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Original Article

Association between self-reported empathy and sport experience in young adults

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Abstract:
Problem Statement Empathy, which consists of two components such as cognitive empathy and affective empathy, is an essential skill in humans that allows to create and maintain relationships with others. Although the usual physical activity amount positively correlates with cognitive empathy in healthy young adults, the effect of sport experience on empathy is unclear. *Purpose* This study aimed to clarify the relationship between sport experience (including type of sports and level of sport success) and self-reported empathy. *Approach* The participants were college students; there were 189 individual sport athletes and 187 team sport athletes who had over 6 years of sport experience and 128 non-athletes. Self-reported empathy and usual amounts of physical activity in subjects were evaluated using the Questionnaire of Cognitive and Affective Empathy and the International Physical Activity Questionnaire short form, respectively. In addition, their sport major and history of sport experiences were recorded. *Results* In this study, we determined that both individual sport and team sport athletes showed higher cognitive empathy than non-athletes, although affective empathy was not related to sport experience in the participants. In addition, there was no difference in self-reported empathy between individual sport athletes and team sport athletes. Furthermore, the level of sport success was not related to self-reported empathy in the athletes *Conclusion* Our results suggest that sport experience may contribute to attaining better empathy in humans regardless of type of sports and level of sport success, which implies the potential role of physical education and extracurricular activities in school on empathy in adolescents.
KeyWords:**Cognitive Empathy, Affective Empathy, Type of Sports, Physical Activity**

Introduction

Empathy is an essential ability in humans, which allows to notice emotions and to create and maintain relationships with others (Decety & Jackson, 2004; Preston & de Waal, 2002).Becauseimpaired empathy is associated with aggressive behavior in humans (Gandhi et al., 2017; Winter et al., 2017), an increase in harassmentvictimization issues occurs owing to empathy deficiency in humans (Jussen et al., 2019; Moore & Mennicke, 2020). Therefore, innovating strategies for treating empathy contribute to a decrease in harassmentvictimization issues and better quality of life in humans.

Human empathy consists of two components such as cognitive empathy and affective empathy (de Waal, 2008; Preston & de Waal, 2002; Shamay-Tsoory, 2011). Cognitive empathy is related to perspective-taking, which is an importantability for noticing the emotional states of others (Healey & Grossman, 2018). The persons with higher cognitive empathycan assess situations and feelings from others' perspective;thus,such peoplehave a more objective and rational perspective and empathic behavior compared to those with lower cognitive empathy(Green et al., 2018). Affective empathy, which is another component of empathy related to emotional contagion, is an important ability to synchronize the feelings of others without any direct emotional stimulation to oneself(Healey & Grossman, 2018). Higher affective empathy is related to an increase in prosocial behavior (Van Lissa et al., 2017). To innovate strategies for treating empathy, these component differences should be considered.

As a strategy for treating empathy, sports activity is expected.Previous studies have reported that sports activity has positive effects on social competence (Bedard et al., 2020; Laberge et al., 2012; Stein et al., 2007) and personality (Steca et al., 2018; Wilson & Dishman, 2015).In addition, recent studies have proposed that physical activity enhances empathic behavior and empathy-related neuronal system(Sadeghi Bahmani et al., 2020; Xu et al., 2019, 2020; Yüksel et al., 2019);physical activity is a possible therapeutic strategy for disrupted empathic ability in people with multiple sclerosis (Sadeghi Bahmani et al., 2020). Furthermore, lack of physical activity leads to bullying in adolescents (Arufe-Giráldez et al., 2019).Recently, we have determined that physical activity contributes to maintaining better cognitive empathy in healthy young adults(Shima et al., 2021); cognitive empathy in humans isaffected by physical activity. an increase in physical activity and/or sports activity is a potential strategy for treating empathy, especially cognitive empathy.

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To date, previous studies have reported differences in human personality by sport type such as individual and team sports. For example, anxiety and depressive behavior are less prevalent in team sport athletes compared to individual sport athletes(Nixdorf et al., 2016; Pluhar et al., 2019).In addition, individualsport athletes show higherautonomyand lower sociotropycompared to team sport athletes(Nia & Besharat, 2010). Furthermore, there is differencein personality dimension of the Big Five; individual-sport athletes exhibit higher conscientiousness and aremore energetic and open than team-sport athletes, and team-sport athletes exhibit higher agreeableness(Nia & Besharat, 2010; Steca et al., 2018). In addition, Steca *et al*. refer to the difference of the Big Five; high-level athletes exhibit higher agreeableness, conscientiousness, and emotional stability than low-level athletes. However, it is unclear whether sport experience, including effects by sport type and level of sport success, affects empathy in healthy young adults.

Accordingly, we aimed to clarify the relationship between sport experience and self-reported empathy using the Questionnaire of Cognitive and Affective Empathy (QCAE) (Reniers et al., 2011).

Material & methods

Participants

The participants were college students; 189 individual sport athletes (18.8 ± 0.8 years [range 18-22 years]; 110 males and 79 females) and 187 team sport athletes (18.8 ± 0.7 years [range 18-22 years]; 161 males and 26 females) with over 6 years of sport experience, and 128 non-athletes (18.8 ± 1.2 years [range 18-28 years]; 37 males and 91 females) were enrolled in this study.All participants did not have history of neurological, psychiatric or respiratory disorders, diabetes, anemia, or other medical problem. They were willing to participate in this study after being explained the procedures. Table 1 shows the frequency of sport major in individual and team sport athletes. The participants answered theInternational Physical Activity Questionnaire short form(IPAQ-SF), the QCAE, and history of sport experiences; then, the results were cross-sectionally analyzed. This study was approved by the Gunma University Ethical Review Board for Medical Research Involving Human Subjects (ethical number: HS2019-304).

Table 1 Frequency of sport majors in each group

Sport major	Individual sports athletes (n = 189)		Team sports athletes (n = 187)	
	Low-level athletes (n = 134)	High-level athletes (n = 55)	Low-level athletes (n = 157)	High-level athletes (n = 30)
Swimming (n = 43)	37	6	-	-
Tennis (n = 32)	25	7	-	-
Track and field (n = 30)	18	12	-	-
Kendo (n = 18)	11	7	-	-
Table tennis (n = 13)	12	1	-	-
Badminton (n = 12)	10	2	-	-
Dance (n = 9)	6	3	-	-
Karate (n =9)	4	5	-	-
Ski (n = 6)	5	1	-	-
Judo (n = 5)	3	2	-	-
Kyudo (n = 3)	1	2	-	-
Rhythmic gymnastics (n = 3)	1	2	-	-
Gymnastics (n = 2)	1	1	-	-
Skating (n = 1)	0	1	-	-
Kyogi-Karuta (n = 1)	0	1	-	-
Motorsports (n = 1)	0	1	-	-
ShorinjiKempo (n = 1)	0	1	-	-
Soccer (n = 70)	-	-	64	6
Basketball (n = 46)	-	-	41	5
Baseball (n = 45)	-	-	40	5
Volleyball (n = 17)	-	-	9	8
Softball (n = 2)	-	-	2	0
Handball (n = 2)	-	-	0	2
Hockey (n = 2)	-	-	0	2
Water polo (n = 2)	-	-	1	1
Rugby (n = 1)	-	-	0	1

The data are presented as N

Measurements

The participants answered questions regarding their characteristics (including age and gender) and sport major (including term of experience and level of sport success). Athletes competing at prefecture levels were categorized as low-level athletes, and athletes competing at regional, national, and international levels were categorized as high-level athletes.

The measurements of self-reported scores of cognitive empathy and affective empathy in participants were performed using the QCAE (Reniers et al., 2011) (https://sites.google.com/site/okadaxakihiro/, in Japanese), which consisted of 31 items. Theparticipants answered on a 5-point Likert scale ranging from 1: strongly disagree to 5: strongly agree. Higher scores in QCAE for each component indicate higher empathy in the individuals.

The IPAQ-SF (Craig et al., 2003; Murase et al., 2002)was used to measure self-administered amounts of walking, moderate-intensity and vigorous-intensity activities, and sitting time in the participant. Moderate activities refer to activities that make people breathe somewhat harder than normal, and vigorous physical activities refer to activities that make people breathe much harder than normal. The amount of physical activity (MET-minutes/week) were calculated for each participant according to the follows.

- Walking: MET-minutes/week = 3.3 × walking minutes × walking days
- Moderate: MET-minutes/week = 4.0 × moderate-intensity activity minutes × moderate days
- Vigorous: MET-minutes/week = 8.0 × vigorous-intensity activity minutes × vigorous-intensity days
- Total physical activity: MET-minutes/week = sum of Walking + Moderate + Vigorous MET-minutes/week.

Statistical analysis

The data were analyzed using IBM SPSS Statistics version 26.0. (SPSS Inc., Chicago, IL). Comparison betweenindividual sport athletes, team sport athletes, and non-athletes was conducted using the Chi-square test, one-way ANOVA, or ANCOVA. The differencesinself-administered amounts of physical activity were analyzed by ANCOVA with age and gender as covariates followed by Fisher's least significant difference post-hoc test. The differences in self-reported empathy score were analyzed by ANCOVA with age, gender, months of sport experience, and MET-minutes/week of total physical activity as covariates followed by Fisher's least significant difference post-hoc test. Comparison betweenlow-andhigh-levelsport athleteswasconducted by ANCOVAwith age, gender, months of sport experience, and MET-minutes/week of total physical activity as covariates. Correlations were analyzed by partial correlation adjusted for age and gender.Because gender and age relate to individual empathy (Grühn et al., 2008; Toccaceli et al., 2018; Van der Graaff et al., 2014, 2018), the data on sex and age as variables were included in ANCOVA and correlation analysis. The statistical significance was set at $p< 0.05$.

Results

Table 2 shows the characteristics of patients in non-athlete, individual and team sport athlete groups. There was difference in gender ratio among non-athletes, individual sport athletes, and team sport athletes (X^2 = 105.654, df = 2, $p< 0.001$), but not in age ($F_{(2, 501)} = 0.054$, $p = 0.947$).The total amount of physical activityin both individual and team sport athlete groups wassignificantly highercompared to that in the non-athlete group ($F_{(2, 499)}$ =6.628, $p = 0.001$; non-athletes vs. individual sport athletes, $p< 0.05$; non-athletes vs. team sport athletes, $p< 0.001$).Both athlete groups also exhibited a significantly higher amount of vigorous-intensity activities compared to the non-athlete group ($F_{(2, 499)} = 11.034$, $p< 0.001$; non-athletes vs. individual sport athletes, $p< 0.01$; non-athletes vs. team sport athletes, $p< 0.001$). Only team athlete groupparticipants showed a significantly higher amount of moderate-intensity activities ($F_{(2,499)}$ =3.576, $p = 0.029$; non-athletes vs. team sport athletes, $p< 0.01$), and shorter sitting time than those in the non-athlete group ($F_{(2, 499)}$ =, $p = 0.023$; non-athletes vs. team sport athletes, $p< 0.01$). Amount of walking was not differences between the three groups ($F_{(2, 499)} = 1.312$, $p = 0.270$).

Table 2 Characteristics of participants among non-athletes, individual sport athletes, and team sport athletes

	Non-athletes	Individual sport athletes	Team sport athletes	*p*
n (%)	128 (25.4)	189 (37.5)	187 (37.1)	-
Age	18.8 ± 1.2	18.8 ± 0.8	18.8 ± 0.7	0.947[a]
Gender	37/91	110/79	161/26	< 0.001[b]
Athletic level (low/high)	-	134/55	157/30	-
Months of sport experience	-	97.1 ± 28.4	106.0 ± 28.4	-
MET-minutes/week				
Total activity	1172.8 ± 1735.1	1760.6 ± 2179.9[*]	2310.8 ± 3005.9[***]	0.001[c]
Vigorous activity	231.0 ± 640.3	922.2 ± 1577.2[**]	1334.1 ± 1921.4[***]	< 0.001[c]
Moderate activity	252.8 ± 522.9	384.7 ± 605.3	454.4 ± 962.3[**]	0.029[c]
Walking	678.1 ± 1193.8	455.7 ± 832.9	527.7 ± 1002.9	0.270[c]
Sitting Time	569.5 ± 381.4	516.2 ± 246.3	454.1 ± 239.1[**]	0.023[c]

The data are presented as mean ± SD or N. [*] $p < 0.05$, [**] $p < 0.01$, [***] $p < 0.001$ vs. Non-athlete. [a] one-way ANOVA, [b] Chi-square test, [c] ANCOVA with age and gender as covariates(Fisher's least significant difference post-hoc test)

The total amount of physical activity indicated a significant positive correlation with cognitive empathy score adjusted for age and gender (Fig. 1A: $r = 0.096$, $p = 0.032$), but not with affective empathy (Fig. 1B: $r = 0.053$, $p = 0.234$).

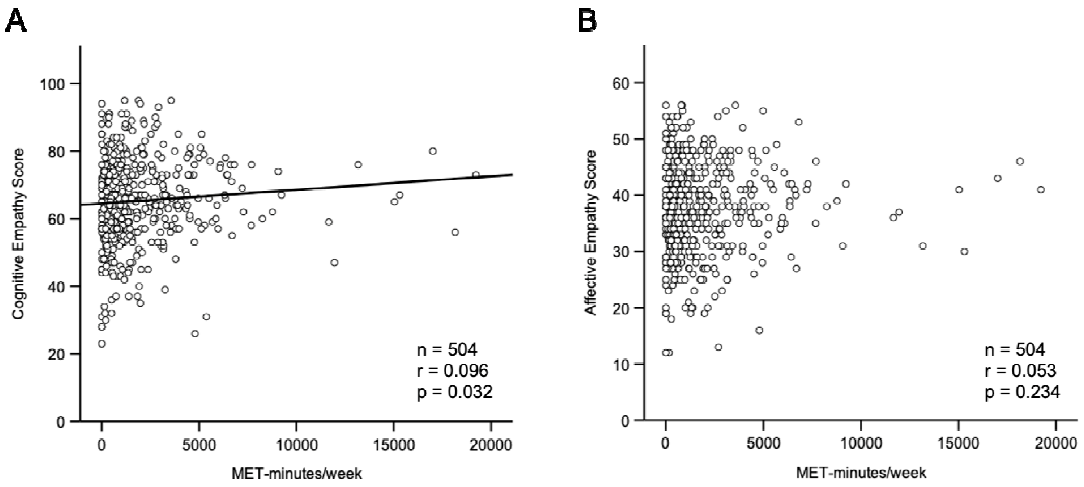

Fig. 1 Correlation between the amount of usual physical activity and self-reported cognitive empathy (A) and affective empathy (B) after controlling for gender. The line in the scatter diagram indicates significance.

Both individual sport and team sport athletes exhibit higher cognitive empathy scoreadjusted for age, gender, months of sport experience and total amount of physical activity (Fig. 2A: $F_{(2, 497)} = 3.280$, $p = 0.038$; non-athletes vs. individual sport athletes, $p < 0.05$; non-athletes vs. team sport athletes, $p < 0.05$), although there was no difference in affective empathy score (Fig. 2B: $F_{(2, 497)} = 0.104$, $p = 0.901$).

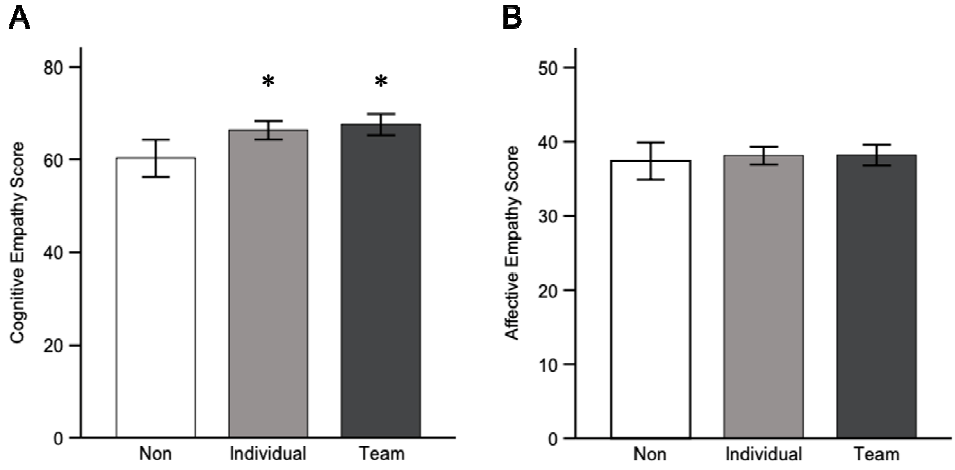

Fig. 2 Effect of sports experience on self-reported cognitive empathy (A) and affective empathy (B) in young adults (mean±95% confidence interval). White bars, non-athletes (n = 128); gray bars, individual sport athletes (n = 189); black bars, team sport athletes (n = 187).

The data were analyzed by ANCOVA with age, gender, months of sport experience and MET-minutes/week of total activity as covariates. $^{*}p < 0.05$ vs.non-athletes (Fisher's least significant difference post-hoc test)

When comparing low- and high-level of sport success groups, there was no alternation of self-reported empathy adjusted for age, gender, months of sport experience, and total amount of physical activity in either individual sport or team sport athletes (Fig. 3A: cognitive empathy in individual sport athletes, $F_{(1, 183)} = 0.325$, $p = 0.570$; Fig. 3B: affective empathy in individual sport athletes, $F_{(1, 183)} = 0.123$, $p = 0.726$; Fig. 3C: cognitive empathy in team sport athletes, $F_{(1, 181)} = 0.737$, $p = 0.392$; Fig. 3D: affective empathy in team sport athletes, $F_{(1, 181)} = 0.119$, $p = 0.0.730$).

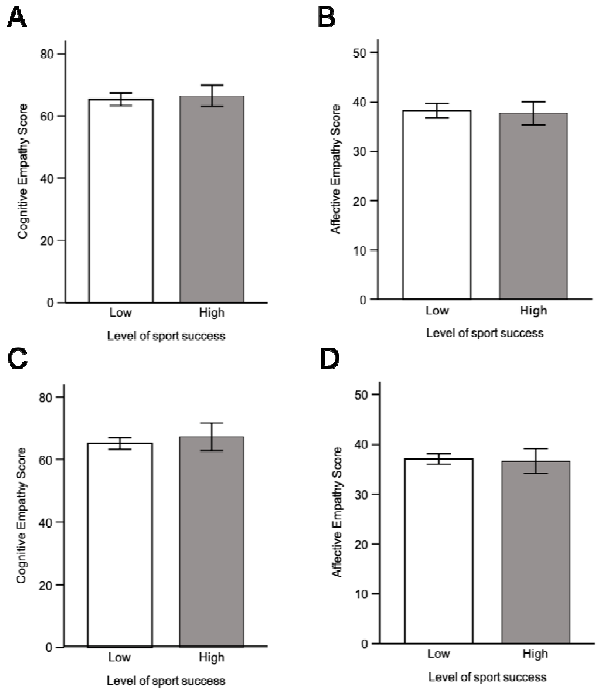

Fig. 3 Comparison of self-reported cognitive and affective empathy between low-level and high-level of sport success in individual sport athletes (A, B) and team sport athletes (C, D) (mean±95% confidence interval). White bars, low-level athletes; gray bars, high-level athletes. Low-level individual sport athletes (n = 134), high-level individual sport athletes (n = 55), low-level team sport athletes (n = 157), high-level team sport athletes (n = 30). The data were analyzed by ANCOVA with age, gender, months of sport experience, and MET-minutes/week of total activity as covariates.

Discussion

This study determined that both individual sport and team sport athletes showed higher cognitive empathy compared to non-athletes, although there was no difference in affective empathy associated withsport experience in the participants.There was no significant difference between individual sport and team sport athletes, and the level of sport success was not related to self-reported empathy in the athletes.

Similar to a previous study(Shima et al., 2021), the cognitive empathy score in our participants indicated a significant positive correlation with the amount of normal physical activity (Fig. 1A). Our results imply that the positive relationship between physical activity levels and cognitive empathyis promising, and physical activity contributes to keeping better cognitive empathy in humans.

Interestingly, we also determined that both individual sport and team sport athletes exhibit higher cognitive empathy score measured by QCAE (Fig. 2A). Although individual sport and teamsport differently affect human personality (Nia & Besharat, 2010; Nixdorf et al., 2016; Pluhar et al., 2019; Steca et al., 2018),theeffectsofsportexperienceonempathywere similarbetweenindividualsportandteamsport.It is possible that the amount of physical activity through sportactivities helps to change cognitive empathy in humans. In fact, our data showed no difference in the amounts of normal physical activity between individual sport and team sport athletes (Table 2) and a positive correlation between physical activity levels and cognitive empathy (Fig. 1A). Thus, there may be no difference in cognitive empathy by sport type, which may indicate the potentialeffect of sport activities, includingphysical education and extracurricular activities in school, on cognitive empathy.

Affective empathy did not differwith sport experience (Fig. 1B and 2B). These results are similar to those in a previous report (Shima et al., 2021), which suggest that cognitive empathy is more responsive to sport activities than affective empathy in humans.In contrast to our findings, an earlier study hasreported that regular exercise in healthy mice enhanced their helping behavior (Yüksel et al., 2019), which reflects affective empathy (De Waal & Preston, 2017). Thus, we should investigate the intervention effects of sport activity on human empathy in a future study.

This study demonstratedthat both cognitive and affective empathy were not affected by the level of sport success. A previousstudy has reported that high empathic ability can possibly impair athletic performance(Astokorki et al., 2020). It was expected that high-level athletes have lower empathy compared to low-level athletes.However, there is no difference in cognitive and affective empathy between low- and high-

level athletes (Fig.3A–D). These results led us to speculate that high-level athletes have great regulation of empathy to optimize athletic performance in competition; thus, this should be investigated in more detail.

There are several limitations in this study. First, we assessed only self-reported empathy using a questionnaire, but did not evaluate empathic behavioral outcomes in the participants; this should be investigatedin a future study. Second, this study did not assess peer relationship, which may be a confounding factor of empathy (Boele et al., 2019). Sport activities involve creating and maintainingpeer relationship; thus, further studies are needed.In addition,environment at home and education are also confounding factors of empathy(Boele et al., 2019; Hojat et al., 2009);we need in-depth studies to consider the involvement of such possible confounding factors. Finally, this studyincludedparticipantswith diverse sport major;thus, it is also necessary to perform a studywith a limited number of sport majors.

Conclusions

Wedeterminedthat both individual sport and team sport athletes showed higher cognitive empathy compared to non-athletes, although there was no difference in affective empathy. The level of sport success was not related to the difference in self-reported empathy in the athletes. Our results suggest that sport experience may contribute to growing better empathy in humans, regardless of sport type and level of sport success. Furthermore, the obtained results indicate a potential role of physical education and extracurricular activitiesin school on empathy in adolescents.

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Conflicts of interest

The authors certify that there is no conflict of interest with any financial organization regarding the material discussed in this manuscript.

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