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Household structure and dietary diversity among older adults in rural and urban China: a cross-sectional study

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Abstract

Background Household structure can significantly affect older adults' eating behaviours and diet quality. However, the difference in dietary diversity in various household structures in urban and rural has rarely been investigated. This study aimed to investigate the association between household structure and dietary diversity among older Chinese adults and examine whether the association differed by urban and rural.

Methods The study used data from the 2018 wave of the Chinese Longitudinal Healthy Longevity Survey (CLHLS). The participants were individuals aged 60 and over with available dietary and household structure data. Dietary diversity was defined as 'high' if respondents had a dietary diversity score (DDS) above the mean value. Household structures were classified into four mutually exclusive categories: (1) living alone; (2) spouse only; (3) at least with a great/grandchild(ren); (4) non-empty-nested. Binary logistic regression was applied to investigate the association between household structures and dietary diversity.

Results Non-empty-nested older adults had the highest probability (OR = 1.64, 95% CI = 1.44–1.87) of having high dietary diversity. People who only lived with their spouse and at least lived with a great/grandchild(ren) were 1.45 (OR = 1.45, 95% CI = 1.23–1.71) and 1.23 (OR = 1.23, 95% CI = 1.08–1.41) times as likely to have diverse diets than older adults who lived alone. The difference in dietary diversity among various household structures is more evident in urban than rural areas. Solo-living older adults were the most disadvantaged regarding dietary diversity in urban and rural areas.

Conclusions Household structures are significantly associated with dietary diversity among older Chinese adults aged 60 years and over. The findings emphasise the need to reduce nutritional inequality, encourage dietary diversity, and consider both the household structures and residences when providing health intervention programs to the older population.

Keywords Dietary pattern, Living arrangement, Residential heterogeneity, Ageing

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Background

The population of older persons has been substantially increasing in numbers and proportions around the globe [1]. China has become an ageing society, with an expected 26.1% of people aged 65 and over in the total population by 2050 [2]. In recent years, ageing has been among China's most significant factors driving household changes. Households with older adults have increased, and instead of living with adult children, older Chinese adults are forming their own households, which has caused a substantial increase in the proportion of older adults living alone and living with a spouse [3].

Living within different household structures goes beyond describing the living conditions of individuals as it may impact health conditions. Previous studies reported that household structures can significantly affect older adults' eating behaviours and diet quality [4]. In rural areas of China, co-residing with family members, particularly adult children and grandchildren, can positively contribute to healthier diets. In contrast, older individuals living alone tend to consume fewer fruits, meat, eggs, and dairy products, leading to lower diet quality [5]. In South Korea, those living alone are nutritionally disadvantaged compared to those living with a spouse. Research shows that older adults living alone experience higher frequencies of skipping meals and have lower consumption of various foods and nutrients [4]. Similarly, in Thailand, insufficient intake of fruits and vegetables is common among older adults living alone, while those residing with their children, grandchildren, or a spouse benefit from more adequate dietary intake [6]. Diet quality is vital in reducing the risk of noncommunicable diseases and promoting healthy aging processes among older adults [7]. High dietary diversity, an essential part of diet quality, is recommended in dietary guidelines across countries as it can provide adequate nutrients that the human body needs [8]. It has been observed as a key modifiable factor that is related to cognitive impairment [9, 10], physical function [11], frailty [12], and mortality risk [13] among older adults. Moreover, previous studies have highlighted the urban-rural disparity in diet quality [14]. Older urban residents tend to have higher dietary diversity than those living in rural areas, largely due to long-term socioeconomic gaps and a lack of dietary knowledge [15–17]. Lifestyle and health conditions are also considered as important factors influencing the diets of older adults. Chronic diseases and physical limitations would impact nutrient intake [18].

Previous studies have provided evidence for relationships between household structures and specific food group consumption, such as fruits and vegetables. The difference in dietary diversity in various household structures in urban and rural has rarely been investigated [5, 6]. Understating the association between household structures and dietary diversity in different residences is crucial for improving dietary diversity, narrowing area disparity in nutrition and ultimately alleviating disease burden among older adults. Therefore, the present study utilised the 2018 Chinese Longitudinal Healthy Longevity Survey (CLHLS) dataset to investigate the association between household structure and dietary diversity among older Chinese adults and examined whether the association varied by urban and rural.

Methods

Data

The data used in the present study was obtained from the 2018 wave of the CLHLS. It is a nationally representative cross-sectional survey covering 23 Chinese provinces, municipalities, and autonomous regions. All participants gave their written informed consent before participating in the study. The CLHLS program was approved by the biomedical ethics committee of Peking University (IRB00001052–24713074). The details about the CLHLS were described in a previous publication [19].

The current study sample prescribed criteria for inclusion, which were older adults aged 60 years and over, had valid dietary and socio-demographic information and excluded individuals who lived in institutions and had dementia. A total of 10,458 participants were included in the final analysis.

Measurements

Assessment of dietary diversity

In a face-to-face interview, participants were asked to report intake frequencies of various food groups, including fresh fruits, fresh vegetables, meat, fish, egg, beans, milk, and nuts. The current study followed the food group categories outlined in the Chinese Food Pagoda [20]. Cereals and oil were excluded from the construction of dietary diversity score (DDS), because they are consumed daily by nearly all Chinese people [9, 21]. Since DDS can be tailored to research objectives and local culture contexts [22], these eight food groups can more effectively represent dietary quality and diversity. The intake frequency of each food group was measured on a 5-point scale, "almost every day," "at least once a week," "at least once a month," "not every month, but occasionally," and "rarely or never." If the response for one food group is "almost every day" or "at least once a week," then one point is given. Otherwise, no points would be given. The DDS equals the sum of the points for all eight food groups mentioned above. The total score ranged from 0 to 8, with the higher DDS indicating better dietary diversity. Cronbach's alpha coefficient of dietary frequencies of the eight food groups in CLHLS was 0.63, demonstrating moderate reliability, which means DDS is reliable for measuring dietary diversity.

Previous studies used mean-based criteria for having a lower or higher dietary diversity [21, 23], due to there are no established cut-off points for the number of food groups to indicate adequate or inadequate dietary diversity [24]. Therefore, the mean score was used for the analytical purposes in the present study rather than the median because the subsequent residential subsample analysis will be biased if the median value were utilised. Dietary diversity was defined as 'low' if the DDS was lower than the mean value (DDS<4); it was defined as 'high' if respondents had scores above the mean (DDS>=4).

Assessment of household structure

The household structures were classified into four mutually exclusive categories: (1) living alone, in which none others live with older adults; (2) spouse only, which means older adults only with their spouse in households and no one else; (3) at least with a great/grandchild(ren), in which older adults at least co-resident with a great/grandchild(ren), spouse(s) of their great/grandchild(ren) or living with a grandchild(ren), great-grandchild(ren), spouse(s) of their great/grandchild(ren) and other family members; (4) non-empty-nested, which means older adults live with other family members, include spouse, adult child(ren), spouse of adult child(ren), siblings, parent(s) or parent(s)-in-law. All these cases involve living without grandchild(ren), great-grandchild(ren), or spouse(s) of them. Further details about the measurement of household structure are provided in the supplementary file [see Additional file 1].

Covariates

Based on previous studies [21, 25, 26], several demographic factors were used as covariates. Covariates include socio-demographic information (age, sex, residence, marriage, education, occupation, and self-perceived economic status), lifestyle (smoking, alcohol drinking, exercising), and health conditions (self-rated health, number of natural teeth, activity limitation, and chronic disease).

Age was categorised into age groups: 60–69, 70–79, 80–89, and 90 or above. Residence includes two categories: urban and rural. Marital status was classified into two groups: married and living/separated, and divorced/widowed/never married. Education level was dichotomised into 'literate' (schooling years ≥ 1) or 'illiterate' (schooling years=0). Occupation was defined as 'farmer' if an individual's primary occupation before age 60 was agriculture, forestry, animal husbandry, or fishery. Economic status was measured by asking participants, 'How do you rate your economic status compared with others in your local area?' The response was grouped into 'poor' and 'not poor' [27]. The number of natural teeth was self-reported by older adults, and dental status is associated with diet quality and nutrient intake [28, 29]. Having at least 20 natural teeth is associated with acceptable oral health and diverse diets [29, 30]. We categorised the number of natural teeth into two groups: having 0–19 natural teeth and having at least 20 natural teeth. Activity limitation was assessed by asking participants the question "For at least the last 6 months, have you been limited in activities people usually do because of a health problem?" Response options include "yes, strongly limited", "yes, limited", and "not limited." It was classified as 'yes' if respondent reported "yes, strongly limited" or "yes, limited [31]." The answers for self-rated health include "very good", "good", "fair", "bad", and "very bad." It was defined as 'bad' if older adults answered "bad" or "very bad [32]." Chronic disease was defined as 'yes' if older adults reported suffering from any chronic disease. Smoking, alcohol drinking, and exercising were defined as 'yes' if respondents smoke, drink, and do regular exercise at present [33].

Statistical analysis

Participants' characteristics by dietary diversity (low and high) were compared by chi-square tests for categorical variables and t-tests for continuous variables. Binary logistic regression was applied to explore the association between household structure and dietary diversity, in which living alone was defined as the reference group. To further examine whether the associations of household structures with dietary diversity varied by urban and rural, the effects of household structures on dietary diversity were separately assessed among urban and rural residents.

The associations with high dietary diversity are presented as odds ratio (OR) with 95% confidence intervals (CI). The threshold for statistical significance was set as $p<0.05$.

Results

Descriptive statistics

Table 1 presents the main characteristics of the study participants stratified by dietary diversity; 5260 older adults had low dietary diversity (mean (DDS)=2.87), and 5198 had high dietary diversity (mean (DDS)=6.05). Participants who are only living with a spouse (56.3%) and non-empty-nested (53.4%) were more likely to have high dietary diversity compared to those living alone (40.1%) and at least living with a great/grandchild(ren) (45.3%). Apart from smoking, statistically significant differences were found with all independent variables. Older Chinese adults who have high dietary diversity tend to be younger, male, urban inhabitants, married, literate, non-farmer, have high self-perceived economic status, drink alcohol, exercise regularly, have good self-rated health, have

Table 1 Characteristics of study participants by dietary diversity

	Total	Dietary diversity		*p*-value
		Low (*n* = 5260, 50.3%)	High (*n* = 5198, 49.7%)	
Household structure				**< 0.001**
Living alone	1775(17)	1064 (59.9)	711 (40.1)	
Non-empty-nested	3266 (31.2)	1522 (46.6)	1744 (53.4)	
Spouse only	2629 (25.1)	1149 (43.7)	1480 (56.3)	
At least with a great/grandchild(ren)	2788 (26.7)	1525 (54.7)	1263 (45.3)	
DDS	4.46 (1.90)	2.87 (1.07)	6.05 (1.01)	**< 0.001**
Age group				**< 0.001**
60–69	1351 (12.9)	638 (47.2)	713 (52.8)	
70–79	2734 (26.1)	1267 (46.3)	1467 (53.7)	
80–89	2570 (24.6)	1336 (52)	1234 (48)	
90+	3803 (36.4)	2019 (53.1)	1784 (46.9)	
Sex				**< 0.001**
Female	5805 (55.5)	3097 (53.4%)	2708 (46.6)	
Male	4653 (44.5)	2163 (46.5)	2490 (53.5)	
Residence				**< 0.001**
Rural	4541 (43.4)	2703 (59.5)	1838 (40.5)	
Urban	5917 (56.6)	2557 (43.2)	3360 (56.8)	
Marriage				**< 0.001**
Divorced/widowed/never married	5729 (54.8)	3125 (54.5)	2604 (45.5)	
Married and living/separated	4729 (45.2)	2135 (45.1)	2594 (54.9)	
Education				**< 0.001**
Illiterate	4922 (47.1)	2970 (60.3)	1952 (39.7)	
Literate	5536 (52.9)	2290 (41.4)	3246 (58.6)	
Occupation				**< 0.001**
Farmer	6541 (62.5)	3986 (60.9)	2555 (39.1)	
Non-farmer	3917 (37.5)	1274 (32.5)	2643 (67.5)	
Economic status				**< 0.001**
Poor	1055 (10.1)	792 (75.1)	263 (24.9)	
Not poor	9403 (89.9)	4468 (47.5)	4935 (52.5)	
Smoking				0.2
No	8834 (84.5)	4418 (50)	4416 (50)	
Yes	1624 (15.5)	842 (51.8)	782 (48.2)	
Drinking				**< 0.001**
No	8860 (84.7)	4548 (51.3)	4312 (48.7)	
Yes	1598 (15.3)	712 (44.6)	886 (55.4)	
Exercising				**< 0.001**
No	7031 (67.2)	3879 (55.2)	3152 (44.8)	
Yes	3427 (32.8)	1381 (40.3)	2046 (59.7)	
Self-rated health				**< 0.001**
Bad	5526 (52.8)	3070 (55.6)	2456 (44.4)	
Good	4932 (47.2)	2190 (44.4)	2742 (55.6)	
Number of natural teeth				**< 0.001**
0–19	7628 (72.9)	4073 (53.4)	3555 (46.6)	
>=20	2830 (27.1)	1187 (41.9)	1643 (58.1)	
Activity limitation				**< 0.001**
No	7036 (67.3)	3412 (48.5)	3624 (51.5)	
Yes	3422 (32.7)	1848 (54)	1574 (46)	
Chronic disease				**< 0.001**
No	3082 (29.5)	1701 (55.2)	1381 (44.8)	
Yes	7376 (70.5)	3559 (48.3)	3817 (51.7)	

Note: Data were shown as n (%) for categorical variables and mean (SD) for continuous variables. DDS: Dietary diversity score. Statistical significance (*p*-value less than 0.05) is displayed in bold in the table

at least 20 natural teeth, have no limited at daily living activities due to health issues, and have chronic disease.

Association between household structure and dietary diversity

Binary logistic regression analysis was applied to assess the associations between household structure, socio-demographic characteristics, and dietary diversity (Table 2). The results demonstrate that older Chinese adults who were non-empty-nested (OR=1.64, 95% CI=1.44–1.87) had the highest probability of having high dietary diversity. People who only lived with their spouse (OR=1.45, 95% CI=1.23–1.71) and at least lived with a great/grandchild(ren) (OR=1.23, 95% CI=1.08–1.41) were 1.45 and 1.23 times as likely to have diverse diets than older adults who lived alone. The older adults aged 70–79 years (OR=1.21, 95% CI=1.05–1.40), 80–90 years (OR=1.17, 95% CI=1.00-1.37) and over 90 years (OR=1.30, 95% CI=1.10–1.55) were more likely to have higher dietary diversity than people aged 60–69 years. Living in an urban area (OR=1.33, 95% CI=1.22–1.45), being educated (OR=1.47, 95% CI=1.33–1.63), not working in the agriculture industry before 60 years old (OR=2.27, 95% CI=2.07–2.50), having a high self-perceived economic status (OR=2.46, 95% CI=2.12–2.87), smoking (OR=0.82, 95% CI=0.72–0.92), drinking alcohol

Table 2 The association between household structure and dietary diversity among older adults

	Dietary diversity		
	Odds Ratios	**CI**	***p*-value**
Household structure (Ref.=living alone)			
Non-empty-nested	1.64	1.44–1.87	**< 0.001**
Spouse only	1.45	1.23–1.71	**< 0.001**
At least with a great/grandchild(ren)	1.23	1.08–1.41	**0.002**
Age group (Ref.=60–69)			
70–79	1.21	1.05–1.40	**0.008**
80–89	1.17	1.00–1.37	**0.045**
90+	1.30	1.10–1.55	**0.002**
Sex (Ref.=female)			
Male	0.96	0.86–1.06	0.378
Residence (Ref.=rural)			
Urban	1.33	1.22–1.45	**< 0.001**
Marriage (Ref.=divorced/widowed/never married)			
Married and living/separated	1.09	0.96–1.24	0.175
Education (Ref.=Illiterate)			
Literate	1.47	1.33–1.63	**< 0.001**
Occupation (Ref.=farmer)			
Non-farmer	2.27	2.07–2.50	**< 0.001**
Economic status (Ref.=poor)			
Not poor	2.46	2.12–2.87	**< 0.001**
Smoking (Ref.=no)			
Yes	0.82	0.72–0.92	**0.001**
Drinking (Ref.=no)			
Yes	1.24	1.09–1.40	**0.001**
Exercising (Ref.=no)			
Yes	1.27	1.16–1.40	**< 0.001**
Self-rated health (Ref.=bad)			
Good	1.41	1.29–1.53	**< 0.001**
Number of natural teeth (Ref.=0–19)			
>=20	1.29	1.16–1.43	**< 0.001**
Activity limitation (Ref.=no)			
Yes	0.94	0.85–1.03	0.198
Chronic disease (Ref.=no)			
Yes	1.19	1.08–1.30	**< 0.001**

null.deviance	df.null	logLik	AIC	BIC	Deviance	df.residual	nobs
14,497	10,457	-6535	13,109	13,254	13,069	10,438	10,458

Note: Statistical significance (*p*-value less than 0.05) is displayed in bold in the table. null.deviance: Null Deviance. df.null: Degrees of Freedom for Null Model. logLik: Log-Likelihood. AIC: Akaike Information Criterion. BIC: Bayesian Information Criterion. df.residual: Degrees of Freedom for Residuals. nobs: Number of Observations

(OR=1.24, 95% CI=1.09–1.40), exercising (OR=1.27, 95% CI=1.16–1.40), having good self-rated health (OR=1.41, 95% CI=1.29–1.53), having at least 20 natural teeth (OR=1.29, 95% CI=1.16–1.43), having chronic disease (OR=1.19, 95% CI=1.08–1.30) are significantly associated with high dietary diversity. No significant differences were observed according to sex, marital status, and activity limitation.

Table 3 shows the association between household structure and dietary diversity in urban and rural. The effect of households on dietary diversity was more apparent in urban areas than in rural. Older adults who lived alone were the most disadvantaged regarding dietary diversity in urban and rural China. In urban areas, non-empty-nested (OR=1.91, 95% CI=1.60–2.28) participants were 1.91 times more likely to have higher dietary diversity than people who live with no one else. In contrast, among rural inhabitants, living with a spouse (OR=1.37, 95% CI=1.07–1.75) was the most beneficial household for high dietary diversity. Older adults lived in urban and aged 80–89 (OR=1.24, 95% CI=1.00–1.54), and 90+(OR=1.37, 95% CI=1.08–1.73) tend to have diverse diets than those aged 60–69 years. In rural areas, only older adults aged 70–79 (OR=1.25, 95% CI=1.01–1.55)had higher dietary diversity compared to the reference group. Additionally, exercising (OR=1.43, 95% CI=1.26–1.62), smoking (OR=0.77, 95% CI=0.65–0.91), activity limitation (OR=0.85, 95% CI=0.75–0.97), and chronic disease (OR=1.28, 95% CI=1.12–1.46) were significantly associated with diverse diets only in urban areas.

Discussion

It was observed that in the present analyses that household structure was related to dietary diversity among older adults in China. This was especially notable when comparing those who lived alone and those in other household structures. Previous study in China indicates that living with adult children or grandchildren is beneficial for increasing daily food consumption and diet quality for older adults, as they play a crucial role in daily diets and have spillover effects on older adults living in the same household [5]. On the other hand, the percentage of senior older adults living alone was higher than that of younger older adults [3]. Except for having poor health, they usually have poor dietary diversity. Thus, it is essential for local governments to implement interventions to increase their health status and provide social support. Further details about the mean DDS across household structures, along with the consumption of each food group by different household types in urban and rural areas, are provided in the supplementary file [see Additional file 1]. Studies in other Asian countries had similar findings. A study conducted in Korea found that older adults living alone had lower dietary quantity and quality than those living with spouses. Also, they tend to have less diverse diets and skip meals [4]. Similar situations occur in Thailand; those cohabiting with at least one child or living in a skipped-generation household were two times more likely to have sufficient fruit and vegetable intake than those who lived alone [6].

In addition, associations were found in different residences, and the relationship between household structures and dietary diversity was more apparent in urban. Rural residents have lower dietary diversity than their counterparts, which aligns with previous studies [14, 15]. The high cost of access to diverse food, such as transportation and electricity costs, could be a possible explanation for regional differences [34]. Older adults living in rural areas and alone face more difficulties with healthy diets and eating behaviours. Therefore, policies balancing dietary quantity and quality among households and regions are required in China.

Older individuals are more likely to have higher dietary diversity than those aged 60–68. The differences between the age groups in terms of dietary were observed in previous research. The eating frequency of various foods and dietary quality increased with age groups [35–37]. It may be attributed to older age groups having maintained better dietary quality throughout their lives. In other words, those who have optimal diets tend to live longer than those with poor diets [38]. Another possible reason is that with the presence of chronic diseases, older adults become more health conscious, leading them to adopt healthier diets to manage chronic disease [38, 39].

It is noteworthy that activity limitation and exercise had a significant effect on dietary diversity in urban areas. This could be explained by the clustering of healthy lifestyles among older populations [40]. For instance, older adults with poor diets tend to exhibit other unhealthy lifestyle behaviors [33]. In China, urban residents typically have better die-related knowledge, attitude, and behaviors compared to rural residents [42], thus making them more likely to adopt healthier lifestyle due to strong association between healthy literacy and lifestyles [41]. Additionally, exercise could contribute to prevent or reduce appetite loss in older adults by slowing down cellular and molecular cascades [43], which in turn affects dietary intake and diversity [44, 45]. Older adults who are disabled and mobility-impaired may face challenges in accessing foods. The interplay of disability with chronic disease, social isolation, and inadequate transportation could further exacerbate the nutritional disadvantages faced by this group [18, 46]. In the present study, sex had no significant effect on dietary diversity in rural and urban. The relationship between sex and dietary diversity was not consistent among previous studies. Some studies found that being female is positively associated with high

Table 3 The association between household structure and dietary diversity among older adults in urban and rural

	Urban		Rural	
	Odds Ratios	***p*-value**	**Odds Ratios**	***p*-value**
Household structure (Ref.=living alone)				
Non-empty-nested	1.91 (1.60–2.28)	**< 0.001**	1.31 (1.08–1.59)	**0.007**
Spouse only	1.54 (1.23–1.92)	**< 0.001**	1.37 (1.07–1.75)	**0.012**
At least with a great/grandchild(ren)	1.25 (1.04–1.50)	**0.016**	1.21 (1.00–1.48)	0.054
Age group (Ref.=60–69)				
70–79	1.20 (0.99–1.46)	0.067	1.25 (1.01–1.55)	**0.037**
80–89	1.24 (1.00–1.54)	**0.048**	1.09 (0.86–1.39)	0.469
90+	1.37 (1.08–1.73)	**0.008**	1.24 (0.96–1.59)	0.103
Sex (Ref.=female)				
Male	0.88 (0.77–1.00)	0.059	1.10 (0.95–1.28)	0.204
Marriage (Ref.=divorced/widowed/never married)				
Married and living/separated	1.15 (0.96–1.36)	0.126	1.03 (0.85–1.24)	0.766
Education (Ref.=Illiterate)				
Literate	1.57 (1.37–1.81)	**< 0.001**	1.26 (1.09–1.46)	**0.002**
Occupation (Ref.=farmer)				
Non-farmer	2.81 (2.49–3.18)	**< 0.001**	1.38 (1.18–1.62)	**< 0.001**
Economic status (Ref.=poor)				
Not poor	2.14 (1.73–2.65)	**< 0.001**	2.81 (2.26–3.52)	**< 0.001**
Smoking (Ref.=no)				
Yes	0.77 (0.65–0.91)	**0.003**	0.90 (0.75–1.08)	0.277
Drinking (Ref.=no)				
Yes	1.19 (1.00–1.41)	**0.046**	1.31 (1.09–1.56)	**0.003**
Exercising (Ref.=no)				
Yes	1.43 (1.26–1.62)	**< 0.001**	1.05 (0.91–1.22)	0.477
Self-rated health (Ref.=bad)				
Good	1.34 (1.19–1.51)	**< 0.001**	1.52 (1.34–1.73)	**< 0.001**
Number of natural teeth (Ref.=0–19)				
>=20	1.34 (1.17–1.55)	**< 0.001**	1.18 (1.01–1.38)	**0.041**
Activity limitation (Ref.=no)				
Yes	0.85 (0.75–0.97)	**0.016**	1.05 (0.91–1.21)	0.537
Chronic disease (Ref.=no)				
Yes	1.28 (1.12–1.46)	**< 0.001**	1.05 (0.92–1.20)	0.448

null.deviance	df.null	logLik	AIC	BIC	Deviance	df.residual	nobs

Table 3 (continued)

			Urban			Rural	
			Odds Ratios		*p*-value	Odds Ratios	*p*-value
8093	5916	-3552	7143	7270	7105	5898	5917
6129	4540	-2924	5886	6008	5848	4522	4541

Note: Statistical significance (*p*-value less than 0.05) is displayed in bold in the table. null.deviance: Null Deviance. df.null: Degrees of Freedom for Null Model. logLik: Log-Likelihood. AIC: Akaike Information Criterion. BIC: Bayesian Information Criterion. df.residual: Degrees of Freedom for Residuals. nobs: Number of Observations

dietary diversity [47], while others found negative [48] or no relationship [49]. Further research is needed to examine the possible reasons.

The intake of dietary diversity and dietary behaviors is significantly influenced by the food environment. In China, dietary diversity is positively associated with food accessibility [37]. In rural areas, high transportation and electricity costs limit rural residents' ability to enhance both the quantity and quality of their diets. Rapid economic and social development has increased the reliance on food accessibility for improving dietary quality. For those not engaged in agriculture, living near markets can reduce the cost of accessing more diversified food and contribute to higher diet quality [50]. A study in Beijing found that the neighborhood food environment can impact DDS; older individuals with better access to supermarkets tend to have higher dietary diversity [51]. Additionally, the average diet quality within a community can influence the dietary behaviors of older adults [52]. Therefore, to alleviate nutritional inequality, it is essential to recognize the differences in healthy food environments between urban and rural areas and consider community-specific factors in local interventions [34].

This study has some limitations. First, this study only used eight food groups to measure dietary diversity, which makes it hard to capture the complete picture of people's dietary habits. Second, the food consumption frequency data is self-reported, which may be subject to recall bias and reporting errors. Last, this study only investigated the association using cross-sectional data, and the causal relationship between household structure and dietary diversity cannot be tested. Due to data limitations, this study is not able to include health literacy, which may have great impact on food choices and contributes to nutrition and health disparities between urban and rural residents. Despite these limitations, the present study systematically explored the association between household structure and dietary diversity among the older urban and rural population, which could offer a practical reference for health intervention targeting Chinese older adults.

Conclusions

This study found dietary diversity inequalities among older adults who lived in different households. Individuals who are only living with a spouse, are non-empty-nested, and living at least with a great/grandchild(ren) tend to have higher dietary diversity than those who live alone. The difference in dietary diversity among various household structures is more evident in urban than rural areas, which could be explained by the economic gaps between urban and rural areas. The results emphasise the need to reduce nutritional disparity among different households and residences.

Abbreviations

DDS Dietary diversity score
CLHLS Chinese Longitudinal Healthy Longevity Survey

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12889-024-20434-8.

Additional file 1: **Table S1**. The description of household categories. **Table S2**. Comparison of mean dietary diversity score across four household structures in urban areas. **Table S3**. Comparison of mean dietary diversity score across four household structures in rural areas. **Table S4**. Consumption of eight food groups across four household structures in urban areas. **Table S5**. Consumption of eight food groups across four household structures in rural areas.

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Author contributions

CD conceptualized the study, performed the analysis, and prepared the draft. PMMV checked the data and revised the manuscript.

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Data availability

The CLHLS datasets are publicly available at the National Archive of Computerized Data on Aging (https://www.icpsr.umich.edu/web/NACDA/series/487).

Declarations

Ethics approval and consent to participate

All subjects gave their informed consent for inclusion before they participated in the study. The study was approved by the biomedical ethics committee of Peking University (IRB00001052–24713074).

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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