Original Article

Relationship between dietary knowledge, food preference, and long-short term health status among Chinese adults

Shujuan Wang PhD[1], Yajing Shang BE[1], Xiaoli Guo PhD[1], and Lingling Cui MD[2]

[1]*School of Mathematics and Information Science, Zhengzhou University of Light Industry, Zhengzhou, China*
[2]*College of Public Health, Zhengzhou University, Zhengzhou, China*

Background and Objectives: In recent years, with the improvement of people's living standards and changes in dietary patterns, dietary knowledge and food preference have been playing an increasingly crucial role in health. The aim of our study was to examine the relationship between dietary knowledge, food preference, and long-short term health status among Chinese adults aged 18-70. **Methods and Study Design:** This study employed cross-sectional data from the 2015 China Health and Nutrition Survey obtained from 4822 adults. We utilized self-assessed health status as an indicator of long-term health status and utilized sickness in the last four weeks as a measure of short-term health status. Taking advantage of ordered probit regression, long-term health status was regressed on all predictors, while the binary logistic regression was used to analyze the factors influencing short-term health status. The propensity score matching is employed to account for potential selection bias in analysis, thereby increasing the robustness and credibility of results. **Results:** The analysis revealed that dietary knowledge and food preference can improve an individual's long-term health status significantly. However, there is no evidence to show that short-term health status is affected by food preference. Furthermore, dietary knowledge is negatively associated with short-term health status. **Conclusions:** These findings highlight the importance of dietary education and healthy eating habits in improving the long-term health status of Chinese adults. The study suggests implications for public health strategies aimed at enhancing the health and well-being of Chinese adults.

Key Words: dietary knowledge, food preference, propensity score matching, health status, CHNS

INTRODUCTION

The fast pace and convenience of modern life contributed to an over-reliance on foods high in sugar, fat, and salt at the expense of fresh fruit, vegetables, and whole grains. This unbalanced diet, accompanied by frequent consumption of processed foods, has resulted in many people consuming excessive calories with lacking essential nutrients. Poor dietary habits can lead to many health problems, obesity is one of the major health problems caused by it.[1] Large quantities of high-calorie, high-sugar foods, and beverages, coupled with sedentary lifestyles,[2,3] have caused a sharp rise in obesity among Chinese adults.[4-6] Obesity not only affects appearance but also seriously increases the risk of cardiovascular disease,[7-9] diabetes,[10,11] high blood pressure,[12] and even certain types of cancer.[13,14] Meanwhile, another problem to consider is a high-salt diet. Excessive salt consumption results in high blood pressure and a high risk of heart disease and stroke. So, it is crucial to understand the relationship between dietary knowledge, food preference, and long-short term health status.

The maintenance and promotion of adult health is a key element of national economic prosperity and social well-being. Health status is a dynamic concept that changes with nutritional intake,[15] physical exercise,[16] living environment, and other factors.[17,18] Therefore, when we measure health status, we need to consider both long-term health status with far-reaching implications, and short-term health status with immediate effects. Concerning the data from the China Health and Nutrition Survey, we employed self-assessed health and sickness in the last four weeks to respectively reflect the long-term and short-term health status of individuals.

In 2007, China issued its first Dietary Guidelines for Chinese Residents,[19] which was designed to provide Chinese residents with guidance and advice on healthy eating.

Previous studies have shown that dietary knowledge has a significant positive effect on self-assessed health status.[20,21] Individuals with adequate dietary knowledge are more inclined to make healthy food choices.[22] The quality and quantity of food in one's diet significantly correlate with their overall health status.[23,24] For example,

Corresponding Author: Dr Shujuan Wang, School of Mathematics and Information Science, Zhengzhou University of Light Industry, Zhengzhou, China. Tel:+8613838287672. Email: sjwangred@163.com; Dr Lingling Cui, College of Public Health, Zhengzhou University, Zhengzhou, China. Tel:+8618638652600. Email: cll@zzu.edu.cn
Manuscript received 20 March 2024. Initial review completed 01 April 2024. Revision accepted 09 April 2024.
doi: 10.6133/apjcn.202406_33(2).0008

colorectal cancer (CRC) is strongly associated with a high intake of processed and red meats,[25] and an individual's dietary behaviors are strongly associated with health status. Dietary behaviors have an impact on mortality and morbidity from non-communicable diseases (NCDs),[26,27] the risk of specific diseases (e.g. cardiovascular disease,[28-30] metabolic syndrome,[31-33] cancer,[34,35] and on overall mortality).[36] Some researchers found that healthy dietary intake can prevent chronic diseases such as obesity and high cholesterol.[37,38] In contrast, food preference on health has been under-researched relative to research on the impact of dietary knowledge on health. Lee, et al. reported that food preference is significantly associated with mental health.[39] Kim et al. demonstrated the absence of a correlation between health status and somatic food preference.[40] Li et al. suggested that unhealthy food preference is positively associated with overweight and obesity in adolescents.[41]

Previous studies have primarily focused on the impact of dietary knowledge on health status, providing limited insight into the connection between food preference and health status. Additionally, these studies have exclusively addressed long-term health status, overlooking considerations for short-term health conditions. In view of this, the purpose of this study is to investigate the relationship between dietary knowledge and food preference with long-short term health status of Chinese adults using regression methods. Additionally, the study aims to increase the robustness and credibility of the findings by using propensity score matching and to explore the significant factors influencing long-short term health status.

METHODS

Materials

Data

The China Health and Nutrition Survey (CHNS) is a prospective multilevel survey jointly conducted by the University of North Carolina at Chapel and the Chinese Centre for Disease Control and Prevention (CDC).[42] Considering that minors may not understand dietary knowledge and the older people may be in poor health themselves, in this study we used data from people aged 18 to 70 years in the 2015 survey. We excluded samples of individuals without employment because they lacked income. For variables with less than 10% missing, we replaced continuous type variables with mean values, and for subtyped variables with plurality. For variables with more than 10% missing, the multiple imputation approach was used. The sample outliers were also excluded and 4,822 survey participants were finally included in the study.

Ethics

This research was approved by the Institutional Review Board at the University of North Carolina at Chapel Hill, the China-Japan Friendship Hospital, Ministry of Health, and the National Institute for Nutrition and Health, Chinese Center for Disease Control and Prevention. All participants signed an informed consent. All data were anonymized.

Variables

Independent variables

The dietary knowledge and food preference were used as independent variables. The questions of dietary knowledge included 1 question with two response options and 12 questions with 5 response options (individuals who chose "Unknown" were excluded).: "1=Strongly disagree", "2=Disagree", "3=Neutral", "4=Agree", and "5=Strongly agree". In reference to the previous study,[43] we coded the question with two response options as yes (coded 5) and no (coded 1) for consistency with other questions. Based on the existing literature,[44] the study judged the above options (Supplementary Table 1). The scores for questions 2, 4, 6, and 12 for incorrect statements were redistributed by reversing the scores of the options. The final sum of the 13 questions was calculated, with higher scores representing greater dietary knowledge.

In addition, the food preference section included five questions with 5 response options: "1=Dislike very much", "2=Dislike", "3=Neutral", "4=Like", and "5=Like very much". The study assessed these five food preference questions (Supplementary Table 1), we reassigned questions 2 and 5, by reversing the scores for each option. The final sum of the scores for the five questions was calculated, with higher scores representing participants with healthier food preference.

Dependent variables

Idler & Benyamini found that self-assessed health has been shown to be an independent predictor of mortality.[45] Respondents had five options: "1=Very good", "2=Good", "3=Fair", "4=Bad", and "5=Very bad". To make it clearer, we reversed the option sequence so that higher scores indicated better long-term health status.

The answer to the question "During the past 4 weeks, have you been sick or injured?" was used as an indicator of short-term health. Respondents chose one of two answers: "0=No", or "1=Yes". Eventually, we reversed the scoring of the options, so that higher scores represented better short-term health status.

Covariant variables

The covariant variables included individual characteristics, household characteristics, and lifestyle. Individual characteristics included age, gender, height, weight, total net individual income, education level, marital status, and geographic location; household characteristics included total net household income and household; lifestyle included smoking, drinking alcohol, sleep time, medical insurance, medical institutions, and health service. We showed the definitions and summary statistics of the variables (Supplementary Table 2).

Statistical analysis

We employed the chi-square test, one-way ANOVA, or independent samples t-test as deemed appropriate, based on the nature of the data. The regression model included all variables that were found to be significantly different by univariate analysis ($p < 0.10$) and other certain variables that were reported to be significantly associated with health status by other researchers. Factors affecting long-

term health status were analyzed through the ordered probit regression, while factors affecting short-term health status were analyzed through a binary logit regression model. The propensity score matching method was used to estimate the precise impact of dietary knowledge and food preference on long-term health status. The random forest approach was used to rank the important variables for predicting long-short term health status in adults. Statistical Package for the Social Sciences (SPSS) version 21.0, Stata17, and Python software were used for statistical analysis, and p values < 0.05 were considered to be statistically significant.

RESULTS

Data on the basic characteristics of the 4,822 Chinese adults were shown (Supplementary Tables 3-4). For long-term health status, compared with adults in bad health (including very bad), adults in good health (including very good) were significantly younger ($p < 0.001$), they had a higher ratio of educational level as senior high school, vocational school and college ($p < 0.001$), a greater proportion of marital status as unmarried, divorced and separated ($p < 0.001$), a higher total net individual income and total net household income (all $p < 0.001$), a higher proportion of living in urban sites ($p < 0.001$), a greater proportion had not visited medical institutions ($p < 0.001$), and a higher proportion of living in southern China ($p < 0.001$). The majority of good health (including very good health) adults had significantly higher levels of height, weight, dietary knowledge, and food preference (all $p < 0.001$). No differences were found among participants in terms of gender, smoking, drinking alcohol, health service, medical insurance, and sleep time (all $p > 0.05$). For short-term health status, compared with adults with poor short-term health status, adults with good short-term health status were significantly younger ($p < 0.001$), taller ($p = 0.023$), they had higher rates of high school, vocational school, and college ($p = 0.01$), lower rates of visits to medical institutions ($p < 0.001$), higher food preference ($p < 0.001$), and longer sleep time ($p < 0.001$). No differences were found between participants in terms of gender, weight, total net individual income, total net household income, household, smoking, drinking alcohol, health service, medical insurance, dietary knowledge, and geographic location ($p > 0.05$).

The effect of dietary knowledge and food preference score on long-term health status

Results in Table 1 show the impact of responders' dietary knowledge and food preference on long-term health status. It was found that the influence of dietary knowledge and food preference on long-term health status is significantly positive (B = 0.014, SE = 0.004, p <0.001; B = 0.047, SE = 0.008, p <0.001, respectively). Age is negatively correlated with long-term health status (B = -0.012, SE = 0.002, $p < 0.001$). Urban households have better long-term health than rural households (B = -0.073, SE = 0.037, $p = 0.048$). Gender, height, and weight have no significant effect on long-term health status (all $p > 0.05$).

A Master degree or above has no significant effect on long-term health status ($p = 0.202$). Being remarried, widowed, and separated have no significant effect on long-term health status (all $p > 0.05$), while being divorced has a significant negative effect on long-term health status (B = -0.332, SE = 0.139, $p = 0.017$). Total net individual income has no significant effect on long-term health status ($p = 0.738$). Total net household income is positively associated with long-term health status (B = 7.30e-0.7, SE = 1.76e−0.7, $p < 0.001$). Adults who go to medical institutions have worse long-term health status (B = -0.307, SE = 0.131, $p = 0.019$). We found that adults living in northern China have better long-term health status than those living in southern China (B = -0.206, SE = 0.034, p <0.001). Health services have no significant effect on long-term health status ($p = 0.132$).

The effect of dietary knowledge and food preference score on short-term health status

The impact of responders' dietary knowledge and food preference on short-term health status are presented in Table 2. It was found that there is a significant negative impact of dietary knowledge on short-term health status (B = -0.027, SE = 0.012, $p = 0.028$). We hypothesized that the observed result may be attributed to the fact that individuals with underlying disease tend to be more conscientious with their diet, leading to higher scores in dietary knowledge. The older people may have underlying diseases, which can lead to poor short-term health instead of high dietary knowledge scores. To validate this hypothesis, we also removed the sample with underlying disease and redid a binary logit regression. The empirical results ($p = 0.177$) can confirm our conjecture (Supplementary Table 5). However, food preference then has no significant impact on an individual's short-term health status ($p = 0.138$). Moreover, since food preference apparently has a greater impact on long-term health, it may be difficult to observe a significant effect of food preference on health in the short term. There is also a significant negative impact of age on short-term health status (B = -0.019, SE = 0.005, $p < 0.001$). Only junior high school graduation is significantly and positively associated with short-term health status (B = 0.354, SE = 0.164, $p = 0.032$). Short-term health is worse for those who have been to medical institutions (B = -2.088, SE = 0.250, $p < 0.001$). Our results also show that an individual's short-term health status worsens as a result of having received health service (B = -0.851, SE = 0.216, $p < 0.001$). Sleep time is positively correlated with short-term health status (B = 0.236, SE = 0.052, $p < 0.001$). Finally, there is no evidence to suggest that short-term health status is influenced by one's total net individual income, household, and height (all $p > 0.05$).

Propensity score matching

In this way, much bias present with traditional statistical methods can be avoided.

Analyzing the impact of dietary knowledge on long-term health status based on propensity score matching model

The propensity score matching requires that the treatment variable is a binary dummy variable. Therefore, the samples were divided into two groups at the median position after sorting the samples according to high and low die-

Table 1. Factors influencing long-term health status

Variables	Model 1			Model 2			Model 3		
	B	*SE*	*p* value	*B*	*SE*	*p* value	*B*	*SE*	*p* value
Dietary knowledge	0.019	(0.004)	<0.001	0.015	(0.004)	<0.001	0.014	(0.004)	<0.001
Food preference	0.044	(0.008)	<0.001	0.048	(0.008)	<0.001	0.047	(0.008)	<0.001
Age	-0.015	(0.002)	<0.001	-0.012	(0.002)	<0.001	-0.012	(0.002)	<0.001
Household	-0.166	(0.033)	<0.001	-0.076	(0.037)	0.038	-0.073	(0.037)	0.048
Gender	-0.076	(0.032)	0.017	0.033	(0.040)	0.397	0.003	(0.040)	0.941
Height				0.008	(0.003)	0.008	0.005	(0.003)	0.079
Weight				0.003	(0.002)	0.102	0.001	(0.002)	0.379
Education level									
Junior high school				0.099	(0.053)	0.062	0.107	(0.053)	0.043
Senior high school				0.182	(0.061)	0.003	0.184	(0.061)	0.003
Vocational school				0.196	(0.069)	0.005	0.184	(0.069)	0.008
College				0.254	(0.063)	<0.001	0.222	(0.064)	0.001
Master degree or above				0.284	(0.160)	0.076	0.205	(0.160)	0.202
Marital status									
Remarried				-0.099	(0.069)	0.149	-0.125	(0.069)	0.070
Divorced				-0.335	(0.139)	0.016	-0.332	(0.139)	0.017
Widowed				-0.216	(0.137)	0.115	-0.236	(0.137)	0.086
Separated				0.104	(0.372)	0.780	0.128	(0.373)	0.732
Total net individual income							$1.10e^{-0.7}$	($3.28\ e^{-0.7}$)	0.738
Total net HH income							$7.30e^{-0.7}$	($1.76e^{-0.7}$)	<0.001
Medical institutions							-0.307	(0.131)	0.019
Geographic location							-0.206	(0.034)	<0.001
Health service							-0.140	(0.093)	0.132

B: regression coefficient; total net HH income: Total net Household income
p values were derived from analysis of ordered probit regression

Table 2. Factors influencing short-term health status

Variables	Model 1			Model 2			Model 3		
	B	*SE*	*p* value	*B*	*SE*	*p* value	*B*	*SE*	*p* value
Dietary knowledge	-0.028	(0.012)	0.015	-0.029	(0.012)	0.015	-0.027	(0.012)	0.028
Food preference	-0.037	(0.024)	0.129	-0.039	(0.024)	0.110	-0.037	(0.025)	0.138
Age	-0.024	(0.005)	<0.001	-0.023	(0.005)	<0.001	-0.019	(0.005)	<0.001
Household	-0.148	(0.106)	0.164	-0.133	(0.118)	0.260	-0.205	(0.121)	0.089
Height	0.010	(0.007)	0.130	0.008	(0.007)	0.218	0.008	(0.007)	0.221
Education level									
Junior high school				0.322	(0.164)	0.051	0.354	(0.164)	0.032
Senior high school				0.266	(0.180)	0.141	0.294	(0.183)	0.108
Vocational school				0.305	(0.216)	0.157	0.357	(0.220)	0.105
College				0.139	(0.195)	0.476	0.160	(0.195)	0.414
Master degree or above				0.171	(0.549)	0.756	0.201	(0.556)	0.717
Total net individual income				0.012	(0.011)	0.271	0.011	(0.012)	0.332
Medical institutions							-2.088	(0.250)	<0.001
Health service							-0.851	(0.216)	<0.001
Sleep time							0.236	(0.052)	<0.001

B: regression coefficient
p values were derived from analysis of ordered probit regression

Table 3. Matching ATT results

Matching method	Process group	Control group	ATT	Robust standard deviation	T − stat	Pseudo R^2
Dietary knowledge on long-term health status						
1:4 match in calipers	3.810	3.728	0.082**	0.032	3.14	0.001
nuclear match	3.809	3.726	0.083**	0.025	3.42	0.001
0.01 radius match	3.811	3.729	0.081**	0.025	3.33	0.001
0.05 radius match	3.810	3.726	0.084**	0.025	3.49	0.001
Food preference on long-term health status						
1:4 match in calipers	3.766	3.623	0.144**	0.029	5.51	0.001
nuclear match	3.766	3.619	0.147**	0.020	6.30	0.000
0.01 radius match	3.766	3.619	0.147**	0.026	6.29	0.000
0.05 radius match	3.766	3.619	0.147**	0.025	6.29	0.000
Dietary knowledge on short-term health status						
1:4 match in calipers	0.901	0.921	-0.020	0.011	-2.02	0.001
nuclear match	0.901	0.982	-0.021*	0.009	-2.22	0.001
0.01 radius match	0.902	0.921	-0.019*	0.009	-2.08	0.001
0.05 radius match	0.901	0.922	-0.021*	0.009	-2.23	0.001

The standard error is obtained by repeated sampling 300 times using the Bootstrap method.
* $p < 0.05$; ** $p < 0.001$

tary scores in this study. The implementation of propensity score matching involves the following steps: first, the logistic model was used to analyze the factors affecting the level of adults' dietary knowledge; second, estimated probabilities of high dietary knowledge scores for each adult were obtained by computation and used as propensity scores; finally, the Stata17 software was used to do intra-cardinal 1:4 matching, kernel matching, and radius matching with radius coefficients of 0.01 and 0.05 to measure the Average Treatment Effect on the Treated (ATT) for both samples with high and low dietary knowledge scores after matching and to calculate the corresponding Pseudo R^2 values.

The Pseudo R^2 after matching with the four matching methods are all 0.001, which indicate that there is almost no systematic difference between the treatment group and the control group after matching with the four matching methods (Table 3). In order to see the effect more intuitively and effectively before and after sample matching, we plotted the probability distributions of the propensity score values before matching and used the kernel matching method after matching (Figure. 1A and Figure. 1B). From the figure, we can see that the difference between the treatment group and the control group before matching is extremely significant, while the difference of two sample groups after matching is very close. This indicates that the matched samples are balanced and the results of ATT are robust.

The matching results show that the ATT is significant for four matches (all $p < 0.001$). The ATT are 0.0817, 0.0826, 0.0813, and 0.0840 for intra-caliper 1:4 matching, kernel matching, radius matching of 0.01, and radius matching of 0.05, respectively (Table 3). So dietary knowledge has a significant positive effect on long-term health status.

Analyzing the impact of food preference on long-term health status based on propensity score matching model

Similar to the methods used for dietary knowledge, food preference was also handled as a binary variable. The Pseudo R^2 values after matching are very small, indicating little systematic difference between the treatment and control groups (Table 3). The probability distributions of pre-matching and post-kernel-matching propensity score values were plotted (Figure. 1C and Figure. 1D). From the figure, we can see that difference of two sample groups after matching is very close. This suggests that the matched samples are balanced and that the results of the ATT are robust.

The results indicate that the ATT is significantly positive regardless of the matching method used. The ATT are 0.144, 0.147, 0.147, and 0.147 for intra-caliper 1:4 matching, kernel matching, radius matching of 0.01, and radius matching of 0.05, respectively (Table 3). This shows that food preference has a significant positive effect on long-term health status.

Analyzing the impact of dietary knowledge on short-term health status based on propensity score matching model

The results of the ATT estimated through different matching methods exhibited slight variations, but generally indicates a significant negative effect of dietary knowledge on short-term health status. This trend remains generally consistent across the different methods, which indicates stability in the results. Specifically, the intra-

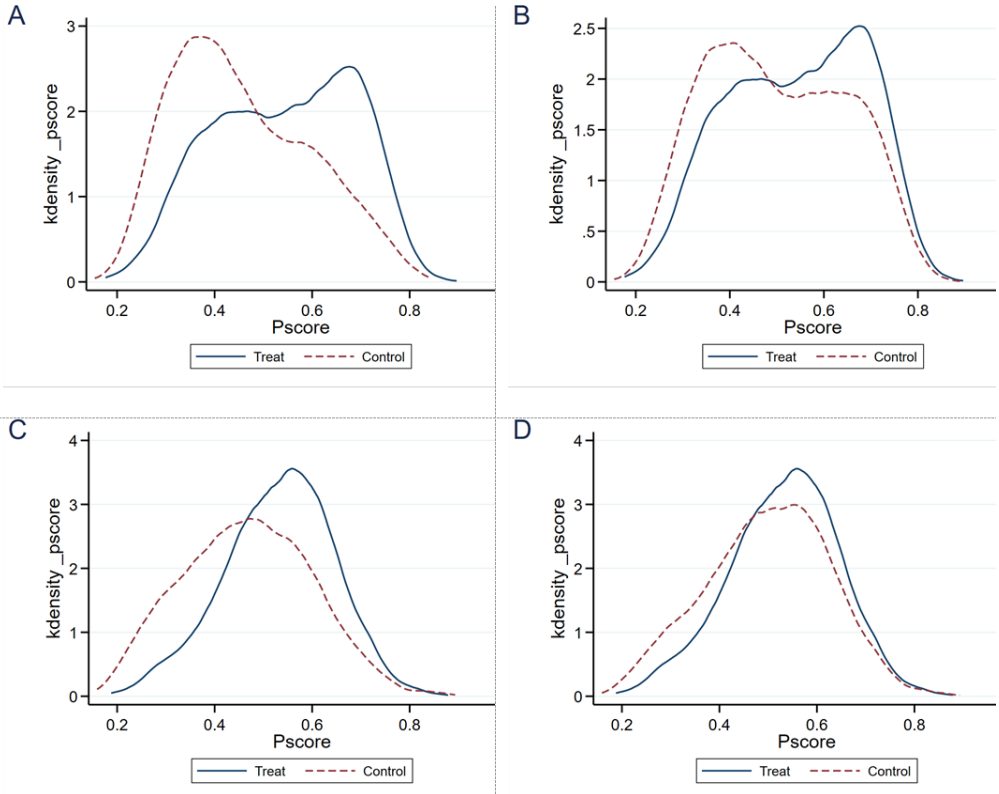


Figure 1. Feature Score Density Distribution Before and After Matching. (A) feature score density distribution before matching (dietary Knowledge); (B) feature score density distribution after matching (dietary Knowledge); (C) feature score density distribution before matching (food preference); (D) feature score density distribution after matching (food preference)

caliper 1:4 matching method is significant ($p < 0.10$), while the kernel matching and radius matching with radius coefficients of 0.01 and 0.05 methods are significant (all $p < 0.05$). The ATT are -0.0200 for intra-caliper 1:4 matching, -0.0205 for kernel matching, -0.0194 for 0.01 radius matching, and -0.0205 for 0.05 radius matching, respectively (Table 3). This indicates that dietary knowledge has a significant negative effect on short-term health status.

Assessing variables based on importance

The random forest approach was used to rank the variables based on importance for predicting long-short term health status. We found that total net household income (38.1%), age (23.6%), dietary knowledge (18.1), and food preference (13.2%) are the most four important independent factors associated with predicting long-term health status. At the same time, age (42.0%), dietary knowledge (36.6%), sleep time (16.1%), and medical institutions (3.42%) are the most four important independent factors associated with predicting short-term health status (Figure 2A and Figure 2B).

DISCUSSION

In this study, the main purpose of the study is to explore the effect of dietary knowledge and food preference on long-short term health status. Based on the results of the above analysis, we learn that both dietary knowledge and food preference have a significant positive effect on long-term health status, dietary knowledge has a significant negative effect on short-term health status, and food preference has no significant effect on short-term health status. Moreover, it is demonstrated that the above findings are robust and credible by using the propensity score matching model. The conclusions drawn by the study on dietary knowledge on long-term health are consistent with the direction of previous studies.[46] They found enhancing an individual's dietary knowledge can improve their lifestyle and reduce their prevalence of disease.

In addition, the findings indicate that age plays a very

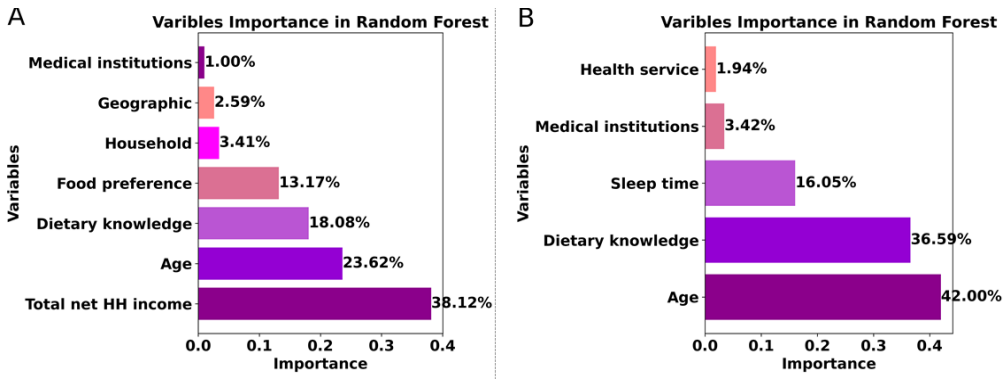
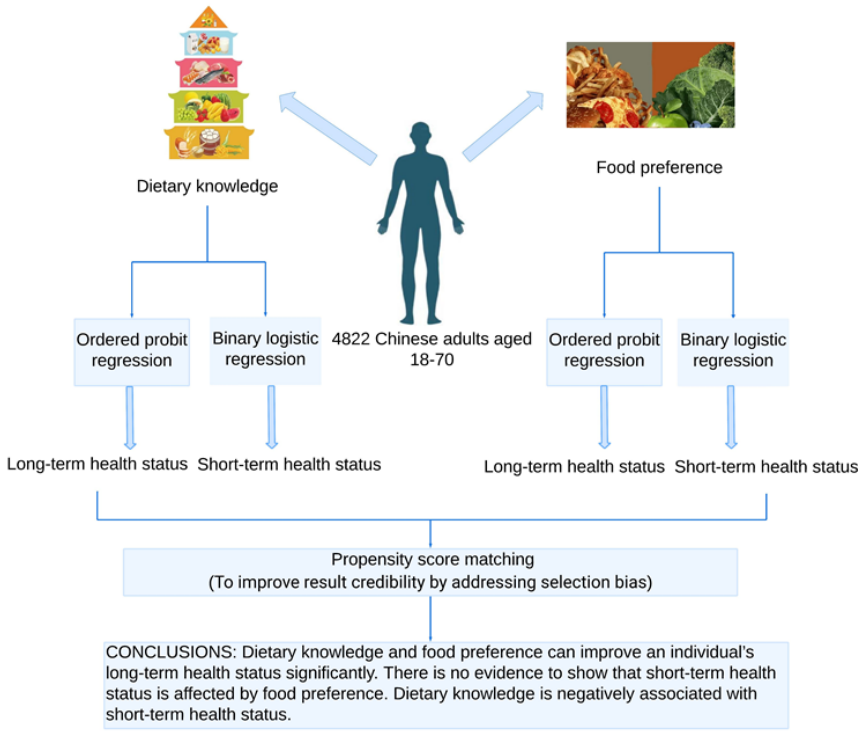


Figure 2. Rank independent variables by The Importance on The Random Forest Model. (A) ranking of importance of variables affecting long-term health status; (B) ranking of importance of variables affecting short-term health status



Graphical abstract

important role in the development of long-short term health status of Chinese adults. The long-short term health status of Chinese adults deteriorates with increasing age, which has been confirmed in previous studies. A possible explanation for this phenomenon is that as we grow older, our bodily functions slowly decline, which increases the risk of diseases and health problems.[47]

The study also revealed a correlation between decreasing total net household income and a deterioration in the long-term health status of Chinese adults, highlighting a significant influence of economic conditions on the development of their long-term health status. This finding is consistent with previous research.[48] This could be attributed to the notion that adverse economic conditions may induce psychological stress.[49,50] Consequently, this stress might contribute to an elevated frequency of alcohol consumption and smoking,[51] leading to an increased prevalence of chronic diseases and consequently,[52] a deterioration in long-term health. The study also revealed that the long-term health status of Chinese adults improves with increasing levels of education level and height. A possible explanation for the effect of education level is that people with higher education have easier access to health resources to adopt healthier lifestyles.[53] While a potential explanation for the observed effect of height is that being taller could confer certain advantages. Greater height is associated with better cardiovascular health and an overall healthier lifestyle.[54]

We also found that individuals from urban registration tend to exhibit a better long-term health status relative to rural residents. This might be because living in urban areas has better access to modern healthcare facilities and new medical technologies, while living in rural areas have difficulties in accessing basic services.[55] Moreover, individuals from northern China have better long-term health status relative to those from southern China. It might be because southern China generally exhibits a greater ability to alleviate environmental pressures while simultaneously enhancing human well-being compared to the less developed northern China.[56]

The study ranked the independent variables based on their importance associated with predicting long-short term health status through a random forest model. We have identified several important factors that impact long-term health status as total net household income, age, dietary knowledge, and food preference. The important influencing factors on short-term health status are age, dietary knowledge, sleep time, and medical institutions.

The key strengths of our study are listed as follows. First, we have ensured that the sample covers the entire country by using a stratified sampling method. Second, this study comprehensively considers both short-term and long-term health factors to enhance the accurate assessment of health status. Third, we used a propensity score matching model to enhance the robustness and credibility of the research results. The results of these statistical analyses can provide theoretical support for the development of rational strategies to improve the long-term and short-term health status of Chinese adults.

However, several limitations of the study should be also considered. First, the data used in the study is only the sample of 2015, which may bring some bias to the results. Second, the limitations of the used data do not allow us to explore the relationship at the micro-cognitive level. Third, due to data limitations, this paper only investigated the effects of dietary knowledge and food preference on long-short term health status, but we did not provide empirical analyses of the effects of specific dietary behaviors on long-term and short-term health status.

Given the above findings, efforts should be made to improve individuals' dietary knowledge and develop healthy food preference. Therefore, nutritional health organizations and other organizations should develop more concise and easy-to-understand dietary guidelines for different groups of people.

ACKNOWLEDGEMENTS

This research uses data from China Health and Nutrition Survey (CHNS). We are grateful to research grant funding from the National Institute for Health (NIH), the Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD) for R01 HD30880 and R01 HD38700, National Institute on Aging (NIA) for R01 AG065357, National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) for R01 DK104371 and P30 DK056350, National Heart, Lung, and Blood Institute (NHLBI) for R01 HL108427, the NIH Fogarty grant D43 TW009077, the Carolina Population Center for P2C HD050924 and P30 AG066615 since 1989, and the China-Japan Friendship Hospital, Ministry of Health for support for CHNS 2009, Chinese National Human Genome Center at Shanghai since 2009, and Beijing Municipal Center for Disease Prevention and Control since 2011. We thank the National Institute for Nutrition and Health, China Center for Disease Control and Prevention, Beijing Municipal Center for Disease Control and Prevention, and the Chinese National Human Genome Center at Shanghai.

CONFLICT OF INTEREST AND FUNDING DISCLOSURES

The authors declare that there is no conflict of interest.

This work was supported in part by the National Natural Science Foundation of China under Grant [61773018]; Fundamental Research Fund of Zhengzhou University of Light Industry (No. 23XJCYJ078); and in part by the Scientific Research Foundation of the Higher Education Institutions of Henan Province of China under Grant [23A110003].

REFERENCES

1. Tazeoglu A, Kuyulu Bozdoğan FB. The effect of watching food videos on social media on increased appetite and food consumption. Nutr Clin y Diet Hosp. 2022; 42: 73-9. doi: 10.12873/422tazeoglu.
2. Chau JY, Van der ploeg HP, Merom D, Chey T, Bauman AE. Cross-sectional associations between occupational and leisure-time sitting, physical activity and obesity in working adults. Prev Med. 2012; 54: 195-200. doi: 10.1016/j.ypmed.2011.12.020.
3. Silveira EA, Mendonca CR, Delpino FM, Elias souza GV, Desouza rosa LP, De Oliveira C, Noll M. Sedentary behavior, physical inactivity, abdominal obesity and obesity in adults and older adults: A systematic review and meta-analysis. Clin Nutr ESPEN. 2022; 50: 63-73. doi: 10.1016/j.clnesp.2022.06.001.
4. Hu FB, Malik VS. Sugar-sweetened beverages and risk of obesity and type 2 diabetes: epidemiologic evidence. Physiol Behav. 2010; 100: 47-54. doi: 10.1016/j.physbeh.2010.01.036.

5. Stoeckel LE, Weller RE, Cook EW, Twieg DB, Knowlton RC, Cox JE. Widespread reward-system activation in obese women in response to pictures of high-calorie foods. Neuroimage. 2008; 41: 636-47. doi: 10.1016/j.neuroimage.2008.02.031.
6. Grumezescu AM, Holban AM. Managing metabolic health impact of fructose-containing beverages. In: Mihai Grumezescu A, Hblban AM, editors. Production and Management of Beverages. Duxford: Woodhead Publishing; 2019. pp. 1-45.
7. Ren ZY, Sun WD, Wang SH, Ying JY, Liu W, Fan LJ, Zhao Y, Wu C, Song P. Status and transition of normal-weight central obesity and the risk of cardiovascular diseases: A population-based cohort study in China. Nutr Metab Cardiovasc Dis. 2022; 32: 2794-802. doi: 10.1016/j.numecd.2022.07.023.
8. Hritani R, Al Rifai M, Mehta A, German C. Obesity management for cardiovascular disease prevention. Obes Pillars. 2023; 7: 100069. doi: 10.1016/j.obpill.2023.100069.
9. Liu JT, Yao HY, Yu SC, Liu JJ, Zhu GJ, Han SM, Xu T. Joint association of metabolic health and obesity with ten-year risk of cardiovascular disease among Chinese adults. Biomed Environ Sci. 2022; 35: 13-21. doi: 10.3967/bes2022.003.
10. Haas J, Franko MA, Olinder AL, Nystrom T, Persson M. Time-trends in body mass index, and overweight and obesity as independent risk factors for diabetes angiopathy in young females with type 1 diabetes–A nationwide study in Sweden. Diabetes Res Clin Pract. 2023; 204: 110899. doi: 10.1016/j.diabres.2023.110899.
11. Bays HE, Bindlish S, Clayton TL. Obesity, diabetes mellitus, and cardiometabolic risk: an obesity medicine association (OMA) clinical practice statement (CPS). Obes Pillars. 2023; 5: 100056. doi: 10.1016/j.obpill.2023.100056.
12. Lowe Clayton T, Fitch A, Bays HE. Obesity and hypertension: Obesity medicine association (OMA) clinical practice statement (CPS) 2023. Obes Pillars. 2023; 8: 100083. doi: 10.1016/j.obpill.2023.100083.
13. Mazzarella L, Disalvatore D, Bagnardi V, Rotmensz N, Galbiati D, Caputo S, Curigliano G, Pelicci PG. Obesity increases the incidence of distant metastases in oestrogen receptor-negative human epidermal growth factor receptor 2-positive breast cancer patients. Eur J Cancer. 2013; 49: 3588-3597. doi: 10.1016/j.ejca.2013.07.016.
14. Nagrani R, Mhatre S, Rajaraman P, Soerjomataram I, Boffetta P, Gupta S, Parmar V, Badwe R, Dikshit R. Central obesity increases risk of breast cancer irrespective of menopausal and hormonal receptor status in women of South Asian Ethnicity. Eur J Cancer. 2016; 66: 153-61. doi: 10.1016/j.ejca.2016.07.022.
15. Choi JS, Kwon SO, Baek HY. Nutritional Status and Related Factors of the Elderly in Longevity Areas: III. Relation among Self-rated Health, Health-related Behaviors, and Nutrient Intake in Rural Elderly. Korean J Nutr. 2006; 39: 286-98. doi: CorpusID:73893062.
16. Pinto BM, Frierson GM. Physical Activity and Health. In: Gellman MD, Turner JP, editors. Encyclopedia of Behavioral Medicine. New York: Springer New York; 2013. pp. 1472-7.
17. Aretz B, Doblhammer G, Janssen F. Effects of changes in living environment on physical health: a prospective German cohort study of non-movers. Eur J Public Health. 2019; 29: 1147-53. doi: 10.1093/eurpub/ckz044.
18. Jing ZW, Xiao Q, Yan YH, Jun LJ, Cheng YS, Zhang T. Influence of built environment in hygienic city in China on self-rated health of residents. Biomed Environ Sci. 2022; 35: 1126-32. doi: 10.3967/bes2022.142.
19. Zhu YY, Zhang Y, Zhu XH. The evolution process, characteristics and adjustment of Chinese dietary guidelines: A global perspective. Resour Conserv Recycl. 2023; 193: 106964. doi: 10.3967/bes2022.142.
20. Sun YY, Dong DX, Ding YL. The impact of dietary knowledge on health: Evidence from the China Health and nutrition survey. Int J Environ Res Public Health. 2021; 18: 3736. doi: 10.3390/ijerph18073736.
21. Yang Y, He D, Wei LY, Wang SZ, Chen L, Luo M, Mao ZF. Association of diet-related knowledge, attitudes, behaviors and self-rated health among Chinese adults: a population-based study. BMC Public Health. 2020; 20: 720. doi: 10.21203/rs.2.18289/v2.
22. Kolodinsky J, Harvey-Berino JR, Berlin L, Johnson RK, Reynolds TW. Knowledge of current dietary guidelines and food choice by college students: better eaters have higher knowledge of dietary guidance. J Am Diet Assoc. 2007; 107: 1409-1413. doi: 10.1016/j.jada.2007.05.016.
23. Prakash R. The acute and chronic toxic effects of vitamin A. Am J Clin Nutr. 2006; 84: 462. doi: 10.1093/ajcn/84.2.462.
24. Trapani S, Rubino C, Indolfi G, Lionetti P. A narrative review on pediatric scurvy: the last twenty years. Nutrients. 2022; 14: 684. doi: 10.3390/nu14030684.
25. Clinton SK, Giovannucci EL, Hursting SD. The world cancer research fund/American institute for cancer research third expert report on diet, nutrition, physical activity, and cancer: impact and future directions. J Nutr. 2020; 150: 663-71. doi: 10.1093/jn/nxz268.
26. Ikeda N, GBD 2017 Diet Collaborators. Health effects of dietary risks in 195 countries, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017. Lancet. 2021; 393: 1958-72. doi: 10.1016/S0140-6736(19)30041-8.
27. Mora-Garcia G, Trujillo A, Garcia-Larsen V. Diet quality, general health and anthropometric outcomes in a Latin American population: evidence from the Colombian National Nutritional Survey (ENSIN) 2010. Public Health Nutr. 2021; 24: 1385-92. doi: 10.1017/S1368980019005093.
28. Zhang J, Du W, Huang F, Li L, Bai J, Wei YL, Wang ZH, Zhang B, Wang HJ. Longitudinal study of dietary patterns and hypertension in adults: China Health and Nutrition Survey 1991–2018. Hypertens Res. 2023; 46: 2264-71. doi: 10.1038/s41440-023-01322-x.
29. Kumma WP, Loha E. Dietary patterns and their association with cardiovascular risk factors in Ethiopia: A community-based cross-sectional study. Front Nutr. 2023; 10: 1074296. doi: 10.1016/j.numecd.2011.12.005.
30. Zhang YX, Wang YH, Chen Y, Zhou J, Xu LN, Xu KL, Wang N, Fu CW, Liu T. Associations of dietary patterns and risk of hypertension in Southwest China: a prospective cohort study. Int J Environ Res Public Health. 2021; 18: 12378. doi: 10.3390/ijerph182312378.
31. Rouhani P, Mirzaei S, AsadiA A, Akhlaghi M, Saneei P. Nutrient patterns in relation to metabolic health status in overweight and obese adolescents. Sci Rep. 2023; 13: 119. doi: 10.1038/s41598-023-27510-w.
32. George ES, Gavrili S, Itsiopoulos C, Manios Y, Moschonis G. Poor adherence to the Mediterranean diet is associated with increased likelihood of metabolic syndrome components in children: The Healthy Growth Study. Public Health Nutr. 2021; 24: 2823-33. doi: 10.1017/S1368980021001701.
33. Asghari G, Yuzbashian E, Mirmiran P, Hooshmand F, Najafi R, Azizi F. Dietary approaches to stop hypertension (DASH) dietary pattern is associated with reduced incidence of metabolic syndrome in children and adolescents. J

Pediatr. 2016; 174: 178-84. doi: 10.1016/j.jpeds.2016.03.077.
34. Rho J, Choi S. A study on the knowledge, attitudes, cancer preventive dietary behavior, and lifestyles of adults in the Jeonbuk area. Korean J Hum Ecology. 2013; 22: 201-13. doi: 10.5934/KJHE.2013.22.1.201.
35. Glanz K. Behavioral research contributions and needs in cancer prevention and control: dietary change. Prev Med. 1997; 26: S43-S55. doi: 10.1006/pmed.1997.0209.
36. Atkins JL, Whincup PH, Morris RW, Lennon LT, Papacosta O, Wannamethee S. High diet quality is associated with a lower risk of cardiovascular disease and all-cause mortality in older men. J Nutr. 2014; 144: 673-80. doi: 10.3945/jn.113.186486.
37. Alfawaz H, Khan N, Alhuthayli H, Wani K, Aljumah MA, Khattak MNK. Awareness and knowledge regarding the consumption of dietary fiber and its relation to self-reported health status in an adult arab population: A cross-sectional study. Int J Environ Res Public Health. 2020; 17: 4226. doi: 10.3390/ijerph17124226.
38. Silva AR, Lopes MS, Campos SF, Dos Santos LC, Freitas PP, Lopes ACS. Dietary and nutrient intake among participants of a Brazilian health promotion programme: a cross-sectional study. Public Health Nutr. 2021; 24: 6218-26. doi: 10.1017/S1368980021002330.
39. Lee YH, Shelley M, Liu CT, Chang YC. Assessing the association of food preferences and self- reported psychological well-being among middle-aged and older adults in contemporary China-results from the China Health and Nutrition Survey. Int J Environ Res Public Health. 2018; 15: 463. doi: 10.3390/ijerph15030463.
40. Kim YY, Yoo JH, Park KH, Siwoo L. The effects of constitutional food preference on health status of the twenties. Journal of Sasang Constitutional Medicine. 2012; 24: 31-8. doi: 10.7730/JSCM.2012.24.2.031.
41. Li M, Dibley MJ, Sibbritt DW, Yan H. Dietary habits and overweight/obesity in adolescents in Xi'an City, China. Asia Pac J Clin Nutr. 2010; 19: 76-82. doi: CorpusID:21270985.
42. Clement M, Bonnefond C. Does social class affect nutrition knowledge and food preferences among Chinese urban adults. Cambridge J China Stud. 2015; 10: 2. doi: CorpusID:4710406.
43. Cui L, Chen T, Li ZL, Yu ZL, Liu X, Li JX, Guo YY, Xu DM, Wang X. Association between dietary related factors and central obesity among married women: China Health and Nutrition Survey. Appetite. 2022; 168: 105785. doi: 10.1016/j.appet.2021.105785.
44. Zhou L, Zeng QY, Jin SS, Cheng GY. The impact of changes in dietary knowledge on adult overweight and obesity in China. PLoS One. 2017; 12: e0179551. doi: 10.1371/journal.pone.0179551.
45. Idler EL, Benyamini Y. Self-rated health and mortality: a review of twenty-seven community studies. J Health Soc Behav. 1997; 38: 21-37. doi: 10.2307/2955359.
46. Bonaccio M, Di Castelnuovo A, Costanzo S, De Lucia F, Olivieri M, Donati MB, De Gaetano G, Iacoviello L, Bonanni A. Nutrition knowledge is associated with higher adherence to Mediterranean diet and lower prevalence of obesity. Results from the Moli-Sani study. Appetite. 2013; 68: 139–46. doi: 10.1016/j.appet.2013.04.026.
47. Nie XQ, Li YH, Li CN, Wu J, Li L. The association between health literacy and self-rated health among residents of China aged 15–69 years. Am J Prev Med. 2021; 60: 569-78. doi: 10.1016/j.amepre.2020.05.032.
48. Wu L, Gao Y, Niu Z, Fahad S, Chen RJ, Nguyen-Thi-Lan H. A study assessing the impact of income relative deprivation and cooperative membership on rural residents' health: A pathway towards improving the health status of rural residents. One Health. 2023; 16: 100494. doi: 10.1016/j.onehlt.2023.100494.
49. Gero K, Miyawaki A, Kawachi I. Relative income deprivation and all-cause mortality in Japan: Do life priorities matter. Ann Behav Med. 2020; 54: 665-79. doi: 10.1093/abm/kaaa010.
50. Wang W, Rehman MA, Fahad S. The dynamic influence of renewable energy, trade openness, and industrialization on the sustainable environment in G-7 economies. Renew Energy. 2022; 198: 484-91. doi: 10.1016/j.renene.2022.08.067.
51. Eibner C, Evans WN. Relative deprivation, poor health habits, and mortality. J Hum Resour. 2005; 40: 591–620. doi: stable/4129553.
52. Blázquez Cuesta M, Budria S. Income deprivation and mental well-being: The role of non-cognitive skills. Econ Hum Biol. 2015; 17: 16-28. doi: 10.1016/j.ehb.2014.11.004.
53. Chen JY, Cheng JR, Liu YY, Tang Y, Sun XM, Wang T et al. Associations between breakfast eating habits and health promoting lifestyle, suboptimal health status in Southern China: a population based, cross sectional study. J Transl Med. 2014; 12: 348. doi: 10.1186/s12967-014-0348-1.
54. Muller SM, Floris J, Rohrmann S, Staub K, Matthes KL. Body height among adult male and female Swiss Health Survey participants in 2017: Trends by birth years and associations with self-reported health status and life satisfaction. Prev Med Rep. 2022; 29: 101980. doi: 10.1016/j.pmedr.2022.101980.
55. Passarelli-Araujo H, de Souza GM. Urban-rural health disparities in Brazil: Do sociodemographic attributes play a role. Prev Med. 2023; 175: 107679. doi: 10.1016/j.ypmed.2023.107679.
56. Jiang M, Behrens P, Lyu L, Tang ZP, Chen DJ, Cao YH et al. Additional north-south differences in China revealed by the Planetary Pressure-Adjusted Human Development Index. Resour Conserv Recycl. 2023; 198: 107191. doi: 10.1016/j.resconrec.2023.107191.

Supplementary Tables

Supplementary Table 1. Dietary knowledge and food preference questionnaire

Serial number	Problem statement	Judgement
Dietary knowledge questionnaire		
1	Choosing a diet with a lot of fresh fruits and vegetables is good for one's health.	T
2	Eating a lot of sugar is good for one's health.	F
3	Eating a variety of foods is good for one's health.	T
4	Choosing a diet high in fat is good for one's health.	F
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.	T
6	Consuming a lot of animal products daily (fish, poultry, eggs and lean meat) is good for one's health.	F
7	Reducing the amount of fatty meat and animal fat in the diet is good for one's health.	T
8	Consuming milk and dairy products is good for one's health.	T
9	Consuming beans and bean products is good for one's health.	T
10	Physical activities are good for one's health.	T
11	Sweaty sports or other intense physical activities are not good for one's health.	T
12	The heavier one's body is, the healthier he or she is.	F
Food preference questionnaire (How much do you like this food)		
1	Fast food (KFC, pizza, hamburgers, etc.)	Unhealthy
2	Salty snack foods (potato chips, pretzels, etc.)	Unhealthy
3	Fruits	Healthy
4	Vegetables	Healthy
5	Soft drinks and sugared fruit drinks	Unhealthy

Supplementary Table 2. Definition and evaluation of dependable variables

Variable Name	Variable Meaning	Variable Value
Independent variables		
Dietary knowledge	cumulative score for 13 dietary knowledge questions	actual scores
Food preference	cumulative score for 5 food preference questions	cumulative score for 5 food preference questions
Dependent variables		
Long-term health status	self-assessed health in 2015	very bad=1; bad=2; fair=3; good=4; very good=5
Short-term health status	have you had an illness or injury in the last four weeks?	yes=0; no=1
Individual characteristic variables		
Age	age	real age
Gender	gender	boys=1; girls=2
Height	height	actual height(cm)
Weight	weight	actual weight(kg)
Total net individual income	total annual net individual income	CNY/year
Education level	educational level	primary school=1; junior=2; high school=3; vocational school=4; college=5; master's degree=6
Marital status	marital status	unmarried=1; remarried=2; divorced=3; widowed=4; separated=5
Geographic location	live in the South or North?	northern China=1; southern China=2
Household characteristics		
Total net HH income	total annual net household income	CNY/year
Household	urban and rural areas	urban=1; rural=2
Lifestyle		
Smoking	do you smoke?	no=0; yes=1
Drinking alcohol	do you drink alcohol?	no=0; yes=1
Sleep time	sleep time	sleep duration(h)
Medical insurance	whether or not you have medical insurance	no=0; yes=1
Medical institutions	have you ever been to a medical institution?	no=0; yes=1
Health service	have you had access to health service?	no=0; yes=1

Supplementary Table 3. The basic characteristics of the participants by long health status: CHNS 2015[†]

Characteristics	Overall	Long-term health status (S−health)					*p*
		Very bad (N = 10)	Bad (N = 167)	Fair (N = 1698)	Good (N = 2211)	Very good (N = 736)	
Personal characteristics							
Age (mean ± SD)	44.6 ± 11.7	47.6 ± 14.9	49.8 ± 11.3	46.3 ± 11.7	43.6 ± 11.7	42.6 ± 11.4	<0.001
Gender (n, %)							0.289
Boys	2694 (55.9%)	5 (50.0%)	81 (48.5%)	968 (57.0%)	1225 (55.4%)	415 (56.4%)	
Girls	2128 (44.1%)	5 (50.0%)	86 (51.5%)	730 (43.0%)	986 (44.6%)	321 (43.6%)	
Height (cm, mean ± SD)	164 ± 8.2	162 ± 9.4	162 ± 9.0	163 ± 8.0	164 ± 8.2	166 ± 8.1	<0.001
Weight (kg, mean ± SD)	65.2 ± 12.3	65.0 ± 11.6	63.3 ± 13.7	64.4 ± 12.0	65.2 ± 12.0	67.3 ± 12.9	<0.001
Education level (n, %)							<0.001
Primary school	599 (12.4%)	1 (10.0%)	43 (25.7%)	254 (15.0%)	248 (11.2%)	53 (7.2%)	
Junior high school	1648 (34.2%)	3 (30.0%)	61 (36.5%)	650 (38.3%)	720 (32.6%)	214 (29.1%)	
Senior high school	805 (16.7%)	2 (20.0%)	20 (12.0%)	291 (17.1%)	370 (16.7%)	122 (16.6%)	
Vocational school	533 (11.1%)	1 (10.0%)	13 (7.8%)	168 (9.9%)	261 (11.8%)	90 (12.2%)	
College	1183 (24.5%)	2 (20.0%)	29 (17.4%)	321 (18.9%)	588 (26.6%)	243 (33.0%)	
Master degree or above	54 (1.1%)	1 (10.0%)	1 (0.6%)	14 (0.8%)	24 (1.1%)	14 (1.9%)	
Marial status (n, %)							<0.001
Unmarried	336 (7.0%)	0	4 (2.4%)	87 (5.1%)	174 (7.9%)	71 (9.6%)	
Remarried	4303 (89.2%)	10 (100.0%)	150 (89.8%)	1538 (90.6%)	1955 (88.4%)	65 (88.3%)	
Divorced	80 (1.7%)	0	4 (2.4%)	30 (1.8%)	41 (1.9%)	5 (0.7%)	
Widowed	94 (1.9%)	0	9 (5.4%)	41 (2.4%)	36 (1.6%)	8 (1.1%)	
Separated	9 (0.2%)	0	0	2 (0.1%)	5 (0.2%)	2 (0.3%)	
Total net individual income (CNY/year, mean ± SD)	42277 ± 60537	23132 ± 18050	27021 ± 32704	37546 ± 56864	45987 ± 68248	45768 ± 46457	<0.001
Family characteristics							
Total net HH income (CNY/year, mean ± SD)	96666 ± 113131	86372 ± 76051	63561 ± 56166	82997 ± 112071	106039 ± 120099	107698 ± 98639	<0.001
Household (n, %)							<0.001
Urban	2295 (47.6%)	5 (50.0%)	58 (34.7%)	717 (42.2%)	1095 (49.5%)	420 (57.1%)	
Rural	2527 (52.4%)	5 (50.0%)	109 (65.3%)	981 (57.8%)	1116 (50.5%)	316 (42.9%)	
Lifestyle (n, %)							
Smoking (yes)	1534 (31.8%)	4 (40.0%)	49 (29.3%)	559 (32.9%)	711 (32.2%)	211 (28.7%)	0.266
Drinking alcohol (yes)	1687 (35.0%)	3 (30.0%)	51 (30.5%)	589 (34.7%)	794 (35.9%)	250 (34.0%)	0.593
Medical institutions (yes)	71 (1.5%)	1 (10.0%)	9 (5.4%)	23 (1.4%)	29 (1.3%)	9 (1.2%)	<0.001
Health service (yes)	144 (3.0%)	1 (10.0%)	8 (4.8%)	59 (3.5%)	51 (2.3%)	25 (3.4%)	0.063

S-health: self-assessed health status; Total net HH income: total net household income

[†]Continuous variables are described as mean ± standard deviation range, and categorical variables as number (frequency)

p values were derived from analysis of independent-sample t-test or variance (ANOVA) for continuous variables according to the nature of data and chi-squared tests for category variables.

Supplementary Table 3. The basic characteristics of the participants by long health status: CHNS 2015[†] (cont.)

Characteristics	Overall	Long-term health status (S−health)					*p*
		Very bad (N = 10)	Bad (N = 167)	Fair (N = 1698)	Good (N = 2211)	Very good (N = 736)	
Lifestyle (n, %)							
Medical insurance (yes)	4729 (98.1%)	10 (100.0%)	165 (98.8%)	1672 (98.5)	2167 (98.0%)	715 (97.1%)	0.244
Sleep time (h, mean ± SD)	7.8 ± 0.9	7.6 ± 1.0	7.6 ± 1.3	7.8 ± 1.0	7.8 ± 0.9	7.8 ± 0.9	0.471
Dietary knowledge (mean ± SD)	46.9 ± 4.7	45.7 ± 3.6	45.7 ± 4.9	46.1 ± 4.7	47.3 ± 4.5	47.6 ± 4.9	<0.001
Food preference (mean ± SD)	18.5 ± 2.3	18.0 ± 2.5	18.9 ± 2.2	18.3 ± 2.2	18.5 ± 2.2	18.8 ± 2.5	<0.001
Geographic location (n, %)							<0.001
Northern China	1957 (40.6%)	6 (60.0%)	58 (34.7%)	611 (36.0%)	884 (40.0%)	398 (54.1%)	
Southern China	2865 (59.4%)	4 (40.0%)	109 (65.3%)	1087 (64.0)	1327 (60.0%)	338 (45.9%)	

S-health: self-assessed health status; Total net HH income: total net household income

[†]Continuous variables are described as mean ± standard deviation range, and categorical variables as number (frequency)

p values were derived from analysis of independent-sample t-test or variance (ANOVA) for continuous variables according to the nature of data and chi-squared tests for category variables.

Supplementary Table 4. The basic characteristics of the participants by short health status: CHNS 2015†

Characteristics	Overall	Short-term health status (Fsickness)		*p*
		Yes (N = 456)	No (N = 4366)	
Personal characteristics				
Age (mean ± SD)	44.6 ± 11.7	47.9 ± 12.9	44.3 ± 11.6	<0.001
Gender (n, %)				0.244
Boys	2694 (55.9%)	243 (53.3%)	2451 (56.1%)	
Girls	2128 (44.1%)	213 (46.7%)	1915 (43.9%)	
Height (cm, mean ± SD)	164 ± 8.2	163 ± 8.4	164 ± 8.2	0.023
Weight (kg, mean ± SD)	65.2 ± 12.3	64.3 ± 12.2	65.3 ± 12.3	0.130
Education level (n, %)				0.01
Primary school	599 (12.4%)	82 (18.0%)	517 (11.8%)	
Junior high school	1648 (34.2%)	148 (32.5%)	1500 (34.4%)	
Senior high school	805 (16.7%)	76 (16.7%)	729 (16.7%)	
Vocational school	533 (11.1%)	44 (9.6%)	489 (11.2%)	
College	1183 (24.5%)	101 (22.1%)	1082 (24.8%)	
Master degree or above	54 (1.1%)	5 (1.1%)	49 (1.1%)	
Total net individual income (CNY/year, mean ± SD)	42277 ± 60537	37558 ± 48416	42770 ± 61649	0.08
Family characteristics				
Total net HH income (CNY/year, mean ± SD)	96666 ± 113131	89186 ± 102278	97448 ± 114188	0.138
Household (n, %)				0.076
Urban	2295 (47.6%)	199 (43.6%)	2096 (48.0%)	
Rural	2527 (52.4%)	257 (56.4%)	2270 (52.0%)	
Lifestyle (n, %)				
Smoking (yes)	1534 (31.8%)	155 (34.0%)	1379 (31.6%)	0.294
Drinking alcohol (yes)	1687 (35.0%)	161 (35.3%)	1526 (35.0%)	0.880
Medical institutions (yes)	71 (1.5%)	33 (7.2%)	38 (0.9%)	<0.001
Health service (yes)	144 (3.0%)	32 (7.2%)	112 (2.6%)	0.063
Medical insurance(yes)	4729 (98.1%)	450 (98.1%)	4279 (98.0%)	0.317
Sleep time (h, mean ± SD)	7.8 ± 0.9	7.5 ± 1.1	7.8 ± 0.9	<0.001
Dietary score (mean ± SD)	46.9 ± 4.7	47.2 ± 4.2	46.8 ± 4.7	0.059
Food preference score (mean ± SD)	18.5 ± 2.3	18.9 ± 2.1	18.4 ± 2.3	<0.001
Geographic location (n, %)				0.364
Northern China	1957 (40.6%)	176 (38.6%)	1781 (40.8%)	
Southern China	2865 (59.4%)	280 (64.1%)	2585 (59.2%)	

Fsickness: illness in the past four weeks; Total net HH income: total net household income
†Continuous variables are described as mean ± standard deviation range, and categorical variables as number(frequency)
p values were derived from analysis of independent-sample *t*-test or variance (*ANOVA*) for continuous variables according to the nature of data and chi-squared tests for category variables.

Supplementary Table 5. Factors influencing short-term health status (exclude samples with underlying diseases)

Variables	Model 1			Model 2			Model 3		
	B†	*SE*	*p* value	*B*†	*SE*	*p* value	*B*†	*SE*	*p* value
Dietary knowledge	-0.019	(0.013)	0.157	-0.019	(0.014)	0.172	-0.019	(0.014)	0.177
Food preference	-0.033	(0.028)	0.239	-0.036	(0.028)	0.200	-0.031	(0.028)	0.267
Age	-0.014	(0.005)	0.008	-0.013	(0.006)	0.017	-0.010	(0.006)	0.091
Household	-0.123	(0.123)	0.315	-0.110	(0.139)	0.428	-0.201	(0.142)	0.157
Height	0.014	(0.008)	0.056	0.012	(0.008)	0.119	0.013	(0.008)	0.100
Education level									
Junior high school				0.423	(0.196)	0.034	0.434	(0.198)	0.031
Senior high school				0.466	(0.224)	0.037	0.469	(0.225)	0.038
Vocational school				0.392	(0.260)	0.133	0.403	(0.269)	0.134
College				0.181	(0.229)	0.431	0.180	(0.232)	0.438
Master degree or above				0.042	(0.565)	0.941	0.082	(0.576)	0.887
Total net individual income				0.017	(0.014)	0.222	0.016	(0.014)	0.272
Medical institutions							-2.227	(0.304)	<0.001
Health service							-0.891	(0.266)	0.001
Sleep time							0.253	(0.062)	<0.001

B: regression coefficient
p values were derived from analysis of ordered probit regression