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Relationship between peer group size and active outdoor play in children aged 9–12 years

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Abstract Outdoor play during childhood is vital for physical, cognitive, and social development. Outdoor play is influenced by friends, though the relationship between outdoor play and the number of close friends is not clear. This study aimed to investigate the association between peer group size and outdoor play among children aged 9–12 years. This study was cross-sectional in design. We recruited fourth- to sixth-grade children from two public elementary schools. Outdoor play contents and duration on weekdays were collected via a questionnaire, and the total duration of outdoor play on five weekdays was calculated. We asked the children to nominate up to 10 of their closest friends. We calculated the peer group size as the total number of reciprocal closest friends for each child. A multivariate linear regression analysis was conducted to investigate the association between peer group size and outdoor play duration, adjusted for gender, grade, school, body mass index, sports club participation, and screen time. This study included 291 children (137 girls, mean age: 10.6 ± 1.0 years). The peer group size was associated with outdoor play duration after adjusting for confounding factors (β: 0.18, 95% CI: 0.07-0.30). This study revealed that children aged 9–12 years, with larger peer group size showed a significantly longer duration of outdoor play.

Keywords : child development, physical activity, social relationships, adolescence, play

Introduction

Currently, the number of children playing outdoors annually is decreasing worldwide[1,2]. Outdoor play is defined as "unstructured physical activities that occur outdoors during a child's free time"[3]. Daily physical activities during childhood encompass physical education classes, sports club participation, and outdoor play. Outdoor play accounts for the largest percentage of physical activities time during childhood[4]. Therefore, promoting outdoor play during childhood may encourage the healthy development of children. Previous studies show that gender[5], weight status[6,7], and organized sports[8] affect physical activities during childhood. Additionally, social networks and friendships are associated with physical activity[9-12]. Therefore, focusing on friendships is important for encouraging outdoor play.

Peer group is an indicator of friendship among children because children increase their interactions with peers and form peer groups as they develop into adolescents[13]. A peer group is defined as an individual's intimate group of peers who interact regularly[14]. Peer groups are important significant factors of motivation and achievement. For example, a previous study found that peer groups positively affect academic performance[15]. A review on the influence of peer groups on daily physical activities found that friends' physical activity levels appear to significantly influence individual physical activity levels[9]. Although previous studies evaluated objective physical activity levels, they could not distinguish conclusive data[9]. Unlike

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other physical activities (e.g., organized sports), outdoor play offers a choice between many physical activities in which children can participate[16]. Peer groups, which influence children's behavioral motivation, are considered to influence outdoor play. However, no study has clarified the relationship between peer groups and outdoor play.

This study aims to investigate the relationship between peer group size and outdoor play among children aged 9–12 years. After school, children spend most of their time outdoors with friends[17]. Outdoor play, which accounts for most physical activities after school, is considered influenced by peer groups[4].

Materials and Methods

Study population and design

The present study used a cross-sectional design. We recruited 312 fourth- to sixth-grade children from two public elementary schools in Kobe, Japan, in October 2020. Healthy children were included in the study, and children with missing data were excluded. We explained the study protocol to the children, principals, and teachers and obtained informed consent from the children and their parents. The research team made every effort to ensure free and informed consent and confidentiality, and the study protocol was approved by the Research Ethics Committee of Kobe University Graduate School of Health Science [approval number: 545-4].

Measures

1. Outdoor play

The frequency of outdoor play was measured using a self-report questionnaire. Outdoor play was defined as "unsupervised physical activity performed outside, in free time." First, the contents and duration of outdoor play for each day of the week were collected based on the following question: "What kind of outdoor play did you do after school on weekdays last week?" Next, the total duration of outdoor play on five weekdays was calculated[18,19]. This study does not evaluate the duration of outdoor play on weekends.

2. Peer group size

The peer group size was measured using a self-report questionnaire. We asked children to nominate up to 10 of their closest friends as their friendship group, described to children as "the friends you hang around with and talk to the most in your grade"[7]. Peer group size was calculated as the total number of reciprocal friends in each individual's friendship group. Reciprocal friends were defined as friends who nominated one another as a friend both individual and peer[20].

3. Confounding factors

We defined the two schools where this study was conducted as "School 1" and "School 2", respectively. Data on age, gender, grade, sports club participation, and screen time were collected using a self-report questionnaire. Height (cm) and weight (kg) were collected from the records of anthropometric measurements at the elementary schools. Body mass index (BMI) was calculated using participant height and weight (kg/m^2). The number of days the children participated in sports clubs was used for sports club participation scores. For screen time scores, participants were asked about their average daily usage time of phones (cell phone or smartphone), television (TV), tablets, and playing video games, using a nine-point Likert scale: "never," "about 30 minutes," "about 1 hour," "2 hours," "3 hours," "4 hours," "5 hours," "6 hours," and "at least 7 hours"[21]. In this study, the total screen time was calculated by summing the screen time of phones, TV, tablets, and video games.

Analysis

Data were presented as numbers (percentages) for categorical variables and as mean (standard deviation [SD]) for continuous variables. To assess the gender-specific difference in variables, we used, as appropriate, an unpaired *t*-test or the Mann–Whitney U test for continuous variables and the chi-square test for categorical variables. Univariate and multivariate linear regression analyses were used to investigate the association between peer group size and outdoor play duration. The following variables were used as confounding factors in an adjusted model: gender[5], grade, school affiliation, BMI[6,7], sports club participation[8], screen time. Standard partial regression coefficient (β), 95% confidence intervals (CI), and *p*-values (*p*) were calculated. The level of significance (*p*) was set to $p < 0.05$. Data were analyzed using the free software R 4.0.3 version[22].

Results

We recruited 312 children and excluded 21 children with missing data. Therefore, 291 children were included in the analysis.

Table 1 presents the characteristics of all participants by gender. No significant difference was observed between genders in all variables. The mean age of the participants was 10.6 ± 1.0 years. Children spent 2.1 ± 2.5 h/weekdays in outdoor play. Regarding the type of outdoor play, the most common response was tag (playground game) with 45.0% (n = 131), followed by soccer with 15.8% (n = 46). The mean peer group size was 3.9 ± 2.1.

Table 2 presents outdoor play contents and their frequency (%) during the weekdays.

Fig. 1 presents the distributions of outdoor play frequency and peer group size respectively.

Table 2 presents the results of univariate and multivariate linear regression analyses. In the univariate linear regression analysis, children with a large peer group size were significantly associated with outdoor play duration

Table 1. Characteristics of study population.

	Total *n* = 291 (%)	Girls *n* = 137 (%)	Boys *n* = 154 (%)	*p-value*
Age (years)	10.6 ± 1.0	10.6 ± 1.0	10.6 ± 1.1	0.65
Grade				0.92
4th	99 (34.0)	48 (35.0)	51 (33.1)	
5th	88 (30.2)	40 (29.1)	48 (31.2)	
6th	104 (35.7)	49 (35.8)	55 (35.7)	
School				0.74
1	116 (40.0)	56 (40.9)	60 (39.0)	
2	175 (60.1)	81 (59.1)	94 (61.0)	
BMI (kg/m^2)	17.8 ± 3.1	17.6 ± 2.8	18.0 ± 3.3	0.57
Peer group size	3.9 ± 2.1	4.0 ± 2.1	3.8 ± 2.1	0.45
Outdoor play time (h/weekdays)	2.1 (2.5)	1.8 (2.4)	2.3 (2.6)	0.031
Sports club participation				0.051
0	167 (57.4)	90 (65.7)	77 (50.0)	
1	77 (26.5)	31 (22.6)	46 (29.9)	
2	25 (8.6)	6 (4.4)	19 (12.3)	
3	10 (3.4)	4 (2.9)	6 (3.9)	
4	5 (1.7)	2 (1.5)	3 (1.9)	
5	7 (2.4)	4 (2.9)	3 (1.9)	
Screen time (h/day)	5.5 ± 3.8	5.2 ± 3.6	5.8 ± 4.0	0.28

Note: Data are presented as mean ± SD, *n* (%); BMI: body mass index; SD: standard deviation

(β: 0.20, 95% CI: 0.08-0.32). After adjustment for gender, grade, school affiliation, BMI, sports club participation, and screen time, children with a large peer group size showed significantly longer outdoor play duration (β: 0.18, 95% CI: 0.07-0.30).

Tables 4 and 5 present the results of the linear regression analyses by gender. Girls with a large peer group size showed significantly longer outdoor play duration in both univariate (β: 0.26, 95% CI: 0.10-0.43) and multivariate (β: 0.24, 95% CI: 0.07-0.41) linear regression analyses (Table 3). However, among boys, the positive association between peer group size and outdoor play duration was significant in univariate (β: 0.16, 95% CI: 0.00-0.32), but not multivariate (β: 0.12, 95% CI: −0.04-0.29) linear regression analysis (Table 4).

Discussion

This study investigated the association between peer group size and outdoor play among children aged 9–12 years. The results showed that children with a larger peer group spent significantly longer duration in outdoor play, even after adjusting for gender, grade, school affiliation, BMI, sports club participation, and screen time.

This study suggests that children's self-selected physical activities may be associated with their number of friends. Previous studies have reported a positive association between friendships and physical activities[9,23,24]. The findings of this study support those of previous studies. Children tend to imitate their friends' physical activities[23]. Moreover, the level of the physical activities of children are significantly correlated with the levels of their close friends[9]. We show that the most popular outdoor games among participants were tag and soccer, which require a large number of people. Above all, having a larger number of peers could drive children to engage in outdoor games, which requires a lot of participants.

Additionally, we examined the association after stratifying by gender. A significant positive association was observed between peer group size and outdoor play duration among girls. The result is consistent with that of a previous study, which reported that the presence of reciprocal friendships is positively associated with physical activities among adolescent girls[25]. Peer group size consisted of reciprocal nomination of friends in this study. Therefore, an association between peer group size and outdoor play duration was found among girls especially. In boys, the positive association between peer group size and out-

door play duration was significant in univariate analysis, but not significant in multivariate analysis. This is consistent with previous studies showing a positive association between the number of nominations from friends and organized physical activity, including sports clubs[24]. In this study, boys tended to participate in a sports club more than girls. This suggests that boys may spend more time in organized physical activity than outdoor play compared to girls. Therefore, the relationship between friendship indicators and physical activity differs between boys and girls according to the contents of the physical activity. However, as this study did not investigate details, further research is needed on the relationship between peer groups and type of outdoor play and organized physical activity.

Table 2. Contents of outdoor play.

Tag	131 (45.0)
Soccer	46 (15.8)
Volleyball	25 (8.6)
Dodgeball	19 (6.5)
Baseball	14 (4.8)
Swinging	12 (4.1)
Running	12 (4.1)
Basketball	11 (3.8)
Keidoro	10 (3.4)
Cycling	8 (2.7)
Four squares	8 (2.7)
Kick the can	7 (2.4)
Badminton	6 (2.1)
Tennis	6 (2.1)
Iron rod	6 (2.1)
Jump rope	6 (2.1)
Walking	5 (1.7)
Long jump rope	5 (1.7)
Hide and seek	4 (1.4)
Skateboard	4 (1.4)
Catch	2 (0.7)
Others	13 (4.5)

Note: Data are presented as *n* (%)

Previous studies have investigated the relationship between peer groups and the amount of physical activity (measured by accelerometers)[9,23]. However, accelerometer-based measurements cannot distinguish physical activity content. Friends' influence on children's behavior may vary depending on whether the activity is organized or unorganized (e.g., sports or outdoor play, respectively). Outdoor play is an outlet through which children can freely select their physical activity and tends to be conducted in large groups compared to indoor play (e.g., playing video games)[26]. This study suggests that large peer groups are associated with physical activity, especially outdoor play. However, as many friends may be needed for outdoor play, an inverse causal relationship should also be considered.

This study includes two strengths. First, we measured a peer group comprising up to 10 members. Several earlier studies have investigated the relationship between peers and physical activity. However, a best friend[27,28] or three or four close friends[29,30] were defined as peer groups. In reality, peer groups are conceptualized with an average of 4-6 members[13], and the average size of the peer group in this study was 3.9 members. Therefore, the present study assessed the characteristics of children's peer groups more adequately than previous studies. Second, we measured reciprocal friendships. Reciprocal friendships have

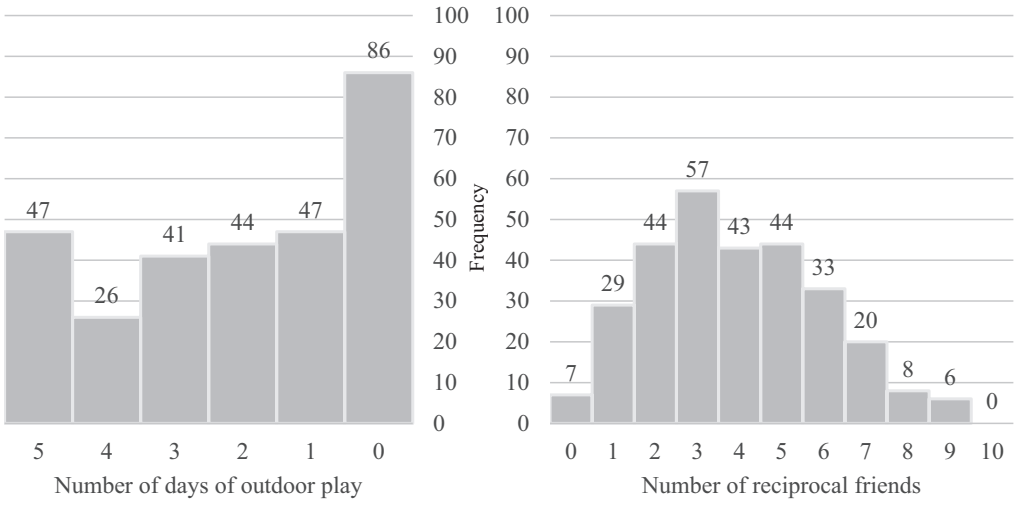

Fig. 1 Distributions of outdoor play frequency and peer group size

Table 3. Linear regression analysis of relationship between peer group size and outdoor play duration (n = 291).

	Univariate		Multivariate	
	β	95% CI	β	95% CI
Peer group size	0.20***	0.08-0.32	0.18**	0.07-0.30
Gender (ref. boys)			−0.11	−0.22-0.01
Grade			0.04	−0.07-0.16
School (ref. school 1)			−0.10	−0.21-0.02
BMI			−0.10	−0.22-0.02
Sports club participation			−0.02	−0.14-0.09
Screen time			0.10	−0.02-0.22

Note: **: $p < 0.01$; ***: $p < 0.001$; β: standardized partial regression coefficient; CI: confidential interval; BMI: body mass index

Table 4. Linear regression analysis of relationship between peer group size and outdoor play duration in girls (n = 137).

	Univariate		Multivariate	
	β	95% CI	β	95% CI
Peer group size	0.26**	0.10-0.43	0.24*	0.07-0.41
Grade			0.03	−0.14-0.20
School (ref. school 1)			0.00	−0.17-0.17
BMI			−0.12	−0.29-0.06
Sports club participation			−0.08	−0.25-0.09
Screen time			0.15	−0.02-0.33

Note: *: $p < 0.05$; **: $p < 0.01$; β: standardized partial regression coefficient; CI: confidential interval; BMI: body mass index

Table 5. Linear regression analysis of relationship between peer group size and outdoor play duration in boys (n = 154).

	Univariate		Multivariate	
	β	95% CI	β	95% CI
Peer group size	0.16*	0.00-0.32	0.12	−0.04-0.29
Grade			0.05	−0.11-0.21
School (ref. school 1)			−0.18*	−0.34-−0.02
BMI			−0.08	−0.24-0.09
Sports club participation			0.03	−0.13-0.19
Screen time			0.06	−0.11-0.22

Note: *: $p < 0.05$; β: standardized partial regression coefficient; CI: confidential interval; BMI: body mass index

a stronger influence on friends' behavior compared to unidirectional friendships[31]. The present study supports a previous study, in which only the number of reciprocal nominations received by friends was considered[32]. These two strengths enabled this study to assess friendships with higher quality than previous studies and demonstrate the relationship between friendships and outdoor play more accurately.

However, this study has several limitations. First, as this study used cross-sectional data, the causal relationship is unclear. There could be an inverse association in which participating in outdoor play leads to larger peer groups. Thus, longitudinal, simulation, and intervention studies are needed to investigate the association between peer group size and outdoor play. Second, this study was conducted in only two elementary schools. As outdoor play is affected by physical environmental factors[33], further studies should include children from multiple different locations for more robust results. Third, there are no standardized measurements of outdoor play, and the reliability and validity of the measurement method have not been demonstrated[3]. In addition, we investigated the duration of outdoor play on weekdays only, and did not evaluate the duration on weekends. A previous study found that 52.2% of children spent over an hour outdoors during the week, while 61.1% spent more than two hours outdoors on the weekends[34]. This suggests that our data may not accurately represent the time of children's outdoor play. Therefore, validated measurements for outdoor play (i.e., frequency, quantity, and content) are necessary, and validated measures of physical activity such as the International Physical Activity Questionnaire and the Physical Activity Questionnaire for Children should be included simultaneously. However, in the present study, the recall bias was minimized, as the contents of outdoor play on each day of the week were included with the number of days of outdoor play. Finally, in view of personal information protection, we could not collect information on factors such as family environment and parental support. Further studies should consider individual factors along with environmental factors.

Conclusion

This study revealed that peer group size was significantly associated with participation in outdoor play for children aged 9–12 years. The results suggest that encouraging children to interact with each other may promote their participation in outdoor play.

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Conflicts of Interest

There are no conflicts of interest to disclose.

Author Contributions

KT, RO, RG, YU and TS conceptualized and designed the study, drafted the initial manuscript, and reviewed and revised the manuscript. NY and KN designed the data collection instruments, collected data, conducted initial analyses, and reviewed and revised the manuscript. KU, KH, KS, HE, MT and MM conceptualized and designed the study, coordinated and supervised data collection, and critically reviewed the manuscript for important intellectual content. All authors approved the final manuscript as submitted and agreed to be accountable for all aspects of the work.

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