

Sex differences in social cognitive factors and physical activity in Korean college students

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Abstract. [Purpose] This study examined sex differences in physical activity and social cognitive theory factors in Korean college students. [Subjects and Methods] A cross-sectional survey of 688 college students (285 men and 403 women) in Korea was conducted using a self-reported questionnaire. [Results] There was a significant difference in the level of physical activity between male and female students. The significant predictors of physical activity for male students were physical activity goals, physical activity self-efficacy, and sitting time. Meanwhile, those for female students were perceived weight, physical activity goal, physical activity outcome expectations, and sitting time. [Conclusion] Sex differences should be considered when developing interventions to increase physical activity.

Key words: Physical activity, College students, Social cognitive theory

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INTRODUCTION

Modern lifestyles are generally sedentary and involve substantially little physical activity (PA), thereby increasing the risks of obesity and chronic diseases¹⁾. PA begins to decrease beginning in adolescence, especially between 18 and 24 years of age when people move from high school to college^{2, 3)}. Adolescents and young adults of both sexes benefit from PA³⁾.

To maintain and promote health, adults should participate in moderate-intensity exercise for at least 30 minutes 5 times per week or vigorous-intensity exercise for at least 20 minutes 3 times a week⁴⁾. However, 52% of American college students do not meet the federal guidelines for PA⁵⁾, and only 20.8% of Korean college students regularly participate in moderate-intensity PA⁶⁾. A study of college students in East Asian countries including Taiwan, Hong Kong, South Korea, Singapore, and Malaysia reports Korean students are the least likely to be physically active²⁾. Therefore, interventions to increase the PA of Korean college students are urgently required.

Young adulthood is when PA patterns are established; such patterns are likely to be maintained throughout adult-

hood and therefore affect an individual's lifelong health¹⁾. In particular, college is an opportune time for self-directed learning and modification of lifestyle behaviors. Considering that 79% of Korean young adults aged 18–24 years are in college, PA interventions targeting college- or university-age people may be effective⁷⁾. However, despite the need for interventions to facilitate college students' PA levels, there is a paucity of experimental research in this field. A few PA interventions have targeted college students, but the overall results are not very encouraging^{1, 8, 9)}. Studies on only report modest⁸⁾ or short-term effects⁹⁾ of PA interventions. These results highlight the need for understanding the factors that influence college students' PA levels.

Most prior studies on college students' PA focused on demographic factors such as age, body mass index (BMI), perceived health, and sitting behavior^{10, 11)} as well as psychosocial factors such as self-efficacy, goal setting^{7, 12)}, outcome expectations¹³⁾, and social support¹²⁾. In addition, sex impacts college students' PA. For instance, female students have remarkably lower PA levels than male students²⁾. While male students exercise to increase muscular strength, female students do so to manage weight¹¹⁾. Therefore, it is necessary to identify the predictors of PA by sex in order to develop intervention programs suitable for the different needs of male and female college students.

Social cognitive theory (SCT) is a robust theoretical framework for explaining and predicting PA¹²⁾. SCT basically uses personal, psychosocial, and environmental factors to predict behavior. Key SCT factors of PA are self-efficacy, social support, goal setting, outcome expectation, and the environment¹²⁾. Self-efficacy is a key to regular exercise,

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while environmental factors including social support and the environment are important for exercise compliance¹²). In addition, outcome expectation affects motivation to participate in specific activities and is thus important for college students' PA⁷). However, motivation alone is insufficient to maintain regular exercise; self-regulation including setting exercise goals is also important¹²). However, previous studies that adopted the SCT model to explain the PA of college students included only some SCT variables¹²). In addition, while some studies included subjects of both sexes, sex-specific analysis is rare¹³). Furthermore, few studies have investigated the influence of sex on the effects of SCT variables on PA among Korean college students, who have a high inactivity rate.

Therefore, based on SCT and previous studies^{1, 12}), this study identified differences in PA levels and SCT factors to predict PA by sex among Korean college students.

SUBJECTS AND METHODS

This study used a comparative cross-sectional descriptive design. After approval by the university institutional review board, data were collected between May and July 2013. With a significance level of 0.05, power of 0.8, and effect size of 0.3 in the correlation and regression analysis, 82 subjects per comparative group were needed. The inclusion criteria were as follows: (1) age \geq 18 years, (2) enrolled in college or university, and (3) provision of written informed consent to participate in the survey. Participants were excluded if they had physical limitations hindering PA, such as blindness, musculoskeletal problems, and cardiopulmonary disease. College students who specialized in physical education or belonged to a college sports team were also excluded.

Out of 47 colleges in two provinces, a convenience sample of college students at three and four colleges in provinces A and B, respectively, was recruited using posters posted on bulletin boards. A total 724 students initially indicated interest in the study, and 702 met the study criteria. Of the 702 questionnaires collected, data from 14 questionnaires were excluded because of missing data or inaccurate responses, resulting in a final sample of 688 including 285 men and 403 women.

General characteristics included age, grade, BMI, perceived weight, perceived health, living arrangement, and sitting time.

BMI was computed from the participants' self-reported height and weight (weight in kg / height in m²). Perceived weight was the participants' perception of his/her weight, ranging from 1 (very underweight) to 5 (very overweight). Perceived health was measured using a single-item instrument developed by the principal investigator of this study; perceived health was rated on a scale from 1 (poor) to 5 (excellent), with higher scores indicating a more positive perception of health. Living arrangement was a dichotomous variable, i.e., whether the student was living with family or not. Sitting time was assessed using a single question from the International Physical Activity Questionnaire-Short Form (IPAQ-SF) developed by Craig et al.¹⁴); the time spent in sedentary behavior over the previous week was assessed in minutes and included time spent sitting at work, at home,

in class, and during leisure activities as well as time spent sitting or reclining at a desk, meeting friends, reading books, riding in a car, and watching TV. The IPAQ-SF sitting behavior subscale is both reliable and valid among adult men and women in various countries¹⁵).

SCT characteristics included PA self-efficacy, PA social support, PA outcome expectations, PA goal, and PA environment.

PA self-efficacy was measured using the 5-item Exercise Self Efficacy (ESE) scale developed by Marcus et al.¹⁶); this tool assesses the confidence in one's ability to maintain exercise under all circumstances on a 5-point scale from 1 (not confident at all) to 5 (very confident), with higher scores indicating higher PA self-efficacy. The α coefficient of this instrument is reported to be 0.82; in the current study, the internal consistency was acceptable (Cronbach's $\alpha = 0.89$).

PA social support was measured using the Social Support for Exercise Behavior (SSEB) scale developed by Choi¹⁷), a 7-item tool that measures the influences of family and friends on exercise behavior on a 5-point Likert scale; higher scores indicate higher social support related to PA. The reliability coefficient of an earlier study in a Korean population (2005) was 0.89; Cronbach's α was 0.87 in the current study.

The Outcome Expectations for Exercise Scale (OEE) was used to assess PA outcome expectations¹⁸). The OEE is a 9-item scale with answers rated on a 5-point scale, with 1 and 5 indicating low and high outcome expectations for exercise, respectively; higher scores indicate higher outcome expectations for exercise. Its internal consistency ranges from 0.72–0.93; Cronbach's α was 0.87 in the current study.

PA goal was measured by the Exercise Goal-setting Scale (EGS) developed by Rovniak et al.¹²). The EGS includes 10 items related to goal setting, self-monitoring, and problem solving. Higher scores indicate higher levels of PA goal setting rated on a 5-point scale. The reliability of this tool was 0.89 when it was developed¹²); in the current study, the internal consistency was acceptable (Cronbach's $\alpha = 0.85$).

PA environment was measured by the Exercise Environment Scale (EES) developed by Choe et al.¹⁹). The EES includes 4 questions about the safety of the exercise environment, presence of a sidewalk, availability of public facilities, and sports equipment answered on a 2-point scale (1 = no, 2 = yes); higher scores indicate a better PA environment. The reliability of this tool was reported to be 0.72¹⁹); Cronbach's α was 0.79 in the current study.

PA was measured using the Korean version of the IPAQ-SF²⁰). This self-reported survey measures the frequency and average duration of vigorous-intensity, moderate-intensity, and walking activities in the past 7 days. The total duration of PA was classified as "sufficient" or "insufficient" according to the PA guidelines for health benefits⁴): sufficient PA for health benefits for adults is defined as moderate-intensity aerobic PA for a minimum of 30 minutes on 5 days/week or vigorous-intensity aerobic activity for a minimum of 20 minutes on 3 days/week, while insufficient PA is defined as not meeting the sufficient PA standards.

The data were analyzed with SPSS version 19.0 (SPSS, Chicago, IL, USA). Differences in general characteristics, SCT factors, and PA status between male and female college students were analyzed using t-tests and χ^2 tests. The χ^2 test

Table 1. General characteristics of male and female college students ($N = 688$)

Characteristics	Categories	Male (n = 285)	Female (n = 403)	
		$\bar{x} \pm SD$ or n (%)	$\bar{x} \pm SD$ or n (%)	
Personal characteristics				
Age (years)		20.39 \pm 1.29	20.53 \pm 1.65	
Grade	Freshman	67 (23.5)	115 (28.5)	
	Sophomore	73 (25.6)	114 (28.3)	
	Junior	70 (24.6)	89 (22.1)	
	Senior	75 (26.3)	85 (21.1)	
BMI		23.14 \pm 2.98	20.54 \pm 2.33	*
Perceived weight		3.17 \pm 0.93	3.42 \pm 0.81	*
Perceived health		3.60 \pm 0.93	3.41 \pm 0.77	
Living with family	Yes	79 (27.7)	127 (31.5)	
	No	209 (72.3)	276 (68.5)	
Sitting time (min/day)		784.41 \pm 339.77	937.56 \pm 376.24	*
Social-cognitive characteristics				
PA outcome expectation		3.71 \pm 1.07	3.55 \pm 0.83	*
PA self-efficacy		3.25 \pm 0.89	2.75 \pm 0.84	*
PA social support		2.76 \pm 0.78	2.59 \pm 0.76	*
PA goal		2.25 \pm 0.71	2.04 \pm 0.76	*
PA environment		1.87 \pm 0.22	1.81 \pm 0.25	*

PA: physical activity. * $p < 0.05$

was used to examine differences in PA by sex. Independent t-tests and χ^2 tests were used to examine differences in personal characteristics and SCT factors with respect to PA category. Finally, logistic regression analysis was used to determine predictors of PA among college students by sex.

RESULTS

The general characteristics of male and female college students are presented in Table 1. There were significant differences in BMI, perceived weight, perceived health, and sitting time between sexes. The BMI of male students was significantly higher than that of female students (23.1 vs. 20.5, $p < 0.001$). Female students perceived their weight between moderate and overweight, which was significantly higher than that of male students ($p < 0.001$). Male students reported significantly better perceived health than female students ($p = 0.004$). Female students spent significantly more time sitting per day than male students (937.5 vs. 784.4 minutes, $p < 0.001$). There were significant differences in social and cognitive characteristics in PA social support, PA self-efficacy, PA outcome expectations, PA goal, and PA environment. PA social support scores were significantly higher in male students than female students ($p = 0.003$). The scores of PA self-efficacy, PA outcome expectations, PA goal, and PA environment were also significantly higher in male students than female students ($p < 0.001$, $p = 0.041$, $p < 0.001$, $p = 0.003$, respectively).

The PA participation of male and female college students over the past week is shown in Table 2. Significantly more male students performed PA sufficient for health benefits (57.5% vs. for women, $p < 0.001$).

Table 2. Physical activity levels of male and female college students ($N = 688$)

PA category	Male (n = 285)	Female (n = 403)	
	n (%)	n (%)	
Insufficient PA	121 (42.5)	268 (66.5)	*
Sufficient PA	164 (57.5)	135 (33.5)	

PA: physical activity. * $p < 0.05$

The characteristics of PA by sex are presented in Table 3. There were significant differences between the male students with sufficient and insufficient PA: those with sufficient PA had significantly better perceived health and shorter sitting time than those with insufficient PA ($p < 0.001$, $p = 0.001$, respectively). In addition, male students with sufficient PA had higher scores of PA self-efficacy, PA social support, and PA goal than those with insufficient PA ($p = 0.001$, $p = 0.003$, $p = 0.002$, respectively).

There were significant differences between female students with sufficient and insufficient PA. Significantly more female students with sufficient PA perceived themselves as overweight than those with insufficient PA ($p = 0.021$) and reported significantly shorter sitting time ($p = 0.001$). In addition, female students with sufficient PA had significantly higher scores in PA outcome expectations, PA self-efficacy, PA social support, and PA goal than those with insufficient PA ($p = 0.012$, $p < 0.001$, $p = 0.001$, $p < 0.001$, respectively).

The predictors of PA in male and female college students are shown in Table 4. Logistic regression analysis including all variables significantly associated with PA in univariate

Table 3. Associations between general characteristics and physical activity level in male and female college students ($N = 688$)

Characteristics	Male (n = 285) $\bar{x} \pm SD$ or n (%)		Female (n = 403) $\bar{x} \pm SD$ or n (%)		χ^2 or t/p
	Insufficient PA (n = 121)	Sufficient PA (n = 164)	Insufficient PA (n = 268)	Sufficient PA (n = 135)	
Age (years)	22.97 \pm 3.04	22.85 \pm 2.55	20.41 \pm 1.54	20.76 \pm 1.83	
Grade					
Freshman	31 (25.6)	36 (22)	74 (27.6)	41 (30.4)	
Sophomore	31 (25.6)	42 (25.6)	133 (49.6)	53 (39.3)	
Junior	33 (27.3)	37 (22.6)	37 (13.8)	23 (17)	
Senior	26 (21.5)	49 (29.9)	24 (9.0)	18 (13.3)	
BMI	22.80 \pm 2.98	23.38 \pm 2.97	20.39 \pm 2.36	20.86 \pm 2.25	
Perceived weight	3.08 \pm 1.00	3.25 \pm 0.88	3.35 \pm 0.79	3.55 \pm 0.83	*
Perceived health	3.37 \pm 0.99	3.77 \pm 0.85	3.29 \pm 0.86	3.37 \pm 0.78	*
Living with family					
Yes	30 (10.5)	49 (17.2)	80 (19.9)	47 (11.7)	
No	91 (31.9)	115 (40.4)	188 (46.7)	88 (21.8)	
Sitting time (min/day)	862.99 \pm 349.14	726.43 \pm 321.60	982.90 \pm 370.83	847.55 \pm 372.02	*
PA outcome expectation	3.69 \pm 0.99	3.72 \pm 1.13	3.48 \pm 0.83	3.70 \pm 0.80	*
PA self-efficacy	3.05 \pm 0.78	3.39 \pm 0.93	2.64 \pm 0.84	2.98 \pm 0.80	*
PA social support	2.91 \pm 0.76	3.23 \pm 0.94	2.81 \pm 0.86	3.09 \pm 0.78	*
PA environment	1.86 \pm 0.19	1.87 \pm 0.23	1.80 \pm 0.27	1.84 \pm 0.22	
PA goal	2.10 \pm 0.69	2.36 \pm 0.71	1.94 \pm 0.77	2.24 \pm 0.71	*

PA: physical activity. * $p < 0.05$ **Table 4.** Predictors of physical activity in male and female college students ($N = 688$)

	β	S.E.	Wald χ^2	Odds ratio	95% CI
Male					
Constant	-0.818	0.599	1.868	0.44	
PA goal	0.407	0.196	4.333	1.50	1.02–2.20
PA self-efficacy	0.321	0.157	4.185	1.37	1.01–1.87
Sitting time	-0.002	0.001	9.425	0.98	0.97–0.99
Female					
Constant	-4.078	0.842	23.465	0.01	
Perceived weight	0.424	0.145	8.563	1.52	1.15–2.02
PA goal	0.376	0.173	4.700	1.45	1.03–2.04
PA outcome expectation	0.367	0.141	6.798	1.44	1.09–1.90
Sitting time	-0.002	0.001	13.148	0.98	0.97–0.99

PA: physical activity; CI: confidence interval

analysis was performed. The significant predictors of PA for male students were PA goal (odds ratio [OR] = 1.50, 95% CI = 1.02–2.20, $p = 0.037$), PA self-efficacy (OR = 1.37, 95% CI = 1.01–1.87, $p = 0.041$), and sitting time (OR = 0.98, 95% CI = 0.97–0.99, $p = 0.002$).

The predictors of PA for female students were perceived weight (OR = 1.52, 95% CI = 1.15–2.02, $p = 0.003$), PA goal (OR = 1.45, 95% CI = 1.03–2.04, $p = 0.030$), PA outcome expectation (OR = 1.44, 95% CI = 1.09–1.90, $p = 0.009$), and sitting time (OR = 0.98, 95% CI = 0.97–0.99, $p < 0.001$).

DISCUSSION

In the present study, approximately half of Korean college students failed to meet the PA guidelines for health benefits. This result is similar to those of previous studies^{1, 12, 21}) showing the participation of college students in PA is low because of their relatively low interest in health compared to other age groups, their focus on sedentary activities, particularly studying, as a primary daily activity¹), and reduced opportunities to participate in structured exercise¹²). More female students than male students had insufficient PA, corroborating previous findings^{10, 22}). Therefore, customized

exercise programs are required to promote the health benefits of PA in female college students, because the negative effects of inactivity and sedentary behavior on health are more significant in females than males.

In the present study, there were significant sex differences in the effects of personal characteristics and SCT variables on the PA of college students. Regarding general personal characteristics, female students were more likely to perceive themselves as overweight despite having a BMI in the normal range. In addition, female students engaged in PA more when they considered themselves to be overweight, which is similar to previous findings²³). It is likely that a woman who considers herself overweight may attempt to lose weight by changing her behavior, including increasing PA. The results of logistic regression analysis showed that perceived weight is an independent predictor of PA in female students but not male students; this result is concordant with previous reports¹⁰), which found that the major motives for exercise of male students are the demonstration of capability and pursuit of victory, while female students exercised to improve their appearance and lose weight. The present findings demonstrate the importance of perceived weight with regard to Korean female students' PA level. Korean female college students tend to place great value on physical beauty and strongly desire to become inappropriately thin, which can result in increasing their PA and/or changing their diet despite being normal weight²³). Therefore, it is important to educate female students about suitable weights for height, i.e., BMI standards.

Moreover, male students had a more positive perception of their health than female students, and their PA was greater when they considered themselves healthy, also corroborating previous findings¹¹). However, subjective health perception was not an independent predictor of the PA of male or female college students possibly because of their age or awareness of diseases. College students generally have relatively low levels of morbidity and mortality compared to other age groups. Thus, a lack of knowledge about the risk of diseases may limit their health behaviors including regular PA. However, as major health problems tend to develop gradually over many years, it is important to educate college students about the potential negative long-term impacts of unhealthy habits and the positive effects of regular PA.

Interestingly, increased sitting time was an independent predictor of insufficient PA in both male and female college students; this finding is similar to those of previous studies¹¹), which found longer time spent sitting is associated with fewer days of exercise and strength training per week and that the amount of sitting time after school is a significant predictor of the PA of adolescents²⁴). This may be because increased sitting time reduces free time for exercise and other PA²⁵). The Korean college students in the present study spent 6–8 hours per day sitting, which is equivalent to the “high sitting time category” of previous studies²⁶). Prolonged sitting was recently reported to increase vascular sclerosis, which increases the risk of heart disease even in individuals as young as college students²⁷). Therefore, measures must be taken to reduce the time spent sitting and increase PA.

Students with a higher PA goal score were more likely to

engage in the recommended amount of activity for health maintenance and promotion. PA goal score was a significant predictor of PA in both male and female students, corroborating the findings of previous studies^{7, 12}). Goal setting includes the establishment of a realistic and achievable target; by setting a goal, college students may be more motivated to follow through with exercise^{7, 28}). Consistent with these findings, previous successful PA interventions have included self-regulation elements such as goal setting, planning, and self-monitoring²⁸). Therefore, PA intervention using goal-setting strategies may promote PA in college students of both sexes.

A greater positive PA outcome expectation score was a significant predictor of PA in female students similar to that in previous studies¹³). However, PA outcome expectation score was not a predictor of PA in male students. This may be because more females than males tend to expect physical outcomes from PA, such as weight loss and weight control¹²). Another reason for this may be related to the measurement tool. The OEE includes only the positive outcomes expected from PA. Male students may expect negative outcomes from PA, such as injury or pain¹³), which could be a more significant predictor of PA level in male students.

The present results also show that higher PA social support score was significantly associated with a higher PA participation rate. However, PA social support score was not a significant predictor of PA in male or female college students, which is similar to the findings of previous studies¹⁰). Concordant with our findings, other authors¹²) argue that despite the positive correlation between social support and PA, social support might not directly impact PA because it influences PA through self-efficacy. Therefore, social support may have indirectly predicted the PA of college students. Thus, further studies are required to identify the direct and indirect effects of social support on PA.

There was no significant association between the PA environment score and the PA of college students, similar to previous studies²⁸). Phongsavan et al.²²) report that the effects of environmental factors on PA are not significant under the existence of strong psychosocial factors. However, other studies report that the PA environmental factors such as footpaths safe for walking and access to local facilities are significantly associated with PA level²⁸). Thus, further studies are necessary to clarify the relationship between the PA environment and PA levels.

Another interesting finding of this study is that PA self-efficacy was a significant predictor of the PA of male students but not female students. These findings differ from previous studies showing that PA self-efficacy is a strong predictor of PA for both male and female college students^{12, 29}). This difference may be related to the low PA self-efficacy of Korean female college students; external perspectives and value systems may take precedence over their own judgment or will. Furthermore, the sex differences in the present study may be due to PA benefitting health being the outcome variable. Previous studies¹²) used total PA including walking and moderate- and vigorous-intensity activities as the outcome variable, while the present study measured PA benefitting health, which includes only moderate and vigorous PA. Doerksen et al.⁷) report that the predictors of moderate and

vigorous PA include the SCT variables of PA self-efficacy and PA goal. Thus, PA self-efficacy could be a predictor of higher-intensity PA, which is more challenging than walking. Therefore, for female students with low participation in vigorous PA, PA self-efficacy may not be a sensitive predictor of PA benefitting health.

This study has several limitations. First, this study was cross-sectional, which precludes the determination of causal relationships. Therefore, future studies should incorporate prospective designs. In addition, height, weight, PA, and sedentary behavior data were self-reported, meaning they may be over- or underestimated. Therefore, future research that includes empirical measurements using objective methods is needed.

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