



Physical activity, weight status and psychological well-being among a large national sample of South Korean adolescents



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ABSTRACT

This study examined associations between physical activity (PA), weight status, and psychological well-being (PWB) among South Korean adolescents. Pooled data from a total of 370,568 adolescents (M age = 15.05 years) who participated in the Korea Youth Risk Behavior web-based Surveys 2009–2013 were included in the analyses. Multiple logistic regressions were performed after adjusting for age, gender, region, economic status, and maturity. Though we found that overweight, compared to normal weight, was adversely associated with low/no stress ($OR = 0.91$, $95\%CI = 0.88–0.94$), engaging in PA at least once/week compared to none, regardless of weight status, was favorably associated with happiness (underweight: $OR = 1.53$, $95\%CI = 1.18–1.98$; normal weight: $OR = 1.41$, $95\%CI = 1.28–1.54$; overweight: $OR = 1.51$, $95\%CI = 1.22–1.87$) and low/no stress (underweight: $OR = 1.26$, $95\%CI = 1.12–1.41$; normal weight: $OR = 1.35$, $95\%CI = 1.30–1.41$ in normal weight; overweight: $OR = 1.28$, $95\%CI = 1.16–1.40$). Furthermore, after adjusting for covariates and weight status, a day increase in weekly vigorous PA was associated with higher likelihoods of reporting happiness ($OR = 1.16$, $95\%CI = 1.15–1.17$) and low/no stress ($OR = 1.09$, $95\%CI = 1.09–1.10$) (p -trend < 0.001). Similarly, a 1-day increase in strengthening exercise was associated with happiness ($OR = 1.06$, $95\%CI = 1.05–1.06$) and low/no stress ($OR = 1.05$, $95\%CI = 1.05–1.06$) (p -trend < 0.001). The observed patterns of the relationships suggest that PA participation, even for a minimum amount, may be beneficial to PWB. Also, PA may negate the association between overweight status and PWB among adolescents.

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Poor mental health among adolescents is a substantial public health concern in developed countries (Biddle & Asare, 2011). It is estimated that 20% of adolescents worldwide experience mental health problems, most commonly depression and anxiety, and suicide is a leading cause of mortality among adolescents in some countries (World Health Organization, 2003). Because adolescence is a transitioning period connecting childhood and adulthood, accompanied by remarkable changes in hormones, physique, and

psychosocial aspects, adolescence is a vulnerable period for several mental health issues (Oldehinkel, Verhulst, & Ormel, 2011). However, it is often difficult to detect psychological dysfunction in young people due to several reasons including the poor awareness of mental health and the related social stigma (Jamison, 2006).

Psychological well-being (PWB), which includes positive aspects of psychological functioning (Ryff & Singer, 1996), is conceptualised as a complex, multifaceted construct that covers both emotional functioning and satisfaction (Diener, Sandvik, & Pavot, 1991; Gauvin & Spence, 1996). These may include having positive affect, enjoyment, high levels of self-esteem, capacity to deal with daily stresses, happiness, and life satisfaction (Guavin & Spence, 1996). Because PWB encompasses a broader spectrum of psychological functioning than mental health, examining the presence of wellness as opposed to absence of illness may better capture psychological states and provide more enriched and meaningful information (Parfitt & Eston, 2005).

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Deteriorating PWB is apparent among contemporary South Korean adolescents (Korea thereafter). Specifically, young Koreans consistently score the lowest in happiness compared to their peers in 22 other countries registered in the Organization for Economic Co-operation and Development (OECD) (Yun, 2014). In a study comparing leisure preferences and PWB among adolescents from three East Asian countries, Korean adolescents reported the lowest in happiness and life satisfaction than their Chinese and Japanese counterparts (Lee, Yi, Walker, & Spence, 2016). Furthermore, in a representative sample of Korean adolescents, more than half reported that they have suicidal thoughts because of poor academic performance and pressure that comes with it (Korea Statistical Information Service, 2013). These statistics are alarming because poor PWB may predispose young people to a variety of psychological and social problems such as depression and maladaptive relationships with others (Park, 2004).

Participating in physical activity (PA) on a regular basis is known to be associated with health and overall well-being among young people (Parfitt & Eston, 2005; Poitras et al., 2016). However, compared to the amount of literature examining the associations between PA and physical health, studies examining PA with PWB is limited. Also, most available studies involve small sample sizes, female participants only, or are of low quality (Poitras et al., 2016). In addition, the vast majority of research is performed in Western countries which limits our ability to confirm and generalise the potential benefit of PA on in the global community. Furthermore, only a few studies examined and found positive associations between PA and PWB after adjusting for weight status (Kantomaa, Tammelin, Ebeling, & Taanila, 2008; Lu et al., 2012). Given the separate bidirectional relationships between weight status and PWB (Braet, Mervielde, & Vandereycken, 1997; Williams, Wake, Hesketh, Maher, & Waters, 2005), and weight status and PA (Biddle & Asare, 2011; Hills, Andersen, & Byrne, 2011), weight status should be taken into consideration when examining associations between PA and PWB.

Therefore, this study examined cross-sectional associations between PA, weight status (i.e., underweight, normal weight, and overweight), and PWB, namely happiness and stress, in 370,568 Korean adolescents using pooled data from national surveys. We hypothesized that PA would be favorably while weight status would be adversely associated with happiness and low/no stress. In addition, regularly participating in PA would be positively associated with PWB regardless of weight status.

1. Methods

1.1. Study participants

Data from Korea Youth Risk Behavior Web-based Surveys (KYRBS) collected between 2009 and 2013 were used for the analyses. The KYRBS is an annual, cross-sectional, nationwide school-based web survey that monitors health risk behavior among Korean adolescents in grades 7–12 (aged 13–18 years). The survey was developed by the Korea Centers for Disease Control and Prevention (KCDC) in collaboration with the Ministry of Education, and the Ministry of Health and Welfare (Ministry of Education, Ministry of Health and Welfare, & KCDC, 2013). It employs a multi-stage cluster sampling design to obtain a nationally representative sample of Korean adolescents (Kim et al., 2016). Survey procedures were designed to protect students' privacy by allowing for anonymous and voluntary participation. Before survey administration, consent was obtained from the participating school boards, individual schools, teachers, and parents. Students completed a self-administered 129-item questionnaire developed by selected committee members with expertise in the related field of study

(Ministry of Education, Ministry of Health and Welfare, & KCDC, 2013). All surveys included a set of core questions, and additional questions to obtain more information on specific issues. The core information included demographic background (e.g., age, gender), risk behaviors (i.e., smoking, alcohol use, diet, PA) and health outcomes (i.e., self-rated health, or health, obesity). A total of 370,568 Korean students participating over the five-year period (response rate: 95.5%–97.7%) were included in the analyses. The study protocol was approved by the Centers for Disease Control and Prevention Review Board. Detailed information regarding the survey methodology is published elsewhere (Kim et al., 2016).

1.2. Measures

Physical activity (PA). PA refers to “any bodily movement produced by skeletal muscles that results in energy expenditure (Caspersen, Powell, & Christenson, 1985).” Leisure-time PA was assessed using questions translated from the Youth Risk Behavior Surveillance System (YRBSS) questionnaire (available at <http://www.cdc.gov/HealthyYouth/yrbs/index.htm>). Validity against accelerometry (moderate PA: sensitivity = 0.19–0.23; specificity = 0.74–0.92; vigorous PA: sensitivity = 0.72–0.92, specificity = 0.23–0.26) and test-retest reliability ($r = 0.46$ – 0.51) of the scale were previously reported (Brenner, Collins, Kann, Warren, & Williams, 1995; Troped et al., 2007). Specifically, participants were asked the following two questions: “On how many of the past seven days: (1) did you engage in vigorous-intensity physical activity (VPA) (e.g., jogging, soccer, Taekwondo, mountain climbing, bicycling, swimming, and moving heavy objects) for more than 20 min; (2) did you do engage in strengthening exercises (SE) (e.g., push ups, sit-ups or weight lifting)?” Responses were scaled from 1 (non-participation) to 6 (≥ 5 day/week).

Weight status. Body mass index (BMI; kg/m^2) was calculated using self-reported height and weight which was then classified into three groups based on the 2007 Growth Charts for Korean children and adolescents (Moon et al., 2008): 1) < 5th percentile (underweight; boys: < 15.35–17.80 kg/m^2 ; girls: < 15.20–17.68 kg/m^2); 2) 5th – 85th percentile (normal weight; boys: < 23.32–25.08 kg/m^2 ; girls: < 22.22–23.99 kg/m^2); 3) \geq 85th percentile (overweight; boys: \geq 23.32–25.08 kg/m^2 ; girls: \geq 22.22–23.99 kg/m^2). Acceptable validity of self-reported height and weight of KYRBS database has been provided—69% sensitivity, 100% specificity, and kappa score of 0.8 (Bae et al., 2010).

Psychological well-being (PWB). Measures of happiness and stress were used to indicate PWB. Happiness refers to a mental or emotional state of well-being defined by positive or pleasant emotions about one's overall well-being (Argyle & Martin, 1991). Stress refers to a state of mental or emotional strain or tension resulting from adverse or demanding circumstances (Hawker, 2007). Happiness was measured using a single item asking respondents to rate how happy they are on regular days. Response options were scaled from 1 (very unhappy) to 5 (very happy). Similarly, stress was measured by asking respondents to report how often they feel stressed on regular days with response options ranging from 1 (not at all) to 5 (very often). Acceptable validity and reliability of these measures were reported previously (Kim et al., 2016). Stress scores were recoded such that high scores reflect positive mental health and low scores reflect low PWB, which is consistent with the happiness scale. Dichotomous variables were developed for the two PWB indicators based on the mid-point of the scale (i.e., positive state vs. neutral/non-positive state).

Covariates. Covariates included age, gender, region, economic status, and sexual maturity. Region was divided into urban (Seoul, Incheon metropolitan cities, and Gyeonggi province) and rural areas. Economic status was determined based on perceived

household economic status. The response categories were highest, high, middle, low, and lowest. Evidence suggests that controlling for individual variations in sexual maturity is important in the research of adolescent health (Cumming et al., 2012). Therefore, the year of menarche for girls and the year of semenarche for boys were used as indicators of sexual maturity.

1.3. Statistical analysis

The population weights provided for the KYRBS were applied in all analyses (Kim et al., 2016). Descriptive statistics were calculated to estimate means and standard errors, or percentages. Unadjusted and adjusted binomial logistic regression analyses were conducted to generate prevalence odds ratios (OR) with 95% confidence intervals (95%CI) for PA frequency associated with PWB. Exposure variables included VPA and SE, criterion variables included happiness and stress, and covariates included age, gender, region, economic status, and sexual maturity. Because of the large sample included in this study, all statistical inferences were based on a significance level of p (one-sided) < 0.001 and effect sizes are presented. Specifically, ORs of 1.68, 3.48, and 6.71 are considered as equivalent to Cohen's d scores of 0.2 (small effect), 0.5 (medium effect), and 0.8 (large effect) (Chen, Cohen, & Chen, 2010).

A p -value for a linear trend was also calculated to determine if a dose-response association existed between the ordered categories of a predictor variable, i.e. PA frequency, and PWB (p -trend < 0.001). All analyses were conducted using *Complex Samples Procedures* in IBM SPSS 21.0.

2. Results

The sample characteristics are shown in Table 1. Of the eligible 370,568 adolescents, the mean age was 15.05 ± 0.01 (15.06 ± 0.02 in boys vs. 14.03 ± 0.02 in girls). The proportions of students who participated in VPA and SE for ≥ 5 day/week were 12.9% (19.2% in boys vs. 5.8% in girls), and 8.3% (12.8% in boys vs. 3.3% in girls) respectively. The prevalence of overweight was 12.5% (13.9% in boys vs. 11.1% in girls). Proportions of participants feeling happy and reporting low or no stress were 55.7% (58.8% in boys vs. 52.6% in girls), and 16.3% (20.4% in boys vs. 11.7% in girls) respectively.

To examine associations between weight status and PWB, we estimated the relative odds of reporting happiness and low/no stress across three weight groups after adjusting for PA and other covariates (Table 2). Underweight adolescents were more likely to feel happy (OR = 1.05, 95%CI = 1.02–1.08) and less/not stressed (OR = 1.08, 95%CI = 1.04–1.12) compared to their normal weight counterparts. Conversely, overweight adolescents were less likely to be less/not stressed (OR = 0.91, 95%CI = 0.88–0.94) compared to their normal weight counterparts.

Table 3 shows the associations between PA and PWB by weight status. In all weight status categories, those who participate in VPA at least once/week were more likely to be happy (underweight: OR = 1.53, 95%CI = 1.18–1.98; normal weight: OR = 1.41, 95%CI = 1.28–1.54; overweight: OR = 1.51, 95%CI = 1.22–1.87) and less/not stressed (underweight: OR = 1.26, 95%CI = 1.12–1.41; normal weight: OR = 1.35, 95%CI = 1.30–1.41; overweight: OR = 1.28, 95%CI = 1.16–1.40) compared to those who did not participate in any types of PA.

Table 4 shows the associations of VPA and SE with PWB before and after adjusting for covariates and weight status. Compared to no participation in VPA, a 1-day increase in more than 20 min of VPA per week was associated with incrementally higher odds of reporting happiness (OR = 1.16, 95%CI = 1.15–1.17; p -trend < 0.001) and low/no stress (OR = 1.09, 95%CI = 1.09–1.10; p -trend < 0.001) even after adjusting for covariates and weight status. These dose

dependent patterns were also observed on the associations between SE and PWB. Specifically, compared to non-participation in SE, a 1-day increase in SE participation per week was associated with incrementally higher odds of reporting happiness (OR = 1.06, 95%CI = 1.05, 1.06) and low/no stress (OR = 1.05, 95%CI = 1.05, 1.06).

3. Discussion

This study examined the cross-sectional associations between PA, weight status, and PWB in a large, representative sample of Korean adolescents. Though the associations between weight status and PWB varied by weight groups and tended to be small, PA was consistently and favorably associated with happiness and low/no stress in all weight groups after adjusting for covariates. Furthermore, PA was favorably associated with happiness and low/no stress in a dose dependent manner after further adjusting for weight status. Specifically, though the associations were generally small, participating in PA more frequently, compared to non-participation, was associated with feeling happy and low/no stress. Since most existing cross-sectional and longitudinal studies focused on examining negative psychological states, such as depressed symptoms (Goldfield et al., 2011; Johnson et al., 2008; Toseeb et al., 2014) or depression (Wiles, Hasse, Lawlor, Ness, & Lewis, 2012), our findings suggest the importance of PA for positive aspects of PWB.

As expected, overweight adolescents, compared to their normal weight counterparts, were less likely to be happy and more likely to feel stressed. However, participating in any type of PA at least once per week was associated with higher odds of reporting happiness and less/no stress in all three weight groups (i.e., underweight, normal weight, and overweight). These results suggest that overweight adolescents may be at risk of feeling unhappy and stressed compared to their normal weight peers, but participating in PA may lower the risk of having negative PWB. Our findings also showed that underweight adolescents are more likely to be happier and less/not stressed than their normal weight counterparts after adjusting for demographic and developmental factors. These findings may be explained by desired body ideal among teenagers in the contemporary Korean society (Lim & Wang, 2013). Similar to adolescents in Western, developed countries, thin and lean body type is preferred among Korean adolescents (Kim, Yun, & Kim, 2015). Such body ideals may also explain our results showing that underweight adolescents are more likely to be happier and less/not stressed compared to their normal weight peers. Similarly, overweight adolescents are more susceptible to experiencing negative psychological issues including low self-esteem and body dissatisfaction (Kim et al., 2015).

The importance of PA has been highlighted by a number of researchers in Korea (Lee & Yi, 2016; Lee et al., 2016); however, it is often difficult to implement education and public health policies that may be at odds with the long-held belief that Korean children should spend many hours focusing on their studies and homework (Lee et al., 2016; Song, Yang et al., 2016). Though recent reform of Korea's physical education (PE) curriculum is based on the importance of PA in developing a talented whole person (Korea Ministry of Culture, Sports, and Tourism, 2013), PE is still considered as a minor subject and often replaced by self-study time for university admission (Lee & Cho, 2014). This may reduce the opportunities to participate in structured PA for Korean adolescents (Lee & Yi, 2016). In addition, Korean students face difficulties participating in PA as they are enrolled into higher grades with increasing time demands (Lee & Spence, 2016; Lee & Yi, 2016). Indeed, most Korean students attend after school tutoring (Yun, 2014), and spend an average of 15 h per day studying (ICEF Monitor, 2014) which leaves little time for PA given that the majority of the remaining nine hours of spare

Table 1

Sample characteristics—Korea Youth Risk Behavior Web-based Survey 2009–2013 (N = 370,568).

	Total	Boys	Girls (47.3%)
Age (yr) (M ± SE)	15.05 ± 0.01	15.06 ± 0.02	14.03 ± 0.02
Height (cm) (M ± SE)	165.15 ± 0.07	169.82 ± 0.06	159.98 ± 0.02
Weight (kg) (M ± SE)	56.37 ± 0.07	60.57 ± 0.07	51.70 ± 0.04
Economic status (%)			
High	6.8	8.6	4.7
Middle-high	23.6	24.7	22.4
Middle	46.9	44.4	49.6
Low-middle	17.4	16.5	18.3
Low	5.4	5.7	5.0
Region (%)			
Urban	46.8	46.9	46.7
Rural	53.2	53.1	53.3
Sexual maturity (%) (Reached)	73.1	53.2	95.2
Psychological well-being (%)			
Happiness (happy)	55.7	58.8	52.6
Stress (low/no stress)	16.3	20.4	11.7
Physical activity (%)			
Vigorous physical activity			
None	28.2	16.4	41.4
1-day/week	19.7	17.5	21.8
2-day/week	18.5	20.4	16.7
3-day/week	14.6	18.2	10.8
4-day/week	6.1	8.4	3.5
≥ 5-day/week	12.9	19.2	5.8
Strengthening exercises			
None	49.2	35.1	64.9
1-day/week	18.9	20.5	17.2
2-day/week	11.8	15.1	8.2
3-day/week	8.4	11.7	4.7
4-day/week	3.4	5	1.6
≥ 5-day/week	8.3	12.8	3.3
Weight status (%)			
Underweight (<5th percentile)	6.7	6.7	6.8
Normal weight (5th - 85th percentile)	80.7	79.4	82.2
Overweight (≥85th percentile)	12.5	13.9	11.1

Results are described as means and standardized errors (M ± SE) or percentages (%).

Table 2

Weight status and psychological well-being among South Korean adolescents aged 12–18 years.

	Happiness		Low/no stress	
	Crude OR (95% CI)	Adjusted OR (95% CI) ^a	Crude OR (95% CI)	Adjusted OR (95% CI) ^a
Underweight	0.99 (0.96–1.02)	1.05 (1.02–1.08)*	1.03 (0.99–1.07)	1.08 (1.04–1.12)*
Normal weight	1 (referent)	1 (referent)	1 (referent)	1 (referent)
Overweight	0.97 (0.95–0.99)*	0.98 (0.96–1.00)	0.93 (0.90–0.95)*	0.91 (0.88–0.94)*

OR = Odds Ratio, 95% CI = 95% Confidence Interval.

p* < 0.001.^a Adjusted for age, gender, region, economic status, and sexual maturity.Table 3**Physical activity and psychological well-being by weight status^a among South Korean adolescents aged 12–18 years.

	Happiness		Not stressed	
	Crude OR (95% CI)	Adjusted OR (95% CI) ^a	Crude OR (95% CI)	Adjusted OR (95% CI) ^a
Underweight (<5th percentile)				
No PA/week	1 (referent)	1 (referent)	1 (referent)	1 (referent)
Any PA ≥ 1-day/week	1.56 (1.21–2.01)*	1.53 (1.18–1.98)*	1.53 (1.36–1.71)*	1.26 (1.12–1.41)*
Normal weight (5th - 85th percentile)				
No PA/week	1 (referent)	1 (referent)	1 (referent)	1 (referent)
Any PA ≥ 1-day/week	1.47 (1.35–1.60)*	1.41 (1.28–1.54)*	1.67 (1.61–1.73)*	1.35 (1.30–1.41)*
Overweight (≥85th percentile)				
No PA/week	1 (referent)	1 (referent)	1 (referent)	1 (referent)
Any PA ≥ 1-day/week	1.66 (1.35–2.03)*	1.51 (1.22–1.87)*	1.59 (1.45–1.74)*	1.28 (1.16–1.40)*

**p* < 0.001.^a Adjusted for age, gender, region, economic status, and sexual maturity.

Table 4

Vigorous-intensity physical activity, strengthening exercises, and psychological well-being among South Korean adolescents aged 12–18 years.

	Happiness		Low/no stress	
	Crude OR (95%CI)	Adjusted OR (95%CI) ^b	Crude OR (95%CI)	Adjusted OR (95%CI) ^b
Weekly VPA ^a				
None	1 (referent)	1 (referent)	1 (referent)	1 (referent)
1 day	1.23 (1.21–1.26)*	1.18 (1.16–1.21)*	1.17 (1.14–1.21)*	1.01 (0.98–1.04)
2 days	1.43 (1.40–1.46)*	1.33 (1.30–1.36)*	1.35 (1.31–1.39)*	1.08 (1.04–1.11)*
3 days	1.59 (1.55–1.63)*	1.42 (1.38–1.45)*	1.60 (1.55–1.65)*	1.15 (1.11–1.19)*
4 days	1.74 (1.69–1.80)*	1.53 (1.48–1.58)*	1.83 (1.76–1.91)*	1.25 (1.20–1.30)*
≥ 5 days	1.72 (1.68–1.76)*	1.53 (1.49–1.57)*	2.07 (2.01–2.14)*	1.39 (1.34–1.44)*
Psychological well-being/1-day increase in VPA	1.09 (1.09–1.10)**	1.16 (1.15–1.17)**	1.07 (1.06–1.08)**	1.09 (1.09–1.10)**
Weekly SE ^a				
None	1 (referent)	1 (referent)	1 (referent)	1 (referent)
1 day	1.24 (1.22–1.27)*	1.16 (1.14–1.19)*	1.28 (1.24–1.31)*	1.06 (1.04–1.09)*
2 days	1.35 (1.32–1.38)*	1.22 (1.19–1.25)*	1.44 (1.40–1.48)*	1.11 (1.08–1.15)*
3 days	1.40 (1.36–1.44)*	1.20 (1.21–1.28)*	1.55 (1.50–1.61)*	1.16 (1.12–1.20)*
4 days	1.46 (1.40–1.52)*	1.31 (1.26–1.37)*	1.64 (1.60–1.72)*	1.23 (1.17–1.30)*
≥ 5 days	1.38 (1.34–1.42)*	1.25 (1.21–1.29)*	1.76 (1.70–1.83)*	1.30 (1.26–1.35)*
Psychological well-being/1-day increase in SE	1.09 (1.08–1.09)**	1.06 (1.05–1.06)**	1.13 (1.12–1.13)**	1.05 (1.05–1.06)**

OR = Odds Ratio, 95%CI = 95% Confidence Interval.

^a $p < 0.001$; ^b p -trend < 0.001 .^a VPA = Vigorous physical activity, SE = Strengthening exercises.^b Adjusted for age, gender, region, economic status, sexual maturity, and weight status.

time will be spent sleeping (Lee & Yi, 2016). Combined, encouraging PA in PE as well as recess time and providing school-based organized sport may allow more opportunities to participate in PA, and, in turn, potentially enhance PWB among Korean adolescents (Song, Lee et al., 2016). These observations can be confirmed in future studies using more rigorous study design (i.e., longitudinal, experimental).

Strengths of this study include the large sample size in which provides representative estimates of the population. In addition, this study provided additional evidence in the understudied population group. Furthermore, by including happiness and stress as outcomes, this study expands our understanding of the associations between PA and PWB among adolescents. Nevertheless, this study is not without limitations. First, a self-reported PA measure was employed which may not be as strong as direct or objective measures. Furthermore, though we observed the clear association between PA and PWB after adjusting for weight status, we were not able to infer causality. Last, though we found associations between PA and PWB, the effects were small (Cohen's $d < 0.2$). Longitudinal and experimental observations are warranted to build on our findings.

4. Conclusion

Consistent with our hypotheses, this study demonstrated that engaging in PA at least once/week, regardless of its mode (i.e., VPA or SE), was associated with PWB regardless of weight status. PA participation, even minimally, may be an important component for happiness and low/no stress among Korean adolescents in all weight groups, and may be particularly beneficial to overweight adolescents. In addition, linearity was observed for the associations between PA frequency and PWB. Because the frequency of feeling happy, rather than the intensity of happiness, is more closely linked to the long-term state of subjective well-being (Diener et al., 1991), promoting daily PA may positively contribute to PWB among Korean adolescents.

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