment for urban inhabitants. Provincial dummy variables, when significant, are positively associated with nutrition knowledge and/or healthier food preferences. This result may be interpreted as a wealth effect in so far as the reference province is Guizhou, the poorest province of China.

4.2.2 The influence of income and social class variables

Introducing income and social class dummies provides interesting information on the social determinants of nutrition knowledge and food preferences. Results reported in Table 2 show that, compared to their poorer counterparts, members of the Chinese middle income class are significantly more likely to have better nutrition knowledge and healthier food preferences. Generally speaking, this finding is consistent with the empirical literature applied to developed countries that tends to emphasize the lack of nutrition knowledge of lower SES groups (Wardle et al., 2000). Some studies also find a positive association between SES and healthy food habits for developed countries (Calnan, 1990; Hupkens et al., 2000). Our results suggest that the social gradient of food preferences is similar to that observed in industrialized countries with higher social classes having better nutrition knowledge and healthier food preferences. The influence of income classes on the five food likes confirms this idea. Although our results underline the fact that being a member of the rich category rather than the poor group has no significant impact on the nutrition knowledge and food preferences indices (Table 2), Table 3 shows that rich adults have a lower preference for fast food than the poor. We also observe that adults belonging to the middle class have a stronger preference for vegetables and a lower preference for snack foods compared to the poor group.

A focus on the different components of the Chinese middle class helps to clarify the associations identified above. While no significant association is found for the old middle class and the lower

middle class, being a member of the elderly and inactive middle class and of the new middle class is positively associated with the nutrition knowledge and food preference indices (at 1% level). Moreover, results in Table 3 show that adults of the elderly and inactive middle class have a higher probability of liking fruit and vegetables than the poor, but also a lower probability of liking snacks and soft drinks. This suggests that the food preferences of the elderly and inactive middle class are relatively distant from the western diet (which is higher in sugar and fat) and more attached to the Chinese traditional diet which is often mentioned as one of the world's healthiest. As stated by Veeck and Burns (2005), there is a kind of resistance to the westernization of dietary patterns and food behaviour in China. For instance, they explain that the emphasis on fresh food, on traditional shopping and cooking remains deeply rooted in Chinese society. Our results could indicate that adults belonging to the elderly and inactive middle class contribute to the perpetuation of such traditional Chinese food habits.

As for members of the new middle class, they tend to have significantly better nutrition knowledge (at the 1% level). This finding can be linked to the work of Bonnefond and Clément (2014) who use the same sample of Chinese urban adults and underline the fact that the Chinese new middle class is relatively well-protected against obesity. Belonging to this group compared to the poorest group also increases the food preferences index. Nevertheless, the association is only significant at the 10% level, reflecting the fact that the association may be weakly significant. This may reflect the fact that having nutrition knowledge does not necessarily result in healthier food preferences. Some studies have already emphasized that nutrition knowledge is not sufficient to ensure the adoption of healthy dietary behaviour (Darmon and Drewnowski, 2008). The weak association between membership of the new middle class and healthy food preferences seems to be confirmed by Table 3. Although members of the new middle class have a significantly higher probability of reporting a preference for vegetables compared to the poor (Table 3), no significant association is observed for other food likes.

5. CONCLUSION

Based on an urban sub-sample of the 2009 CHNS data, the objective of this article was twofold. First, it aimed to identify social classes in urban China by combining SES dimensions (income, education and occupation) to construct an indicator of social class, with a focus on the middle class. By means of a two-step methodology, we have identified six social classes: (i) the rich; (ii) the poor; (iii) the elderly and the inactive middle class, mainly composed of pensioners; (iv) the old middle class, composed of self-employed workers; (v) the marginal middle class, composed of skilled and unskilled workers; and (vi) the new middle class, composed of highly educated wage earners in the public sector.

Second, an econometric analysis relying on multivariate regression procedures aimed to identify the impact of social class on nutrition knowledge and food preferences. Broadly speaking, our results show that the social gradient of food preferences is quite similar to that observed in developed countries with higher social classes having better nutrition knowledge and healthier food

preferences. We also shed light on the specific role of the middle class in the diffusion of nutrition knowledge and healthy food preferences and particularly the elderly and inactive middle class and the new middle class that are its richest components and who account for approximately 75% of the total Chinese urban middle class.

The Chinese authorities have become aware of the crucial role of nutrition knowledge policies in tackling the issue of over-nutrition. For instance, the Chinese Nutrition Society defines food-based dietary guidelines which provide principles related to food behaviours. The first guidelines were drawn up in 1989 and then revised in 1997. The latest version was compiled by the Chinese Nutrition Society in 2007 and proclaimed by the Ministry of Health in 2008. These dietary guidelines establish several nutrition principles and are defined for the general population (with eight nutrition guidelines) but also for specific populations (infants, children, adolescents, pregnant women, etc.). These guidelines have been pictured using a Chinese pagoda indicating daily food recommendations to help people to put the guidelines into practice (Ge, 2011). Those tools have been widely used by the Chinese Nutrition Society to disseminate nutrition knowledge through television programs, newspapers, lectures, posters, etc. (Ge et al., 2007).

Our study has several implications for the targeting of such nutrition policies. First, the transmission of nutrition guidelines should target groups of lower SES: the poor, the lowest components of the middle class (i.e. the lower middle class and the old middle class) and rural-to-urban migrants. Those nutrition principles should also be transmitted more effectively to children and adolescents, regardless of their SES, because food tastes are shaped during childhood and adolescence and because children can influence their parents' food preferences. Second, our results suggest that efforts should be made to ensure the preservation of the Chinese traditional diet. As argued by Shi et al. (2005: 1447), "the safeguarding of the traditional Chinese food habits should be at the core of a nutritional policy aiming at preventing overweight and chronic diseases". We argue that the elderly and inactive middle class is probably more attached to this traditional Chinese diet than other social classes. In view of this fact, nutrition policies should also be based on advertising, nutrition labelling and awareness campaigns to promote traditional Chinese food values and such policies should specifically target younger populations and lower social classes.

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APPENDIX

Table A.1: Nutrition knowledge statements.

Statement	Reversed score
1. Choosing a diet with a lot of fresh fruits and vegetables is good for one's health	No
2. Eating a lot of sugar is good for one's health	Yes
3. Eating a variety of food is good for one's health	No
4. Choosing a diet high in fat is good for one's health	Yes
5. Choosing a diet with a lot of staple foods (rice and rice products and wheat and wheat products) is not good for one's health	Yes
6. Consuming a lot of animal products daily (fish, poultry, eggs and lean meat) is good for one's health	Yes
7. Reducing the amount of fatty meat and animal fat in the diet is good for one's health	No
8. Consuming milk and dairy products is good for one's health	No
9. Consuming beans and bean products is good for one's health	No
10. The heavier one's body is, the healthier he or she is	Yes

Source: CHNS (2009).

Table A.2: Nutrition knowledge index and food preferences index by income and social class.

	Poor	Elderly and inactive MC	Old middle class	Lower middle class	New middle class	All middle classes	Rich	All
Nutrition knowledge	13.472	13.758	13.586	13.790	14.037	13.808	13.694	13.654
	(1.436)	(1.198)	(1.231)	(1.365)	(1.392)	(1.280)	(1.270)	(1.361)
Food preferences	13.600	14.255	13.303	13.638	13.711	13.925	13.952	13.784
	(2.034)	(1.908)	(1.925)	(2.281)	(2.112)	(2.038)	(1.888)	(2.035)

Notes: The food knowledge index and the food preferences index range from 0 to 20. Standard deviations into brackets. Source: CHNS (2009).