Supplementary File 3

Data analysis after excluding underweight children

Among the 1,967 children included in the study, there were 151 underweight cases, accounting for 7.7% of the total. After excluding underweight children from the "nonoverweight/nonobese" group, we conducted a statistical analysis again. The results are presented as follows.

The differences in children's overweight/obesity related to various family characteristics and caregivers' health behaviors were consistent with prior statistical findings (variables with $P<0.05$ in the original analysis stayed $P<0.05$ in the new analysis, and vice versa.) (Table S1 and Table S2).

Logistic regression analysis (Table S3) showed that, except for the change in the *P*-value of the correlation between caregiver exercise frequency and children's overweight/obesity, all other conclusions remained consistent with previous statistics. The original analysis indicated that children with caregivers exercising ≥3 times/week were less likely to be overweight and obese compared to those whose caregivers exercised <1 time/week($P=0.045$, OR=0.643, 95% CI: 0.417-0.990). In the new analysis, the *P*-value increased to 0.077 (OR=0.674, 95% CI: 0.436-1.043). While this does not reach statistical significance at the 0.05 level, it still reflects a trend close to significance. Moreover, statistics indicated that among caregivers exercising ≥3 times/week, the proportions of their children who were overweight and obese, normal-weight, and underweight were 10.2%, 15.6%, and 21.2%, respectively. Notably, a higher proportion was found in the underweight group, supporting our conclusion that increased caregiver exercise frequency serves as a protective factor against childhood overweight and obesity. Therefore, excluding underweight children also removed those with a higher proportion of caregivers exercising ≥3 times/week. Consequently, the *P*-value in the regression analysis increased. Aside from this change, there were no differences in other variables' statistical outcomes compared to before.

The prevalence of childhood obesity in China is escalating at an alarming rate. This study focused on children who are overweight and obese. Given the current high rates of childhood obesity and its long-term adverse effects, we prefer to support the protective role of higher caregiver exercise frequency against child overweight/obesity, as well as its potential

long-term benefits.

Table S1 Demographic characteristics of participant

Variables	Total (n=1816)	Group		Statistic	*P value*
		Nonoverweight/nonobesity (n=1533)	Overweight and obesity (n=283)		
Sex, n (%)				x^2=0.511	0.475
Male	895 (49.3)	750(48.9)	145 (51.2)		
Female	921(50.7)	783 (51.1)	138 (48.8)		
Age group(years) , n (%)				*Z*=-7.935	<0.001
2-3	447 (24.6)	415(27.1)	32 (11.3)		
3-4	658 (36.2)	571(37.2)	87 (30.7)		
4-5	402 (22.1)	322 (21.0)	80 (28.3)		
5-6	309 (17.0)	225 (14.7)	84 (29.7)		
Caregivers, n (%)				x^2=0.760	0.684
Parents	1009 (55.6)	846 (55.2)	163 (57.6)		
Grandparents	789(43.4)	671 (43.8)	118 (41.7)		
Others	18 (1.0)	16(1.0)	2 (0.7)		
Annual family income(yuan) , n (%)				*Z* =-0.593	0.553
<100000	503 (27.7)	423 (27.6)	80 (28.3)		
100000～300000	1097 (60.4)	936 (61.1)	161 (56.9)		
>300000	216 (11.9)	174 (11.4)	42 (14.8)		
Father's nutritional status, n (%)				x^2=13.321	<0.001
Nonoverweight/nonobesity	736 (40.5)	649 (42.3)	87 (30.7)		
Overweight and obesity	1080 (59.5)	884(57.7)	196 (69.3)		
Mother's nutritional status, n (%)				x^2=31.168	<0.001
Nonoverweight/nonobesity	1285 (70.8)	1124 (73.3)	161 (56.9)		
Overweight and obesity	531(29.2)	409 (26.7)	122(43.1)		
Father's education level, n (%)				x^2=1.122	0.289
Below college degree	1091 (60.1)	929 (60.6)	162(57.2)		
College degree or above	725(39.9)	604 (39.4)	121 (42.8)		
Mother's education level, n (%)				x^2=0.119	0.731
Below college degree	1018 (56.1)	862 (56.2)	156 (55.1)		
College degree or above	798 (43.9)	671 (43.8)	127 (44.9)		

Table S2 Differences in overweight and obesity among children whose caregivers had different health-related behaviours

Health-related behaviours of caregivers	Total (n=1816)	Group		Statistic	*P value*
		Nonoverweight/no nobesity (n=1533)	Overweight and obesity (n=283)		
Frequency of exercise, n (%)				*Z*=-3.288	0.001
<1 time/week	1045 (57.5)	858 (56.0)	187 (66.1)		
1-2 times/week	503 (27.7)	436 (28.4)	67 (23.7)		
≥3 times/week	268 (14.8)	239 (15.6)	29 (10.2)		
Duration of each exercise session, n (%)				*Z*=-0.483	0.629
<30 minutes	1027 (56.6)	864(56.4)	163(57.6)		
30-60 minutes	473 (26.0)	399(26.0)	74(26.1)		
≥60 minutes	316 (17.4)	270(17.6)	46(16.3)		
Usually encourages children to exercise, n (%)				x^2=14.769	<0.001
No	181 (10.0)	135(8.8)	46(16.3)		
Yes	1635 (90.0)	1398(91.2)	237(83.7)		
Frequency of eating desserts, n (%)				*Z*=-4.110	<0.001
≤1 time/week	1206 (66.4)	1047(68.3)	159(56.2)		
2-3 times/week	446 (24.6)	360(23.5)	86(30.4)		
≥4 times/week	164 (9.0)	126(8.2)	38(13.4)		
Frequency of eating late-night snacks, n (%)				*Z*=-0.790	0.430
≤1 time/week	1657 (91.2)	1402(91.5)	255(90.1)		
2-3 times/week	123 (6.8)	104(6.8)	19(6.7)		
≥4 times/week	36 (2.0)	27(1.8)	9(3.2)		
Frequency of eating fast food, n (%)				*Z*=-2.959	0.003
≤1 time/week	1532 (84.4)	1309(85.4)	223(78.8)		
2-3 times/week	203 (11.2)	166(10.8)	37(13.1)		
≥4 times/week	81 (4.5)	58(3.8)	23(8.1)		
Usually eats regularly, n (%)				x^2=6.196	0.013
Yes	1539 (84.7)	1313 (85.6)	226(79.9)		
No	277 (15.3)	220(14.4)	57(20.1)		
Proportion of meat and vegetables in diet, n (%)				*Z*=-0.572	0.567
Vegetables > meat	1409 (77.6)	1193(77.8)	216(76.3)		
Vegetables = meat	107 (5.9)	90(5.9)	17(6.0)		
Vegetables < meat	300 (16.5)	250(16.3)	50(17.7)		

Table S3 Logistic regression analysis of caregivers' health-related behaviors and the prevalence of overweight and obesity in children

Health-related behaviors of caregivers	β	s_x	**Wald** x^2	**OR(95% CI)**	***P value***
Frequency of exercise					
<1 time/week				1.000	
1-2 times/week	-0.276	0.161	2.929	0.759（0.553-1.041）	0.087
≥3 times/week	-0.394	0.222	3.137	0.674（0.436-1.043）	0.077
Usually encourages children to exercise					
No				1.000	
Yes	-0.685	0.197	12.125	0.504（0.343-0.741）	<0.001
Frequency of eating desserts					
≤1 time/week				1.000	
2-3 times/week	0.428	0.156	7.515	1.535（1.130-2.085）	0.006
≥4 times/week	0.610	0.217	7.893	1.840（1.203-2.816）	0.005
Frequency of eating fast food					
≤1 time/week				1.000	
2-3 times/week	0.297	0.208	2.040	1.346（0.895-2.025）	0.153
≥4 times/week	0.850	0.275	9.522	2.339（1.363-4.011）	0.002
Usually eats regularly					
Yes				1.000	
No	0.415	0.175	5.615	1.515（1.074-2.136）	0.018