Roles of Physical Activity Type in Exercise Motivational Profiles and Behavioral Frequencies Among College Freshmen

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Abstract: This study examined the relationships among gender, race/ethnicity, physical activity (PA) type, exercise motivation, and frequencies of various exercise intensities.College freshmen (N = 170; 68 male, 102 female) in the southwestern U.S. completed an online survey on exercise motivation and behavior. Chi-square tests indicated that males generally performed more fitness training and less aerobic exercise than females, whereas no differences were foundamong racial/ethnic groups. Descriptive discriminant analyses revealed that sport participation contributed to the most adaptive motivational profileand highest behavioral frequencies, suggesting that sport participation is the most effective PA type for college freshmen to maintain exercise.

Keywords*: Sport participation; fitness training; aerobic exercise; self-determination theory*

INTRODUCTION

It is well established that regular exercise produces many health benefits. Beyond physical health benefits, individuals who exercise regularly tend to have better mental health than those who do not (Downs & Ashton, 2011). However, college students, especially those in the U.S., engage in low levels of physical activity (PA). Based on the American College Health Association's (ACHA)Fall 2016 National College Health Assessment (ACHA, 2016), only 43.6% of U.S. college students met the American College of Sports Medicine's (ACSM) recommended exercise guidelines for adults: at least 30 minutes of moderate-intensity aerobic exercise for five days a week, or 20 minutes of vigorous-intensity aerobic exercise for three days a week(ACSM, 2011).The decline in exercise participation has been shown to happen during the transition period from high school to the college freshman year(Bray & Born, 2004; Serlachius, Hamer, & Wardle, 2007). In addition to moderate and vigorous aerobic exercise, adults including college students are recommended to engage in muscle-strengthening exercise that involve all major muscle groups on two or more days a week (ACSM, 2011; U.S. Department of Health and Human Services [USDHHS], 2008), yet only 37.6% of U.S. college students met this guideline(ACHA, 2016). In light of their insufficient PA engagement, ACHA's Health Campus 2020 student objectives target 53.5 % and 41.4% of college students in 2020 who will meet the guidelines for aerobic exercise and muscle-strengthening exercise, respectively (ACHA, 2012). To reach this goal and enhance health benefits among college students, it is imperative to study the correlates of their behavioral frequencies of various exercise intensities.

Investigating exercise motivation and behavior of college freshmen, who are at higher risk for declines in PA levels during college years (Deforche, Van Dyck, Deliens, & De Bourdeaudhuij, 2015), is particularly important for implementing PA interventions. During their transition from high school to college, many college freshmen live apart from their family for the first time and adopt a new lifestyle, such as having more unhealthy food consumption, less PA, and more sedentary behavior (Deforche et al., 2015). Meanwhile, college freshmen who live on campus have more access to the campus recreation facility to engage in various sport and exercise programs. Research has shown that college students who use the campus recreation facility regularly tend to be physically active (Beggs, Nicholson, Elkins, & Dunleavy, 2014). Campus recreation facility, therefore, may serve as a convenient setting for reversing the trend of PA declines during the transition to college.

Concerning PA participation, motivation is a critical factor for individuals to choose which activity to engage(Ball, Rice, & Parry, 2014; Molanorouzi, Khoo, & Morris, 2015). Previous studies have found a majority of college students participate in the following PA types on campus:

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sports, group fitness, aerobic exercise, informal workouts, aquatics, and weight training (Beggs et al., 2014; Lower, Turner, & Petersen, 2013). Yet, little is known about the relations between the PA types and exercise motivation among college students. Examining college freshmen's exercise motivational profiles and behavioral frequencies across PA types in this study, therefore, can further our understanding of how to help this population meet the guidelines for both aerobic exercise and muscle-strengthening exercise during their transition to college.

PA Type

College students who engage in leisure PA mostly did so through the forms of sport participation, fitness training, and aerobic exercise (Ball et al., 2014; Beggs et al., 2014; Molanorouzi et al., 2015; Moreno-Murcia, Silva, Pardo, Sierra Rodríguez, & Huéscar Hernández, 2012). These three forms constitute PA types that are different in nature: (a) sport participation includes activities that focus on physical skills and hand-eye coordination, with elements of competition (e.g., rules, strategies) (Australian Bureau of Statistics, 2008); (b) fitness training refers to multifaceted, structured activities such as exercise for strength training and proprioception training with a primary goal to enhance physical fitness (e.g. muscular strength and endurance) and motor skills (e.g., balance, gait) instead of competition(ACSM, 2011); and (c) aerobic exercise, also referred to as cardio exercise, includes activities that stimulate heart rate and breathing rate to meet the demands of the body's movement for a sustained period(USDHHS, 2008). Worthy of attention is that while aerobic exercise is a type ofPA, not all PA (e.g., regular walking)is aerobic exercise.Different individuals may choose their primary PA type for various reasons. For instance, female college students are more likely to primarily engage in aerobic exercise, such as jogging and group exercise, in order to maintain regular PA instead of training for competition and specific skills (Lowry et al., 2000). Furthermore, the literature suggests that different PA types produce differential health benefits among college students (Australian Bureau of Statistics, 2008; Ball et al., 2014; Lower et al., 2013): (a) sport participation facilitates physical fitness and well-being through vigorous physical training; (b) fitness training promotes specific fitness components such as muscular strength and endurance with a focus on personal achievement; and (c) aerobic exercise enhances weight control and cardiovascular fitness. Therefore, it is important to note the individual preference toward PA types and the physical and psychosocial variables that influence their differential benefits.

Motivation and preference toward PA types vary across sex and race/ethnicity (Kilpatrick, Hebert, & Bartholomew, 2005; Molanorouzi et al., 2015). In general, male college students prefer team sports and strength training activities, whereas their female counterparts prefer aerobic activities including cardio exercises, dance, and yoga (Keating, Guan, Piñero, & Bridges, 2005).Previous studies have revealed the role of race/ethnicity in the types of PA and sport participation among high school and college students (Keating et al., 2005; Turner, Perrin, Coyne-Beasley, Peterson, & Skinner, 2015), but insufficient evidence exists on the relations between race/ethnicity and PA types among college freshmen. Given the diverse student population in college, investigating the prevalence of PA types among various racial/ethnic groups of college freshmen have direct implications on PA promotion during this transitional period.

Exercise Motivational Profiles

Exercise motivation is an important correlate of PA type, because individuals have varied personal goals and motivational processes in sport and exercise engagement (Sebire, Standage, & Vansteenkiste, 2008). Self-determination theory (SDT) is a well-established theory with six mini-theories that examine various motivational factors(Deci & Ryan, 1985).To examine exercise motivational profiles in this study, three mini-theories—goal contents theory (GCT), basic psychological needs theory (BPNT), and organismic integration theory (OIT)—were used to address goal contents, psychological need satisfaction, and motivational regulations, respectively. Adaptive motivational profiles are usually based on learning goals or interests, and they allow individuals to foster long-term involvement and achievement through intrinsic and autonomous motivations(Deci & Ryan, 2000; Heyman & Dweck, 1992). GCT distinguishes two types of goal contents—intrinsic goals stem from enjoyment and personal interests, whereas extrinsic goals are grounded in external factors (e.g., fame) that do not contribute to self-development (Deci & Ryan, 2000). Within an exercise context, intrinsic goals include body image and social recognition, while extrinsic goals include social affiliation, health management, and skill development (Sebire et al., 2008). In addition, BPNT proposes that autonomy (i.e., feeling of volition), competence (i.e., feeling of effectiveness), and relatedness (i.e., feeling of connectedness) are three universal psychological needs that are crucial for optimal functioning and well-being of human beings (Deci & Ryan, 2000). Satisfaction of these three psychological needs was found to be positively associated with intrinsic goals in exercise (Sebire, Standage, & Vansteenkiste, 2009).

Another mini-theory OIT addresses different forms of motivational regulation that influence a targeted behavior, such as exercise adherence (Deci & Ryan, 2000). Intrinsic motivation is a completely internalized regulation that signify engagement in an activity for fun and enjoyment. On the other hand, extrinsic motivation consists of four forms of behavioral regulations (i.e., integrated, identified, introjected, and external)

with varied degrees of internalization that explain engagement in an activity for separable outcomes. Lastly, amotivation represents an absence of internalization and intention for a behavior. Intrinsic motivation and internalized forms of extrinsic motivation (i.e., integrated and identified regulations) are referred to as autonomous motivation. With autonomous motivation, individuals engage in exercise because of enjoyment, personal values, and/or a mastery of activities. On the contrary, the two minimally internalized forms of extrinsic motivation (i.e., introjected and external regulations) are referred to as controlled motivation. With controlled motivation, individuals may engage in exercise due to perceived pressure from others and/or avoidance of negative health outcomes (Deci & Ryan, 2000). Ample research has shown that autonomous motivation is positively related to psychological need satisfaction and intrinsic goals, while controlled motivation is negatively related to psychological need satisfaction and positively related to extrinsic goals (Sebire et al., 2008, 2009).

Individuals who primarily participate in sports tend to be more autonomously motivated than those who primarily engage in fitness activities or habitual exercise (Ball et al., 2014; Frederick-Recascino & Schuster-Smith, 2003; Frederick & Ryan, 1993). Moreover, sport participants generally report higher competence, intrinsic motivation, and enjoyment than individuals engaging in other PA types (e.g., fitness training, aerobic exercise) who tend to report higher extrinsic motivation (Ball et al., 2014; Beggs et al., 2014; Frederick & Ryan, 1993; Molanorouzi et al., 2015; Moreno-Murcia et al., 2012). Most of these past studies compared two PA types within a sample of college students (Ball et al., 2014; Frederick & Ryan, 1993; Molanorouzi et al., 2015), but they neither examined these relationships in college freshmen nor compared all three PA types mentioned in this study. Therefore, comparing all three PA types in relation to exercise motivational profiles would provide better insights into implementing motivational interventions during the transition to college.

Exercise Behavioral Frequencies

College freshmen's primary PA type may be associated with their frequencies of various exercise intensities, including vigorous aerobic exercise, moderate aerobic exercise, and muscle-strengthening exercise. Vigorous aerobic exercise is defined as exercise that triggers substantial increase in heart rates with hard and fast breathing and is commonly achieved through recreational sport participation such as running and ball games(USDHHS, 2008). It is an important protective factor for physical and mental health among college students (Downs & Ashton, 2011). Moderate aerobic exercise is defined as exercise that triggers noticeably faster heartbeats and breathing rate, such as brisk walking and gardening. Moreover, muscle-strengthening exercise, including weight training, can be defined as moderate or vigorous exercise that overloads the major muscle groups of the body (USDHHS, 2008).

Although there is support that sport participation tends to involve more vigorous aerobic exercise (Downs & Ashton, 2011), limited research has examined how primary engagement in fitness training or aerobic exercise contributes to the frequencies of vigorous aerobic exercise, moderate aerobic exercise, and muscle-strengthening exercise. Previous research findings have suggested that individuals who primarily engage in fitness training may have less total exercise time, but more balanced distribution of aerobic exercise and muscle-strengthening exercise, than those primarily engage in aerobic exercise (Heinrich, Patel, O'Neal, & Heinrich, 2014). Because regular participation in both aerobic and muscle-strengthening exercises is recommended in order to achieve health benefits(ACSM, 2011), investigating how PA types relate to exercise behavioral frequencies may inform strategies that help college freshmen meet the PA guidelines for various exercise intensities through a combination of activity choices.

Purposes and Hypotheses

To our knowledge, this study was the first investigation that compared all three popular PA types (i.e., sport participation, fitness training, and aerobic exercise) among college freshmen. A purpose of this study was to explore whether the prevalence of PA types varied across sex and race/ethnicity, while the primary purpose was to examine how these three PA types might contribute to exercise motivational profiles (i.e., goal contents, psychological need satisfaction, and motivational regulations) and behavioral frequencies (i.e., vigorous aerobic exercise, moderate aerobic exercise, and muscle-strengthening exercise). Based on our previously mentioned review that reveals greater competence, intrinsic motivation, and enjoyment in sports than fitness activities and habitual exercise, we hypothesized that (a) the sport participation group would have the most adaptive motivational profile—greatest intrinsic goals, psychological need satisfaction, and autonomous motivation; and(b) the fitness training group would have a more adaptive motivational profile than the aerobic exercise group. We did not hypothesize the potential differences in exercise behavioral frequencies across the PA types due to a lack of research evidence.

METHODS

Participants and Procedures

We obtained the formal approval of the study from the university's institutional review-board (IRB) prior to participant recruitment and data collection at a large-sized public university in the southwestern U.S. To recruit participants,

we contacted the Assistant Vice President for Student Affairs who sent a recruitment email to all 5,487 freshmen (51.3% White, 14.8% Black, 21.4% Hispanic/Latino, 7.1% Asian, and 5.4% other) on our behalf at the beginning of the academic year. These freshmen were invited to participate in the study from September to October 2014. They were eligible to be included in this study if they met all three criteria: (a) a first-time freshman, (b) 18–20 years of age, and (c) at least one campus recreation center entry since August 2014. Of the total 4,890 eligible freshmen who had visited the campus recreation center, a sample of 210 freshmen participated in the study during a two-month period. Upon participants' consent, we collected data via an online survey that took approximately 20 minutes to complete.

Measures

The study measures were composed of demographic information including self-reported sex, age, race/ethnicity, academic major, SDT variables related to exercise motivational profiles (goal content, psychological need satisfaction, and motivation in exercise), as well as exercise behavioral indicators assessing frequency of recreation center visit, PA types, and frequency of various exercise intensities (vigorous aerobic exercise, moderate aerobic exercise, and muscle-strengthening exercise).

Participants responded to a single-item measure based on the aforementioned common PA types of college students: "What is your primary purpose of visiting the recreation center?". Five activity choices were given in order to categorize participants into one of the three PA types: sport participation (i.e., individual sports, team sports), fitness training (i.e., muscle-strengthening exercise, group exercise classes), and aerobic exercise (i.e., cardio machines, jogging).

Participants' goal content for exercise was assessed with the 20-item Goal Contents in Exercise Questionnaire (GCEQ) (Sebire et al., 2008). Participants responded to the items with the prompt "please indicate to what extent these goals are important for you when exercising" in a 7-point scale ranging from 1 (not at all important) through 4 (moderately important) to 7 (extremely important). Of the 20 items, 12 assessed intrinsic goals (e.g., "to acquire new exercise skills") and eight assessed extrinsic goals (e.g., "to improve my appearance"). Research shows this measure to be valid and reliable in college students (Sebire et al., 2008).

Satisfaction of psychological needs (i.e., autonomy, competence, and relatedness) was assessed using the 18-item Psychological Need Satisfaction in Exercise Questionnaire (PNSE) (Wilson, Rogers, Rodgers, & Wild, 2006). Participants responded to the items with the prompt "please answer the following questions by considering how you typically feel while you are exercising" in a 6-point scale ranging from 1 (false) to 6 (true). The measure consisted of three 6-item subscales for measuring autonomy (e.g., "I feel free to exercise in my own way"), competence (e.g., "I feel confident I can do even the most challenging exercises"), and relatedness (e.g., "I feel attached to my exercise companions because they accept me for who I am"), respectively. This measure was shown to have good validity and reliability in college student samples (Wilson et al., 2006)

Exercise motivation was assessed with the 15-item Behavioral Regulations in Exercise Questionnaire (BREQ) (Mullan, Markland, & Ingledew, 1997). Participants responded to the items based on the question "Why do you engage in exercise?" in a 5-point scale ranging from 1 (not true for me) through 3 (sometimes true for met) to 5 (very true for me). Four separate subscales assessed one of the four motivational regulations, including intrinsic motivation (e.g., "I exercise because it's fun"), identified regulation (e.g., "I value the benefits of exercise"), introjected regulation (e.g., "I feel ashamed when I miss anexercise session"), and external regulation (e.g., "I exercise because other people say Ishould"). Previous studies have indicated appropriate factor structures and good reliabilities of this measure among college students (Mullan et al., 1997). Item scores for intrinsic motivation and identified regulation were averaged as a measure of autonomous motivation(i.e., an adaptive motivation), and those scores for introjected regulation and external regulation were averaged as a measure of controlled motivation(i.e., a maladaptive motivation)(Sebire et al., 2008).A motivation was not assessed in this study because all participants had used the recreational center that showed their intention to exercise.

Participants' exercise frequencies of various intensities were assessed using the 3-item Leisure Time Exercise Questionnaire (LTEQ) (Godin & Shephard, 1985). Participants responded to the items according to the question "During a typical week, how many times on average do you do the following kinds of exercise for more than 15 minutes during your free time?". The three items (i.e., types of exercise) were modified to assess corresponding exercise intensities: vigorous aerobic exercise, moderate aerobic exercise, and muscle-strengthening exercise. The construct validity and reliability of the scale have been supported in comparison to objectively-measured PA (Jacobs, Ainsworth, Hartman, & Leon, 1993). The frequency scores for these three items were used separately in data analyses.

Data Analysis

Prior to conducting analyses, all data were checked for missing values, invalid patterns, outliers ($|z| > 3$), and multivariate normality using a graphical methodplotting chi-square values against Mahalanobis D2(Thompson, 1990). There were less than 5% of data missing at random, so expectation maximization (EM) algorithm was used for data imputation (Tabach-

nick & Fidell, 2007). Scores for each corresponding scale and subscale of motivational constructs were averaged.Cronbach's alphas, descriptive statistics, and correlation coefficients were then computed for the study variables. To examine any significant differences in the composition of PA types by sex and race/ethnicity, chi-square tests of independence were conducted with a post-hoc procedure to examine which groups constituted the significant differences based on their adjusted standardized residuals (García-Pérez & Núñez-Antón, 2003). Bonferroni-corrected p values of .0083 (.05/6) and .0042 (.05/12) were used to determine the statistical significance of the chi-square tests regarding six tests for sex and 12 tests for race/ethnicity.

To investigate the association of PA types with exercise motivational profiles and behavioral frequencies, two separate descriptive discriminant analyses (DDA) were performed with two respective functions to identify any significant group differences ($p < .05$) among the three groups (sport participation, fitness training, and aerobic exercise). Canonical correlations (R_c) were used to examine the magnitude of the group differences accounted for by the significant functions, and structure coefficients (r_s) > .30 were used to determine the variables that primarily contributed to these differences (Tabachnick & Fidell, 2007). Follow-up ANOVAs with Bonferroni post-hoc tests were used to examine the significant differences ($p < .05$) among the group centroids that represent the composite scores in a set of variables (i.e., motivational profiles and behavioral frequencies). Cohen's ds were then computed to represent the effect sizes of the centroid differences. DDA is superior to the commonly-used MANOVA with post-hoc univariate tests, because DDA reduces Type I error by specifying what the group differences are using only one statistical procedure (Sherry, 2006), and it accounts for the complex and interrelated nature of variables (e.g., frequencies of various exercise intensities) studied within the exercise context (Barton, Yeatts, Henson, & Martin, 2016). Cohen's d was used to indicate small (0.2), moderate (0.5), and large (0.8) effect sizes for the group differences.

RESULTS

During data screening, we excluded 40 participants of which (a) nine were under 18 years of age, (b) eight were not first-time freshmen, (c) five had missing data for more than half of the survey items, and (e) 18 consisted of univariate and/or multivariate outliers. Therefore, this study included a final sample of 170participants (68 male, 102 female).The demographic composition of the participants, including sex, age, race/ethnicity, college of study, frequency of recreation center visits, are displayed in Table 1. The composition of these demographics is comparable to those of the student population in the same university, except that our sample had a relatively higher female-to-male ratio (60.0% vs. 53.0% female), higher ratios of students in Arts & Sciences (41.8% vs. 34.9%) and Engineering (15.3% vs. 9.7%), and lower ratios of Business (10.0% vs. 16.4%), Public & Community Service (4.7% vs. 9.0%), and Merchandising, Hospitality, & Tourism (1.8% vs. 4.4%) than the general student population.The descriptive statistics of study variables for the overall sample and each PA type are displayed in Table 2. Participants generally perceived high levels of need satisfaction and autonomous motivation and low levels of controlled motivation, while they reported relatively equal levels of intrinsic and extrinsic goals. All study measures demonstrated good internal consistency (αs > .85) in this study.

PA Type Across Sex and Race/Ethnicity

Chi-square tests of independence indicated significant differences in the composition of PA type by sex, X^2 (2) = 13.33, p = .001, but not by race/ethnicity, X^2 (8) = 14.00, p = .08. Upon examination of the PA type composition between the sexes, the male participants consisted of a significantly larger proportion of fitness training (36.8% vs. 16.7%; p = .002) and smaller proportion of aerobic exercise (19.1% vs. 42.2%; p = .003) than the female participants, whereas no significant differences were found in the proportion of sport participation between male and female participants (44.1% vs. 41.1%; p = .70).

Exercise Motivational Profiles and Behavioral Frequencies AcrossPA Types

The DDA of exercise motivational profiles indicated a significant full model of Function 1 to 2, Wilks' λ = .79, X^2 (14) = .38.56, p< .001, but a nonsignificant model of Function 2, Wilks' λ = .95, X^2 (6) = 8.31, p = .21. Function 1 explained 16.8% of the variance in the discrimination of motivational profiles across PA types. Examination of r_s revealed that intrinsic goals, competence, relatedness, and autonomous motivation primarily contributed to the differences in motivational profiles (see Table 3). Follow-up ANOVA results further showed that sport participation had a significantly higher group centroid than fitness training (p < .001, Cohen's d = .75) and aerobic exercise (p < .001, Cohen's d = .99), whereas the group centroids of fitness training and aerobic exercise were not significantly different (p = .58; see Figure 1). Therefore, sport participation had a more adaptive motivational profile, signified by higher intrinsic goals, competence, relatedness, and autonomous motivation, than fitness training and aerobic exercise with medium effect sizes.

The DDA of exercise behavioral frequencies indicated a significant full model of Function 1 to 2, Wilks' λ = .83, $X2$ (6) = .31.29, p< .001, and a significant model of Function 2, Wilks' λ = .95, X2 (2) = 8.29, p = .02. Function 1 and Function 2 respectively explained 13.0% and

Table 1. Demographic Information of Study Participants (N = 170)

Demographic variables	n	%
Sex		
Male	68	40.0
Female	102	60.0
Age		
18	141	82.9
19	28	16.5
20	1	0.6
Race/Ethnicity		
White	94	55.3
Black	20	11.8
Hispanic / Latino	41	24.1
Asian	9	5.3
Other	6	3.5
College of study		
Arts & Sciences	71	41.8
Business	17	10.0
Education	17	10.0
Engineering	26	15.3
Music	10	5.9
Public Affairs & Community Service	8	4.7
Journalism	7	4.1
Merchandising, Hospitality, & Tourism	3	1.8
Visual Arts & Design	8	4.7
Undecided	3	1.8
Recreation center visit per week		
<1	28	16.5
1	27	15.9
2	40	23.5
3	36	21.2
4	21	12.4
>4	18	10.6

4.9% of the variance in the discrimination of behavioral frequencies across PA types. Examination of r_s revealed that vigorous aerobic exercise and muscle-strengthening exercise primarily contributed to the differences in behavioral frequencies for Function 1 and Function 2, respectively (see Table 3). Whereas these contributions were mostly positive, vigorous aerobic exercise negatively contributed to the behavioral frequencies in Function 2. Follow-up ANOVA for Function 1 further showed that sport participation had a significantly higher group centroid than fitness training ($p = .005$, Cohen's $d = .54$) and aerobic exercise ($p < .001$, Cohen's $d = .87$), while the group centroids of fitness training and aerobic exercise were not significantly different ($p = .12$; see Figure 1). On the other hand, follow-up ANOVA for Function 2 showed that fitness training had a significantly higher group centroid than sport participation ($p = .05$, Cohen's $d = .44$) and aerobic exercise ($p = .02$, Cohen's $d = .51$), while the group centroids of sport participation and aerobic exercise were not significantly different ($p = .99$; see Figure 1). Therefore, the differences in exercise behavioral frequencies are characterized by more vigorous aerobic exercise and muscle-strengthening exercise in sport participation than in fitness training and aerobic exercise with

Table 2. Means and Standard Deviations of Exercise Motivational Profiles and Behavioral Frequencies for the Overall Sample and Each Activity Type

		Overall (N = 170)		Sport participation (n = 72)		Fitness training (n = 42)		Aerobic exercise (n = 56)	
	α	M	SD	M	SD	M	SD	M	SD
Intrinsic goals	.87	4.84	1.04	5.12	1.10	4.74	0.94	4.55	0.96
Extrinsic goals	.90	4.77	1.35	4.76	1.40	5.00	1.32	4.60	1.31
Autonomy	.90	5.12	0.82	5.09	0.84	5.06	0.86	5.21	0.77
Competence	.89	4.55	0.92	4.86	0.81	4.41	0.82	4.26	1.01
Relatedness	.91	4.11	1.13	4.31	0.99	3.96	1.29	3.96	1.16
Autonomous motivation	.87	3.94	0.77	4.12	0.64	3.71	0.80	3.87	0.84
Controlled motivation	.85	2.68	0.94	2.66	0.92	2.79	0.98	2.62	0.94
Vigorous aerobic exercise	—	2.63	1.70	3.26	1.65	2.14	1.60	2.18	1.58
Moderate aerobic exercise	—	3.44	2.01	3.33	2.00	3.59	2.25	3.47	1.86
Muscle-strengthening exercise	—	2.39	1.78	2.88	1.80	2.60	1.84	1.56	1.43
Total exercise	—	8.46	3.56	9.47	3.83	8.33	2.81	7.21	3.34

Note.Behavioral frequencies (i.e., vigorous aerobic exercise, moderate aerobic exercise, muscle-strengthening exercise, and total exercise)were based on the number of times per week participants reported engaging in those exercises.

medium-to-large effect sizes, as well as larger ratios of muscle-strengthening exercise to vigorous aerobic exercise in fitness training than in sport participation and aerobic exercise with small-to-medium effect sizes.

DISCUSSION

The purpose of this study, guided by SDT, was to explore whether the prevalence of PA types(i.e., sport participation, fitness training, and aerobic exercise) varied across college freshmen's sex and race/ethnicity and to examine the exercise motivational profiles and frequencies of various exercise intensities across the PA types. Overall, most participants belonged to the sport participation group, followed by the aerobic exercise group. While a larger proportion of male than female participants constituted the fitness training group, an opposite pattern was shown in the aerobic exercise group. This finding supports previous evidence of college students' exercise behavior thatmale college students generally prefer fitness training for better fitness, whereas their female counterpartsgenerally prefer aerobic exercise for weight loss and better appearance (Keating et al., 2005).This activity selection by gender is also in line withSDT and Molanorouzi and colleagues' (2015) finding that male exercisers were more motivated by competition and mastery, while female exercisers were more motivated by physical condition and appearance.

As expected, the sport participation group had the most adaptive motivational profile, differentiated by higher intrinsic goals, competence, relatedness, and autonomous motivation than the fitness training and the aerobic exercise groups. These findings are consistent with previous studies on motivation and PA types, which indicated higher intrinsic motivation among sport participants than exercisers focusing on fitness and/or aerobic activities (Ball et al., 2014; Frederick-Recascino & Schuster-Smith, 2003). SDT posits that autonomy, competence, and relatedness are three basic psychological needs that lead to intrinsic motivation and long-term engagement in an activity (Deci & Ryan, 2000). Supporting these tenets of SDT, the intrinsic nature of sport participation tends to promote skill development, social affiliation, and internal drive to improve, thus providing opportunities

Table 3. Results of the Descriptive Discriminant Analyses

Variable	Standardized coefficient	r_s	r_s^2 (%)
Exercise motivational profiles			
Function 1		R_c= .41	R_c^2= 16.8%
Intrinsic goals	.466	.548*	30.0%
Extrinsic goals	–.180	.044	0.2%
Autonomy	–.826	–.112	1.3%
Competence	.898	.683*	46.6%
Relatedness	–.102	.341*	11.6%
Autonomous motivation	.195	.419*	17.6%
Controlled motivation	–.200	.002	0.0%
Exercise behavioral frequencies			
Function 1		R_c= .36	r_c^2= 13.0%
Vigorous aerobic exercise	.633	.831*	69.1%
Moderate aerobic exercise	–.131	–.100	1.0%
Muscle-strengthening exercise	.573	.804*	64.6%
Function 2		R_c= .22	R_c^2= 4.9%
Vigorous aerobic exercise	–.847	–.505*	25.5%
Moderate aerobic exercise	.229	.156	2.4%
Muscle-strengthening exercise	.904	.593*	35.2%

Note.R_c= canonical correlation; R_c^2= squared canonical correlation; r_s= structure coefficient; r_s^2 = squared structure coefficient. *$|r_s|$>.30. Only significant functions are shown in the table.

to enhance intrinsic goals and motivation as well as to satisfy competence and relatedness (Lower et al., 2013). However, external goals, autonomy, and controlled motivation did not differentiate the PA types in this study. It is plausible that sport participation still contains an extrinsic nature related to competition and outperforming others, thus promoting certain external goals and controlled motivation. However, the attribution of external goals and controlled motivation in the sport participation group is likely different than in the fitness training (i.e., to look fit) and aerobic exercise (i.e., to lose weight) groups. On the other hand, a plausible reason for similar levels of autonomy across PA types is that college freshmen who engage in any of these PA types mostly choose to exercise at a recreational facility instead of being forced to do so. These profiles with mixed goals, psychological need satisfaction, and motivational regulations support the SDT notion that motivational constructs are multidimensional—individuals could score high or low in all the constructs, or a combination of high and low values(Chu, Zhang, & Hung, 2018; Vansteenkiste, Sierens, Soenens, Luyckx, & Lens, 2009).

Regarding exercise behavior, the sport participation group had higher behavioral frequencies, characterized by more vigorous aerobic exercise and muscle-strengthening exercise in general, than the fitness training and aerobic exercise groups. The high frequency of muscle-strengthening exercise in the sport participation group may be attributed to the sport participants' needs to keep improving strength and endurance for better sport performance. The fitness training group had a larger proportion of muscle-strengthening exercise to vigorous aerobic exercise than the sport participation and aerobic exercise groups, although the frequency of muscle-strengthening exercise by itself was lower than in the sport participation group. This finding implies that college freshmen who focus on fitness training perform mostly muscle-strengthening exercise with little vigorous aerobic exercise. Moderate aerobic exercise did not contribute significantly to the group differences in this study, which could be attributed to its activity nature—walking briskly, slow

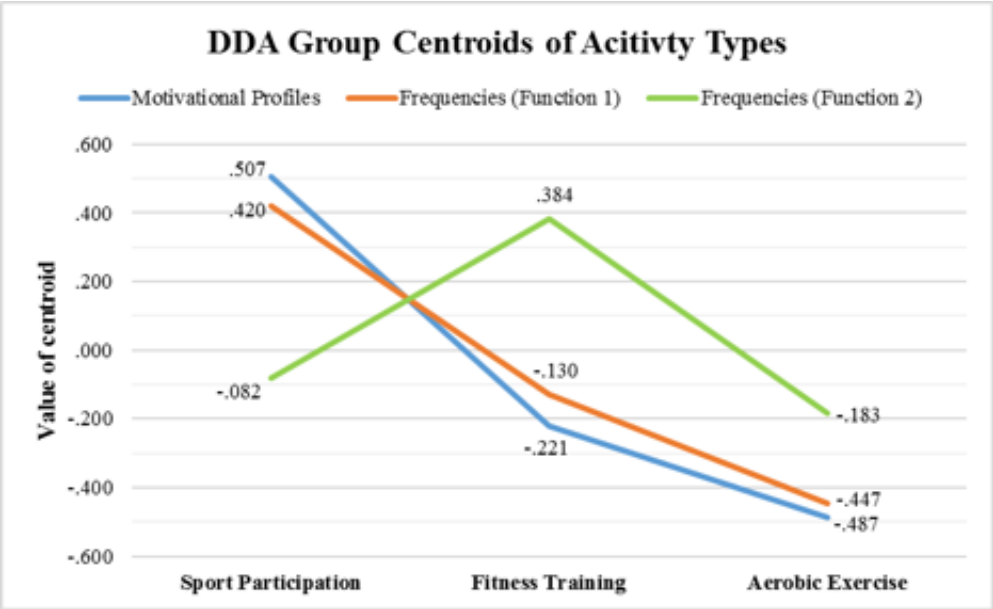

Figure 1.Group centroids of the three activity types from the descriptive discriminant analyses (DDA) in exercise motivation profiles and behavioral frequencies.

bicycling, and jogging are unintentional activities in which most college students do not engage very often(ACHA, 2012). Therefore, the frequency of moderate aerobic exercise did not vary across PA types. These results further suggest that sport participation is the most promising PA type for college freshmen to meet the recommended PA guidelines, although a combination of fitness training and aerobic exercise could potentially accumulate enough vigorous and moderate aerobic exercise. College freshmenin the aerobic exercise group,femalesin particular, shall spend more time on muscle-strengthening exercise through sport participation or fitness training in order to achieve two days minimum of strength training per week (ACSM, 2011).

There are several limitations in this study that need to be acknowledged. First and foremost, all of the study measures were self-reports, so they were subject to biases and social desirability of reporting more adaptive exercise motivational profiles and higher behavioral frequencies. Future research should incorporate objective measures, such as accelerometers, to assess participants' exercise behavioral frequencies. Second, given the cross-sectional research design, we could not interpret any causal effects of PA type on exercise motivational profiles and behavioral frequencies. Experimental or longitudinal research design is needed to understand the potential influence of PA types by studying the changes in motivational profiles and behavioral frequencies over a period of time. Furthermore, more qualitative studies are warranted to further our understanding of "why" PA types may be related to motivational outcomes beyond "what" relationships exist among the variables.

The last limitation is related to the sample of this study. The data were collected from a relatively small sample of freshmen, with about 4% of response rate, at only one large-sized public university in the southwestern U.S. Although this sample was representative of the freshman population in the university, the results might not be generalizable to other smaller universities in a different region, or to other types of institutions. Moreover, all of the participants had some degree of motivation to exercise, andself-selection bias might exist as the college freshmen who chose to participate in this study were likely to value exercise and thus had adaptive motivational profiles. A higher ratio of female than male participants could have also influenced the DDA results, as female exercisers tend to engage in more aerobic exercise and less muscle-strengthening exercise than their male counterparts. Thus, further research with larger sample sizes from a greater variety of collegesare needed to test whether our findings will hold true. Despite this

sampling limitation, the sample characteristics including the distribution of race/ethnicity and college of study were comparable to the student population in the university, which enhanced the internal validity of the study findings.

To our knowledge, this was the first study that investigated PA types based on the differential goals of the activities in which college students tend to participate: sport participation based on social affiliations, fitness training based on physical and personal health awareness, and aerobic exercise based on appearance and health goals. Moreover, examination of the three PA types using multivariate analyses constitutes another major contribution of this study. Instead of using only univariate analyses such as ANOVAs with post-hoc analyses, we conducted DDAs as multivariate analyses, which provided additional information regarding the relative contribution of the variables that differentiated the three PA types. We recommend that future research continue to use multivariate analyses in order to understand the complexity of physical and psychological variables in sport and exercise settings (Barton et al., 2016).

CONCLUSION

In light of the fact that most college freshmen in the U.S. do not meet the recommended PA guidelines (ACHA, 2012), this study highlights that the college freshmen who visited the campus recreation center and primarily participated in sports had the most adaptive motivational profiles and the highest exercise behavioral frequencies. According to the USDHHS(2008), sport activities consist of a substantial amount of recommended moderate and vigorous exercise that active adults should achieve.Thus, sport participants may reap the benefits of having more adaptive motivation and health outcomes. On the other hand, the college freshmen who visited the campus recreation center and primarily engaged in aerobic exercise had the most maladaptive motivational profiles and the lowest behavioral frequencies. Thus, we propose several practical implications for college recreation and health professionalsin a large-sized university setting with similar demographics to consider. First, college campus activities should include, but not limited to, exercise programs that educate freshmen about the health benefits of sport participation and fitness training beyond aerobic exercise. For example, during freshman orientations, campus recreation and student health departments can organize workshops that provide freshmen with information about different opportunities for recreational sport participation. Second, recreational sport programs such as intramural and club sports need to be organized inclusively across skill levels to encourage participation and satisfaction of psychological needs among freshman participants. More specifically, recreational sport staff can create different levels of sport teams within one sport to maximize participants' engagement and enjoyment. Last but not least, health professionals should screen for college students' PA types beyond the quantity of their exercise in order to understand their specific activity engagement.

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