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Association between Parents' Social Capital and Physical Status in Preschool Children in Japan: A Cross-Sectional Multicentre Study

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Abstract

Objective According to a World Health Organization report, in 2016, 41 million young children globally were overweight or obese. The connection between parents' social capital and their children's health has been studied, but associations between parental social capital and children's weight are largely unexamined. Hence, we assessed the relationship between preschool children's weight and parents' social capital.

Methods We used BMI assessment data for 357 children (46.5% girls; mean age 5.3 years) in Japan. We examined parents' structural and cognitive social capital using a self-report questionnaire.

Results Multiple logistic regression analysis revealed associations between parents' social capital and children's BMI. Seventy-two (20.2%) of the children had poor BMI (body mass index; overweight or thin). Interpersonal trust was significantly associated with normal BMI in children after adjustment for all confounding factors (OR 2.68; 95% CI, 1.33–5.44; P = .006) and was independently associated with other social capital factors, including norm of reciprocity (OR 3.38; 95% CI, 1.68–6.79; P < .001) and trust in organization (OR 1.24; 95% CI, 1.09–1.42; P = .001).

Conclusion Social capital factors were independently associated with each other. Japanese parents' high social capital was an independent predictor of normal BMI among preschool children.

Keywords Body mass index · Health literacy · Preschool · Thinness · Social capital

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Significance

Data analysis indicated that parents' social capital was independently associated with their children's poor physical health as indicated by BMI. These results can highlight the effectiveness of strategies aimed at affecting social capital as it relates to the physical health status of children.

Introduction

Obesity rates worldwide have more than tripled since 1975; in 2016, a total of 41 million children under five years of age were overweight or obese (World Health Organization, 2020). In Japan, the prevalence of overweight young children in 2007 was twice that of 1978 (Yoshinaga et al., 2010). According to the Ministry of Education in Japan, the number of thin children has tripled compared to that in 1980. (Ministry of Education. Sports, Science and Technology, 2020). These trends indicate that both obesity and thinness in children are a serious public health problem. In particular, poor

weight status among preschool students tends to be associated with adolescent poor weight status (Shankaran et al., 2011). Previous studies revealed obesity and thinness during adolescence are associated with disease risk in adulthood (Freedman et al., 2007). Further studies have demonstrated that obesity in children between 5 and 14 years old likely begins at younger ages and was more common among children who had entered kindergarten overweight (Cunningham et al., 2014). Accordingly, it is important to pay attention to the poor weight status of preschool children worldwide, including in Japan.

Additionally, studies in recent decades have examined the relationship between social capital and public health in adults (Saito et al., 2017). Social capital refers to the quantity and quality of social relationships, such as formal and informal social connections, as well as norms of reciprocity and trust, that exist in a place or a community (Kawachi, 2006). Although researchers in different disciplines have different definitions of social capital (Putnam, 1994), most define it as having both structural and cognitive aspects (Emmering et al., 2018). Yamaoka (2008) proposed that the structural dimension is characterised by behavioural manifestations of network connections, such as membership in voluntary organizations. The cognitive dimension reflects attitudes, such as general trust in people and the 'norm of reciprocity.' Although many studies of social capital were based on data from the US and Europe, few have been conducted among Asian people (Yip et al., 2007).

The relationship between social capital and health status is now well recognised and well-understood among adults (Emmering et al., 2018; Mizuno et al., 2016; Yamaoka, 2008). One previous study verified that multiple aspects of individual social capital are predictive of all-cause mortality among Japanese people (Aida et al., 2011). Moreover, studies using indicators of cognitive or structural social capital, such as trust or participation, also show social capital as associated with a lower risk of obesity among adults (Wu et al., 2018). Additionally, some studies have investigated various effects of parents' social capital on their children, reporting that parents' low social capital relates to behavioural problems and poor oral health of their children (Yagi et al., 2016). Another study found that mothers' social capital moderated the positive association between greater maternal stress and children's emotional overeating. Thus, the high social capital of a parent promotes not only their own health but also that of their children.

Previous studies have also shown parents' health literacy—the skills, knowledge, and motivation to access, understand, and appraise health-related information to apply informed health decisions in everyday life—may affect children's weight and sleep (Ogi et al., 2018; Nakamura et al., 2018) and sleep is particularly important to children's health (Sørensen et al., 2012). Furthermore, the relationship between parents' health literacy and children's health is significantly impacted by social capital (Amoah, 2018).

While many studies have revealed the effects of parent's social capital on children's health, no clinical studies have investigated the association between poor weight status among preschool children (as indicated by weight relative to their height outside age norms) and their parents' social capital. Based on what is known about children's health as related to parents' social capital, we hypothesised that low social capital of parents would be associated with an increased prevalence of overweight/thinness in their children. The present study tested this hypothesis by examining the association between body mass index (BMI) of Japanese preschool children and the social capital of their parents.

Materials and Methods

Participants

This cross-sectional multicentre study included children between the ages of 3 and 6 years (mean 5.3 years, SD: 0.8) who were attending kindergarten, nursery school, or early childhood education and care centres in Chitose City, Hokkaido, Japan. In February 2020, we distributed leaflets to invite children and their parents (n = 537) to participate. For families with two or more children attending the same facility, only the oldest child was requested to respond to the questions in this study. In total, 362 participants agreed to respond in this study. Children whose height or weight data were not measured in February 2020 (n = 2) and those whose birth weight was less than 1500 g (n = 3) were excluded. Therefore, a total of 357 parents and their children (66%) provided data for study analysis (Fig. 1). Among the participants, 166 of the preschool children were girls (46.5%).

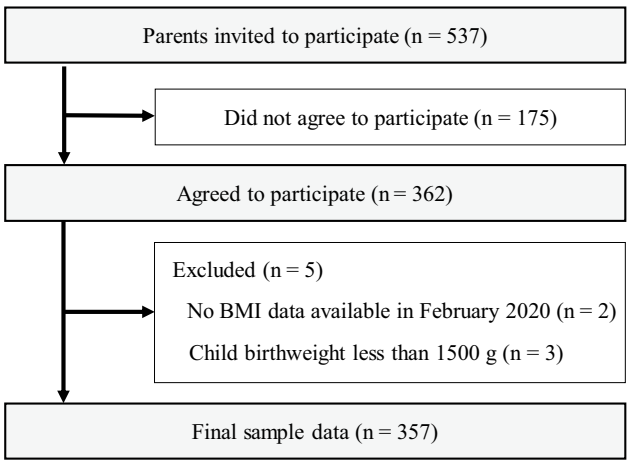

Fig. 1 Flow of participants through the present study. *BMI* body mass index

Study procedures were carried out in accordance with the Declaration of Helsinki and the Good Clinical Practice guidelines.

This study received prior approval from the Research Ethics Committee of Kobe University (Approval number 498-2). All participants were notified of their enrolment in the study and that they could opt-out at any time.

Demographic and Health-Related Data

Data were self-reported by the parents as follows: parent sex (male, female), parent's age (years), parent height and weight, marital status (not married, married), parent education level (up to high school, 2-year college or vocational college, college graduate or above), household income, parent smoking and drinking habits, the 14-item Health Literacy Scale, the Pittsburgh Sleep Quality Index, child sex (boy, girl), age (months), birth weight, number of siblings, and the Japanese version of Children's Sleep Habits Questionnaire. The children's oral health was determined using data from dental examinations conducted in May 2019.

Body Mass Index of Children

Body height and weight were measured by school staff to the nearest 0.1 cm and 0.1 kg, respectively, in January or February 2020. Measurements were taken while the children were clothed in shorts only, in bare feet. BMI was calculated as weight in kilograms divided by height in meters squared. We used the International Obesity Task Force (IOTF) classifications to assess the prevalence of child overweight and thinness using the IOTF BMI cut-off points as national standards for age and gender-specific norms in youths aged 2–18 years old (Cole & Lobstein, 2012).

Social Capital of Parents

We measured structural and cognitive social capital by adopting the method used in a previous study by Yamaoka et al. (2008). The reliability and validity of this instrument has been proven in East Asia, including Japan. In this study, we measured organizational memberships, sense of trust, trust in organizations, and person to consult.

Organizational membership (structural social capital), was measured as being involved in one or more organizations, which included sports, hobby, or literature groups, alumni associations, church groups, or political organizations (1 = belonging to any, 0 = none).

Sense of trust (cognitive social capital) was measured by two items related to trust. These questions involved 'interpersonal trust' (assessed by the question: 'Generally speaking, would you say that most people can be trusted or that you cannot be too careful in dealing with people?' with two possible answers: 'can trust' or 'cannot be too careful') and 'norms of reciprocity' (assessed by the question: 'Would you say that most of the time, people try to be helpful, or that they are mostly just looking out for themselves?' with two possible answers: 'try to be helpful' or 'look out for themselves').

Trust in organizations (cognitive social capital), was measured by ten items related to trust in social organizations and science and technology (religion, the law and the legal system, press and television, police, national government bureaucracy, national assembly, non-profit and non-governmental organizations, social welfare facilities, United Nations, and science and technology). The number of positive responses of 'very confident' or 'somewhat confident' was calculated and used as an indicator of trust in organizations. A higher score denoted greater trust (maximum 10 to minimum 0).

Person to consult (cognitive social capital) was measured by the following question: 'With which of the following people would you consult first for personal problems and important matters?' Response categories are father, mother, brother and sister, other family member or relative, schoolteacher, friend, other, or 'I do not have anyone with whom I can confide' and 'I do not have any problems.' The response 'I do not have anyone with whom I can confide' expressed low social capital.

Statistical Analysis

We conducted statistical analyses after confirming that the data were normally distributed using Kolmogorov–Smirnov tests. First, we classified the participants into two groups: normal BMI or poor BMI (overweight/thinness). Baseline clinical characteristics of parents and their children were analysed using unpaired t-tests or Fisher's exact test to compared normal BMI and poor BMI groups. Logistic regression analysis was used to examine the association between children's BMI and interpersonal trust and each variable.

We conducted two types of logistic regression analysis: the dependent variable was children's BMI in one and interpersonal trust in the other. Variables shown to have a significance of $P < 0.2$ in the univariate analysis were subsequently included in multivariate analysis. The final logistic regression model was developed by forward stepwise selection from all variables potentially associated with children's BMI or parents' interpersonal trust, respectively.

Results are presented as odds ratios (OR) with 95% confidence intervals (CI). The overall level of statistical significance was set at $P < 0.05$. All statistical analyses were performed using EZR (Saitama Medical Center, Jichi Medical University, Saitama, Japan), a graphical user interface for R (The R Foundation for Statistical Computing, Vienna, Austria).

Results

Demographic Differences

Table 1 shows the demographic differences between the 285 (79.8%) participants in the normal BMI group and the 72 (20.2%) participants in the poor BMI group 72 (overweight: 32, thin: 40). Tooth decay and sleep problems differed significantly between groups. The other characteristics of children and parents were almost identical between groups.

There were between-group differences in the cognitive social capital factors interpersonal trust (P = 0.024) and person to consult (P = 0.039). The normal BMI group had significantly more parents with high interpersonal trust (35.9%) than the poor BMI group (23.6%). Additionally, the prevalence of having a person to consult was significantly higher in the normal BMI group (100%) than in

Table 1 Differences between normal BMI group and poor BMI group characteristics

Characteristics	Total (n = 357)	Normal BMI (n = 285)		Poor BMI (n = 72)	P value
Child					
Age, mean (SD), months	64.0 (10.3)	63.6 (10.3)	65.8 (9.8)		.105
Sex, (%) girls	166 (46.5)	132 (46.3)	34 (47.2)		.896
Tooth decay, (%) without decay	287 (80.4)	229 (87.7)	58 (85.3)		.548
Birth weight, mean (SD), g	3022.9 (386.5)	3029.1 (401.3)	2998.5 (322.8)		.549
Number of siblings, mean (SD)	2.3 (0.8)	2.3 (0.8)	2.2 (0.7)		.388
Breakfast, (%) consuming every day	334 (93.6)	264 (92.6)	70 (97.2)		.189
CSHQ-J, (%) with no problem	83 (23.3)	69 (24.4)	14 (19.4)		.437
Parent					
Age, mean (SD), years	36.1 (5.3)	35.8 (5.3)	37.1 (4.9)		.056
Sex, (%) women	335 (93.8)	268 (94.0)	67 (93.1)		.784
BMI, mean (SD), kg/m^2	21.4 (3.2)	21.4 (3.2)	21.4 (3.4)		.893
Non-smoking. (%)	311 (87.1)	246 (86.3)	65 (90.3)		.436
Consume alcohol every day, (%)	41 (11.5)	37 (13.0)	4 (5.6)		.097
Marital status, (%) married	339 (95.0)	271 (95.1)	68 (94.4)		.431
Education, mean (SD), years	13.4 (1.6)	13.4 (1.6)	13.4 (1.6)		.848
Household income, (%) with > 6 million Yen	125 (35.0)	98 (34.4)	27 (38.0)		.677
PSQI, (%) with no problems	217 (60.8)	179 (63.5)	38 (53.5)		.135
High HL group, (%)	252 (70.6)	203 (72.0)	49 (71.0)		.882
Social capital					
High organizational memberships (%)	232 (65.0)	184 (64.6)	48 (66.7)		.783
High person to consult (%)	354 (99.2)	285 (100.0)	69 (95.8)		.039
High interpersonal trust (%)	119 (33.3)	102 (35.9)	17 (23.6)		.024
High norm of reciprocity (%)	133 (37.3)	107 (57.2)	26 (56.5)		> .999
Trust in organization, mean (SD)	4.5 (2.8)	4.6 (2.8)	4.3 (2.9)		.405

CSHQ-J the Japanese version of the children's sleep habits questionnaire, *BMI* body mass index, *PSQI* Pittsburgh sleep quality index, *HL* health literacy

the poor BMI group (95.8%). In contrast, the other factors of social capital, organizational membership, norm of reciprocity, and trust in organization, did not differ significantly between groups.

Logistic Regression Analysis with Children's BMI as the Dependent Variable

Table 2 shows the results of logistic regression analysis with children's BMI as the dependent variable. In the univariate analysis, interpersonal trust (P = 0.023) was positively associated with children's BMI. In the multivariate analysis, interpersonal trust (OR 2.68; 95% CI 1, 0.33–5.44; P = 0.006), child age (OR 0.96; 95% CI, 0.93–0.99; P = 0.009), and parent's age (OR 0.93; 95% CI, 0.88–0.99; P = 0.037) remained statistically significant after adjustment for all confounding factors, such as consumption of breakfast, alcohol consumption, and Pittsburgh Sleep Quality Index scores. All variables with P < 0.2 in univariate analysis were included in the multivariate analysis.

Analysis with Interpersonal Trust as the Dependent Variable

Table 3 shows the results of logistic regression analysis with interpersonal trust as the dependent variable. The univariate analysis indicated that parents' age, smoking, education, household income, health literacy, norm of reciprocity, trust in organizations, and children's overweight were significantly associated with parents' interpersonal trust. In the multivariate analysis, children's overweight (OR 0.16; 95% CI, 0.11–0.81; P = 0.007), parents' smoking (OR 3.01; 95% CI, 1.07–8.44; P = 0.036), norm of reciprocity (OR 3.38; 95% CI, 1.68–6.79; P < 0.001) and trust in organization (OR 1.24; 95% CI, 1.09–1.42; P = 0.001) remained statistically significant after adjustment for all confounding factors.

Discussion

To the best of our knowledge, this study represents the first assessment of the association between parents' social capital and children's poor BMI. We found parents' social capital as independently associated with the prevalence of children's poor BMI after adjustment for confounding variables.

Regarding the association between parent's social capital and their children's poor BMI in this study, first, parents with low social capital might not be able to access health information for their children. Previous research suggests that social capital has positive effects on the scope of health information sources, health information efficacy, and health information-seeking intention (Kim et al., 2015). Second, parents' social capital improves their children's eating habits through relief of the parents' stress. According to some previous studies, social capital is highly effective for relieving stress (Levesque & Quesnel-Vallée, 2019). Further, there is a known association between parent-perceived stress and risks of childhood obesity and related behaviours (Baskind et al., 2019). Similarly, maternal stress is associated with children's overeating only among mothers with low social capital (Mandelbaum, 2020). Consequently, stress relief through parents' high social capital may have a positive effect on their children's weight status and eating habits.

Furthermore, interpersonal trust (a social capital factor) was also independently associated with norm of reciprocity and trust in organizations (additional social capital factors). Putnam defined social capital as 'features of social organization such as networks, norms, and social trust that facilitate coordination and cooperation for mutual benefit,' and suggested that the factors of social capital are not independent, but interact to form a society (Putnam, 1994). Therefore, when studying the relationship between health outcomes such as children's BMI and social capital, it is important to consider social capital comprehensively, including not only interpersonal trust but also the other factors.

In our study, children with poor BMI were likely to be older than those with normal BMI. According to the Ministry of Education in Japan, the prevalence of overweight increases with age in children from 5 to 10 years old (Ministry of Education. Sports, Science and Technology, 2020). Cunningham (2014) suggested that a component of the course to obesity is already established by the age of 5 years. Bodyweight and eating patterns during the period of 3 to 5 years may be strongly related to subsequent obesity risk (Woo Baidal & Taveras, 2012). Taken together, children's BMI is shown to be associated with age. In the present study, we found a statistically significant association between social capital and children's BMI, even after adjusting for children's age. Interventions to improve social capital may improve children's BMI, and eventually improve bodyweight prognosis.

Our results are consistent with another study that indicated the likelihood of smoking participation is negatively and significantly associated with social capital (Islam et al., 2017). Cognitive social capital facilitates trusting social relationships and thereby decreases the need to smoke to relieve stress and anxiety in social situations (Chaung & Chaung, 2008). In contrast, a previous study reported a significant association between individual social capital and alcohol consumption, although this relationship was not found in our study (Åslund & Nilsson, 2013). It is possible that people who have high social capital may be involved in various social occasions where alcoholic beverages are frequently served (Chuang & Chaung, 2008).

Our results are not entirely consistent with prior research that has demonstrated relationships between parental obesity

Table 2 Univariate and multivariate analysis of risk factors for children's poor BMI

Normal BMI group						
	Univariate analysis			Multivariate analysis		
	OR	95% CI	P value	OR	95% CI	P value
Child age (months)	0.98	0.95–1.0	.105	0.96	0.93–0.99	.009
Breakfast (consume everyday)	0.36	0.008–1.57	.173	0.36	0.08–1.68	.192
Parent's age (years)	0.95	0.91–1.00	.057	0.93	0.88–0.99	.037
Consume alcohol everyday	2.54	0.87–7.36	.087	2.61	0.83–8.16	.1
PSQI (no problem)	1.51	0.89–2.55	.125	–	–	–
Interpersonal trust (high)	2.07	1.10–3.89	.023	2.68	1.33–5.44	.006

BMI body mass index, *PSQI* Pittsburgh sleep quality index, *HL* health literacy

Table 3 Univariate and multivariate analysis of factors associated with the high interpersonal trust group

High interpersonal trust						
	Univariate analysis			Multivariate analysis		
	OR	95% CI	P-value	OR	95% CI	P-value
Child sex (girl)	0.69	0.42–1.11	.129	0.56	0.29–1.09	.087
Breakfast (consume everyday)	0.34	0.11–1.07	.065	–	–	–
Children IOTF (obesity)	0.29	0.11–0.81	.018	0.16	0.04–0.61	.007
Children IOTF (thinness)	0.67	0.31–1.43	.295	0.78	0.24–2.61	.693
Parent's age (years)	0.94	0.89–0.98	.006	–	–	–
Parent's smoking (non-smoker)	3	1.31–6.87	.009	3.01	1.07–8.44	.036
Marital status (married)	0.4	0.13–1.26	.116	–	–	–
Education (years)	0.77	0.66–0.90	.001	–	–	–
Household income (> 6 million Yen)	0.52	0.32–0.87	.011	–	–	–
Pittsburgh sleep scale score (normal range)	1.61	0.97–2.67	.062	–	–	–
HL group (high)	0.54	0.31–0.94	.03	0.5	0.23–1.10	.084
Norm of reciprocity	4.19	2.26–7.76	< .001	3.38	1.68–6.79	< .001
Trust in organization	1.25	1.13–1.37	< .001	1.24	1.09–1.42	.001

IOTF International obesity task force, *HL* health literacy

and child obesity or between parents' health literacy and their children's poor BMI (Nakamura et al., 2018). The reason for the nonexistence of these relationships in the present study may be that only one parent—father or mother—answered the questionnaires. We did not consider both parents, and the exclusion of one parent might have been a source of bias. Additionally, 93.8% of the participating parents were female in this study. In some previous studies, maternal obesity was not shown to be significantly associated with preschool children's obesity (Manios et al., 2010). For these reasons, the current study found few associations between parental and child obesity—or parents' health literacy—and their children's poor BMI. Therefore, parents' social capital may have a strong relationship with their children's obesity or thinness.

There are some limitations to this study. The present study was a cross-sectional study, and thus, we cannot determine the causality of various factors. Further, sampling bias may have occurred for the following reasons: Although this was a multicentre cohort study, we assessed one specific area (Chitose City in Japan), the sample size was small (32 overweight children and 40 thin children), and only 6.2% of the participating parents were male. For these reasons, the participants were divided into two groups (normal and poor BMI) instead of three or four groups (e.g., thinness, normal weight, overweight, obesity). As such, there is a need for further studies to assess additional BMI categories. Moreover, several definitions of social capital have been proposed, and they strongly depend on the background disciplines of the authors (Villalonga-Olives & Kawachi, 2015). In addition, activity, nutrition, and socioeconomic status, which might also be related to children's BMI and parent's social capital, were not considered in this study. It is important to compare across multiple countries to account for the impact of cultural differences on social capital. As a result, no unified measurement of social capital was established.

Conclusions

Overweight and thinness in preschool children are important public health problems, although thinness appears to be unique to Japan. Parents' high social capital was an independent predictor of the poor BMI of preschool children after adjustment for all other confounding factors. Therefore, a parent's social capital may be a predictor of the weight status of children. Future studies of more generally representative populations are needed to evaluate further the relationship between improvements in parental social capital and children's BMI.

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Declarations

Conflict of interest The authors declare no conflict of interest.

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