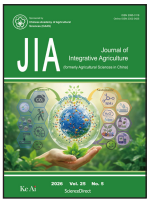
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RESEARCH ARTICLE

Edutainment matters: Can short video apps improve household food consumption in rural China?

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Highlights

- Short video apps boost rural households' food consumption and dietary diversity.
- Improvement in nutrition awareness mediates the positive relationship between short video app use and dietary diversity.
- Effects are stronger for high-income rural groups and remote villages with access to express delivery services.

Abstract

To ensure nutritional intake and reduce the occurrence of diet-related diseases, it is urgent to promote a healthy diet. At present, short video apps with information dissemination, social interaction, and online shopping are widely used, which have changed the way people obtain and exchange information, and the way of life and consumption. Exploring whether short video app use can affect food consumption choices offers new insights for promoting dietary transformation among residents. Based on the first-hand micro-survey data of 2,000 rural households across 100 villages in 5 Chinese provinces in 2023, this study examines the effects of short video app use on rural household food consumption. The results show that short video app use can increase households' per capita food consumption and dietary diversity, mainly by raising consumption of aquatic products, fruits, poultry, pork and soybeans, but it does not improve households' food health index. Short video app use promotes dietary diversity mainly by improving nutrition awareness. Its positive effect on dietary diversity is stronger among high-income groups. It also improves dietary diversity in villages that have express delivery points, but lack food markets and are remotely located. Short video app use can help improve nutrition awareness and to a certain extent, reduce the impact of location and supporting facilities on food access.

Keywords: short video apps, dietary structure, dietary diversity, nutrition level

1. Introduction

Diet patterns are fundamental to human nutritional intake, energy supply, and overall health. A healthy diet helps to prevent various types of malnutrition such as micronutrient deficiencies, overweight, obesity, and diet-related non-communicable diseases (Wang *et al.* 2023). Non-communicable diseases (NCDs) account for 41 million deaths (74% of global total) every year, with unhealthy diet being a primary driver (WHO 2025). To promote safe, diversified, and healthy diets, reduce the incidence of diet-related diseases, and achieve the United Nations SDGs 3 (Good healthy and well-being), the United Nations declared 2016–2025 as the United Nations Decade of Action on Nutrition, aiming to promote the popularization of healthy diets and eliminate various forms of malnutrition by calling on all countries and all stakeholders to act in a unified manner. However, unhealthy diets remain a major global health risk (WHO 2026). In China, rapid socioeconomic development has fundamentally alleviated undernutrition (CNS 2021). However, dietary imbalance remains serious, especially in rural areas where diet structure has gone more dramatic change compared to that in cities over the past decade, necessitating urgent

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dietary shifts (Yuan *et al.* 2019). Food consumption among rural residents is characterized by low diversity and insufficient intake of diary, fruits, aquatic products, and dark vegetables. Consequently, the incidence of malnutrition, anemia, and vitamin A deficiency remains higher in rural areas than that in urban centers (CNS 2021). To protect the health and reduce diet-related diseases, it is urgent to optimize the current food consumption structure and promote healthy diets in rural areas.

To improve dietary habits, numerous studies suggest shifting consumer food choices by enhancing cognitive awareness through public information access (Arrieta and González 2018; Fanzo *et al.* 2020). The key to improving nutritional behavior is to make the citizens correctly understand the importance of rational allocation of nutrients in dietary patterns (Sun *et al.* 2023). Researchers have proposed using publicity and education, advertising, and food labelling to promote healthy and sustainable diets (Kiff *et al.* 2016).

With advancements in information technology, new media platforms have involved rapidly and has gradually become a new means for information publicity and communication. Visual and auditory media such as pictures and videos have accelerated information dissemination and lowered the barriers to information acquisition (Lu *et al.* 2023). Due to their wide coverage and high user engagement, these platforms gradually play an important role in the information sharing (Zhang *et al.* 2024). For rural residents, new media platform promotes the popularization of dietary knowledge. Case studies in Europe show that the use of new media can enhance people's nutrition and health awareness, which in turn leads to positive health outcomes (Campbell and Bogueva 2023). Studies further indicate that new media, represented by social media influence consumers' willingness to consume green products (Nekmahmud *et al.* 2022), especially green food (Simeone and Scarpato 2020; Wu Y *et al.* 2023), and the impact of social media on food consumption is mainly through its social norms and imitation effect (Hawkins *et al.* 2020). While existing studies focus on the impact of new media on specific food consumption, such as green food and fast-food consumption, its impact on the overall food consumption structure and nutrition level is still unclear. Furthermore, despite the focus on social media, there is a lack of research on short video apps, one the most popular new media for information dissemination, and their influence on food consumption.

In China, short video apps are dominant social media platforms. Represented by Douyin (TikTok) and Kuaishou, short video apps are widely disseminated and have become a mainstream way for entertainment and information dissemination in China. As of 2023, the number of users of short video apps in China has reached 1.03 billion (CNNIC 2023). Because short videos provide multimodal visual and auditory content that is streamlined and focused (Opoku-Baah *et al.* 2021), they are highly persuasive (Yang *et al.* 2023). Additionally, the short video apps integrate social and shopping functions, influencing residents' life and consumption patterns in diverse ways. To promote the transformation of dietary structure, many institutions have carried out science popularization of health and nutrition knowledge through new media platforms. For instance, in 2019, health science short videos in China surpassed 2.2 billion views (Wang and Wang 2023).

However, it remains unclear whether the widespread use of new media effectively influence residents' consumption habits and promote the transformation of rural households' food consumption. Therefore, based on the first-hand survey data of rural residents in 2023, this study explores whether the use of short video apps can promote the adjustment of family dietary structure towards a healthy diet, providing empirical support for the role of information technology in improving rural nutrition. The heterogeneity and underlying mechanism are also analyzed to further explore the role of short videos in the food consumption transition. The rest of this article is organized as follows: Section 2 introduces the data sources and methods. Section 3 presents the main results and heterogeneity analysis. Section 4 explores the influence mechanism. Section 5 summarizes the conclusions and policy implications.

2. Data and methods

2.1. Data and variables

Data were collected from a field survey of the "China Rural Development Survey" project, conducted by the International Ecosystem Management Partnership of the United Nations Environment Programme in 2023. A stratified random sampling method was employed to select 2,029 rural households across 100 sample villages, 25 sample counties and 5 provinces in China, including Jiangsu, Sichuan, Shaanxi, Jilin, and Hebei. Interviewers received systematic training and simulation before the survey to ensure the accuracy and consistency of information obtained. During the survey, they were divided into two independent teams to collect data from administrative villages and rural residents. The questionnaire response rate was 100%, and the sample counties are shown in Appendix A. After excluding households that did not eat at home for seven consecutive days, 2,000 households were retained for analysis.

To measure household dietary structure and quality, the China Healthy Diet Index (CHDI), dietary diversity score (DDS), per capita food expenditure and per capita consumption of various foods were selected as dependent variables. The CHDI is a suitable indicator for evaluating the dietary quality of the Chinese population based on the Chinese dietary guidelines and the characteristics of the dietary structure of the Chinese population (He *et al.* 2017), and the calculation method and scoring standards are shown in Appendix B. The DDS was used to represent household food diversity following Food and Agriculture Organization of the United Nation (FAO) guidelines. In the DDS calculation, food was divided into 10 groups: cereals, potatoes, vegetables, fruits, meat, aquatic products, eggs, soybeans and nuts, milk and dairy products, and oil. During the 7-day review period, if the family consumed food from a specific group, the score was one point, these scores of all food groups were summed up to obtain the household DDS (FAO 2011). In addition, the survey collected household per

capita food expenditure and per capita consumption data for various food types to reflect dietary structure.

Regarding short video app usage, "whether the household uses short video apps such as Douyin (TikTok) and Kuaishou" was selected as the main explanatory variable. Interviewees were permanent residents familiar with household conditions. Among them, 92.85% of the interviewees are family cooks or head of households, whose cognition and behavior often affect the family's food consumption choices. Referring to the existing research on household food consumption, control variables include family characteristics, householder characteristics, family cooker characteristics, and village characteristics (Usman and Haile 2022; Cui *et al.* 2024).

To explore the mechanism of the impact of short video apps usage on food consumption, dietary cognition was measured *via* five questions such as "Do you agree that eating sugar is harmful to health". The dietary cognition score was calculated following the established method of the existing research (Zhang and Xu 2020); specifically, responses of "agree" and "strongly agree" received 1 point, while other options receive 0 point. Furthermore, our research collected information on "ways to obtain dietary nutrition information" and "short video content preference" to verify the mechanism. In the sample, 22.36% of them obtain dietary nutrition information through short videos, and 15.35% of them pay attention to food-related content. Table 1 shows the descriptive statistical results of each variable.

2.2. Empirical model

A multiple linear regression model was established as a benchmark to explore the impact of watching short videos on household food consumption as shown in eq. (1).

$$y_i=\beta_0+\beta_1 usage_i+\beta_2 X_i+\varepsilon_i \quad (1)$$

where y_i is the dependent variables, including CHDI, DDS, per capita food expenditure and per capita consumption of various foods. $usage_i$ is the main explanatory variable, indicating whether to use short video apps. X_i are the control variables including the characteristics of the household, the characteristics of the head of the household, the characteristics of the cook and the characteristics of the village. ε_i is the random error. β_0 is the constant term. β_1 and β_2 are parameters to be estimated.

To address potential "self-selection problem", that is, the family's dietary differences may be due to differences between groups. Groups that use short video apps may be more receptive to new things, and their cognitive abilities and preferences are different from those of groups that do not use short video apps, which leads to differences in food consumption choices. The propensity score matching (PSM) method that can reduce the sample selection bias problem was selected for estimation to ensure the robustness of the results (Thoemmes and Kim 2011). In this study, all the control variables in eq. (1) are selected as the matching covariates, and the K-nearest neighbor matching method is used. Subsequently, the regression analysis is performed on the matched samples. To ensure the reliability of the PSM results, a balance test was performed on the matching results. Results indicated that the standardized biases of all covariates after matching were less than 10%, and the results of the *t*-test did not reject the null hypothesis, implying there was no systematic difference between the treatment group and the control group (the results and chart of the balance test are shown in Appendices C and D, respectively).

To overcome estimation bias caused by endogeneity, which can be caused by uncontrollable factors such as family beliefs and preferences, the instrumental variable (IV) method is used to avoid potential endogeneity in the model. Commonly used IV in the existing literature are the proportion of village Internet or short video use (Zhu *et al.* 2020; Shi *et al.* 2023) and household communication expenditure (Zhu and Leng 2018; Cui and Cheng 2023). Because the average proportion of short video apps usage in the village in the sample is not related to whether the family uses short video apps. In addition, household communication expenditure tends to correlated to household income, which in turn affects household food consumption and cannot meet exogenous conditions. Therefore, we select the personal annual mobile phone cost of the interviewee in the previous year as the IV. Due to the "subscription package system" of mobile phone costs in China, people with Internet use needs often need to pay higher mobile phone costs. So mobile phone costs have a strong correlation with short video apps usage, and personal mobile phone costs in the previous year is difficult to affect the food consumption structure of the household that year and meet the exogenous conditions. After adding the IV, the two-stage least squares (2SLS) model is established. The first stage equation of the 2SLS model is shown in eq. (2).

$$usage_i=\alpha_0+\alpha_i X_i+\gamma_i \text{phone_charges}_i+\mu_i \quad (2)$$

where $usage_i$ is the main explanatory variable: whether to use short video apps. X_i are the control variables including the characteristics of the household, the characteristics of the head of the household, the characteristics of the cook and the characteristics of the village. phone_charges_i is the IV: the interviewee's personal mobile phone cost in 2022. μ_i is the random error. α_i and γ_i are parameters to be estimated. α_0 is the constant term.

The second-stage equation of 2SLS is shown in eq. (3).

$$Y_i=\delta_0+\theta_i \widehat{usage}_i+v_i X_i+\omega_i \quad (3)$$

where Y_i is the explained variables, including CHDI, DDS, per capita food expenditure and per capita consumption of various foods. $\widehat{usage}_i$ is the predicted value of $usage_i$ in the first stage. X_i are the control variables. δ_0 is the constant term. θ_i and v_i are parameters to be estimated. ω_i is the random error.

3. Results

3.1. The impact of short video apps usage on healthy diet

Table 2 presents the ordinary least square (OLS) (1–3 columns), PSM-OLS (4–6 columns) and 2SLS (7–9 columns) model regression results regarding the impact of the use of short video apps on the family healthy diet. As shown in Table 2, the regression results of OLS and PSM-OLS models are consistent, indicating the benchmark estimates are robust. In the 2SLS model, the regression results of the first stage are significant, demonstrating a significant correlation

Table 1 Descriptive statistics of variables

Category	Variable	Description	Unit	Obs	Mean	Std. dev.	Min	Max
Dependent variables	CHDI	Chinese Health Diet Index	–	2,000	53.716	12.193	12.700	85.700
	DDS	Dietary diversity score	–	2,000	6.917	1.593	3	10
	per_totalcons	Per capita total food expenditure of 7 days	CNY	2,000	80.517	73.990	3.504	960.897
	poultry	Per capita consumption of poultry of 7 days	kg	2,000	0.182	0.444	0	5.426
	beef and mutton	Per capita consumption of beef and mutton of 7 days	kg	2,000	0.051	0.262	0	5.250
	pork	Per capita consumption of pork of 7 days	kg	2,000	0.513	0.616	0	7.500
	aquatic	Per capita consumption of aquatic of 7 days	kg	2,000	0.140	0.408	0	7
	egg	Per capita consumption of eggs of 7 days	kg	2,000	0.404	0.471	0	8.750
	fruit	Per capita consumption of fruit of 7 days	kg	2,000	0.459	0.745	0	10.150
	vegetable	Per capita consumption of vegetables of 7 days	kg	2,000	1.692	1.588	0	25
	grain	Per capita consumption of grain of 7 days	kg	2,000	1.953	1.707	0	28
	tuber	Per capita consumption of tuber of 7 days	kg	2,000	0.412	0.673	0	7
	dairy	Per capita consumption of dairy of 7 days	mL	2,000	536.149	1,423.839	0	31,104
	bean	Per capita consumption of beans of 7 days	kg	2,000	0.241	0.477	0	10.370
	nut	Per capita consumption of nuts of 7 days	kg	2,000	0.0420	0.167	0	2.500
Major independent variable	usage	Whether to use short video apps such as TikTok and Kuaishou (1=yes; 0=no)	–	2,000	0.587	0.493	0	1
Mediating variable	dietscore	Dietary knowledge score	–	1,977	3.329	1.0767	0	5
IV	phone_charges	Personal annual mobile phone fee	CNY	1,988	696.664	759.0631	0	11,200
Control variables	hhnumber_male	Household male population	person	2,000	2.0350	1.0447	0	8
	edumean	Household average years of education	year	2,000	7.287	2.608	0	15.500
	hhnumber16	The number of family members under 16 years old	person	2,000	0.608	0.842	0	5
	hhnumber65	The number of family members over 65 years old	person	2,000	0.858	0.856	0	3
	netincome	Annual net income of household	10,000 CNY	2,000	9.856	13.602	–34.770	227.895
	farmland	Family-cultivated land area	mu[1)]	2,000	15.129	85.0312	0	3,002.200
	garden	Home garden area	mu[1)]	2,000	0.0972	1.0885	0	30
	near_distance1	Distance from home to the nearest food market (walking distance)	m	2,000	3,258	5,215	0	100,000
	near_distance2	Distance from home to the nearest supermarket (walking distance)	m	2,000	2,130	4,216	0	100,000
	near_distance3	Distance from home to the nearest restaurant (walking distance)	m	2,000	3,701	5,942	0	100,000
	head_gender	Gender of the head of household (1=male; 0=female)	–	2,000	0.904	0.295	0	1
	head_age	Age of head of household	year	2,000	60.740	10.679	25	100
	head_eduyear	Years of education of the head of household	year	2,000	7.230	3.359	0	16
	cook_eduyear	The average years of education of family cooks	year	2,000	6.0453	3.693	0	16
	cook_age	The average age of family cooks	year	2,000	59.344	10.770	6	93
	cook_gender	The proportion of men of family cooks	–	2,000	0.239	0.384	0	1
	vid_income	The annual per capita net income of the village	10,000 CNY	2,000	1.740	1.0613	0.200	7.500
	vid_market	The number of food markets in the village	–	2,000	0.318	0.659	0	3
	vid_mall	The number of super marks in the village	–	2,000	6.988	15.575	0	130
	vid_restaurant	The number of restaurants in the village	–	2,000	4.321	12.139	0	67

[1)] 1 ha=15 mu.

between the IV and the main explanatory variables. The model passes the unrecognized test (Kleibergen-Paap rk LM statistic) and the weak IV test (Kleibergen-Paap rk Wald F statistic), thus the personal annual mobile phone cost in 2022 satisfies the statistical test and meets the requirements or an IV. Since the 2SLS model addresses endogeneity bias, the subsequent analysis is based on its estimation results.

Table 2 reveals that using short video apps has a significant positive impact on household per capita food consumption and dietary diversity but no significant impact on CHDI. A study in rural Ghana has shown that the use of the Internet, the main social media platform, can increase the diversity of household food consumption (Twumasi *et al.* 2021). Dietary diversity is one of the important indicators of healthy diet. Increased dietary diversity is related to the increase in nutritional adequacy in diet (FAO 2011), and represents an important way to improve nutritional quality (Matita *et al.* 2021). Short video apps usage promotes higher household food diversity. However, short video apps usage does not significantly increase the CHDI. The change in CHDI is related to balanced food structure and food diversity. The improvement in food consumption does not necessarily

Table 2 Regression results of the impact of short video apps usage on healthy diet

Variable	OLS			PSM-OLS			2SLS		
	per_totalcons	CHDI	DDS	per_totalcons	CHDI	DDS	per_totalcons	CHDI	DDS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
usage	15.304***	1.637***	0.402***	15.673***	1.674**	0.415***	83.699***	7.110	1.738**
	(3.433)	(0.587)	(0.073)	(3.551)	(0.609)	(0.076)	(28.210)	(5.080)	(0.723)
Control variables	yes	yes	yes	yes	yes	yes	yes	yes	yes
Province dummy	yes	yes	yes	yes	yes	yes	yes	yes	yes
Constant	74.846***	51.922***	6.868***	75.590***	51.445***	6.899***	–2.511	46.0574***	5.377***
	(18.236)	(3.115)	(0.387)	(19.957)	(3.424)	(0.426)	(38.413)	(6.606)	(0.919)
Observations	2,000	2,000	2,000	1692	1692	1692	1,988	1,988	1988
Kleibergen-Paap rk LM statistic							23.328***	23.328***	23.328***
Kleibergen-Paap rk Wald F statistic							29.780	29.780	29.780
phone_charges							0.0000714***	0.0000714***	0.0000714***
							(0.0000131)	(0.0000131)	(0.0000131)

Standard errors in parentheses: *** indicates $P<0.01$, ** indicates $P<0.05$, and * indicates $P<0.10$.

bring a more balanced diet, explaining the lack of a significant increase in the CHDI.

The dietary behavior of short video users may be influenced by the content consumed on these apps. To verify the robustness of the results, the main explanatory variable was replaced by "whether pay attention to food programs (among those who use short video apps)", the regression results remain significant, as shown in Table 3.

Table 3 Regression results of the impact of watching food programs on dietary diversity

Variable	DDS
foodshow	0.227**
	(0.090)
Control variables	yes
Province dummy	yes
Constant	7.099***
	(0.502)
Observations	1,173

Standard errors in parentheses: *** indicates $P<0.01$, ** indicates $P<0.05$, and * indicates $P<0.10$.

3.2. The impact of short video apps use on dietary structure

The 2SLS regression results of the impact of using short video apps on household food consumption structure are shown in Table 4. Short video apps usage significantly increases per capita consumption of poultry, pork, aquatic products, fruits and soybeans, thus increasing the total per capita food consumption of households (Table 2). However, dietary structure is still imbalanced. According to the "Dietary Guidelines for Chinese Residents 2022", at least 300–500 g of aquatic products per week and 200–350 g of fruit per day should be guaranteed. However, the per capita weekly intake of aquatic products and per day intake of fruit in the sample are only 150 and 65.57 g, respectively (Table 1), which is significantly lower than the recommended levels. Aquatic products are rich in high-quality proteins, vitamins, and minerals (Byrd *et al.* 2022), while fruits are rich in vitamins, dietary fiber, and other trace elements required by the human body. Adequate intake of aquatic products and fruits helps to reduce the occurrence of chronic diseases related to eating habits (Jayedi and Shab-Bidar 2020; Stewart *et al.* 2023). Both are important components of a healthy and balanced diet. The increase intake of aquatic and fruit intake associated with short video apps usage is of great significance for promoting the dietary structure adjustment in rural areas.

Excessive meat intake persists in rural areas of China. According to the "Dietary Guidelines for Chinese Residents 2022", the recommended weekly intake of livestock and poultry meat is 300–500 g. According to Table 1, the current per capita weekly intake of livestock and poultry meat is about 745.8 g, far exceeding the recommended intake. Study has shown that excessive intake of meat is not conducive to physical health (Papier *et al.* 2022). The increase of livestock and poultry meat associated with short video apps usage warrants attention.

Therefore, the positive impact of short video apps on the transformation of dietary structure is reflected in the increase of dietary diversity and the increase of consumption of aquatic products and fruits. Although short video apps promote food consumption diversity and intake of aquatic products and fruits, the improvement level is insufficient to significantly increase CHDI.

3.3. Heterogeneity analysis of household income

Household income significantly affects household food consumption, and there are differences in consumption preferences and habits among different income groups (Ren *et al.* 2018, 2019). To explore the heterogeneity of the impact of short video app usage on the dietary diversity of different income groups, the samples are divided into low-, middle- and high-income groups according to the proportions of 25, 50 and 25% of the households, respectively (Hunt *et al.* 2019). As shown in Table 5, using short video apps significantly improves the dietary diversity of high-income groups but has no significant impact on the dietary diversity of low- and middle-income groups. Studies have shown that high-income groups pay more attention to health (Sekabira and Qaim 2017), and they tend to consume more diverse

Table 4 Regression results of the impact of short video apps usage on dietary structure

Variable	poultry	beef and mutton	pork	aquatic	egg	fruit
	(1)	(2)	(3)	(4)	(5)	(6)
usage	0.702***	0.037	0.723**	0.383*	0.012	1.251***
	(0.244)	(0.090)	(0.296)	(0.196)	(0.166)	(0.435)
Control variables	yes	yes	yes	yes	yes	yes
Province dummy	yes	yes	yes	yes	yes	yes
Constant	–0.574*	0.026	–0.471	–0.058	0.371*	–0.625
	(0.311)	(0.108)	(0.391)	(0.239)	(0.214)	(0.545)
Observations	1,988	1,988	1,988	1,988	1,988	1,988
Variable	vegetable	grain	tuber	dairy	bean	nut
	(7)	(8)	(9)	(10)	(11)	(12)
usage	0.238	–0.933	0.166	–16.723	0.419*	0.073
	(0.638)	(0.630)	(0.273)	(353.284)	(0.231)	(0.069)
Control variables	yes	yes	yes	yes	yes	yes
Province dummy	yes	yes	yes	yes	yes	yes
Constant	1.436*	2.888***	0.077	711.547	–0.128	–0.043
	(0.817)	(0.816)	(0.345)	(670.301)	(0.279)	(0.088)
Observations	1,988	1,988	1,988	1,988	1,988	1,988

Standard errors in parentheses: *** indicates $P<0.01$, ** indicates $P<0.05$, and * indicates $P<0.10$.

Table 5 Income heterogeneity regression results of the impact of short video apps usage on dietary diversity

Variable	Low income	Middle income	High income
	DDS	DDS	DDS
usage	0.014	1.346	1.992**
	(3.106)	(0.879)	(0.989)
Control variables	yes	yes	yes
Province dummy	yes	yes	yes
Constant	7.083	5.777***	5.771***
	(4.939)	(0.941)	(1.709)
Observations	497	994	497

Standard errors in parentheses: *** indicates $P<0.01$, ** indicates $P<0.05$, and * indicates $P<0.10$.

foods (Ren *et al.* 2019). Short video apps usage has further broadened the access of rural high-income groups to health knowledge, and high-income group can afford more food. Therefore, compared with the promoting of family non-agricultural employment (Ma *et al.* 2022), the dissemination of information can more effectively improve the diet diversity of high-income groups.

3.4. Heterogeneity analysis of village characteristics

Purchasing is a primary method for rural residents to obtain food. The infrastructure and location characteristics of the village could affect rural residents' access to obtain food (Kim *et al.* 2019). To achieve a diversified diet, it is necessary to ensure a diversified dietary supply (Nabuuma *et al.* 2021). To explore the heterogeneous impact of village characteristics, the sample was grouped based on the presence of express delivery points and food markets, and the distances from the township. The presence of express delivery point determines whether the residents can receive express delivery to get food online. A village food market means the residents can obtain fresh and diversified food easily. The distance from villages to towns reflects the geographical location of villages. Villages closer to towns are often more susceptible to urban radiation, which may affect residents' consumption habits and food access. Referring to relevant literature (Qiao 2019), the sample is divided into villages closer to towns (distance <15 km) and villages farther away (distance ≥15 km). Since the village infrastructure and location characteristics are often correlated with village income, the average annual net income of the village is controlled to mitigate this effect.

Table 6 shows that short video apps usage can significantly improve the dietary diversity of villages with express delivery points, villages without food markets and villages far from town. Food market is one of the main places for residents to buy agricultural products. For villages without food market, it is more difficult for residents to obtain fresh and diverse foods through offline purchasing. The villages far away from the township are less affected by the radiation of town, and are difficult to be affected by the food consumption habits of urban residents. In addition, and the transportation costs of residents in villages far away to buy food and other commodities are higher. However, short video apps such as Douyin (TikTok) provide online shopping opportunities through live broadcasts and other channels. Express delivery points are the "last mile" at the end of the delivery channel in which couriers deliver goods to consumers' homes. The establishment of express delivery points creates online shopping opportunities for residents (Morganti *et al.* 2014), providing food access for residents in villages without market and far from town. Research in China indicates that the establishment of express delivery points promotes residents' online shopping and reduces the spatial inequality of shopping opportunities by 30% (Wu Z *et al.* 2023). Therefore, short video apps usage may significantly increase dietary diversity through online shopping. To a certain extent, it reduces the impact of location and supporting facilities on food access.

4. Discussion

Since using short video apps significantly promotes the increase in family dietary diversity, the mechanism of its impact on the increase of dietary diversity is further analyzed. As shown in Fig. 1, based on literature and theoretical

Table 6 Village characteristics heterogeneity regression results of the impact of short video apps usage on dietary diversity

Variable	With express delivery	Without express delivery	With market	Without market	<15 km	≥15 km
	DDS	DDS	DDS	DDS	DDS	DDS
usage	4.357**	0.178	1.133	1.765**	–6.838	1.431**
	(2.078)	(0.702)	(1.278)	(0.788)	(9.292)	(0.640)
Control variables	yes	yes	yes	yes	yes	yes
Province dummy	yes	yes	yes	yes	yes	yes
Constant	2.485	6.890***	4.989***	5.923***	16.843	5.817***
	(2.534)	(0.944)	(1.566)	(0.988)	(13.482)	(0.817)
Observations	1,006	982	458	1,530	178	1,810

Standard errors in parentheses: *** indicates $P<0.01$, ** indicates $P<0.05$, and * indicates $P<0.10$.

analysis, we assume that watching short videos can enhance households' awareness of healthy diet, thereby promoting an increase in household dietary diversity.

Using short video apps could strengthen the flow of information, making it easier for residents to obtain dietary health knowledge (Min *et al.* 2022). The extensive dissemination of science-based healthy diet videos improves the dietary health knowledge of the viewing group (Sekabira and Qaim 2017). As shown in Table 7, using short video apps significantly increases the family's dietary cognition score. According to the Cognition and Behavior Theory, changes in cognition can change motivation and lead to different behaviors. In the field of consumption, changes in cognition of products or services directly affect consumers' consumption behavior. To correct consumers' erroneous consumption behavior and promote the adjustment of consumption structure, changing consumers' cognition and attitude is one of the important means (Zhang *et al.* 2023). Previous study has also confirmed that changes in dietary cognition can help individuals or families adjust their dietary habits, further promoting increased dietary diversity and the adjustment of dietary structure (Hou *et al.* 2021).

5. Conclusion and policy recommendation

Utilizing primary survey data of 2,000 rural households across 100 villages in 5 provinces of China in 2023, this study explored the impact of short video apps usage on household food consumption. The regression results indicate that using short video apps can significantly increase the per capita food consumption and dietary diversity of households, but has no significant effect on the CHDI. The increase in per capita food consumption is manifested in the promotion of consumption of poultry, pork, aquatic products, fruits and soybeans. Since meat and soybean consumption in rural China has already exceeded the recommended intake of dietary guidelines, short video apps usage does not promote the increase in the CHDI. The positive impact of short video apps usage on dietary structure transformation is mainly reflected in enhanced dietary diversity and increased aquatic and fruit consumption. This study provides an empirical basis for whether new promotional channels can promote healthy diets.

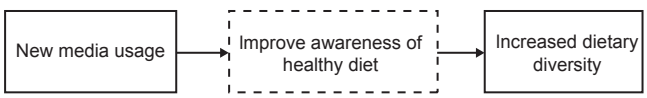


Fig. 1 Impact mechanism diagram.

Table 7 Regression results of mechanism analysis

Variable	dietscore
usage	1.676***
	(0.572)
Control variables	yes
Province dummy	yes
Constant	1.514**
	(0.756)
Observations	1,965

Standard errors in parentheses: *** indicates $P<0.01$, ** indicates $P<0.05$, and * indicates $P<0.10$.

The impact mechanism of short video apps on family dietary diversity is to alter the household food consumption choice by significantly improving the residents' nutritional cognition. The results of heterogeneity analysis show that using short video apps can significantly promote the increase of dietary diversity among high-income families. In addition, it can significantly increase the dietary diversity of villages with express delivery points, without food markets and at far distances. Using short video apps reduces the impact of location and supporting facilities on food acquisition to a certain extent.

To improve the diversity of rural residents' food consumption and promote the health-oriented adjustment of dietary structure, it is necessary to give full play to the information dissemination function of short video apps. Therefore, firstly, it is necessary to promote the popularization of infrastructure such as the Internet in rural areas, encourage rural residents to use new media such as short video apps to obtain dietary and nutrition information. Secondly, it is necessary to strengthen the supervision and guidance of short video apps to ensure the accuracy of dietary and nutrition information dissemination, such as blocking videos with error guidance through optimization algorithms and expert supervision. In addition, in order to promote the improvement of dietary behavior, the relevant publicity departments of the government can make easy-to-understand popular science-based videos to enhance the health awareness of residents. Especially regarding current situation of dietary imbalance among rural residents, it is necessary to publicize the importance of dietary diversity and how to adjust the current dietary structure, such as reducing the intake of pork, chicken and other meat, and increasing the intake of aquatic products, fruits and vegetables. Thirdly, it

is necessary to expand the construction of related supporting facilities in rural areas, such as transportation, logistics and express delivery networks, and gradually achieve full coverage of express delivery points, making it more convenient for rural residents to send and receive packages, specially focusing on the infrastructure construction of remote villages.

Due to data limitations, we were unable to delve into the impact of specific content types in short video applications, such as health education videos and food promotion videos, on food consumption choices. In the future, we hope to further clarify the impact of specific types of short videos on food consumption through data supplementation.

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Declaration of competing interest

The authors declare that they have no conflict of interest.

Declaration of generative AI and AI-assisted technologies in the writing process

The authors declare that they did not use AI in the preparation and writing of this manuscript.

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