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Personal Prioritization of Healthy Eating among Chinese Adults and Its Association with Dietary Behaviors: Findings from the China Health and Nutrition Survey

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OBJECTIVE: China faces a growing non-communicable disease (NCD) burden linked with diet. The link between attitudes towards healthy diets and specific eating behaviors has been underexplored in Chinese settings. The aim of this study was to evaluate disparities in personal healthy eating prioritization among Chinese adults and its association with specific dietary patterns.

METHODS: Data from the 2011 China Health and Nutrition Survey (CHNS) were used to examine healthy eating prioritization (how important 'eating a healthy diet' was to participants) and its association with socio-demographic, interpersonal, and physical health variables, along with plant-based and healthy eating dietary patterns, and consumption of specific food groups. Descriptive and multivariable regression analyses were conducted to assess the association between healthy eating prioritization and socio-demographic, interpersonal, physical health, and eating behaviors (Plant-based Diet Index (PDI), Chinese Healthy Eating Index (CHEI), and consumption of select food groups). A total of 13,501 participants with healthy eating prioritization data were included in the analysis; those with missing CHEI or PDI data 5,450 (40.4%), were excluded during analyses of eating behaviors.

RESULTS: Overall, 95.1% of participants believed eating a healthy diet to be important. Individuals who believed healthy eating was unimportant were less likely to be older (adjusted odds ratio [AOR]: 0.98, 95%CI:0.98–0.99), more educated (AOR: 0.12, 95%CI: 0.07–0.19), live in urban environments (AOR: 0.76, 95%CI:0.63–0.83), live with both parents (AOR: 0.69, 95%CI:0.48–0.98), or have a past self-reported diagnosis of an NCD (AOR:0.76, 95%CI:0.59–0.96), while more likely to be male (AOR: 1.42, 95%CI:1.20–1.69) or unmarried (1.36, 95%CI:1.08–1.71). Believing healthy eating to be unimportant was also associated with lower vegetable and meat intake (AOR: 0.77, 95%CI:0.62–0.96; AOR:0.80, 95%CI:0.63–1.00).

CONCLUSION: Interventions aimed at changing dietary attitudes in China may benefit from considering the unique role of vegetable and meat intake in the conceptualization of a healthy diet. However, mixed findings with respect to other food groups and general indicators of a healthy diet suggest that the true impact of prioritizing healthy eating warrants further scrutiny through research focused on better understanding the complexities and nuances of Chinese dietary attitudes.

Key Words: healthy diet ▪ diet attitudes ▪ diet behaviors ▪ China ▪ non-communicable disease

The promotion of healthy diets (such as those involving the consumption of fruits, vegetables, healthy proteins, fats, and grains while limiting excessive intake of salt and sugar)[1] has become a public health priority for countries such as China, which is facing a high burden of non-communicable diseases (NCDs) linked with poor diets.[2] In the last two decades, diet quality in China has been observed to fluctuate, with more recent trends showing decrease in diet quality in part due to changes in the consumption of fruits, vegetables, fats, sodium, and alcohol.[3,4] However, past research has observed that personal motivation and values placed on healthy eating practices are salient barriers to establishing healthy diets,[5,6] including among ethnic Chinese populations,[7] which may directly impact both the efficacy and sustainably of promotional or interventional efforts aimed at fostering healthy diets.

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POPULAR SCIENTIFIC SUMMARY

- Given the growing diet-related chronic disease burden faced in China, this study examined factors associated with personal prioritization of a healthy diet and its relationship with healthy and plant-based dietary patterns.
- While most Chinese adults were observed to believe eating a healthy diet to be important, this belief was held less by younger, less-educated, rural-living, male, or unmarried individuals.
- Believing a healthy diet to be unimportant was associated with lower vegetable and meat intake despite no significant associations with healthy and plant-based dietary patterns.
- Findings identify pathways for dietary interventions to consider differences in dietary attitudes and their associations with specific eating behaviors and call for further research to disentangle different facets of Chinese dietary attitudes.

The importance of values and personal prioritizations of healthy diets can be understood through the theory of planned behavior (TPB), which has been extensively employed to understand and intervene in healthy eating behaviors.[8–12] In applying TPB to understand healthy eating behaviors, the role of values and personal prioritization of healthy eating can be understood through the construct of attitudes, which a recent meta-analysis on dietary patterns identified as having the strongest association with behavioral intention compared to all other TPB constructs.[8] Although there has been limited exploration of TPB in Chinese settings to understanding healthy eating behaviors, a study among Chinese Americans employing TPB observed that attitudes, overall health concern, and self-efficacy accounted for 58% of the variability in behavioral intentions regarding fat-related dietary behaviors.[13] The saliency observed in the TPB attitude construct highlights the importance of understanding disparities and predictors of these attitudes to better inform behavioral interventions.

Socio-demographic characteristics, such as sex, age, and education, have been observed to be associated with positive attitudes towards healthy eating behaviors.[14,15] In China, residence (i.e. urban versus rural) plays a significant role in catalyzing certain resource and social environment disparities, and has been associated with diet-related attitudes and behaviors.[16,17] Disease history (notably history of diet-related NCDs) has also been linked with motivations and attitudes towards healthy diets, along with other biopsychosocial factors.[18] Interpersonal factors, such as marital status[14,15] and family circumstances,[19–21] have also been observed to indirectly or directly play salient roles in healthy diet-related motivations and behaviors. Indeed, family dynamics have also been observed to be key contributors to body mass index trends in China;[22] however, little is known on its impact on attitudes and personal prioritization of health behaviors in the country, such as maintaining a healthy diet. Indeed, disentangling the contributors and impact of dietary attitudes in China can be powerful in tailoring NCD interventions in the country.[23]

While past research has linked dietary attitudes to specific food-related behaviors,[14,24,25] this remains largely unexplored with respect to specific food consumption patterns (e.g. consumption of certain food groups) in China. Understanding this link has the potential to identify important ways that dietary attitudes connect with dietary behaviors in China. While the association with dietary attitudes and behaviors related to diet related information seeking and preferences (proactively looking for nutrition knowledge and preference for fruits and vegetables) has been explored in China,[17] the association between dietary attitudes and specific dietary behaviors has not been examined. Therefore, this study aims to evaluate socio-demographic, interpersonal, and physical health-related determinants of personal prioritization of healthy diets among Chinese adults, as well as the link between these attitudes and specific dietary patterns.

METHODS

Data were analyzed from the 2011 China Health and Nutrition Survey (CHNS), an ongoing, longitudinal, nationwide survey initiated in 1989 among a sample of Chinese residents aged ≥2 years, with a follow-up duration of every 2–4 years. Given changes in recent years in health promotional efforts in China and the impact these efforts may be having on knowledge and attitudes regarding healthy diets,[26] a cross-sectional analysis of the 2011 CHNS data was chosen, given that it is the most recent survey wave with complete publicly available nutrition and behavioral data. Details on the full questionnaire and methodology of data collection have been described elsewhere.[27] In short, the survey utilized a multistage random-cluster sampling process to select samples from nine provinces across China. Individuals were provided written questionnaires formatted slightly different depending on the age category. Participants provided written informed consent prior to survey commencement. Dietary data were collected through three consecutive 24-h recall surveys and a food inventory assessment conducted during the same time period. Individual intake data were collected by inquiring each family member separately to report all of the food that they had consumed at home and away from home with a 3-day, 24-h recall method. Household dietary intake data were calculated by examining changes in the inventory from the beginning to the end of the survey, which used a combination of weighing and measuring technique. The amount of food in each dish and the proportion of each dish which was consumed were asked by interviewers.

During the questioning process, vivid pictures and food models were used by trained interviewers to help participants to recall the types, amounts, and places of each meal they consumed the previous day. Two ways helped to control the quality of data collected. First, all interviewers were trained systematically with a high-quality course for more than 3 days. Second, interviewers compared the difference in food intake at individual level and individual's average intake calculated from the household inventory. If the significant differences existed, interviewers revisited the individuals and their corresponding families together, and collected the information of individual food intake. The survey methodology and data collection procedures were approved by the Institutional Review Board of the University of North Carolina at Chapel Hill, NC, USA and the National Institute for Nutrition and Health, Chinese Center for Disease Control and Prevention, Beijing, China.

Healthy eating prioritization was measured as part of a set of five-point Likert-scale question asking participants how important different priorities were in their lives, include a specific question on 'eating a healthy diet' as a priority. Participants were asked to select: (1) not important at all, (2) not very important, (3) important, (4) very important, (5) the most important, and (6) unknown. Responses were then further categorized into (1) unimportant (not important at all, not very important), and (2) important (important, very important, the most important).

Socio-demographic variables assessed included age (continuous), sex (male, female), highest level of educational attainment (graduated from primary school, lower middle school degree, upper middle school degree, technical or vocational degree, university or college degree, master's degree or higher), whether the respondent was presently working (yes, no), and residence (urban, rural). Interpersonal variables included marital status (never married, married, divorced, widowed, separated, unknown), and two separate questions on whether respondent's (1) mother or (2) father lived in their household (yes, no). Marital status was recoded into married and single/other (all other responses) for analysis. An additional variable was calculated to indicate whether both of the respondent's parents lived in their household. The history of NCD was assessed through four separate questions asking participants if a doctor had ever told them that they suffered from (1) high blood pressure, (2) diabetes, (3) myocardial infarction, or (4) stroke or transient ischemic attack. A further variable was synthesized to indicate whether participants had suffered any of the included NCDs.

The Chinese food consumption table was then used to derive the daily intake of 18 different food groups.[28,29] Of the 18 food groups, only 5 groups were found to have an internal distribution in mean daily intake large enough to conduct meaningful analyses of intake above and below a specific sample median value: vegetables, refined grains, meat, eggs, and legumes. An overall plant-based diet index (PDI), a healthful plant-based diet index (hPDI), and an unhealthful plant-based diet index (uPDI) were calculated using guidelines described elsewhere.[29] A higher PDI score indicated greater consumption of plant-based foods, with a higher hPDI indicating greater consumption of healthy plant-based foods (e.g. whole grains, fruits, and vegetables) and a higher uPDI indicating greater consumption of unhealthy plant-based foods (e.g. refined grains, fruit juices, and sugar-sweetened beverages). Similarly, based on prior guidelines, a Chinese Healthy Eating Index (CHEI) score was calculated for each participant, a higher score indicating a healthier diet.[30]

Descriptive analyses were first conducted to examine socio-demographic, interpersonal, and physical health disparities among those who did or did not believe a healthy diet was important (outcome variable). Multiple logistic regression analyses were then used to examine the unadjusted and adjusted association of the socio-demographic, interpersonal, and physical health variables with healthy eating prioritization. Multiple linear regression analyses were then conducted to examine the association between healthy eating prioritization with PDI, hPDI, uPDI, and CHEI scores, as well as logistic regression analyses on its association with above-median intake of vegetables, refined grains, meat, eggs, and legumes. Models were first adjusted by age, sex, employment status, education, and residence, followed by additional adjustment with interpersonal and physical health variables. Participants with missing data for any of the included indicators were excluded from adjusted analyses.

RESULTS

Overall, 13,501 participants had data on healthy eating prioritization; participants with an 'unknown' response (n = 152) were excluded. Most participants (n = 12,839, 95.1%) believed that eating a healthy diet was important (Table 1), although responses ranged from most important (n = 610, 4.5%), very important (n = 4,369, 32.4%), important (n = 7,860, 58.2%), not very important (n = 556, 4.1%), and not important at all (n = 106, 0.8%). The mean age was 50.2 years (SD:15.1), and the study sample was majority female (51.9%), employed (59.8%), lived in rural environments (59.2%), married (84.7%), did not live with either their father (89.6%) or their mother (86.8%), and did not have a past diagnosis of high blood pressure, diabetes, heart attack, or stroke (82.2%).

Odds of believing healthy eating to not be important significantly differed across select socio-demographic, interpersonal, and physical health indicators (Table 2). In the fully adjusted models, odds of believe healthy eating to not be important was lower among participants with increased age (AOR: 0.98, 95%CI:0.98–0.99), higher educational attainment (AOR [university degree or higher

Table 1. Characteristics of participants with data on personal prioritization of healthy diets from 2015 CHNS database.

	Total (n = 13,501)	How important is this priority in your life: eating a healthy diet	
		Important (n = 12,839)	Unimportant (n = 662)
Socio-demographic			
Age, mean (SD)	50.2 (15.1)	50.2 (15.1)	51.0 (15.7)
Sex (Male), n (%)	6,597 (48.1)	6,162 (48.0)	335 (50.6)
Employment status (Not employed), n (%)	5,423(40.2)	5,157 (40.2)	266 (40.2)
Education, n (%)			
None	2,568 (19.1)	2,345 (18.3)	223 (33.7)
Primary school	2,234 (16.6)	2,104 (16.4)	130 (19.7)
Middle school	4,308 (32.0)	4,110 (32.1)	198 (30.0)
High school	1,791 (13.3)	1,746 (13.6)	45 (6.8)
Technical/vocational degree	971 (7.2)	928 (7.2)	43 (6.5)
University degree and above	1,608 (11.9)	1,586 (12.4)	22 (3.3)
Residence (Urban), n (%)	5,502 (40.8)	5,324 (41.5)	178 (26.9)
Interpersonal			
Marital status (Single/Other), n (%)	2,058 (15.3)	1,936 (15.2)	122 (18.5)
Father living in house (Yes), n (%)	1,408 (10.4)	1,356 (10.5)	62 (9.4)
Mother living in house (Yes), n (%)	1,776 (13.2)	1,346 (10.5)	73 (11.0)
Both parents living in house (Yes), n (%)	1,258 (9.3)	1,208 (9.4)	50 (7.6)
Physical health			
Past high BP diagnosis (Yes), n (%)	2,052 (15.2)	1,967 (15.4)	85 (12.9)
Past diabetes diagnosis (Yes), n (%)	522 (3.9)	506 (4.0)	16 (2.4)
Past heart attack diagnosis (Yes), n (%)	118 (0.9)	112 (0.9)	6 (0.9)
Past stroke diagnosis (Yes), n (%)	208 (1.5)	196 (1.5)	12 (1.8)
Past NCD[a] diagnosis (Yes), n (%)	2,405 (17.8)	2,311 (18.1)	94 (14.2)

[a]Past high blood pressure, diabetes, heart attack, or stroke diagnosis

Variables with missing data: education (n = 21), marital status (n = 69), father living in house (n = 6), mother living in house (n = 11), both parents living in house (n = 4), past high bp (n = 33), diabetes (n = 33), heart attack (n = 11), stroke (n = 3), and any NCD (n = 3) diagnosis.

vs. no education]:0.12, 95%CI: 0.07–0.19), those living in urban compared with rural environments (AOR: 0.76, 95%CI:0.63–0.83), those living with both parents (AOR:0.69, 95%CI:0.48–0.98), and those with past diagnoses of NCDs (AOR: 0.76, 95%CI:0.59–0.96). Odds were higher among males (AOR: 1.42, 95%CI:1.20–1.69) and those who were single (or other) compared with married individuals (AOR: 1.36, 95%CI:1.08–1.71).

The distribution of PDI, hPDI, uPDI, and CHEI scores among those who believed healthy diets to be important or not be important are displayed in Figure 1. CHEI analyses excluded 5,450 participants (40.4%) with missing data, while PDI, hPDI, uPDI and food group analyses excluded 219 (1.6%) of participants with missing data; while those with missing PDI, hPDI, uPDI and food group data did not report significant differences in belief about the importance of healthy diet, those with missing CHEI were marginally more likely to believe healthy eating to be unimportant (5.8% vs. 4.3%). Comparing scores of those who believed eating a healthy diet to be unimportant vs. important, average PDI was higher (41.58, SD:5.01 vs. 40.75, SD:5.13), average hPDI was higher (53.47, SD:4.81 vs. 53.07, SD:4.97), average uPDI was higher (59.57, SD:5.10 vs. 58.35, SD:5.27), and average CHEI was lower (56.72, SD:6.92 vs. 58.11, SD:6.99) (P-difference < 0.001). However, in the adjusted regression analyses (Table 3), no statistically significant association was observed with believing a healthy diet to be important and any of the PDI or CHEI scores.

In adjusted analyses of specific food groups (Table 4), it was also found that compared to those who believed eating a healthy diet to be important, those who did not reported lower vegetable and meat intake (AOR: 0.77, 95%CI:0.62–0.96; AOR: 0.80, 95%CI:0.63–1.00).

DISCUSSION

Overall, while only approximately 5% of Chinese adults analyzed reported believing healthy eating to be unimportant, given the enormity of the overall Chinese population, the findings emphasize continued concerns that many Chinese adults may not be prioritizing healthy

Table 2. Odds ratios of believing healthy eating to unimportant across socio-demographic, interpersonal, and physical health indicators Chinese adults.

	Model 1 (UOR)	Model 2 (AOR)	Model 3 (AOR)
Socio-demographic			
Age	1.00 (1.00–1.01)	**0.99 (0.98–0.99)**	**0.98 (0.98–0.99)**
Sex (Male)	1.11 (0.95–1.30)	**1.35 (1.14–1.59)**	**1.42 (1.20–1.69)**
Employment status (Not employed)	1.00 (0.85–1.17)	1.10 (0.92–1.32)	1.09 (0.91–1.32)
Education			
None	Ref	Ref	Ref
Primary school	**0.65 (0.52–0.81)**	**0.55 (0.44–0.70)**	**0.56 (0.44–0.71)**
Middle school	**0.51 (0.42–0.62)**	**0.30 (0.31–0.49)**	**0.40 (0.32–0.51)**
High school	**0.27 (0.19–0.37)**	**0.22 (0.15–0.31)**	**0.23 (0.16–0.33)**
Technical/vocational degree	**0.49 (0.34–0.67)**	**0.41 (0.28–0.58)**	**0.42 (0.28–0.60)**
University degree or higher	**0.15 (0.09–0.22)**	**0.12 (0.07–0.19)**	**0.12 (0.07–0.19)**
Residence (Urban)	**0.52 (0.43–0.62)**	**0.76 (0.63–0.93)**	**0.76 (0.63–0.83)**
Interpersonal			
Marital status (Single/Other)	**1.27 (1.03–1.55)**		**1.36 (1.08–1.71)**
Father living in house (Yes)	0.88 (0.67–1.14)		0.97 (0.63–1.48)
Mother living in house (Yes)	0.81 (0.63–1.03)		0.71 (0.47–1.05)
Both parents living in house[a] (Yes)	0.79 (0.58–1.04)		**0.69 (0.48–0.98)**
Physical health			
Past High BP diagnosis (Yes)	0.81 (0.64–1.02)		0.83 (0.64–1.07)
Past Diabetes diagnosis (Yes)	**0.60 (0.35–0.96)**		0.69 (0.39–1.13)
Past Heart attack diagnosis (Yes)	1.04 (0.41–2.18)		1.19 (0.46–2.56)
Past Stroke diagnosis (Yes)	1.19 (0.63–2.05)		1.24 (0.62–2.25)
Past NCD diagnosis[b] (Yes)	**0.75 (0.60–0.94)**		**0.76 (0.59–0.96)**

Model 1: Unadjusted.

Model 2: Adjusted for all socio-demographic variables.

Model 3: Adjusted for all socio-demographic, interpersonal, and physical health variables.

[a]Individual variables for father and mother living in house not included in adjusted analyses.

[b]Individual variables for high BP, diabetes, heart attack, stroke not included in adjusted analyses.

eating as part of their daily lives. Likewise, odds of believing healthy eating to be unimportant significantly differed across various socio-demographic, interpersonal, physical health indicators, and those who believed healthy eating to be unimportant had significantly lower vegetable and meat intake. As such, while contributors to dietary behaviors are complex and personal prioritization of healthy eating may only play a limited role (within the context of select food groups), the findings signal the potential for dietary health interventions that also incorporate efforts at changing dietary attitudes (particularly in the context of vegetable and meat consumption) as part of multilayered approaches to improving population health.

Similar to the current study, older age has both quantitatively[31] and qualitatively[32] been associated with positive attitudes towards healthy diets, including in Asian settings.[33] This association has been understood through the significant presence of lifestyle-related health conditions experienced by older adults and self-imposed or provider-recommended dietary restrictions to mitigate NCD related concerns.[32] However, one of the studies in Taiwan among an entirely elderly population observed that younger age groups had more positive attitudes about general nutrition[34]; this may suggest that the association between older age and dietary attitudes is not necessarily consistent across all older age groups. Sex disparities have also been identified in past analysis of dietary attitude data,[35,36] including in Chinese settings,[16,37] which corroborate the findings of this study. Indeed, sex and the cultural and social forces driving certain gender-based roles and behaviors have been observed to play a prominent role in driving many health disparities in China.[38,39] Therefore, with respect to both age and sex, to address the disparities observed in dietary attitudes among Chinese adults it is important to consider the unique contextual factors underpinning the mechanisms of this association. Indeed, as has been done in other settings,[32] further qualitative or mixed-methods research is needed to examine social, cultural, or other reasons behind why age and sex may be determinants of dietary attitudes to build on the findings

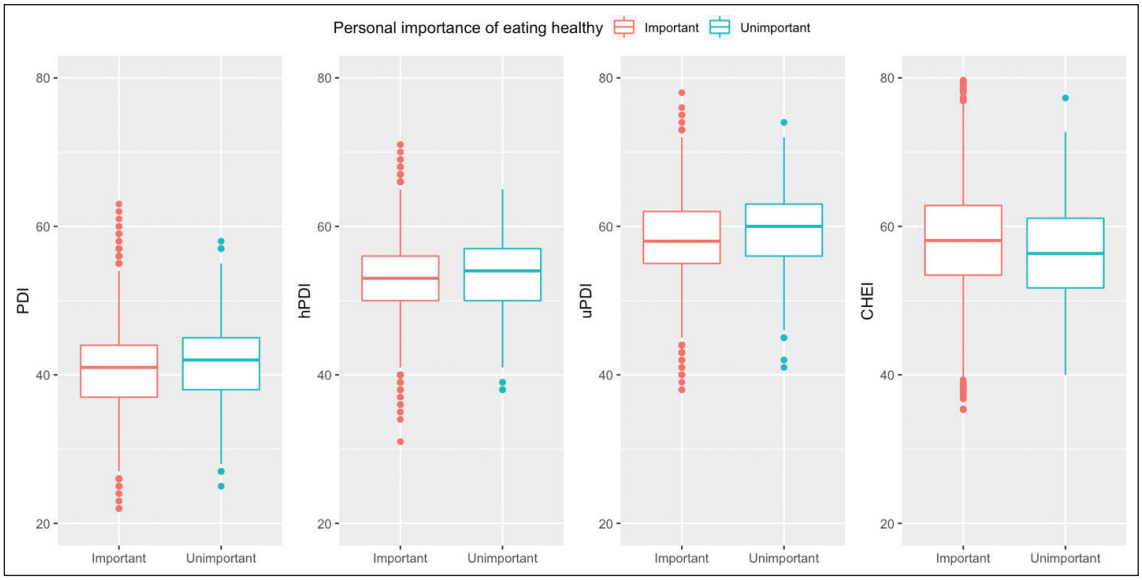

Figure 1. **Plant-based diet index (PDI) and China healthy eating index (CHEI) scores among Chinese adults by attitude towards eating healthy.**

Table 3. **Adjusted linear regression analyses of plant-based diet index (PDI) and China healthy eating index (CHEI) scores among Chinese adults by attitude towards eating healthy (Ref: eating a healthy diet is important).**

	Model 1 (β)	Model 2 (β)	Model 3 (β)
PDI	**0.83 (0.43–1.24)**	0.30 (–0.09–0.69)	0.27 (–0.12–0.67)
hPDI	**0.41 (0.02–0.80)**	0.14 (–0.25–0.52)	0.14 (–0.25–0.53)
uPDI	**1.22 (0.81–1.63)**	0.36 (–0.03–0.75)	0.35 (–0.04–0.75)
CHEI	**–1.39 (–2.14–[–0.65])**	–0.53 (–1.26–0.20)	–0.50 (–1.24–0.23)

Model 1: Unadjusted.

Model 2: Adjusted for all socio-demographic variables.

Model 3: Adjusted for all socio-demographic, interpersonal, and physical health variables.

Table 4. **Adjusted odds of above-median consumption of select food groups among Chinese adults by attitude towards eating healthy (Ref: eating a healthy diet is important).**

	Model 1 (UOR)	Model 2 (AOR)	Model 3 (AOR)
Vegetables	0.90 (0.72–1.11)	**0.78 (0.63–0.97)**	**0.77 (0.62–0.96)**
Refined grains	1.20 (0.97–1.49)	0.91 (0.72–1.14)	0.88 (0.70–1.11)
Meat	**0.70 (0.56–0.87)**	**0.79 (0.63–0.98)**	**0.80 (0.63–1.00)**
Eggs	0.96 (0.77–1.19)	1.06 (0.85–1.31)	1.05 (0.85–1.31)
Legumes	1.08 (0.88–1.34)	1.12 (0.90–1.39)	1.13 (0.91–1.41)

Model 1: Unadjusted.

Model 2: Adjusted for all socio-demographic variables.

Model 3: Adjusted for all socio-demographic, interpersonal, and physical health variables.

of this study and better tailor lifestyle behavioral attentions. Educational attainment and residence type (urban vs. rural) were observed to be the most significant predictor of personal prioritization of healthy eating, which corroborates the past research highlighting their connection with dietary attitudes[24,34,40] and role in driving health disparities in China.[16,38] These socio-economic and regional disparities must also be considered in how health communication interventions are targeted, and also the important role of addressing structural disparities in education and regional disparities to meet broader population health goals in China.

Compared with married individuals, past research has also observed single individuals to have more negative dietary attitudes[15] and increased frequency of fast-food intake,[41] although research in Chinese settings is notably limited. Likewise, past evidence has found a strong association between parental behaviors and attitudes in driving similar behavioral and attitudinal disparities with respect to diet in children.[42,43] However, findings that

personal prioritization of healthy eating was only associated with living with both parents suggest that in Chinese settings, the presence of living with only one parent may not be a salient enough predictor of dietary attitudes. Indeed, this evidence suggests that further mixed-method research is warranted to examine the specific mechanisms underpinning the role both marital status and living with parents play in driving specific dietary attitudes among Chinese adults. Importantly, other types of interpersonal dynamics may also be involved in dietary attitude formation and are worthy of further exploration; in three-generation Chinese households for example, grandparents have been observed to play key roles in eating behaviors of children,[44] and thus, may hold influence on dietary attitudes as well.

Moreover, despite limited quantitative[18] and qualitative evidence[32] linking physical health with diet related attitudes and behavioral motivations, past diagnosis of different individual health conditions was not associated with different odds of personal prioritization of healthy diets. However, an association was observed with past diagnosis of any of these health conditions (in combined analyses), suggesting that NCD or overall health status, in general, may be more salient predictor. Nonetheless, further research among Chinese adults with hypertension, diabetes, or other NCDs to assess drivers of dietary attitudes and different reasons behind why diagnosis of these NCDs may or may not be translating into changes in dietary attitudes (along with changes in dietary behaviors). Although attitudes towards healthy eating have been operationalized in different ways, increased intake of vegetables and breakfast cereal was associated with negative attitudes towards healthy eating behaviors in Ireland,[14] while higher diet quality has been associated with favorable attitudes towards healthy eating in France[24] and the United States.[25] Although Fila and Smith observed an association between positive attitudes and healthy eating behaviors among Native American youth,[45] behavior in this context was operationalized through self-identified general eating behaviors. Although no adjusted associations were observed in indicators of plant-based or healthy dietary patterns in the current study, descriptive analyses, indeed, suggested a slightly higher overall healthy diet among those who believed eating healthy diet to be important.

A surprising finding was that those who believed eating a healthy diet to be unimportant had higher PDI and hPDI scores. While a higher uPDI score may be expected, a slightly higher PDI and hPDI suggest that further critical examination between the healthy plant-based diets and attitudes towards healthy eating is warranted. These findings may be explained by the fact that only specific types of healthy plant-based foods may be linked to dietary attitudes among Chinese adults (e.g. an association with vegetable intake was observed, while no association with whole grain or legume intake was observed in disaggregated food group analyses). Nonetheless, it is important to consider the different implications of operationalizing behavior through both specific nutritional data on dietary food consumption and more general self-identified food eating patterns (the latter of which may provide more tangible insights into how attitudes influence the consumption of specific foods).

A key finding of this study was that the intake of vegetables and meat was found to be associated with dietary attitudes. Although corroborating evidence from Asian settings is limited, unlike the current study where negative attitudes towards healthy diets was associated with lower vegetable intake, evidence from a study carried out in Ireland observed negative attitudes to be associated with increased vegetable intake.[14] Importantly, this discrepancy may be explained with differences with operationalizing vegetable consumption (the current study using FFQ-based food intake data) and negative dietary attitudes. However, it may also suggest that the conceptualization of and attitudes towards what a 'healthy diet' entails in China may be in part centered around vegetable and meat intake.

Nonetheless, the findings suggest that, for most key food groups, attitudes towards health diets may not be strongly associated with substantive differences in eating behavior or that, unlike evidence in Western settings,[14,24,25] specific food consumption trends may be less driven by personal attitudes towards healthy diets in China. This is supported by the fact that in the current study, any unadjusted associations identified between quintiles of food group intake and personal prioritization of healthy eating no longer existed when adjusted for socio-demographic factors. Indeed, research studies into socio-ecological factors involved in the food consumption patterns displayed by Chinese adults have highlighted unique and complex interpersonal, food retail environment-related, and socio-economic factors under the backdrop of dramatic structural and behavioral changes as a result of China's nutrition transition.[46–48] These potential contributors to dietary patterns may play a more salient role in China, although further research is needed.

There are a number of limitations to this analysis that must be acknowledged. First, due to the cross-sectional study design, causality or temporality between personal prioritization and the examined independent variables could not be assessed. Given the complexity of dietary attitudes, further research may benefit from in-depth analyses of its association with other indicators (such as food insecurity) to expand the understanding of its multifaceted determinants. Likewise, the mixed findings with eating behavior variables suggest that further qualitative or mixed-method research aimed at understanding the different dimensions of dietary attitudes prevalent in

China are warranted (particularly as it pertains to the consumption of plant-based diets). Importantly, self-indicating one's perceived importance of healthy eating may be subject to social desirability biases, with no additional analogous or parallel dietary attitude indicator in the dataset to compare findings; further exploration of other rigorous indicators of dietary attitudes (e.g. validated attitudinal scales) is warranted.

Moreover, although strength of the data was the robust and large sample size of Chinese adults across different regions and socio-economic levels, the limited sample size of certain sub-groups (notably participants with past diagnosis of NCDs as well as those living with their parents) limited the power of analysis. Furthermore, the study involved analysis of self-reported past diagnosis of NCDs and, although the study did not aim to provide nationwide prevalence on NCD outcomes, this information may be different from other NCD indicators (e.g. biomarkers). However, since dietary attitudes are ultimately a personalized, subjective, and dynamic set of values and opinions informed by one's knowledge and belief frameworks, the actual awareness of information relevant to dietary attitudes (e.g. diagnosis of an NCD) may be a more salient NCD variable in the context of dietary attitudes than underlying biomarkers. Nonetheless, future longitudinal assessments may consider integrating clinical measures to assess any distinct role such outcomes may play in the context of dietary attitudes. Likewise, a comprehensive analysis of interpersonal predictors could not be conducted due to limited variety of variables in the dataset; further research is warranted to examine both different interpersonal relationships and the quality of these relationships (e.g. family or parental social support) as predictors of dietary attitudes. Finally, due to limitations in the distribution of different food consumption patterns, only a limited number of key food groups could be examined to assess quintile-based associations with personal prioritization of healthy diet; from these preliminary findings, further research is warranted to examine more diverse food groups and assess other indicators of food behavior (such as food purchasing and cooking behaviors).

This study provides some of the first substantive insights into disparities in personal prioritization of healthy eating (as a dietary attitude) in China, as well as what association this prioritization has with food consumption patterns. The key socio-demographic, interpersonal, and physical health disparities identified signal the need for more targeted health communication or lifestyle behavioral interventions in China, as well as for more in-depth mixed-method exploration for the drivers of personal prioritization of healthy diets in China. Moreover, public health professionals may consider vegetable and meat intake as key dietary behaviors with the potential for substantive behavior change in interventional efforts aimed at improving attitudes towards healthy eating. Yet, the limited associations observed with other food consumption trends suggest a need to consider how specific dietary attitudes translate into specific food behavior changes, whether there are other contextual factors which interact with this association more prominently in Chinese settings, and further research (beyond the food groups examined in this current study) on different ways that dietary attitudes connect with dietary behaviors in China is warranted.

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DECLARATIONS

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Conflicts of interest/Competing interests

None.

Authors' contributions

SHA was involved in the study conceptualization, methodology, formal analysis, and writing – original draft. YG was involved in the study methodology, formal analysis, writing – review & editing. CY was involved in the study methodology and writing – review & editing. RJD was involved in the study writing – review & editing and supervision

Availability of data and material

Data used for analyses are publicly available (https://www.cpc.unc.edu/projects/china)

Ethics approval

The survey methodology and data collection procedures were approved by the Institutional Review Board of the University of North Carolina at Chapel Hill, NC, USA and the National Institute for Nutrition and Health, Chinese Center for Disease Control and Prevention, Beijing, China.

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