



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



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ARTICLE INFO

Article history:

Received 2 September 2016
Received in revised form
11 February 2017
Accepted 11 February 2017
Available online 20 February 2017

Keywords:

Happiness
Stress
Exercise
KYRBS

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 (Brener, 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

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