Letter to the Editor

Dietary Behaviors and Influencing Factors among Rural Left-behind Children Aged below 7 Years in China[*]

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Left-behind children comprise a special population in Chinese rural areas. According to the 2007 China Census, the number of left-behind children aged ≤ 14 years was estimated at 58 million, which suggested that these children constituted a large population, especially in Chinese rural areas[1]. Till date, only a few studies have investigated the problems of dietary behaviors in rural left-behind children. A pilot study indicated that approximately 50% of left-behind children in Chinese rural areas had poor dietary behaviors[2]. Nevertheless, there is still a lack of research with large sample sizes that could reveal the actual background of dietary behaviors in these children. Therefore, we conducted this study to explore the dietary behaviors and their influencing factors among rural left-behind children aged < 7 years in China, which may provide a scientific basis to improve the dietary behaviors of these children.

The study population comprised left-behind children and a control group consisting of children aged < 7 years living in Chinese rural areas. All the left-behind children were aged < 7 years and had been living in the same home town for the past 6 months. The survey was a sub-project of the 'Investigation of left-behind children's nutrition and health in Chinese rural areas'. Multistage stratified cluster sampling and random sampling methods were adopted. First, seven representative provinces, including Jiangxi, Sichuan, Hunan, Hubei, Guizhou, Henan, and Anhui, were randomly selected from the 13 provinces that had the majority of left-behind children (> 80%) according to the geographical distribution data of left-behind children provided by the Population and Development Center of China[1].

Second, three counties were randomly selected from each chosen province based on economic status, which was typical of good, fair, and poor, respectively (21 counties in total). Finally, in the same manner, three towns were randomly selected from each chosen county (63 towns in total). Based on the definition of left-behind children, we ascertained the name list of left-behind children aged < 7 years from the local government population register system and then randomly selected about 120 left-behind children in each selected town after considering the distribution of the children's age and gender. Children in the control group were selected at a ratio of 1:1. Inclusion criteria for the control group were the same residential area as that of the left-behind children (the same village or an adjoining village), the same gender, similar age (an age gap of less than 2-3 months), and other conditions such as similar birth weight and birth situation. Based on these inclusion criteria, we first identified these children in the local government population register system and then randomly selected them to match the sample of the rural left-behind child according to age and gender.

A questionnaire based on items used in various published studies[2,3] was developed by 15 experts through three waves of consultation (the Delphi method). Our experts were from the departments of Nutrition Science, Pediatrics, Child Health, Behavioral Science, Epidemiology, and Statistics of different national universities, and all of them were outstanding in their field. This questionnaire had already been used in a pilot study[3], and a corresponding revision of one item was made according to the results of the pilot study. All the

items in the questionnaire were strongly associated with the total score of dietary behaviors ($r = 0.71$-0.90). We reinvestigated 200 children 1 week after the first investigation, and the Cronbach's α coefficient was computed to be 0.82.

We conducted face-to-face interviews using the questionnaire in the selected study areas. Before beginning the formal investigation, we organized a series of training programs at nation-, province-, and county-level. All the investigators were trained in a unified manner, and a quality control team was arranged for quality control during the investigation. The questionnaire was administered in the Chinese language. Caregivers voluntarily participated in this investigation. During the interview, the interviewers read a list of questions, and the caregivers listened to and answered each question honestly (20-30 min). After the completion of the questionnaire by the caregivers, their children received a free health examination as an incentive. If caregivers were reluctant to participate, we replaced them with others (considering the same living area, gender, age, and birth condition). Fortunately, the majority of our caregivers chose to accept the interview, thus resulting in a response rate of 94.60%. The research protocol was approved by the ethical committees from the Health Departments of Jiangxi, Sichuan, Hunan, Hubei, Guizhou, Henan, and Anhui provinces and all the 21 chosen counties, and informed oral consent was obtained from the non-parent and parent caregivers.

EpiData 3.0 was used to establish the database, and the statistical analysis was conducted using SPSS 13.0. (International Business Machines Corporation, USA) Categorical variables were compared using the χ^2 test, and continuous variables were compared using Student's t-test. K-means cluster was used to categorize 'overall dietary behavior' into 'good (7-10)', 'middle (4-6)', and 'poor (0-3)', with total score as the cluster variable. To identify the factors associated with dietary behaviors, the rank sum test was used to perform univariable analysis considering the categories of overall dietary behavior as the dependent variable. Multivariable analysis was further conducted using an ordinal logistic regression model considering the significant factors in the univariable analysis ($P < 0.05$) as the independent variables.

Overall, the results indicated that the dietary behaviors of the left-behind children were worse than those of the control group, which was consistent with the previous study[3]. We found that up to 56.9% of left-behind children occasionally or never drank milk. The possible reasons for this finding are that the rural area is relatively impoverished, leading to less milk consumption, and the low educational level of the caregivers, resulting in a lack of knowledge regarding the importance of drinking milk. We also found that 54.0% of the left-behind children ate snacks more than three times per week. This result may be attributed to two reasons. On the one hand, the food additives in the snacks have made the snack more attractive for children[4]; on the other hand, caregivers lack the knowledge about nutrition and blindly fulfill the children's snacking requirements. There were 63.4% picky eaters of different extents among the left-behind children, which was consistent with the result of Xin Xiao-qing[5]. This finding may be due to the lack of self-control and the excessive focus on taste of food among the children, as well as the failure of caregivers in correcting this behavior in time (Table 1). The sociodemographic characteristics of the left-behind children and the control group are shown in Supplementary Table S1 (available in www.besjournal.com).

Based on the univariable analysis (Table 2), we also observed that the dietary behaviors of the left-behind children are influenced by various factors, which could be categorized into three aspects, characteristics of left-behind children, family economic level, and caregiver factors, through the multivariable analysis (Table 3). First, the left-behind children's own characteristics included age, being only-child, and living conditions associated with their dietary behaviors. The results showed that younger age was associated with the severity of the unhealthy dietary behaviors, which was in agreement with the result of Jin Xing-ming[6]. We also found that the dietary behaviors of children in the non-only-child category were poorer than those in the only-child category. Caregivers of the non-only-child category generally had heavier burden in terms of economic status and attending the children, so that their attention toward every child was less than that toward the only-child. Children attending kindergarten were found to have healthier dietary behaviors than those who did not attend kindergarten. This finding was consistent with some studies[7,8], which have demonstrated that school-based interventions could promote the formation of children's healthy dietary behaviors. Second, the results revealed that the fees for living sent back in time promoted healthy dietary

behaviors, whereas high annual per capita income was associated with poorer dietary behaviors. This finding was consistent with some previous studies[9,10], suggesting that family income has a two-way influence on the children's dietary behaviors. Parents and caregivers in high-income families should allocate dietary expenditure reasonably to not only guarantee the dietary requirements of left-behind children but also reduce excessive consumption on snacks. Finally, we also observed that caregiver factors, including age, willingness of care, and social relationships, were associated with children's dietary behaviors. A caregiver plays an important role in children's food preferences and development of dietary behaviors. We observed that the left-behind children cared by caregivers of older age or weaker willingness of care

had poorer dietary behaviors. Caregivers with limited physical strength and energy, older age, and who themselves are in need of care are not suitable for taking care of children. Caregivers with a weaker willingness of care lack responsibility. In addition, the lower nutrition KAP of older, low-willingness caregivers may influence the formation of children's dietary behaviors[3]. Moreover, grandparents may cosset children excessively, and other caregivers are not conscientious; therefore, the left-behind children cared by these caregivers may tend to have poorer dietary behaviors. This suggests the need for implementing targeted education and intervention among these caregivers, and parents should be prudent to choose caregivers with ability and responsibility.

Table 1. Comparison of Dietary Behaviors between Left-behind and Control Group Children in Chinese Rural Areas

Dietary Behaviors	Left-behind Children, n (%)	Control Group, n (%)	Z	P	Total, n (%)
Average frequency of breakfast per week			-1.971	0.051	
Almost every day (≥ 6 times/week)	5,700 (75.1)	5,769 (76.3)			11,469 (75.7)
Often (3-5 times/week)	1,257 (16.6)	1,251 (16.6)			2,508 (16.6)
Occasionally or never (≤ 1-2 times/week)	628 (8.3)	537 (7.1)			1,165 (7.7)
Average frequency of milk per week			-8.682	0.000	
Almost every day (≥ 6 times/week)	1,681 (22.2)	2,177 (28.8)			3,858 (25.5)
Often (3-5 times/week)	1,587 (20.9)	1,516 (20.1)			3,103 (20.5)
Occasionally or never (≤ 1-2 times/week)	4,317 (56.9)	3,864 (51.1)			8,181 (54.0)
Average frequency of snacks per week			-1.053	0.292	
Almost every day (≥ 6 times/week)	1,470 (19.4)	1,374 (18.2)			2,844 (18.8)
Often (3-5 times/week)	2,624 (34.6)	2,680 (35.5)			5,304 (35.0)
Occasionally or never (≤ 1-2 times/week)	3,491 (46.0)	3,503 (46.4)			6,994 (46.2)
Regularity of three meals per day			-2.279	0.023	
On time (every meal/week)	6,504 (85.7)	6,578 (87.0)			13,082 (86.4)
Basically on time (1-2 meals/week not)	929 (12.2)	828 (11.0)			1,757 (11.6)
Not on time (≥ 3 meals/week not)	152 (2.0)	151 (2.0)			303 (2.0)
Picky eaters			-1.360	0.174	
Non-picky eaters	2,854 (37.6)	2,869 (38.0)			5,723 (37.8)
Mild picky eaters	2,969 (39.1)	3,034 (40.1)			6,003 (39.6)
Moderate picky eaters	1,248 (16.5)	1,204 (15.9)			2,452 (16.2)
Severe picky eaters	514 (6.8)	450 (6.0)			964 (6.4)
Overall dietary behavior (considering the above mentioned five behaviors)			-14.550	0.000	
Good	2,805 (37.0)	3,749 (49.6)			6,554 (43.3)
Middle	4,414 (58.2)	3,447 (45.6)			7,861 (51.9)
Poor	366 (4.8)	361 (4.8)			727 (4.8)

Table 2. Univariable Analysis of Influencing Factors on Left-behind Children's Dietary Behavior

Selected Factors	Poor, n (%)	Middle, n (%)	Good, n (%)	Z/H	P
Left-behind type				-9.879	0.000
One parent going out	147 (6.4)	1,486 (64.6)	666 (29.0)		
Both parents going out	219 (4.1)	2,928 (55.4)	2,139 (40.5)		
Age (years)				139.183	0.000
0-2	92 (3.9)	1,179 (49.4)	1,115 (46.7)		
3-4	112 (4.5)	1,562 (62.2)	838 (33.4)		
5-7	162 (6.0)	1,673 (62.3)	852 (31.7)		
Living condition (days attending kindergarten per week)				-10.980	0.000
≥ 4	229 (5.4)	2,659 (63.1)	1,325 (31.5)		
< 4	137 (4.1)	1,755 (52.0)	1,480 (43.9)		
Household per capita annual income (RMB)				40.286	0.000
≤ 2,000	140 (5.4)	1,537 (59.6)	903 (35.0)		
2,001-4,000	144 (5.0)	1,733 (60.3)	997 (34.7)		
> 4,000	82 (3.8)	1,144 (53.7)	905 (42.5)		
Fees for living provided by parent/parents sent back in time				-10.099	0.000
Yes	288 (5.1)	3,461 (61.3)	1,896 (33.6)		
No	78 (4.0)	953 (49.1)	909 (46.9)		
Caregiver's age (years)				109.955	0.000
≤ 35	95 (6.4)	1,015 (68.2)	378 (25.4)		
36-60	215 (4.6)	2,633 (56.2)	1,836 (39.2)		
> 60	56 (4.0)	766 (54.2)	591 (41.8)		
Caregiver's educational level				8.320	0.016
Primary school and lower	267 (4.6)	3,360 (57.8)	2,189 (37.6)		
Junior high	861 (5.5)	940 (60.4)	530 (34.1)		
Senior high and higher	13 (6.1)	114 (53.5)	86 (40.4)		
Willingness of care				313.483	0.000
Very willing	141 (6.8)	1,455 (70.5)	467 (22.6)		
Willing	209 (4.2)	2,749 (55.2)	2,020 (40.6)		
Not willing	16 (2.9)	210 (38.6)	318 (58.5)		
Caregiver's social relationship				161.529	0.000
Father/mother	126 (6.6)	1,299 (67.7)	493 (25.7)		
Grandparents	237 (4.3)	3,072 (55.3)	2,242 (40.4)		
Others	3 (2.6)	43 (37.1)	70 (60.3)		

Table 3. Multivariable Ordinal Logistic Regression Analysis of Influencing Factors on
Left-behind Children's Dietary Behavior in Chinese Rural Areas

Variables	β	S.E.	Wald χ^2	P	OR (95% CI)
Constant					
Poor	-6.835	0.374	333.361	0.000	-
Middle	-1.740	0.358	23.560	0.000	-
Age (years)					
0-2	0.557	0.083	45.304	0.000	1.746 (1.484-2.053)
3-4	0.004	0.064	0.004	0.950	1.004 (0.886-1.138)
5-7	0	-	-	-	-
Living condition (days attending kindergarten per week)					
≥ 4	-0.248	0.068	13.459	0.000	0.780 (0.683-0.891)
< 4	0	-	-	-	-
Household per capita annual income (RMB)					
≤ 2,000	-0.532	0.064	69.400	0.000	0.587 (0.518-0.666)
2,001-4,000	-0.397	0.062	41.433	0.000	0.672 (0.596-0.759)
> 4,000	0	-	-	-	-
fees for living provided by parent/parents sent back in time					
Yes	-0.453	0.056	65.492	0.000	0.636 (0.570-0.709)
No	0	-	-	-	-
Caregiver's age					
≤ 35	-0.497	0.134	13.811	0.000	0.608 (0.468-0.791)
36-60	-0.192	0.065	8.656	0.003	0.825 (0.726-0.938)
> 60	0	-	-	-	-
Caregiver's educational level					
Primary school and lower	-0.325	0.159	4.175	0.041	0.722 (0.529-0.987)
Junior high	-0.182	0.163	1.248	0.264	0.834 (0.606-1.147)
Senior high and higher	0	-	-	-	-
Willingness of care					
Very willing	-1.502	0.108	194.342	0.000	0.223 (0.180-0.275)
Willing	-0.690	0.095	52.966	0.000	0.502 (0.417-0.604)
Not willing	0	-	-	-	-
Caregiver's social relationship					
Father/mother	-1.116	0.230	23.435	0.000	0.328 (0.209-0.515)
Grandparents	-0.812	0.204	15.849	0.000	0.444 (0.298-0.662)
Others	0	-	-	-	-

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Supplementary Table S1. Sociodemographic Characteristics of Left-behind Children and
Control Group Aged < 7 Years in Chinese Rural Areas

Characteristics	Left-behind Children, *n* (%)	Control Group, *n* (%)	χ^2	*P*	Total, *n* (%)
Age (years)			0.046	0.977	
0-2	2,386 (31.5)	2,386 (31.6)			4,772 (31.5)
3-4	2,512 (33.1)	2,506 (33.2)			5,018 (33.1)
5-7	2,687 (35.4)	2,665 (35.3)			5,352 (35.3)
Gender			0.240	0.624	
Boy	4,283 (56.5)	4,297 (56.9)			8,580 (56.7)
Girl	3,302 (43.5)	3,260 (43.1)			6,562 (43.3)
Only child			103.430	0.000	
Yes	3,418 (45.1)	2,791 (36.9)			6,209 (41.0)
No	4,167 (54.9)	4,766 (63.1)			8,933 (59.0)
Living condition (days attending kindergarten per week)			1.264	0.261	
≥ 4	4,213 (55.5)	4,266 (56.5)			8,479 (56.0)
< 4	3,372 (44.5)	3,291 (43.5)			6,663 (44.0)
Father's occupation			1096.247	0.000	
Peasant	7,337 (96.7)	5,997 (79.4)			13,334 (88.1)
Worker	79 (1.0)	306 (4.0)			385 (2.5)
Village cadre	10 (0.1)	105 (1.4)			115 (0.8)
Others	159 (2.1)	1,149 (15.2)			1,308 (8.6)
Father's educational level			10.421	0.005	
Primary school or lower	2,143 (28.3)	2,194 (29.0)			4,337 (28.6)
Junior high	4,618 (60.9)	4,435 (58.7)			9,053 (59.8)
Senior high or higher	824 (10.9)	928 (12.3)			1,752 (11.6)
Mather's occupation			374.436	0.000	
Peasant	7,372 (97.2)	6,812 (90.1)			14,184 (93.7)
Worker	93 (1.2)	111 (1.5)			204 (1.3)
Village cadre	11 (0.1)	44 (0.6)			55 (0.4)
Others	109 (1.4)	590 (7.8)			699 (4.6)
Mather's educational level			5.585	0.061	
Primary school or lower	3,263 (43.0)	3,265 (43.2)			6,528 (43.1)
Junior high	3,845 (50.7)	3,748 (49.6)			7,593 (50.1)
Senior high or higher	477 (6.3)	544 (7.2)			1,021 (6.7)
Household per capita annual income (thousands, mean ± SD)	3.7 ± 3.1	4.0 ± 3.6	-4.704[*]	0.000	0.38 ± 0.33

Note. Data are number (percentage) or mean (*SD*). [*] is *t*-test. *P* values are from χ^2 test (categorical variables) or Student's *t*-test (continuous variables).