

# Caregiver perceptions of child diet status: What influenced their judgement

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## Research

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## Abstract

**Background:** Caregiver perceptions of child diet status can influence the effect of health intervention, but research focused on the correctness of caregiver's perception is limited. This study aimed to figure out the correctness of caregiver's perception of their child's diet status and find out the factors which may influence their judgement.

**Methods:** 815 children from grade 3<sup>rd</sup> to 6<sup>th</sup> and their caregivers were recruited from two primary schools by cluster sampling. 3-day 24-hour recall was used to record children's diet, caregiver's perceptions was obtained through questionnaires. Multivariate logistic regression models were used to explore the influencing factors of the correctness of caregiver's perception.

**Results:** Among the 597 children with "balanced" diet, 62.1% were correctly perceived as having a "healthy" diet by their caregivers; but for the 218 children with "imbalanced" diet, just 16.1% were correctly identified. Those who were correctly identified as having an unhealthy diet consumed less fruits and more snacks than those unidentified ( $p < 0.05$ ). Obese children were more likely to be perceived as having unhealthy diet even when they actually had a balanced diet ( $OR = 0.305, p = 0.016$ ). Caregivers with high educational level were more likely to correctly perceive children's healthy diet status ( $OR = 3.628, p = 0.038$ ).

**Conclusions:** Caregivers were generally lack of the ability to identify children's unhealthy diet. Obesity, significantly low consumption of fruits or high consumption of snacks can raise caregivers' awareness. Extensive health education targeting caregivers is in emergency.

## Background

Among the 20 most populous countries, China ranked first in terms of the number of obese children in 2015<sup>[1]</sup>. 10.5% of the boys and 7.1% of the girls were obesity in China<sup>[2]</sup>, with the continuous development of the economy, this ratio will keep rising. But at the same time, 2.4% and 4.1% of the Chinese children were stunted or wasted, respectively<sup>[3]</sup>. The problem of micronutrient deficiency still exist, micronutrients including vitamin D, vitamin A, vitamin B<sub>12</sub>, Fe and Zn were deficient to varying extents<sup>[4-6]</sup>. Child malnutrition is widely exists in countries all over the world, in 2016, 22.9% of children around the world were stunted, 2.5% were wasted, and 6.0% were overweight<sup>[7]</sup>.

Diet quality, as a potentially modifiable factor in maintaining people's health, plays an important role in weight control<sup>[8, 9]</sup>. Diet with less energy-dense nutrient-poor (EDNP) food and adequate fruits and vegetables can not only help people stay in shape<sup>[10-12]</sup>, but also reduce the risk of negative health outcomes and all-cause mortality<sup>[13-17]</sup>. Previous studies have revealed that more than 60% of the Chinese school-age children failed to meet the recommendations issued by Chinese Dietary Guidelines on their fruits and vegetables intake<sup>[18]</sup>, which is undoubtedly detrimental to the development of children. And since child's diet habits might be carried into adulthood and cause long-term health outcomes<sup>[19, 20]</sup>, early detection of children's imbalanced diet and take actions in time is of great importance.

In order to cultivate healthy eating habits at an early stage, researchers and governments have started to organize nutrition education activities targeting school-age children. But in fact, children (especially young children) have little autonomy in their food choices, almost all foods are provided by their caregivers. Thus, caregiver's attitudes are crucial to the effect of interventions<sup>[21, 22]</sup>, if they are unwilling to help their children to change their unhealthy habits, the effect of health education will be small. Previous researches found parents with correct conception on their child's overweight status are more likely to make changes to their children's lifestyles and participate in healthy lifestyle behaviors with their children, while those who failed to recognize their child's weight problem are less motivated to address the problem<sup>[23, 24]</sup>. So we have the reason to judge that caregivers with correct perception on their children's unhealthy diet can also be more willing to participate in the nutrition promotion activities with their children, which could greatly improve the effectiveness of health interventions.

However, to date, limited research focused on caregiver's perception of child's diet. So in the current study, we aimed to figure out the correctness of caregiver's perception of their child's diet status and to find out the factors which may influence their judgement.

## Design And Methods

### Participants

Participants were recruited from two primary schools by cluster sampling. Considering that children's diet need to be reported by themselves and the cognitive ability of students in lower grades are limited, so in the current study, we selected children of grade 3<sup>rd</sup> to 6<sup>th</sup> and their caregivers as objects. Written consent from both children and caregivers were required in order for both them to participate. The study was approved by Ethics Committee of Wuhan University of Science and Technology (No. 201519).

## Demographic Characteristics

After consulting experts, self-designed questionnaire on basic information of children (including age, gender, number of brothers/sisters, and the frequency and location of meals, etc.) and caregivers (including age, gender, relationship with children, annual household income, and caregiver's educational level, etc.) was used to collect the demographic characteristics. A group of research team members, including faculty and postgraduates of the school of public health, helped students to fill the questions about their basic information. Caregivers' questionnaires were brought home by the students, the primary caregiver of the child was asked to fill the questionnaire, then they will be brought back to school by the students the next day. The Cronbach's  $\alpha$  coefficient of this questionnaire was 0.776.

## Diet Survey And Evaluation

3-day 24-hour recall was used to conduct diet survey. For three consecutive days, the investigators went into the classroom after lunch, using the food size reference models, they asked and recorded all the food consumed by each student in the past 24 hours (including drinks, snacks, inter-class meals, etc).

Chinese Children Dietary Index (CCDI) was put forward by Guo Cheng et al<sup>[18]</sup>, it was developed based on the Chinese dietary intake recommendations (Chinese Dietary Guidelines and Chinese DRIs) and health-promoting behaviors. The effectiveness of CCDI in evaluating the dietary status of Chinese school-age children have been proved, detailed descriptions of the CCDI have been published elsewhere<sup>[18]</sup>. Since we don't have the water intake and sedentary behavior data, CCDI was slightly modified to evaluate the dietary status of children in the current study. The total score is 150 points and if the child got scores over 90 points, he/she will be considered to have a healthy diet, otherwise, his/her diet will be regarded as unhealthy.

## Caregiver Perception

Caregiver's perception of their child's diet was assessed using the question 'How would you describe your child's diet status?' and they were given three choices: healthy, unhealthy, and unknown (reason is needed). The accuracy of the perception was assessed by comparing caregiver's perception and child's diet status, caregivers who have mismatch perception with their child's diet were deemed to have incorrectly perceived their child's diet status.

## Covariates

Migrant is classified based on the registered place reported by the caregivers, if the child's registered place is in Wuhan, he/she will be regarded as local child, otherwise, he/she will be regarded as migrant child. Primary caregiver is the person who takes care of the child (prepares food for the child) most often. The caregiver's educational level was defined as the highest degree that the primary caregiver completed at the time of the survey. Family income refers to the average annual household income, including but not limited to wages, self-employed income and agricultural income.

Children's weight and height were obtained from the data of physical examination made by Wuhan ChangeDong Hospital, height was measured with a precision of 0.1 cm and weight was measured with a precision of 0.1 kg. Children's Body Mass Index (BMI) was calculated, obesity was defined according to the BMI cutoffs points issued by the National Health Commission of the People's Republic of China<sup>[25]</sup>.

## Statistical analysis

Descriptive statistics included the frequency and percentages for categorical variables and means (SD) for continuous variables. T tests for continuous variables and chi-square tests for categorical variables were used. Univariate and multivariate logistic regression models were used to explore the influencing factors of the correctness of caregiver's perception. All analyses in this study were performed in Stata (version 13.0; StataCorp, College Station, TX, USA). Differences were considered significant if  $p < 0.05$ .

## Results

Complete data was obtained from 815 child-caregiver pairs, Fig. 1 provides an overview of the recruitment. More than half (57.9%) of the children were migrant children, 50.7% of the families had an average annual income lower than ¥50,000 (Table 1). Most caregivers weren't well-educated, 51.8% of them just got middle school degree or lower. 597 (27.4%) children had imbalanced overall diet, boys and overweight/obese children seemed to be more likely to have an unbalanced diet ( $p < 0.05$ )(Table 1).

Table 1  
Characteristics of study participants <sup>a</sup>

Characteristic		Child diet status		$\chi^2$	p-value
		Balance(n = 597)	Imbalance(n = 218)		
Migrant	Yes	348(58.3%)	124(56.9%)	0.130	0.718
	No	249(41.7%)	94(43.1%)		
Gender	Boys	243(40.7%)	114(52.3%)	8.714	<b>0.003</b>
	Girls	354(59.3%)	104(47.7%)		
Primary caregiver	Mother	400(67.0%)	151(69.3%)	0.604	0.739
	Father	102(17.1%)	37(17.0%)		
	Grandparents	95(15.9%)	30(13.7%)		
Number of brothers/sisters	0	218(36.5%)	77(35.3%)	0.184	0.912
	1	308(51.6%)	113(51.8%)		
	> 2	71(11.9%)	28(12.9%)		
Family income	< 50000¥	298(49.9%)	115(52.7%)	0.514	0.473
	≥ 50000¥	299(50.1%)	103(47.3%)		
Caregiver's educational level <sup>b</sup>	Primary school	44(7.4%)	21(9.6%)	3.646	0.302
	Middle school	258(43.2%)	99(45.4%)		
	High school	231(38.7%)	83(38.1%)		
	College	64(10.7%)	15(6.9%)		
Weight status	Normal weight	493(82.6%)	164(75.2%)	6.496	<b>0.039</b>
	Overweight	73(12.2%)	34(15.6%)		
	Obesity	31(5.2%)	20(9.2%)		
Caregiver's perception	Healthy	371(62.1%)	131(60.1%)	3.012	0.222
	Unhealthy	69(11.6%)	35(16.1%)		
	Unsure	157(26.3%)	52(23.8%)		
<sup>a</sup> Data are presented as counts(percentages).					
<sup>b</sup> Caregiver's educational level: represented as the highest degree of the primary caregiver.					

## Caregiver Perception

Of the 815 caregivers, 209(25.6%) couldn't make a clear judgment on their child's diet for they didn't know the definition of "healthy diet" or didn't pay attention to their children's diet. Compared to the caregivers with clear answer, these caregivers had no difference in educational level, family income and their child's gender, weight status, and diet scores ( $p > 0.05$ ).

Among the 597 children with "balanced" diet, 371 (62.1%) were correctly perceived as having a "healthy" diet by their caregivers, and among the 218 children with "imbalanced" diet, just 35 (16.1%) were correctly perceived as "unhealthy"(Table 1).

## Children's Daily Food Intake

Children's dietary reference values issued by Chinese Dietary Guidelines varied by age and sex<sup>[26]</sup>, so food intakes were converted to food density(g/1,000 kcal) for the purpose of comparison (except for snacks and beverages), details available from supplementary table. Table 2 shows that children with imbalanced diet had lower intakes of vegetables, fruits, fish, eggs, beans, and milk ( $p < 0.01$ ), and higher intakes of grain, snacks, and beverages ( $p < 0.01$ ). In the "imbalanced" group, those who were correctly identified as having an unhealthy diet by their caregivers consumed less fruits than those unidentified, and they are more likely to consume snacks and beverages than the others ( $p < 0.05$ ).

Table 2  
Food consumed by each group according to diet status and caregiver's perception( $\pm S$ )

Food group	Balanced diet <sup>a</sup>			Imbalanced diet		
	Correct	Incorrect	Total	Correct	Incorrect	Total
	(n = 371)	(n = 69)	(n = 440)	(n = 35)	(n = 131) <sup>b</sup>	(n = 166) <sup>c</sup>
Grain (g/1,000 kcal)	159.0 $\pm$ 1.1	156.6 $\pm$ 2.4	158.6 $\pm$ 1.0	170.9 $\pm$ 3.6	168.4 $\pm$ 1.8	168.9 $\pm$ 1.6 $\Delta$
Vegetables (g/1,000 kcal)	106.9 $\pm$ 1.6	104.7 $\pm$ 3.3	106.5 $\pm$ 1.4	94.0 $\pm$ 4.0	95.2 $\pm$ 1.8	94.9 $\pm$ 1.6 $\Delta$
Fruit (g/1,000 kcal)	111.5 $\pm$ 3.3	119.9 $\pm$ 7.5	112.8 $\pm$ 3.0	35.0 $\pm$ 7.4	58.5 $\pm$ 4.9*	53.5 $\pm$ 4.3 $\Delta$
Meat (g/1,000 kcal)	27.9 $\pm$ 0.7	27.5 $\pm$ 1.4	27.9 $\pm$ 0.6	29.9 $\pm$ 3.1	27.9 $\pm$ 1.5	28.3 $\pm$ 1.3
Fish (g/1,000 kcal)	8.5 $\pm$ 0.5	10.4 $\pm$ 1.4	8.8 $\pm$ 0.5	5.9 $\pm$ 1.6	6.2 $\pm$ 0.8	6.1 $\pm$ 9.3 $\Delta$
Egg (g/1,000 kcal)	13.6 $\pm$ 0.6	15.2 $\pm$ 1.9	13.8 $\pm$ 0.6	9.2 $\pm$ 2.5	7.7 $\pm$ 1.2	8.0 $\pm$ 1.1 $\Delta$
Beans (g/1,000 kcal)	6.1 $\pm$ 0.3	5.7 $\pm$ 0.8	6.1 $\pm$ 0.3	3.4 $\pm$ 0.7	3.5 $\pm$ 0.5	3.5 $\pm$ 0.4 $\Delta$
Milk (g/1,000 kcal)	55.3 $\pm$ 3.1	57.4 $\pm$ 6.9	55.6 $\pm$ 2.8	17.5 $\pm$ 5.7	16.6 $\pm$ 2.5	16.8 $\pm$ 2.3 $\Delta$
Snacks (g/day)	20.3 $\pm$ 0.5	22.0 $\pm$ 1.1	44.4 $\pm$ 2.7	28.8 $\pm$ 1.6	21.3 $\pm$ 0.8*	64.2 $\pm$ 5.4 $\Delta$
Beverages (g/day)	44.3 $\pm$ 2.9	44.9 $\pm$ 7.1	20.6 $\pm$ 0.4	89.0 $\pm$ 13.8	57.5 $\pm$ 5.6*	22.9 $\pm$ 0.8 $\Delta$
<sup>a</sup> Balanced diet/imbalanced diet represents child diet status, correct/incorrect represents caregiver's recognition.						
<sup>b</sup> T-test for food intake between correct group and incorrect group (* $p < 0.05$ ).						
<sup>c</sup> T-test for food intake between balanced diet group and imbalanced diet group ( $\Delta$ $p < 0.05$ ).						

## Influence Factors Of Caregiver's Perception On Diet

Migration, child sex, caregiver's association with the child, family income and breakfast habit didn't affect caregiver's recognition on their child's unhealthy diet. Caregivers were more likely to identify unhealthy dietary status among children who consumed less fruits ( $OR = 0.989$ ,  $p = 0.031$ ) or those eat more snacks ( $OR = 1.074$ ,  $p = 0.004$ ). And they are more likely to correctly identify unhealthy diets ( $OR = 3.532$ ,  $p = 0.040$ ) in obese children, but those children were also more likely to be perceived as having unhealthy diet even when they actually had a balanced diet ( $OR = 0.305$ ,  $p = 0.016$ ). Moreover, caregivers with high educational level were more likely to correctly perceive children's healthy diet status ( $OR = 3.628$ ,  $p = 0.038$ ) (Table 3)

Table 3

Regression models between caregiver's perception status and other socio-demographic predictors, and intake of some kinds of food <sup>a</sup>

	Balanced diet( <i>n</i> = 440) <sup>b</sup>				Imbalanced diet( <i>n</i> = 166)			
	Univariate Model		Multivariate Model		Univariate Model		Multivariate Model	
	<i>OR</i> (95% <i>CI</i> )	<i>p</i> -value	<i>OR</i> (95% <i>CI</i> )	<i>p</i> -value	<i>OR</i> (95% <i>CI</i> )	<i>p</i> -value	<i>OR</i> (95% <i>CI</i> )	<i>p</i> -value
Migrant								
Yes	Reference				Reference			
No	1.550(0.903,2.663)	0.112			1.641(0.775,3.474)	0.196		
Child's sex								
Boy	Reference				Reference			
Girl	1.101(0.652,1.860)	0.718			1.004(0.473,2.134)	0.991		
Primary caregiver								
Mother	Reference		Reference		Reference			
Father	1.208(0.580,2.519)	0.613	1.175(0.556,2.484)	0.673	0.852(0.292,2.486)	0.770		
Grandparents	2.261(0.931,5.494)	0.072	2.168(0.884,5.316)	0.091	1.184(0.426,3.292)	0.746		
Weight status								
Normal weight	Reference		Reference		Reference		Reference	
Overweight	0.849(0.392,1.839)	0.649	0.850(0.389,1.859)	0.684	0.938(0.322,2.729)	0.906	1.109(0.357,3.443)	0.858
Obesity	0.340(0.131,0.881)	0.026	0.305(0.116,0.805)	<b>0.016</b>	4.500(1.523,13.296)	0.007	3.532(1.056,11.805)	<b>0.040</b>
Caregiver's educational level								
Primary school	Reference		Reference		Reference			
Middle/High school	1.944(0.861,4.389)	0.110	1.980(0.866,4.529)	0.106	0.949(0.290,3.101)	0.930		
College	3.528(1.068,11.651)	0.039	3.628(1.076,12.229)	<b>0.038</b>	0.700(0.107,4.594)	0.710		
Breakfast								
5-7days/week	Reference				Reference			
0-4days/week	0.651(0.296,1.429)	0.285			1.220(0.447,3.330)	0.699		
Fruits intake	0.998(0.994,1.002)	0.314			0.990(0.982,0.999)	0.027	0.989(0.980,0.999)	<b>0.031</b>
Snacks intake	0.982(0.956,1.009)	0.193			1.082(1.039,1.126)	< 0.001	1.074(1.023,1.129)	<b>0.004</b>
Beverages intake	0.999(0.995,1.004)	0.730			1.006(1.001,1.011)	0.020	1.001(0.995,1.008)	0.640
<sup>a</sup> According to the dietary status of children, two logistic regression models were established respectively, the dependent variables were the correctness of the caregivers' judgement.								
<sup>b</sup> Balanced diet/imbalanced diet represents child diet status.								

## Discussion

The purpose of the current study was to investigate caregiver's conception of their child's diet status and explore the potential factors that may influence their judgement. To our knowledge, this is one of the first studies to examine caregiver's perception of child diet status, our results showed that less than a fifth of children with "imbalanced" diet were correctly distinguished as having an "unhealthy" diet by their caregivers. Most

caregivers cannot correctly identify the unhealthy dietary conditions of their children, the judgment is influenced by children's consumption of certain types of food or their body type, rather than their overall diet, which is not optimistic.

Children in the "imbalanced" group had lower intakes of several kinds of food except grain and meat, and their snacks and beverages intakes were significantly higher, but only extremely low intakes of fruits or high intakes of snacks could call up caregivers' awareness, they didn't pay much attention to the other types of food (including vegetables, fish, beans, eggs, and milk). Chinese children's consumption of meat and fish has been rising in the past decade, meat consumption has basically met the amount recommended by the Chinese Dietary Guidelines, but their fish intakes were still at a low level<sup>[27]</sup>. The traditional view is that the nutrients in meat, fish and eggs are about the same, among which the red meat was the most nutritious, so most caregivers tend to prepare enough red meat for their children, ignoring their intake of fish and eggs. Most caregivers knew the benefits of milk and ordered school milk for their children (one box per day distributed during the school days), but some children didn't drink them for different reasons, which may led to caregivers' overestimation of children's milk intake. Caregivers generally know that fruits and vegetables are good for health while eating too many snacks is harmful, and they order school milk for their children initiatively, which showed that most caregivers had the most basic nutritional knowledge, but their knowledge is incomplete, or even incorrect, nutritional education for caregivers needs to be strengthened.

Generally, highly educated caregivers have more access to correct health information and are more likely to make accurate judgements about children's diet. In this study, parents with college degree or above were indeed made more accurate judgement in the "balanced" group, but not in the "imbalanced" group. A study targeted parental perception on child's weight status indicated that what influenced the accuracy of parent's physique estimation was not parental education, but parental health literacy<sup>[28]</sup>. Children's diet is associated with caregiver's nutrition knowledge and their attention to the child's diet, so one of the possible reason is that caregivers in the "imbalanced" group are not initiative to the nutrition knowledge, they rarely pay attention to these messages, even if exposed to them. As a result, these caregiver's health literacy didn't increase with their educational degree. Another possibly reason is that caregivers of children in the "balanced" group paid more attention to their children's diet behaviors and fully used their knowledge when making the judgement. But for the other group, caregivers may paid less attention and knew little about children's diet status, their knowledge wasn't fully used. Future health education should not neglect highly educated parents.

Whether in the "balanced" group or "imbalanced" group, obese children were more likely to be considered as having an unhealthy diet. Caregivers knew that improper diet can lead to obesity, but they may ignored the influence of genetics, sports, mental health and other factors, which further proved that they are lack of the correct health knowledge.

Regardless of immigration, educational level and family income, unable to identify unhealthy diets seems to be a common phenomenon. Some people indicated that parents' judge on their child's actual weight is not a cognitive task, but an emotional evaluation<sup>[29]</sup>, this may also suitable for diet judgement: caregivers tend to believe their children are healthy and normal when they are not sure whether their children's diet is up to the health standard. This tendency may further lead caregivers to refuse to participate in health promotion courses, for people believe that only unhealthy/abnormal children need to participate in such classes, its necessary for us to teach them how to judge diet in a right way.

## Strengths and limitations

There are several limitations in this study. Firstly, the participants were recruited from 2 local schools, which is not nationally representative, the results of this study cannot be generalized to other samples. Secondly, In order to increase the compliance of the subjects, the 3-day diet data are collected in the school during the weekday, the data may not represent children's diet on the weekends. Third, since there is no widely accepted indices to measure the diet quality of Chinese children, CCDI is used to assess children's diet status, although not widely used, the effectiveness of CCDI has been proved in other study on children of the same age<sup>[18]</sup>. Despite these limitations, the study is one of the first studies to examine parent's perception of child diet status and its influencing factors, the results can help realize the inadequate health awareness among parents and provide the direction for health intervention.

## Conclusions

Caregivers in this study were generally lack of the ability to identify children's unhealthy diet, especially those in "imbalanced" group. Obesity, significantly low consumption of fruits or high consumption of snacks can raise caregivers' awareness. But if the child is normal weight or overweight, and they didn't show any special rejection/preference for fruits and snacks, their imbalanced diet are less likely to be noticed. This situation is worrisome, if the caregivers can't notice their child's diet problems, they might be less motivated to change their diet behaviors, increasing the risk of obesity and chronic diseases in the future. Extensive health education targeting caregivers is in emergency.

## List Of Abbreviations

BMI—Body Mass Index; CCDI—Chinese Children Dietary Index; DRIs—Dietary Reference Intakes.

## Declarations

## Ethics approval and consent to participate

The study was approved by Ethics Committee of Wuhan University of Science and Technology (No. 201519). Written informed consent was obtained from all subjects.

## Consent for publication

Not applicable.

## Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

## Competing interests

The authors declare that they have no competing interest.

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## Authors' contributions

JZ designed the study; MY and BX performed statistical analyses; QH collected the data; LS wrote the original draft; JZ, LH and XY reviewed and edited the manuscript. All authors read and approved the final manuscript.

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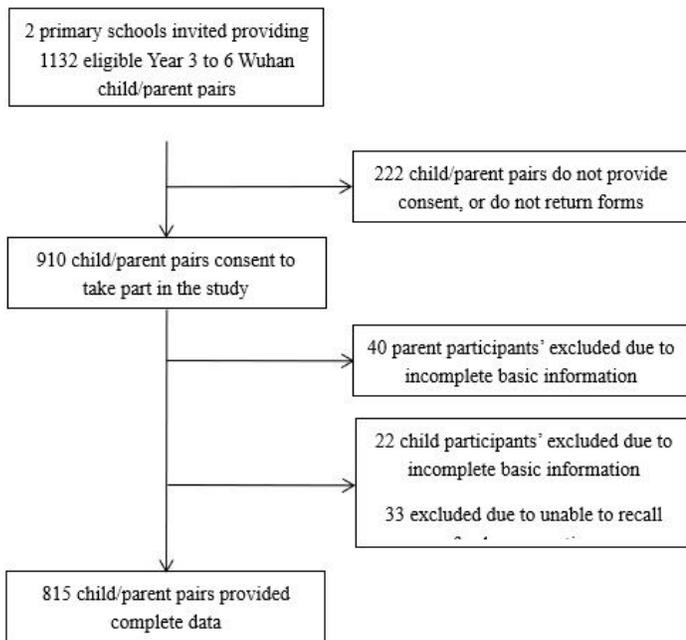
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## Figures



**Figure 1**

Recruitment flowchart

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