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Original Article

Association of socioeconomic and lifestyle behavioral factors with obesity and thinness among migrant peasant workers' children, by comparison with rural and urban children in China

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Abstract: Background: Since 1980s migrant peasant workers in China have migrated from rural areas to urban areas to seek for employment opportunities. More and more of migrant peasant workers' children accompanied their parents to the cities and became another special population in modern Chinese urban areas. This study aimed to discuss the association between socioeconomic and lifestyle behavioral factors and obesity or thinness ,among rural, migrant peasant workers' and urban children, with a special focus on migrant peasant workers' children. Methods: We conducted a cross-sectional study among 2457 children and adolescents aged 7-12 years old, including 914 migrant peasant workers' subjects, 795 subjects of Shanghai citizens and 748 subjects from immigrant original rural areas (Anhui province). Physique measurements and self-reported information on socioeconomic factors, lifestyle habits were collected by the questionnaire. SPSS18.0 was used in the analysis. Results: This study indicated that the average value of BMI among migrant peasant workers' children, was higher than that of rural children, but lower than that of children of citizens of Shanghai City, except for 7 to 9-year-old girls. Thinness was highly prevalent among rural children, while overweight or obesity was largely observed among children of citizens of Shanghai City. Moreover, the results showed that the prevalence of overweight or obesity among migrant peasant workers' children was much higher than that of rural children. It was found that overweight or obese children were more likely to have parents with higher education levels, have higher family monthly income, and have less physical education class per week. Thin children were more likely to have parents with lower education levels, have lower family monthly income, and have less physical education class per week. Conclusion: Our study revealed that the prevalences of overweight or obesity among migrant peasant workers' and Shanghai Citizens' children were relatively high, while there was a high prevalence of thinness among rural children. Socioeconomic and lifestyle behavioral factors were the risk factors related to body shape among migrant peasant workers' children.

Keywords: Obesity, thinness, migrant peasant workers' children, socioeconomic and lifestyle behavioral factors

Introduction

The worldwide prevalence of the childhood overweight and obesity has increased dramatically in recent years. A number of studies have shown that children of low socioeconomic status are more likely to be overweight and obese [1-3]. In contrast, however, in China, children with high socioeconomic status living in urban areas were more likely to be overweight and obese than those living in rural areas. About 8% of children aged 10-12 years in China's cities were considered to be obese and an additional 15% were classified as overweight. In rural areas, 28% of children were malnourished and 19.5% were underweight according to the 2012 Education Ministry data [4]. Many studies have shown that immigrant children with low socioeconomic status, limited health care access and poor lifestyle behaviors, have a higher prevalence of overweight and obesity than native-born children [5-7]. In China, since the Reform and Opening-Up Policy in 1978, the term "migrant peasant workers" has referred to

those who migrate from the rural areas to urban areas, in order to seek for employment opportunities. Most of migrant peasant workers' children accompany their parents to the cities. The number of migrant peasant workers' children aged less than 14 years old was estimated at 15 million, and about 530,000 of those children were in Shanghai City in 2012 [4]. Migrant peasant workers with rural household registration are not entitled to city subsidies, such as life employment, medical insurance, housing, social security and pensions [8]. These may greatly impact on the health status of migrant peasant workers' children. Many studies have showed that migrant peasant workers' children have poorer growth status compared to children of urban citizens [9, 10]. In our previous study, we have found that the physiques of migrant peasant workers' children were bigger than that of children in rural areas and there were strong correlations between physiques and socioeconomic factors [11]. Moreover, children with poor growth status were more likely to be facing poor socioeconomic factors [12]. However, the previously published studies on the health status of migrant peasant workers' children didn't systematically investigate the issue of which factors determined thinness or obesity. Therefore, the goal of the present study was to evaluate the shape of migrant peasant workers' children compared to rural and urban children ,while taking socioeconomic and lifestyle factors into account.

Methods

Study design

This study was a cross-sectional survey of children aged 7-12 years old in Shanghai City and Anhui Province, China.

Study subjects

We conducted a cross-sectional study from May to July 2011 in Wuhu city of Anhui province and Shanghai city respectively. Anhui province was the origin of the greatest number of migrant peasant workers in Shanghai city [13]. Participants included two urban groups in Shanghai City and one rural group in Anhui province. Each group consisted of school children from two primary schools. A total of 4,132 students were recruited as possible participants. Students who were absent during the physical measurement session or did not complete questionnaires were excluded. The final samples included 748 rural children (group RUR), 914 migrant peasant workers' children (group MPW) and 795 urban children whose parents were citizens of Shanghai City (group CSH). The research plan was approved by the Ethical Committee of College of Physical Education & Health, East China Normal University.

Data collection

The questionnaire in the study included children's parental occupation and education, the guardian's cognition of health, the children's living environment and family status, the children's learning and living conditions, children's health status and children's lifestyle of diet. We distributed the questionnaires to each school with the principal's consent. The questionnaires were handed out to the children and collected by the teachers who were in charge of each class. Every child was asked to complete the questionnaire by consulting with his parent or guardian at home.

Anthropometric measurements

Height and weight were measured by trained investigators. Boys were measured wearing underpants only, girls wore a t-shirt and a pair of light trousers; No subject wore shoes. Height was measured against metal column scales, knees not bent, arms at sides, shoulders relaxed, feet flat on the floor, and recorded to the nearest 0.1 cm. Sitting heights were measured sitting against metal column scales, and recorded to the nearest 0.1 cm. Weighing was done on platform scales and recorded to the nearest 0.1 kg. Body mass index (BMI) was calculated using formula: BMI equals weight (kg)/height (m^2).

Analytical framework and statistical analyses

First, we analyzed the differences of average BMI value among the three groups (RUR, MPW, CSH) by ANOVA. Second, thinness, overweight and obesity were defined using age and sex-specific BMI cut-off points developed by the Working Group for Obesity in China (WGOC) references [14]. WGOC derived sex and age-specific BMI cut-offs for 7-18-year-old school children from height and weight data, collected in the 2000 Chinese National Survey on Students Constitution and Health (CNSSCH) with

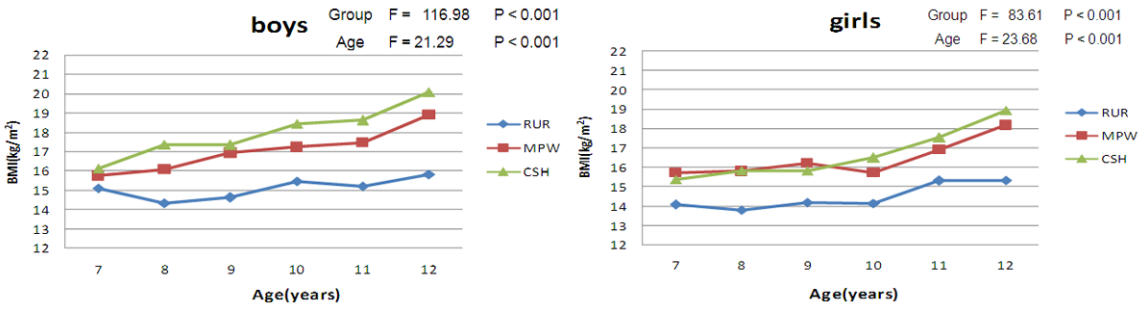

Figure 1. Comparisons of average BMI value among three groups.

Table 1. Distribution of the demographic characteristics of thinness, normal-weight and overweight or obesity among three groups by sex

	$<P_{15}$	P_{15}~P_{85}	$P_{85}<$	F	P	Total
Boys						
Group				116.98	<0.001	
Rural resident	246 (56.2)	175 (40.0)	17 (3.9)			438 (100)
Migrant peasant worker	84 (15.1)	375 (67.3)	98 (17.6)			557 (100)
Citizen in Shanghai city	58 (14.4)	232 (57.6)	113 (28.0)			403 (100)
Girls						
Group				83.61	<0.001	
Rural resident	153 (49.4)	150 (48.4)	7 (2.3)			310 (100)
Migrant peasant worker	49 (13.7)	255 (71.4)	53 (14.8)			357 (100)
Citizen in Shanghai city	69 (17.6)	234 (59.7)	89 (22.7)			392 (100)

Note: ※$<P_{15}$ was defined as thinness, P_{15}~P_{85} as normal-weight, $P_{85}<$ as overweight or obesity.

216,620 subjects throughout China, using below the 15th percentile to define thinness, and above the 85th percentile to do overweight or obesity [14]. Third, chi-square tests were used to examine the differences in the proportion of socioeconomic and lifestyle behavioral factors in each group (RUR, MPW, CSH). Finally, logistic regression analyses were applied to analyze socioeconomic and lifestyle behavioral factors associated with thinness or obesity among children.

Many studies reported that there existed the associations between children's overweight or obese status and family socioeconomic and lifestyle factors [15-18]. Therefore, in the present study, we selected parental education and family monthly income as indices of socioeconomic status, three items of regarding children's living habits were taken as lifestyle behavioral factors. The socioeconomic factors were reclassified as follows: (i) education: primary school or lower, junior high school, senior high school, college or higher; (ii) family monthly income (yuan): ≤2000, 2001-5000, 5001≤ [19]. Chi-square analyses were used to test the differences between categorical variables and BMI status. Logistic regression was applied to analyze the association between children's shape and socioeconomic and lifestyle behavioral factors among migrant peasant workers' children. All statistical analyses were performed using the Statistical Package for the Social Science (SPSS), version 18.0.

Results

A comparison of average BMI value among the three groups is presented in **Figure 1**. There were significant differences across both boys and girls (P<0.001). The average BMI value of group MPW was significantly lower than that of group CSH except for girls aged 7-9 years. Across all ages and regardless of gender, The average BMI value of group MPW was higher than that of group RUR.

Table 1 presents the frequencies and proportions of weight status among three groups (RUR, MPW, CSH), each group was classified

Table 2. Distribution of the demographic characteristics of thinness, normal-weight and overweight or obesity among three groups by age and sex

	Rural resident					Migrant peasant worker					Citizen in Shanghai city				
	$<P_{15}$	P_{15}~P_{85}	$P_{85}<$	P	Total	$<P_{15}$	P_{15}~P_{85}	$<P_{85}$	P	Total	$<P_{15}$	P_{15}~P_{85}	$P_{85}<$	P	Total
Boys															
Age (years)				<0.05					<0.05					ns	
7	13 (36.1)	22 (55.6)	3 (8.3)		36 (100)	10 (15.6)	47 (73.4)	7 (10.9)		64 (100)	8 (16.0)	31 (62.0)	11 (22.0)		50 (100)
8	38 (57.6)	28 (42.4)	0 (0)		66 (100)	13 (11.7)	85 (76.6)	13 (11.7)		111 (100)	6 (10.3)	35 (60.3)	17 (29.3)		58 (100)
9	47 (62.7)	27 (36.0)	1 (1.3)		75 (100)	17 (13.7)	83 (66.9)	24 (19.4)		124 (100)	14 (17.9)	44 (56.4)	20 (25.6)		78 (100)
10	44 (54.3)	28 (34.6)	9 (11.1)		81 (100)	11 (12.4)	60 (67.4)	18 (20.2)		89 (100)	18 (16.4)	54 (49.1)	38 (34.5)		110 (100)
11	57 (58.2)	39 (39.8)	2 (2.0)		98 (100)	22 (19.5)	72 (63.7)	19 (16.8)		113 (100)	10 (12.8)	49 (62.8)	19 (24.4)		78 (100)
12	47 (57.3)	33 (40.2)	2 (2.4)		82 (100)	11 (19.6)	28 (50.0)	17 (30.4)		56 (100)	2 (6.9)	19 (65.5)	8 (27.6)		29 (100)
Girls															
Age (years)				<0.05					<0.05					ns	
7	9 (23.7)	29 (76.3)	0 (0)		38 (100)	4 (9.3)	29 (23.3)	10 (23.3)		43 (100)	5 (10.0)	33 (66.0)	12 (24.0)		50 (100)
8	18 (58.1)	13 (41.9)	0 (0)		31 (100)	12 (16.9)	42 (59.2)	17 (23.9)		71 (100)	10 (17.5)	33 (57.9)	14 (24.6)		57 (100)
9	19 (42.2)	25 (55.6)	1 (2.2)		45 (100)	3 (3.8)	67 (83.8)	10 (12.5)		80 (100)	15 (16.9)	58 (65.2)	16 (18.0)		89 (100)
10	43 (60.6)	28 (39.4)	0 (0)		71 (100)	19 (16.0)	49 (67.1)	5 (6.8)		73 (100)	22 (22.9)	52 (54.2)	22 (22.9)		96 (100)
11	33 (43.4)	39 (51.3)	4 (5.3)		76 (100)	8 (12.9)	46 (74.2)	8 (12.9)		62 (100)	13 (18.3)	42 (59.2)	16 (22.5)		71 (100)
12	31 (63.3)	16 (32.7)	2 (4.1)		49 (100)	3 (10.7)	22 (78.6)	3 (10.7)		28 (100)	4 (13.8)	16 (55.2)	9 (31.0)		29 (100)

Note: ※$<P_{15}$ was defined as thinness, P_{15}~P_{85} as normal-weight, $P_{85}<$ as overweight or obesity.

Table 3. Socioeconomic and lifestyle status of thinness, normal-weight and overweight or obesity among the boys of three groups

	Rural resident					Migrant peasant worker					Citizen in Shanghai city				
	$<P_{15}$	P_{50}~P_{85}	$P_{85}<$	P	Total	$<P_{15}$	P_{50}~P_{85}	$P_{85}<$	P	Total	$<P_{15}$	P_{50}~P_{85}	$P_{85}<$	P	Total
Socioeconomic factors															
Parental education levels															
Father				ns					ns					<0.05	
Primary school or lower	90 (58.8)	58 (37.9)	5 (3.3)		153 (100)	17 (14.2)	77 (64.2)	26 (21.7)		120 (100)	1 (10.0)	7 (70.0)	2 (20.0)		10 (100)
Junior high school	119 (54.8)	89 (41.0)	9 (4.1)		217 (100)	43 (16.5)	173 (66.3)	45 (17.2)		261 (100)	19 (18.8)	60 (59.4)	22 (21.8)		101 (100)
Senior high school	18 (46.2)	19 (48.7)	2 (5.1)		39 (100)	19 (17.6)	77 (71.3)	12 (11.1)		108 (100)	15 (9.6)	92 (58.6)	50 (31.8)		157 (100)
College or higher	5 (55.6)	4 (5.3)	0 (0)		9 (100)	3 (7.0)	31 (72.1)	9 (20.9)		43 (100)	19 (16.7)	60 (52.6)	35 (30.7)		114 (100)
Mother				<0.05					ns					ns	
Primary school or lower	135 (59.2)	88 (38.6)	5 (2.2)		228 (100)	37 (16.7)	149 (67.1)	36 (16.2)		222 (100)	2 (6.1)	20 (60.6)	11 (33.3)		33 (100)
Junior high school	85 (54.1)	67 (42.7)	5 (3.2)		157 (100)	24 (12.6)	130 (68.1)	37 (19.4)		191 (100)	30 (21.1)	80 (56.3)	32 (22.5)		142 (100)
Senior high school	10 (40.0)	10 (40.0)	5 (20.0)		25 (100)	13 (15.9)	53 (64.6)	16 (19.5)		82 (100)	14 (11.3)	71 (57.3)	39 (31.5)		124 (100)
College or higher	3 (60.0)	2 (40.0)	0 (0)		5 (100)	4 (9.8)	32 (78.0)	5 (12.2)		41 (100)	11 (11.7)	54 (57.4)	29 (30.9)		94 (100)
Family monthly income				<0.05					ns					ns	
≤2000	124 (57.9)	83 (38.8)	7 (3.3)		214 (100)	18 (11.8)	109 (71.7)	25 (16.4)		152 (100)	9 (18.8)	22 (45.8)	17 (35.4)		48 (100)

2001-5000	50 (46.7)	49 (45.8)	8 (7.5)		107 (100)	35 (16.4)	146 (68.5)	32 (15.0)		213 (100)	21 (14.9)	83 (58.9)	37 (26.2)		141 (100)
5001≤	17 (68.0)	8 (32.0)	0 (0)		25 (100)	24 (16.2)	29 (19.6)	95 (64.2)		148 (100)	26 (13.5)	116 (60.4)	50 (26.0)		192 (100)
Lifestyle factors															
Physical education class (times/week)				ns					ns					ns	
Once or fewer	100 (53.5)	77 (41.2)	10 (5.3)		187 (100)	4 (18.2)	13 (59.1)	5 (22.7)		22 (100)	1 (6.7)	11 (73.3)	3 (20.0)		15 (100)
Twice	75 (56.0)	55 (41.0)	4 (3.0)		134 (100)	73 (14.9)	328 (67.1)	88 (18.0)		489 (100)	6 (20.7)	16 (55.2)	7 (24.1)		29 (100)
Three times or higher	62 (63.3)	34 (34.7)	2 (2.0)		98 (100)	3 (10.7)	21 (75.0)	4 (14.3)		28 (100)	48 (14.0)	198 (57.6)	98 (28.5)		344 (100)
Duration of playing computer games or watching TV (h/day)				ns					ns					ns	
Do not play or watch	33 (61.1)	21 (38.9)	0 (0)		54 (100)	8 (16.0)	32 (64.0)	10 (20.0)		50 (100)	6 (17.6)	21 (61.8)	7 (20.6)		34 (100)
Less than 1 hour	158 (56.0)	110 (39.0)	14 (5.0)		282 (100)	63 (15.1)	285 (68.5)	68 (16.3)		416 (100)	44 (14.5)	174 (57.4)	85 (28.1)		303 (100)
More than 1 hour	45 (55.6)	35 (43.2)	1 (1.2)		81 (100)	11 (15.3)	44 (61.1)	17 (23.6)		72 (100)	7 (14.3)	26 (53.1)	16 (32.7)		49 (100)
Having many food like or dislike				<0.001					ns					ns	
Many	93 (62.0)	55 (36.7)	2 (1.3)		150 (100)	14 (14.0)	72 (72.0)	14 (14.0)		100 (100)	19 (13.8)	84 (60.9)	35 (25.4)		138 (100)
General	46 (43.4)	49 (46.2)	11 (10.4)		106 (100)	34 (12.5)	190 (69.9)	48 (17.6)		272 (100)	13 (10.2)	74 (58.3)	40 (31.5)		127 (100)
Few	92 (58.2)	63 (39.9)	3 (1.9)		158 (100)	31 (19.1)	98 (60.5)	33 (20.4)		162 (100)	18 (14.6)	68 (55.3)	37 (30.1)		123 (100)

Note: ※<P_{15} was defined as thinness, P_{15}~P_{85} as normal-weight, P_{85}< as overweight or obesity.

Table 4. Socioeconomic and lifestyle behavior's status of thinness, normal-weight and overweight or obesity among the girls of three groups

	Rural resident					Migrant peasant worker					Citizen in Shanghai city				
	<P_{15}	P_{50}~P_{85}	P_{85}<	P	Total	<P_{15}	P_{50}~P_{85}	P_{85}<	P	Total	<P_{15}	P_{50}~P_{85}	P_{85}<	P	Total
Socioeconomic factors															
Parental education levels															
Father				ns					ns					<0.05	
Primary school or lower	45 (47.4)	49 (51.6)	1 (2.3)		95 (100)	12 (16.2)	49 (66.2)	13 (17.6)		74 (100)	0 (0)	6 (100.0)	0 (0)		6 (100)
Junior high school	82 (49.7)	78 (47.3)	5 (3.0)		165 (100)	25 (16.3)	111 (72.5)	17 (11.1)		153 (100)	11 (12.6)	55 (63.2)	21 (24.1)		87 (100)
Senior high school	13 (50.0)	12 (46.2)	1 (3.8)		26 (100)	8 (9.9)	58 (71.6)	15 (18.5)		81 (100)	31 (19.9)	87 (55.8)	38 (24.4)		156 (100)
College or higher	8 (80.0)	2 (20.0)	0 (0)		10 (100)	1 (3.0)	25 (75.8)	7 (21.2)		33 (100)	25 (18.7)	82 (61.2)	27 (20.1)		134 (100)
Mother				ns					ns					ns	
Primary school or lower	81 (49.7)	78 (47.9)	4 (2.5)		163 (100)	23 (13.9)	118 (71.5)	24 (14.5)		165 (100)	2 (9.5)	14 (66.7)	5 (23.8)		21 (100)
Junior high school	46 (43.8)	57 (54.3)	2 (1.9)		105 (100)	20 (17.2)	82 (70.7)	14 (12.1)		116 (100)	17 (12.4)	91 (66.4)	29 (21.2)		137 (100)
Senior high school	17 (68.0)	7 (28.0)	1 (4.0)		25 (100)	4 (8.3)	32 (66.7)	12 (25.0)		48 (100)	25 (23.8)	56 (53.3)	24 (22.9)		105 (100)
College or higher	3 (50.0)	0 (0)	3 (50.0)		6 (100)	0 (3.0)	19 (90.5)	2 (9.5)		21 (100)	20 (17.4)	67 (58.3)	28 (24.3)		115 (100)
Family monthly income				ns					ns					ns	
≤2000	73 (47.7)	76 (49.7)	4 (2.6)		153 (100)	17 (14.7)	85 (73.3)	14 (12.1)		116 (100)	6 (16.2)	25 (67.6)	6 (16.2)		37 (100)
2001-5000	33 (55.0)	26 (43.3)	1 (1.7)		60 (100)	18 (13.1)	25 (18.2)	94 (68.6)		137 (100)	19 (16.5)	60 (52.2)	36 (31.3)		115 (100)
5001≤	11 (68.8)	5 (31.3)	0 (0)		16 (100)	10 (14.5)	50 (72.5)	9 (13.0)		69 (100)	40 (18.5)	135 (62.5)	41 (19.0)		216 (100)
Lifestyle behavioral factors															
Physical education class (times/week)				ns					ns					ns	

Once or fewer	58 (45.5)	67 (51.9)	4 (3.1)		129 (100)	1 (7.1)	10 (71.4)	3 (21.4)		14 (100)	2 (15.4)	9 (69.2)	2 (15.4)		13 (100)
Twice	52 (50.0)	49 (47.1)	3 (2.9)		104 (100)	44 (13.6)	233 (72.1)	46 (14.2)		323 (100)	3 (18.8)	9 (56.3)	4 (25.0)		16 (100)
Three times or higher	37 (56.1)	29 (43.9)	0 (0)		66 (100)	4 (25.0)	9 (56.3)	3 (18.8)		16 (100)	63 (17.5)	214 (59.6)	82 (22.8)		359 (100)
Duration of playing computer games or watching TV (h/day)				ns					ns					ns	
Do not play or watch	14 (48.3)	15 (51.7)	0 (0)		29 (100)	7 (25.9)	19 (70.4)	1 (3.7)		27 (100)	7 (17.5)	21 (52.5)	12 (30.0)		40 (100)
Less than 1 hour	98 (45.0)	114 (52.3)	6 (2.8)		218 (100)	35 (11.9)	212 (72.4)	46 (15.7)		293 (100)	54 (17.4)	190 (61.3)	66 (21.3)		310 (100)
More than 1 hour	31 (63.3)	17 (34.7)	1 (2.0)		49 (100)	6 (20.0)	19 (63.3)	5 (16.7)		30 (100)	8 (22.9)	17 (48.6)	10 (28.6)		35 (100)
Having many food like or dislike				<0.001					ns					ns	
Many	37 (50.7)	35 (47.9)	1 (1.4)		73 (100)	8 (15.4)	39 (75.0)	5 (9.6)		52 (100)	19 (18.8)	65 (64.4)	17 (16.8)		101 (100)
General	58 (49.2)	56 (47.5)	4 (3.4)		118 (100)	29 (14.6)	140 (70.7)	29 (14.6)		198 (100)	21 (15.1)	76 (54.7)	42 (30.2)		139 (100)
Few	542 (47.8)	57 (50.0)	2 (1.8)		113 (100)	11 (11.0)	71 (71.0)	18 (18.0)		100 (100)	29 (19.7)	88 (59.9)	30 (20.4)		147 (100)

Note: ※<P_{15} was defined as thinness, P_{15}~P_{85} as normal-weight, P_{85}< as overweight or obesity.

Table 5. Difference of duration of living in Shanghai of thinness, normal-weight and overweight or obesity among migrant peasant workers' children

	$<P_{15}$	P_{15}~P_{85}	$P_{85}<$	*F*	*P*	Total
Duration of living in Shanghai (years)						
Boys				4.59	ns	
<3	17 (12.4)	97 (70.8)	23 (16.8)			137 (100)
3~5	24 (14.0)	119 (69.2)	29 (16.9)			172 (100)
5<	43 (17.3)	159 (64.1)	46 (18.5)			248 (100)
Girls				5.56	<0.005	
<3	17 (17.3)	71 (72.4)	10 (10.2)			98 (100)
3~5	13 (11.3)	186 (74.8)	16 (13.9)			115 (100)
5<	19 (13.3)	97 (67.8)	27 (18.9)			143 (100)

Note: ※$<P_{15}$ was defined as thinness, P_{15}~P_{85} as normal-weight, $P_{85}<$ as overweight or obesity.

as 3 subgroups ($<P_{15}$ was defined as thinness, P_{15}~P_{85} as normal, $P_{85}<$ as overweight or obesity). Irrespective of sex, there were significant differences among three groups (RUR, MPW, CSH) according to chi-square tests (*P*<0.001). For boys, the high prevalence of thinness was 56.2% in group RUR , the pvevalence of overweight or obesity was 17.6% in group MPW, 28.0% in group CSH. The prevalence of overweight or obesity in group MPW was close to group CSH. For girls, the high prevalence of thinness was 49.4% in group RUR ,the pvevalence of overweight or obesity's was 14.8% in group MPW, 22.7% in group CSH. Similarly, the pvevalence of overweight or obesity in group MPW was close to group CSH.

Table 2 shows the distribution of demographic characteristics of thinness, normal-weight and overweight or obesity among three groups by age and sex. Thinness was descending in the order of group RUR, MPW and CSH. In contrast, overweight or obesity increased in the order of group RUR, MPW and CSH for all age. In the group MPW, a high proportion of overweight or obese children included 12-year-old boys (30.4%) and 8-year-old girls (23.9%). In the group RUR, a high proportion of thinness included 9-year-old boys (62.7%) and 12-year-old girls (63.3%). In the group CSH, a high proportion of overweight or obese children included 8-year-old boys (29.3%) and 12-year-old girls (31.0%).

Table 3 presents the differences in socioeconomic and lifestyle factors among the boys of overweight or obesity, thinness and normal-weight. There were high proportions of thinness with all of the socioeconomic and lifestyle items in group RUR. However, there were relatively high proportions of overweight or obesity with all socioeconomic and lifestyle items in both group MPW and CSH. With regard to girls, the results yielded almost the same as boys (**Table 4**).

Table 5 presents the difference of duration of living in Shanghai with different BMI status in group MPW. There were significant differences among girls (*P*<0.005), with a high proportion of overweight or obesity (18.9%) ,when the children had lived in Shanghai for more than five years.

Figure 2 presents comparisons of average BMI value among children with different durations of living in Shanghai. Across all ages, children's average BMI value tended to increase ,as the durations of living in Shanghai became longer.

Table 6 shows the results of logistic regression analyses of selected socioeconomic factors and lifestyle behaviors' factors among migrant peasant workers' children. Children whose fathers' education levels were low were significantly more likely to be thinness (Primary school or lower: OR=2.24, 95% CI=1.59-3.18; Junior high school: OR=1.77, 95% CI=1.29-2.43), and less likely to be overweight or obese (Primary school or lower: OR=0.50, 95% CI=0.33-0.75; Junior high school: OR=0.55, 95% CI=0.40-0.76), compared with children whose fathers had college education or higher. Similarly, children whose mothers' education levels were low were significantly more likely to be thinness (Primary school or lower: OR=2.59, 95% CI=1.79-3.75; Junior high school: OR=1.89, 95% CI=1.30-2.75; senior high school: OR= 1.57, 95% CI=1.03-2.39), and significantly less likely to be overweight or obese (Primary school or lower: OR=0.50, 95% CI=0.35-0.73; Junior high school: OR=0.65, 95% CI=0.46-0.92; senior high school OR=0.96, 95% CI=0.81-1.70), compared with children whose mothers' education levels were college or higher. Regarding family income, compared with family monthly income of 5001≤, children with lower family monthly income were significantly more

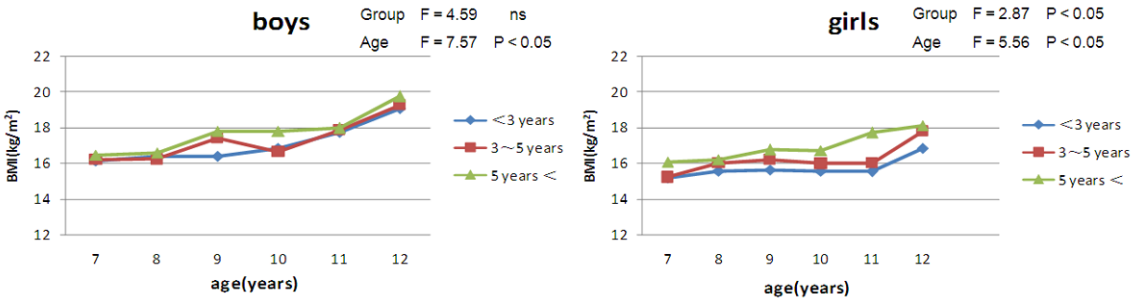

Figure 2. Comparisons of average BMI value among different duration of living in Shanghai.

Table 6. Results of logistic regression analyses of Selected Socioeconomic factors and Lifestyle behavioral factors for overweight or obesity and thinness among migrant peasant workers' children

Socioeconomic and lifestyle behaviors' factors	P_{85}<		<P_{15}	
	OR	95% CI	OR	95% CI
Socioeconomic factors				
Parental education levels				
Father				
Primary school or lower	0.50※	(0.33-0.75)	2.24※	(1.59-3.18)
Junior high school	0.55※	(0.40-0.76)	1.77※	(1.29-2.43)
Senior high school	0.90	(0.64-1.25)	1.01	(0.70-1.45)
College or higher	1	–	1	–
Mother				
Primary school or lower	0.50※	(0.35-0.73)	2.59※	(1.79-3.75)
Junior high school	0.65※	(0.46-0.92)	1.89※	(1.30-2.75)
Senior high school	0.96※	(0.81-1.70)	1.57※	(1.03-2.39)
College or higher	1		1	
Family monthly income				
≤2000	0.58※	(0.42-0.80)	1.97※	(1.53-2.54)
2001-5000	0.96	(0.73-1.27)	1.23	(0.94-1.60)
5001≤	1		1	
Lifestyle behavioral factors				
Physical education class (times/week)				
Once or fewer	2.89※	(1.86-3.56)	1.56※	(1.59-2.69)
Twice	1.34	(0.94-1.70)	1.28	(0.69-1.57)
Three times or higher	1		1	
Duration of playing computer games or watching TV (h/day)				
Do not play or watch	0.74	(0.44-1.22)	0.86	(0.59-1.25)
Less than 1 hour	0.83	(0.59-1.17)	0.61	(0.47-0.80)
More than 1 hour	1		1	
Having many food like or dislike				
Many	0.36	(0.12-0.76)	1.58	(0.81-1.93)
General	0.78	(0.56-1.23)	1.26	(0.96-1.67)
Few	1		1	

Note: ※<P_{15} was defined as thinness, P_{15}~P_{85} as normal-weight, P_{85}< as overweight or obesity, P_{15}~P_{85} was set as reference ※P<0.05.

likely to be thinness (≤2000: OR=1.97, 95% CI=1.53-2.54; 2001-5000: OR=1.23, 95% CI=0.94-1.60), on the contrary, children with higher family monthly income were significantly

more likely to be overweight or obese (≤2000:OR=0.58, 95% CI=0.42-0.80; 2001-5000: OR=0.96, 95% CI=0.73-1.27). As for the lifestyle behavioral factors, children who received less physical education class (time per week) were more likely to be thinness (once or fewer: OR=1.89, 95% CI=1.59-2.69). Similarly, children who had less physical education class time per week were more likely to be overweight or obese (once or fewer: OR=2.89, 95% CI=1.86-3.56).

Discussion

This study showed that the average BMI value of group MPW was higher than that of group RUR and lower than group CSH except for 7 to 9-year-old girls. Thinness was highly prevalent in group RUR, while overweight or obesity was largely observed in group CSH. Moreover, the results showed that the prevalence of overweight or obesity in group MPW was much higher than group RUR. We also found that overweight or obese children were more likely to have parents with higher education levels, have higher family monthly income, and have less physical education class per week. Thin children were more likely to have parents with lower education levels, have lower family monthly income, and have less physical education class per week.

Migrant peasant workers' wages afforded them a higher quality of consumer goods and lifestyle that was unavailable to most children living in rural areas, migrant peasant workers migrated from rural areas to urban areas, this immigration improved their family income, according to Chinese government data [4]. Although migrant peasant workers' family income was improved by the immigration, it was still much lower than group CSH [4]. In our data, family monthly income was high in ascending order of group RUR, MPW and CSH. It led to children's average BMI value in the same ascending order of result (RUR<MPW <CSH). Yan Z has reported the same result that 3245 migrant peasant workers' children aged 7-12 years old had lower average BMI value than urban children, and higher than children living in rural areas where migrant peasant workers' children came from, after observing adjustment by family income in 2005 in Hangzhou, China [20].

We also found that there were high prevalence of thinness in group RUR and high prevalence of overweight or obesity in group CSH. Several studies showed that there were differences of children's growth status between rural and urban areas, only 0.25% of children under six years old were observed as being undernourished in Beijing in 2007; whereas the prevalence of stunting was 21.2% among chidren of some rural areas in Yunnan province during the same period [21-24]. With the rapid development of China's national economy, living standards have been greatly elevated. Rural children' health status have improved, however, the great majority of rural children are still in the stunted or undernourished growth, and low family income is one of the important reasons [25]. In stark contrast, in the most developed metropolitan areas of China, 8% of children aged 10-12 years in China's cities are considered to be obese and an additional 15% are overweight [4]. Urban children with poor lifestyle behaviors are more likely to be overweight or obese [26, 27].

In the present study, we found thin children were more likely to have fathers with lower levels of education, while overweight or obese children were more likely to have fathers with higher levels of education. Fathers with lower levels of education had less resources to promote health in their children and it was difficult to prevent disease [28]. Moreover, parents with lower levels of education may also have a poorer standard of living and health-related behaviors, which had a direct influence on their children [29]. Our results also showed that fathers' higher education levels was correlated with their children's overweight or obesity. Several previous studies have also showed the relationship of weight, high education and high income in China [30, 31]. Family income influenced the ability to purchase foods ,and had an impact on a child's weight. Influenced by outdated rural Chinese convention, migrant peasant workers may provide much more meat than vegetables for their children, which was suggested as one of the most important reasons of excessive childhood weight.

We found that thin children were more likely to have mothers with lower education levels, while overweight or obese children were more likely to have mothers with higher education levels. A substantial amount of evidence existed regarding the link between maternal education and child development [32-34]. Maternal education levels had been recognized as a key determi-

nant of child growth through a number of pathways, such as acquireing better health nutritional knowledge and practices, improving access and use of information, and improving self-confidence and decision-making ability [35, 36]. This could explain correlation between lower maternal education levels and thinness of child, because mothers with low education levels lacked health knowledge and had poor lifestyle behaviors. In contrast, we also found that overweight or obese children were more likely to have highly educated mothers. A major finding of our study is that there are strongly associations between parental education levels and family income.

A substantial amount of evidences existed regarding the relationship between family income and child development [37, 38]. Children with low family income had stunted growth or were underweight because of insufficient calories and poor quality of food [39, 40], the present study indicatedthat thin children were more likely to have lower family income. Inversely, many studies showed that high family income was a risk factor of overweight or obesity among children in developing countries [41-43]. It is thought that health knowledge has lagged among children and their guardians since the implementation of China's one-child policy [44, 45]. Our results corroborate that higher family income is a risk factor for children to be overweight or obese.

We found that thin children were more likely to spend less time on physical education classes each week. Moderate physical activity among children was beneficial for their growth. In fact, exercise in childhood was ritical for maximizing bone growth and preventing osteoporosis in later years. Physical activity represents a major mechanical loading factor for bone through a combination of growth (determining bone size), modelling (deter-mining the shape of bone) and remodeling (maintaining the functional competence of bone) [46].

We also found that overweight or obese children were more likely to have once or fewer physical education classes each week. Numerous studies revealed that physical activity could help to reduce childhood obesity and increase energy expenditure [47-50]. In addition, physical activity had beneficial effects with an increased reliance on fat [51]. This finding was consistent with previous studies. Physical education classes played an important role for school children to meet their physical exercise needed [52].

Our study had several limitations. First, we could not select participants from every province that migrant peasant workers in Shanghai City came from. Therefore, our data were not representative of migrant peasant workers' children throughout the whole country. Second, although questionnaires were modified to make them easier to be understood, a few parents or guardians were still not able to accurately fill out some parts of the questionnaires. Third, it was possible that there could be some errors in physical measurement.

Conclusion

In summary, our study provides preliminary evidences that the average BMI value in the group MPW was higher than group RUR and was lower than group CSH except for girls aged 7-9 years. Thinness was found to be highly prevalent in group RUR, while high prevalence of overweight or obesity was observed in group CSH, Moreover, the prevalence of overweight or obesity in group MPW was much higher than group RUR. Among migrant peasant workers' children, we also found that overweight or obese children were more likely to have parents with higher education levels, have higher family monthly income, and have less physical education classes per week. Thin children were more likely to have parents with lower education levels, have lower family income monthly, and also have less physical education classes per week.

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Disclosure of conflict of interest

None.

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