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Individual differences influence exercise behavior: how personality, motivation, and behavioral regulation vary among exercise mode preferences

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Abstract

Personality traits, participatory motives, and behavior regulation have been linked to physical activity engagement. It is possible that these dimensions are associated with the type of physical activity one chooses to engage. Thus, the purpose of this study was to examine individual differences in those participating in various primary modes of physical activity (PMA) and determine which individual differences are predictive of exercise frequency.

Methods: 403 adults (36.3 ± 11.6 yrs, 35.5% male) completed an online survey. The survey included questions related to their PMA, items for the Big Five Inventory (BFI), Exercise Motivation Inventory (EMI-2), and the Behavioral Regulation in Exercise Questionnaire (BREQ-3). PMAs were divided into 5

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main groups: CrossFit® Training ($n = 89$), Group Exercise ($n = 59$), Aerobic Training ($n = 97$), Resistance Training ($n = 127$), and Sport ($n = 31$).

Results: A multivariate ANOVA revealed significant differences in exercise motivation [$p_s \leq .001$, $\eta_p^2 = .05 - .22$] and behavior regulation [$p_s \leq .05$, $\eta_p^2 = .03 - .06$] between PMAs, but personality dimensions did not differ. A linear regression revealed that differences in motivation and regulation explained 17.1% ($p = .001$) variance in exercise behavior.

Conclusions: These findings support the notion that individual differences exist between motivational dimensions and individuals' preference to engage in a particular physical activity mode. Further, these differences in motivation influence physical activity engagement (i.e., frequency).

Keyword: Psychology

1. Introduction

1.1. Physical activity concepts, behavior, & links to health

It has been well documented that regular physical activity is a useful and effective means for reducing morbidity and mortality risk along with generalized improvements in physical and mental health. Recent evidence suggests physical activity is important to decrease risks associated with metabolic (e.g., diabetes), osteopathic (e.g., osteoporosis), cardiovascular (e.g., coronary artery disease, congestive heart failure, heart attack, stroke), and neurovascular (e.g., dementia, Alzheimer's) diseases, as well as some cancers (e.g., breast, prostate, colon; Arem et al., 2015; McKinney et al., 2016; Swain and Franklin, 2006; USDHHS, 2018). Additionally, evidence suggests greater physical activity behavior relates to reductions in anxiety, depression symptoms, and stress-related disorders (Arem et al., 2015; USDHHS, 2018).

In general, an individual is considered to meet the proposed Physical Activity Guidelines for Americans (USDHHS, 2018) by engaging in at least 150-minutes of moderate-intensity (e.g., brisk walk, swimming) aerobic exercise and at least 2 days of resistance exercise (e.g., lifting weights, body-weight resistance circuits) per week. Unfortunately, even with the existing knowledge of the importance of physical activity and its influence on well-being, only a small percentage (<20%) of the population engages in enough physical activity to reap any health benefits (Kapteyn et al., 2018; Tucker et al., 2011).

Over the past several decades, explanations have been sought to better understand physical activity behavior. In this quest, investigators have examined why individuals adopt (versus neglect) and adhere (versus drops-out) regular physical activity programs (Dalgetty et al., 2019). In order to appropriately examine behavior patterns, it is important to distinguish between "physical activity", "exercise", and

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"sport" terms. Physical activity is generally inclusive of any bodily movement that exceeds resting metabolic rates. Exercise, a sub-set of physical activity, is defined by repetitive, structured, and repetitive bodily movements with the purpose of improving a component of fitness (Guidelines for Exercise Testing and Prescription, 2017, pg 1). More "traditional" approaches to exercise include resistance training (e.g., squats, presses, power lifts, Olympic lifts) and aerobic training (e.g., long distance walking, running, swimming, cycling, rowing, skiing, etc.). In addition to traditional exercises, various group exercise programs exist (e.g., yoga, tai chi, spin class, kickboxing, step class), and some group programs (e.g., CrossFit® Training, Orangetheory Fitness) have developed a significant following as of late (i.e., an exercise trend). Lastly, some adults tend to neglect "traditional exercise programming" and elect to engage in non/competitive sports (i.e., individual versus team), a separate sub-set from exercise, to meet their weekly physical activity requirements. Due to the wide variety of physical activity choices currently available, it is possible that individual differences (e.g., personality, motivation, regulation systems) may exist that drive an individual's preference to adopt (and adhere) a specific physical activity mode, potentially resulting in greater tendency of physical activity engagement.

1.2. Theoretical underpinnings in exercise behavior

Although several behavior change theories and models have been developed in order to promote engagement in regular physical activity (e.g., transtheoretical model, various social cognitive theories, etc.), in large part these theories and models have not been very successful in implementing/encouraging regular activity, outside of the laboratory setting, for the general population (Dalgetty et al., 2019; Rhodes and Nigg, 2011). It is possible that individuals are encouraged to begin exercise programs that are incongruent to their psyche, resulting in neglect or discontinuation of physical activity behavior. Thus, an exploration of the individual, focusing on broad personality facets and motivation styles, would seem an important avenue of interest. Gaining more insight of potential individual differences associated with physical activity preference may result in more optimal physical activity prescriptions.

1.2.1. The Five Factor Model of personality

During the 20th century, personality psychologists determined an emergence of five, broad, consistent personality dimensions, now referred to as the "Big Five" or the Five Factor Model (Goldberg, 1990; John and Srivastava, 1999; McCrae and Costa, 1987). These factors (i.e., personality dimensions) have been named Extraversion (talkative, assertive, energetic), Neuroticism (nervous, easily upset), Openness to experience (intellectual, imaginative), Agreeableness (good natured, cooperative, trustful), and Conscientiousness (orderly, responsible, dependable)

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based on the various traits (i.e., characteristic adjectives) that loaded on each (see Goldberg, 1990).

Unsurprisingly, as personality encompasses various trait characteristics that influence an individual's perception and reaction to various stimuli, certain personality dimensions have been linked to exercise engagement (Allen and Laborde, 2014; Courneya and Hellsten, 1998; Rhodes and Smith, 2006). Allen and Laborde (2014) discussed personality as it relates to sport (i.e., athletic performance) and physical activity (e.g., health-related exercise, leisure activity). More specifically, they elucidate that greater athletic performance is observed in individuals with greater Conscientiousness and Emotional Stability (opposite of Neuroticism), in addition to a tendency toward greater Agreeableness. Similarly, greater Extraversion, Conscientiousness, Openness to experiences, and Emotional Stability were related to greater physical activity/health-related exercise engagement (Allen and Laborde, 2014). Courneya and Hellsten (1998) completed an investigation of personality (Big Five) and exercise behavior (exercise intensity, frequency, and adherence) and reported Neuroticism to be inversely related to more strenuous exercise intensity behavior and exercise adherence, while Extraversion and Conscientiousness were positively associated with strenuous exercise and adherence. In general, the personality dimensions Extraversion, Neuroticism, and Conscientiousness are most associated with exercise adherence and behavior, while Openness to experiences and Agreeableness are related to more specific factors of exercise behavior, and tend to be less influential. However, there is uncertainty as to how these Big Five personality traits may relate to physical activity mode (e.g., long distance, aerobic exercise, resistance exercise, group exercise, sports, etc.). Further, these relationships are likely bidirectional, that is, not only are individuals more inclined to participate in physical activity behaviors due to their personality, but their personality may also be influenced by their physical activity engagement (Allen and Laborde, 2014). Additionally, several mediating factors have been observed between personality and exercise behavior including, but not limited to, attitudes (perceptions), participatory motives, and behavior regulation styles (Allen and Laborde, 2014; Courneya and Hellsten, 1998).

1.2.2. Exercise motivation and Self Determination Theory

Participatory motives, the reasons why individuals engage (or would engage) in a behavior, have been linked to physical activity adherence and drop-out rates (Fisher et al., 2016; Ingledew et al., 1998). The Self Determination Theory introduced three "basic needs" concepts: 1) autonomy (i.e., sense of control/choice in behavior); 2) mastery/competence (i.e., perceived ability to successfully complete behavior); and 3) relatedness (i.e., social connectedness with those engaging in same/similar behavior). It is posited that these three basic needs must be satisfied in order for an individual to continue engaging in a behavior (Ryan and Deci,

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2000; Deci and Ryan, 2008). Regulation style, an individual's tendency to behave independent or dependent of external stimuli, is directly related to the first basic need, autonomy. Behavior regulation has been broken down into several motivation styles, from high external to high internal regulation (Ingledew and Markland, 2008). The motivation-regulation styles include, but are not limited to, amotivation (a lack of motivation), external (highly dependent on external rewards/avoiding punishment), introjected/identified (dependent on external rewards and dependent on self-satisfaction), and integrated/intrinsic (highly dependent on self-satisfaction) regulation (Ingledew and Markland, 2008; Mullan et al., 1997), where a greater tendency towards internal regulation is associated with more autonomous motivation (Ryan and Deci, 2000).

The basic need for autonomy, associated with greater intrinsic regulation, has been linked to greater intention and engagement in exercise behavior (Ingledew and Markland, 2008; Wilson et al., 2006). As such, it is expected that individuals with more autonomous/intrinsic motivations will engage in greater exercise behavior. This has been shown in previous work, where individuals who indicate greater enjoyment, satisfaction, and self-fulfillment were more likely to engage in exercise with greater frequency and duration, as well as adhere to their exercise regimen longer (Heinrich, Patel, O'Neal and Heinrich, 2014; Wilson et al., 2006).

1.3. Purpose and hypotheses

As sedentary behavior continues to be a prominent health issue (Flegal et al., 2016), it is important to determine how individual differences influence physical activity behavior (e.g. mode, frequency). Previous research has demonstrated associations between personality, motivation, regulation styles, and certain behavior variables (i.e., exercise intensity participation, frequency, duration, and adherence; Allen and Laborde, 2014, Courneya and Hellsten, 1998; Heinrich, Patel, O'Neal and Heinrich, 2014; Ingledew and Markland, 2008; Wilson and Dishman, 2015; Wilson et al., 2006), but these relationships have yet to be disentangled as they relate to various modes of physical activity.

The purpose of this study was twofold: (1) examine whether differences exist in personality, participatory motives, and regulation-motivation styles in individuals engaged in various physical activity modalities (i.e., CrossFit® training, aerobic training, resistance training, group exercise, sport) and (2) determine the extent to which these factors predict frequency of behavior. These five, broad physical activity categories were chosen in order to explore potential differences that may exist in these traditional (aerobic, resistance, and group exercise training) and trending (CrossFit® training) exercise forms, along with including individuals who participate in sports. Briefly, the Five Factor Model (see McCrae and John, 1992) suggest Extraversion is related to social affiliations (e.g., positive affinity of social

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interaction, seeks attention), Neuroticism represents a tendency to experience distress, and Conscientiousness references tendency for organization and follow-through of behavior, Agreeableness refers to characteristics of humanity (e.g., altruism, emotional support), and Openness depicts an individual's desire for greater "depth" in knowledge/experiences.

Thus, we hypothesized that those participating in modes of exercise typically done with others (i.e., group exercise, CrossFit training, and sport) would have greater levels of Extraversion, while those participating in modes of exercise that are more often done individually (Aerobic, Resistance Training), that is often motivated by appearance/fitness goals, would have greater levels of Neuroticism and Conscientiousness. However, we do not expect to find differences in Agreeableness and Openness, as these facets are typically not related to exercise behavior, and are conceptually less appropriate in the context of physical activity. Basing our expectations from the findings of Fisher and colleagues (2016), who found greater intrapersonal, body-related, and fitness related participatory motives for individuals engaging in aerobic and resistance training when compared to those in group exercise, we hypothesized that those engaged primarily in aerobic and resistance training would be more strongly motivated by intrapersonal (e.g., enjoyment, stress management), fitness-related (e.g., strength and endurance), and body-related (e.g., weight management, appearance) motives compared to other exercisers. By contrast, those participating in CrossFit training, group exercise, and sports were hypothesized to be more strongly motivated by interpersonal (e.g., social recognition, affiliation) motives. The final hypothesis was that those engaging primarily in aerobic and resistance training modalities would have greater intrinsic motivation/autonomy compared to those engaging in more interpersonal exercise modalities (i.e., CrossFit Training, group exercise, and sport), due to aerobic and resistance training exercise potentially requiring more internal (enjoyment, self-challenge, personal goals) motivation than those that may depend more greatly on social facilitation often seen in group-based exercise. Based on the basic need of self-regulation (autonomy) from SDT, we hypothesized that the more strongly motivated an individual is by self-fulfillment (e.g., challenge, enjoyment, stress-management), the more autonomous and thus intrinsically motivated the individual will be. By contrast, those participating in exercise modes that are more social and competitive are likely to have stronger external motivation styles.

2. Methods

2.1. Design and participants

This study was designed to reach a convenience sample of adults ($\geq$18 years) currently engaged in various exercise and sport modalities. An online questionnaire

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(i.e., Google Forms) was used to allow for digital administration of the questionnaire. The survey was distributed via social media (i.e., Twitter, Facebook) and email, using a snowball sampling approach (Atkinson and Flint, 2004), where no "cover story" was provided, nor previous study information solicited. The link was sent with a short note, such as: "Looking for current exercisers, please complete this 15−20-minute survey".

The online application, Bitly (Bitly, Inc. New York, NY), was used to shorten the survey link and track the number of "clicks" the survey received (1,085 total survey link clicks). The Bitly website allowed us to estimate our reach and calculate a response rate for our survey without storing Internet protocol (IP) addresses from any computer, therefore keeping the survey completely anonymous. Considering the survey did not have any "click" restrictions (e.g., could only click the survey once), it is possible participants could have clicked the survey link several times before completing the survey. It is also possible that some individuals started the survey and did not finish, but due to the type of survey (i.e., anonymous), we are unable to calculate an attrition rate. Rather, we only can calculate how many individuals successfully completed and submitted the entire survey from the total number "clicks" recorded (38.5% response rate). All participants provided informed consent prior to beginning the survey, and the study protocol was approved by the Kennesaw State University Institutional Review Board (Study #17-438). All data were collected via a Google forms survey and downloaded into Excel 2011 (Microsoft Co., Redmond, WA).

2.2. Survey

2.2.1. Descriptive, demographics, exercise/sport

The survey included several descriptive (i.e., sex, age) and demographic questions (i.e., currently residing in the US?), along with questions regarding details of participants' current primary mode of physical activity (PMA). Participants were to choose their PMA from a list containing (with examples provided): 1) CrossFit® training, 2) aerobic exercise (e.g., running, swimming), 3) resistance training (e.g., weight lifting, power/Olympic lifting), 4) group exercise (e.g., Zumba, yoga), 5) sport (i.e., individual, team), or 6) other (where a short answer response could be provided). Participants were then asked to indicate specifics (data not provided) of that exercise (e.g., Kick boxing class, cycling, weight lifting, etc.) or sport (i.e., which sport(s)). Participants were also asked to give details about frequency of exercise (i.e., "In a given week, how frequently do you participate in your primary mode of exercise?"), as well as length of primary mode participation ("How long have you participated in your primary mode of exercise?").

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2.2.2. Personality and motivation

The Big Five Inventory (BFI) is a 44-item valid and reliable questionnaire measure of the personality factors proposed within the Five Factor Model (Goldberg, 1993; John and Srivastava, 1999). Each of the five factors (extraversion, neuroticism, conscientiousness, agreeableness, and openness) is assessed with 8−10 items, rated on a 5-point Likert-scale (1 = "disagree strongly, 3 = "neither agree nor disagree", 5 = "agree strongly"). The items are counterbalanced so that some item scores need to be reverse-scored (e.g., the extraversion item "is reserved" counter balances the item "is outgoing, sociable") before deriving a total subscale score. The items for each subscale are summed and averaged to determine an overall score for each factor.

Motives for participation were assessed with the revised Exercise Motivation Inventory (EMI-2; Markland and Ingledew, 1997). The EMI-2 is a valid, 51-item scale comprised of 14 different subscales. Each subscale is made up of 2−4 items rated on a 6-point Likert-type scale (0 = "not at all true for me"; 5 = "very true for me"), which required participants to reply to statements concerning the reasons why they "personally exercise (or might exercise)". The 14 subscales include items related to five overarching themes: intrapersonal motives (enjoyment, challenge, revitalization, stress management), interpersonal motives (affiliation, social recognition, competition), health-related motives (health pressures, ill-health avoidance, positive health), body-related motives (appearance, weight management), and fitness-related motives (strength and endurance, and nimbleness).

We used a modified version of the Behavioral Regulation in Exercise Questionnaire (BREQ-3; Markland and Tobin, 2004; Mullan et al., 1997; Wilson et al., 2006), which includes 6 styles of behavior regulation: amotivation, external, introjected, identified, integrated, and intrinsic regulation. Each regulation form has 4 items rated on a 5-point Likert-scale (1 = "not true for me", 3 = "sometimes true for me", 5 = "very true for me"). The BREQ-3 supplies mean scores for each regulation subcategory, where each subcategory reflects the continuum of self-determination (or autonomous behavior).

2.3. Statistical analysis

Pearson's correlations were conducted to determine relationships between individual difference measures (i.e., personality, participatory motives, and regulation styles). Then, two, separate Multivariate Analysis of Variance (MANOVA) were conducted. The first examined whether there were differences in personality factors (extraversion, neuroticism, conscientiousness, openness, and agreeableness), and the second examined whether there were differences in participatory motives (e.g., strength and endurance, enjoyment, affiliation), motivation themes (e.g., intrapersonal, interpersonal, health-related motivation), and motivation-regulation styles (e.g.,

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amotivation, internal, and external regulation) among the five self-selected PMAs (i.e., CrossFit®, aerobic, resistance training, group exercise, sport). These MANOVAs were conducted separately as the Big Five personality themes resulted in no-to-very low correlations among the various motivations (participatory motives, themes, and styles). If examined together, violation of the MANOVA assumption of homogeneity of variance would have resulted. Significant age and sex interactions were observed; thus, age and sex were controlled for when completing MANOVAs. When main effects were observed, post hoc analysis, using Bonferroni adjustments, were applied to determine what factors differed between primary modes. Further, using the known correlations, regression models were conducted to examine which individual difference measures predicted exercise behavior frequency. Behavior frequency was analyzed by self-reported engagement in terms of days per week. Lastly, subscale reliability, where all subscales were considered acceptable (α = .763−.928) was conducted and reported along with individual difference correlations. All analyses controlled for sex and age differences, significance was set to $p < .05$ (two-tailed), and data are reported as means (M) and standard deviations (SD). All statistical analyses were completed using SPSS 24.0 for Windows (SPSS, Chicago, IL), and no violations in assumptions were observed in these data for the MANOVAs or multiple linear regression analyses.[1]

3. Results

418 individuals completed the survey, with only 403 analyzed for this study as 15 cases were excluded because a PMA could not be determined/grouped. Of the 403 respondents analyzed, 148 were males (35.5%) and the majority lived in the United States (92.3%). The mean age was 36.3 ± 11.6 years (range of 18−75 yrs), with individuals self-selecting their PMA as resistance training (n = 127), aerobic training (n = 97), CrossFit® training (n = 89), group exercise (n = 59), and sport (n = 31). Additional participant characteristics are provided in Table 1.

3.1. Individual differences between primary modes of physical activity

3.1.1. Big Five personality factors

While controlling for age and sex differences, a MANOVA did not reveal any significant differences in personality factors between PMAs [Wilk's $\lambda = .925$, $F(4, 403) = 1.550$, $p = .057$, $\eta_p^2 = .019$]. Table 2 provides relevant information for personality factors based on primary mode of physical activity.

[1] Assumptions for a multiple linear regression (e.g., multicollinearity, homoscedasticity, independence of residuals, Durbin-Watson statistic; check that residuals are approximately normally distributed) were all checked to insure they were met.

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Table 1. Descriptive characteristics of participants.

	CrossFit	Group	Aerobic	Resistance	Sport	Total
Sample (*n, %*)	89, 22.1%	59, 14.6%	97, 24.1%	127, 31.5%	31, 7.7%	403, 100%
Sex (*% male*)	33.7%	8.4%	34.0%	49.7%	4.8%	35.5%
Age	36.6 ± 9.8	40.5 ± 11.0	37.3 ± 12.8	33.4 ± 10.9	33.5 ± 12.4	36.3 ± 11.6
Exercise behavior						
Frequency (*% PMA group*)						
1 day	0.0%	8.5%	1.0%	2.4%	12.9%	3.8%
2 days	4.5%	8.5%	4.1%	4.7%	12.9%	8.2%
3 days	21.3%	10.2%	23.7%	15.7%	16.1%	19.9%
4 days	24.7%	5.1%	28.9%	39.4%	22.6%	30.5%
5 days	41.6%	10.2%	16.5%	26.0%	9.7%	23.0%
6 days	6.7%	33.9%	19.6%	10.2%	19.4%	11.8%
7 days	1.1%	84.7%	6.2%	1.6%	6.5%	3.1%
Length of participation (*% PMA group*)						
< 6 months	9.0%	8.5%	6.2%	3.1%	6.5%	8.4%
6 − 12 months	18.0%	3.4%	11.3%	9.4%	0.0%	10.6%
1 − 3 years	32.6%	8.5%	11.3%	18.9%	12.9%	20.1%
3 − 5 years	21.3%	6.8%	16.5%	26.0%	3.2%	20.1%
> 5 years	19.1%	20.3%	54.6%	42.5%	77.4%	41.0%

3.1.2. Exercise motives

While controlling for age and sex differences, a MANOVA revealed significant differences [Wilk's $\lambda = .440$, $F(4, 396) = 4.314$, $p < 0.001$, $\eta_p^2 = .186$] between the various motivation variables (i.e., 14 participatory motives, 5 overarching motivational themes, and 6 motivation-regulation styles) and the different PMAs.

3.1.2.1. Differences in participatory motives

For the 14 EMI-2 participatory motives, significant differences among PMAs were observed for all participatory motives [$F_s(4, 396) = 3.717-32.214$, $p_s \leq .006$, $\eta_p^2 =$

Table 2. Personality differences based on primary mode of physical activity (M ± SD).

	CrossFit training	Group exercise	Aerobic training	Resistance training	Sport	Sig. *(p)*	η_p^2
Extraversion	28.6 ± 7.0	27.7 ± 7.5	26.3 ± 6.0	27.1 ± 6.8	29.0 ± 6.7	.132	.02
Neuroticism	19.4 ± 5.2	20.6 ± 6.1	21.7 ± 5.7	21.5 ± 6.3	20.0 ± 7.3	.391	.01
Conscientiousness	36.2 ± 5.3	36.5 ± 5.5	36.4 ± 5.5	35.3 ± 5.6	34.3 ± 5.3	.409	.01
Agreeableness	36.1 ± 4.7	35.7 ± 5.6	36.4 ± 4.8	35.0 ± 5.2	35.2 ± 5.3	.052	.02
Openness	34.9 ± 5.7	37.0 ± 6.4	36.1 ± 6.5	36.2 ± 5.8	37.0 ± 5.6	.178	.02

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.04 − .25], except for stress management and health pressures ($p_s > .23$). Specifically, individuals primarily engaged in CrossFit® training and Sport reported affiliation ($p_s \leq .001$) and competition ($p_s < .02$) as more motivating compared to those engaged in Group exercise, Aerobic, and Resistance training. The CrossFit® training group also reported positive health ($p_s < .05$) as a stronger motivator compared to the Group exercise, Aerobic, and Resistance training groups, and also reported greater appearance ($p_s < .002$), revitalization ($p_s < .01$), challenge ($p_s < .005$) and strength & endurance ($p_s < .01$) motivation compared to all other modes of exercise. Individuals who selected Group exercise as their PMA were least motivated by social recognition ($p_s < .03$) compared to all other PMAs and reported being less motivated by enjoyment ($p_s < .02$) when compared to CrossFit® training, Aerobic, and Resistance training. Those in the Aerobic and Resistance training groups were least motivated by nimbleness ($p_s < .03$) when compared to individuals in the CrossFit® training, Group exercise, and Sport groups. Lastly, individuals who selected Resistance training as their PMA were less motivated by ill-health avoidance ($p_s < .02$) and weight management ($p_s < .001$) compared to those who selected CrossFit® training, Group exercise, or Aerobic training (see Table 3).

3.1.2.2. Differences in motivational themes

After grouping the 14 participatory motives into motivational themes (e.g., intrapersonal, body-related), significant differences were found among PMAs and all motivational themes [$F_s(4, 396) = 3.987-24.240$, $p_s \leq .003$, $\eta_p^2 = .04 - .20$]. For the health-related theme, individuals within the resistance training group were least motivated ($p_s < .01$) compared to individuals in all other PMAs. Those within the CrossFit® training group were more motivated than other PMA groups in body- ($p_s < .04$) and fitness-related ($p_s < .02$) motives, and the CrossFit® training and Sport groups indicated interpersonal ($p_s < .001$) motives as more important when compared to the other PMAs. Additionally, the CrossFit® training group reported greater intrapersonal ($p_s < .03$) motives compared to the Group exercise, Aerobic, and Resistance training groups (see Table 3).

3.1.2.3. Differences in motivation-regulation styles

All of the behavioral regulation constructions, except for amotivation [$F(4, 396) = 2.243$, $p = .06$, $\eta_p^2 = .02$], were significantly different among PMA groups [$F_s(4, 396) = 2.442-6.426$, $p_s \leq .05$, $\eta_p^2 = .03 - .06$]. Although external regulation was relatively low (1.4 ± 0.6) among this group of participants, it was significantly lower in the Resistance training group ($p_s = .01$) compared to individuals who selected CrossFit® training and Group exercise. Further, as regulation constructs (introjected, identified, and integrated) approached greater self-regulation (i.e., autonomy), overall scores increased across PMA groups (3.3 ± 1.1, 4.5 ± 0.6, $4.2 \pm$

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Table 3. Motivation differences based on primary mode of physical activity (Mean ± SD).

	CrossFit training	Group exercise	Aerobic training	Resistance training	Sport	*Sig.* (*p*)	η_p^2
Health-related	3.4 ± 0.6	3.3 ± 0.8	3.3 ± 0.9	3.0 ± 0.8[a,b,c]	3.2 ± 0.9	.005	.04
Health pressures	1.6 ± 1.1	1.6 ± 1.3	1.5 ± 1.2	1.2 ± 1.1	1.7 ± 1.1	.232	.02
Ill health avoidance	4.1 ± 0.8	3.9 ± 1.0	3.9 ± 1.1	3.5 ± 1.1[a,b,c]	3.6 ± 1.2[a]	.002	.05
Positive health	4.6 ± 0.5[b,d,e]	4.4 ± 0.8	4.4 ± 0.9	4.2 ± 0.9[c]	3.2 ± 1.3	.006	.04
Interpersonal	3.1 ± 1.1[b,c,d]	1.6 ± 1.1	1.9 ± 1.3	2.1 ± 1.2[b]	3.2 ± 1.0[b,c,d]	<.001	.21
Social recognition	2.5 ± 1.3[c,d]	1.1 ± 1.3[a,c,d,e]	1.5 ± 1.4	1.9 ± 1.4	2.4 ± 1.4[c]	<.001	.11
Affiliation	3.7 ± 1.0[b,c,d]	2.3 ± 1.5	1.9 ± 1.5	1.8 ± 1.5[b]	3.4 ± 1.2[b,c,d]	<.001	.24
Competition	3.2 ± 1.5[b,c,d]	1.3 ± 1.4[c,d]	2.1 ± 1.7	2.7 ± 1.7[c]	3.8 ± 1.2[b,c,d]	<.001	.13
Body-related	3.8 ± 1.0[b,c,d,e]	3.5 ± 1.0	3.3 ± 1.2	3.0 ± 1.0[b,c]	3.2 ± 1.2	<.001	.07
Appearance	4.0 ± 0.9[b,c,d,e]	3.5 ± 1.1	3.2 ± 1.2	3.2 ± 1.1	3.2 ± 1.2	<.001	.08
Weight management	3.6 ± 1.3	3.4 ± 1.2	3.4 ± 1.4	2.7 ± 1.3[a,b,c]	3.2 ± 1.3	<.001	.05
Intrapersonal	4.0 ± 0.7[b,c,d]	3.3 ± 1.1[e]	3.6 ± 1.0	3.7 ± 0.9	3.7 ± 0.9	<.001	.06
Stress management	3.7 ± 1.0	3.5 ± 1.3	3.7 ± 1.3	3.7 ± 1.2	3.6 ± 1.1	.670	.01
Revitalization	4.4 ± 1.1[b,c,d,e]	3.8 ± 1.1	4.0 ± 1.0	3.9 ± 1.0	3.7 ± 1.0	<.001	.06
Enjoyment	4.3 ± 0.8	3.4 ± 1.4[a,c,d]	3.9 ± 1.3[a]	4.2 ± 1.0	3.9 ± 1.2	<.001	.06
Challenge	3.7 ± 0.9[b,c,d]	2.4 ± 1.3[c,d,e]	2.8 ± 1.3[d,e]	3.3 ± 1.2	3.4 ± 1.3	<.001	.11
Fitness-related	4.3 ± 0.8[b,c,d,e]	3.9 ± 0.9[c,d]	3.5 ± 1.1	3.6 ± 0.9	3.8 ± 0.8	<.001	.10
Strength & endurance	4.5 ± 0.6[b,c,d,e]	4.1 ± 1.0	4.0 ± 1.1	4.2 ± 0.7	4.0 ± 0.9	.001	.05
Nimbleness	4.1 ± 1.0[e]	3.8 ± 1.1	3.0 ± 1.4[a,b,e]	3.0 ± 1.4[a,b,e]	3.5 ± 1.1	<.001	.11

[a] Indicates significant difference from CrossFit® training group at $p < .05$.
[b] Indicates significant difference from Group exercise group at $p < .05$.
[c] Indicates significant difference from Aerobic training group at $p < .05$.
[d] Indicates significant difference from Resistance training group at $p < .05$.
[e] Indicates significant difference from Sport group at $p < .05$.

0.9, respectively). This denotes a trend towards greater intrinsic regulation for the majority of participants (see Fig. 1). The CrossFit® training group had significantly greater introjected regulation ($p_s < .03$) compared to those in Group exercise and Resistance training. Further, the CrossFit® training and Resistance training group indicated greater identified regulation ($p_s < .01$) compared to Group exercise and Sport. Those in the Sport group had lower reported integrated regulation ($p_s < .03$) compared to CrossFit® and Resistance training groups, and those who selected Group exercise were significantly lower than the CrossFit® training group ($p < .02$). Even with all PMA groups reporting relatively strong internal regulation (4.3 ± 0.8), those within the CrossFit® and Resistance training groups reported significantly higher internal regulation ($p_s < .03$) compared to those in Group exercise and Aerobic training (see Table 4).

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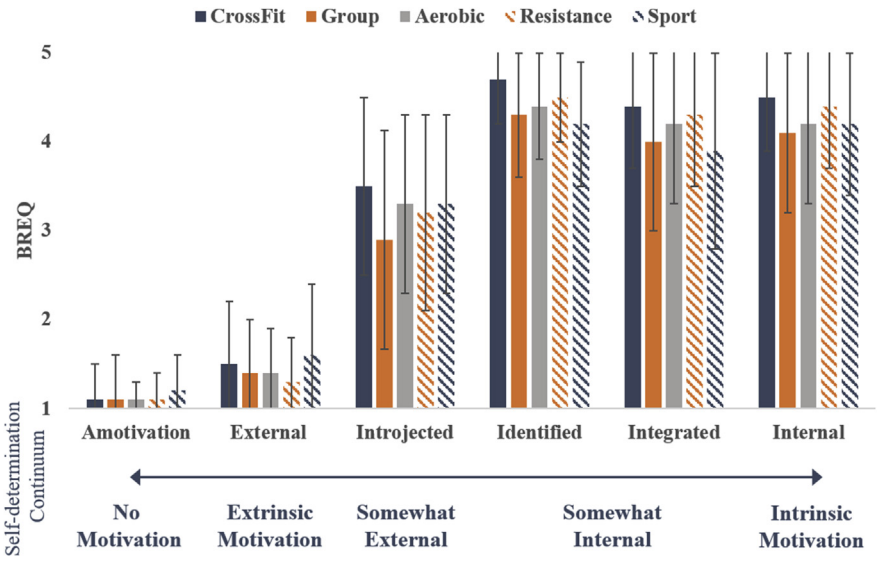

Fig. 1. Regulation responses across PME placed on the Self-determination continuum. Note: The Self-determination continuum was developed by Ryan and Deci (2000).

Table 4. Regulation differences based on primary mode of physical activity (Mean ± SD).

	CrossFit training	Group exercise	Aerobic training	Resistance training	Sport	*Sig.* (*p*)	η_p^2
Lack of							
Amotivation	1.1 ± 0.4	1.1 ± 0.5	1.1 ± 0.2	1.1 ± 0.3	1.2 ± 0.4	.064	.02
Extrinsic							
External	1.5 ± 0.7	1.4 ± 0.6	1.4 ± 0.5	1.3 ± 0.5[a,e]	1.6 ± 0.8	.026	.03
Introjected	3.5 ± 1.0[b,d]	2.9 ± 1.2[c]	3.3 ± 1.0	3.2 ± 1.1	3.3 ± 1.0	.016	.03
Intrinsic							
Identified	4.7 ± 0.5[b,c,e]	4.3 ± 0.7	4.4 ± 0.6	4.5 ± 0.5[b,e]	4.2 ± 0.7	<.001	.06
Integrated	4.4 ± 0.7[b]	4.0 ± 1.0	4.2 ± 0.9	4.3 ± 0.8	3.9 ± 1.1[a,d]	.046	.02
Internal	4.5 ± 0.6[b,c]	4.1 ± 0.9	4.2 ± 0.9	4.4 ± 0.7[b,c]	4.2 ± 0.8	.004	.04

[a] Indicates significant difference from CrossFit® training group at $p < .05$.
[b] Indicates significant difference from Group exercise group at $p < .05$.
[c] Indicates significant difference from Aerobic training group at $p < .05$.
[d] Indicates significant difference from Resistance training group at $p < .05$.
[e] Indicates significant difference from Sport group at $p < .05$.

3.2. Individual differences influencing physical activity behavior

Significant relationships were seen between various individual difference measures and frequency of physical activity behavior (see Table 5). Together, 18.6% variance in frequency was observed using all individual difference measures as predictors in a multiple regression ($R^2 = .186$, $p < .001$). More specifically, the Big Five factors did

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Table 5. Relationships between individual differences and physical activity frequency.

Variable	M ± SD	α	*Correlations*													
			1.	**2.**	**3.**	**4.**	**5.**	**6.**	**7.**	**8.**	**9.**	**10.**	**11.**	**12.**	**13.**	**14.**	**15.**	**16.**
1. Extraversion	27.5 ± 6.8	0.866	1.0															
2. Neuroticism	20.8 ± 6.0	0.806	**−.34**	1.0														
3. Conscientiousness	35.9 ± 5.2	0.810	**.11**	**−.24**	1.0													
4. Agreeableness	35.8 ± 5.2	0.777	**.21**	**.40**	**.31**	1.0												
5. Openness	35.9 ± 6.0	0.767	**.21**	**−.13**	**.15**	.04	1.0											
6. Health-related motives	3.2 ± 0.8	0.833	.06	−.04	**.12**	**.14**	**.19**	1.0										
7. Interpersonal motives	2.2 ± 1.3	0.919	**.19**	−.07	−.08	−.02	.05	**.13**	1.0									
8. Body-related motives	3.3 ± 1.1	0.883	**.15**	−.01	.09	**.13**	.05	**.49**	**.19**	1.0								
9. Intrapersonal motives	3.7 ± 1.0	0.928	**.14**	.01	**.12**	.07	**.17**	**.40**	**.54**	**.18**	1.0							
10. Fitness-related motives	3.8 ± 1.0	0.880	**.14**	**−.15**	**.11**	.09	**.23**	**.58**	**.38**	**.39**	**.56**	1.0						
11. Amotivation style	1.1 ± 0.3	0.794	.02	.09	**−.16**	**−.14**	−.05	−.05	.07	.01	**−.17**	−.05	1.0					
12. External motivation style	1.4 ± 0.6	0.763	−.04	**.13**	**−.23**	−.04	**−.17**	.06	**.14**	**.13**	**−.12**	−.09	**.47**	1.0				
13. Introjected motivation style	3.3 ± 1.1	0.853	−.05	**.19**	−.06	−.06	−.01	**.19**	**.21**	**.40**	**.18**	**.14**	.02	**.16**	1.0			
14. Identified motivation style	4.5 ± 0.6	0.749	**.13**	−.05	**.18**	**.12**	**.12**	**.33**	**.31**	**.23**	**.62**	**.41**	**−.31**	**−.19**	**.36**	1.0		
15. Integrated motivation style	4.2 ± 0.9	0.874	**.14**	−.03	**.14**	**.10**	**.17**	**.33**	**.35**	**.15**	**.61**	**.39**	**−.22**	**−.13**	**.29**	**.73**	1.0	
16. Intrinsic motivation style	4.3 ± 0.8	0.910	**.18**	**−.11**	**.16**	**.12**	**.18**	**.20**	**.42**	.04	**.77**	**.42**	**−.22**	**−.20**	.07	**.59**	**.61**	1.0
17. Exercise frequency (*d/wk*)	4.1 ± 1.4	—	.05	−.07	.08	.02	.04	.02	**.23**	−.01	**.32**	**.10**	**−.10**	**−.12**	.08	**.26**	**.34**	**.27**

Cronbach's alpha (α) are provided for each individual difference subscale and significant Pearson's (*r*) correlations are **bolded**.

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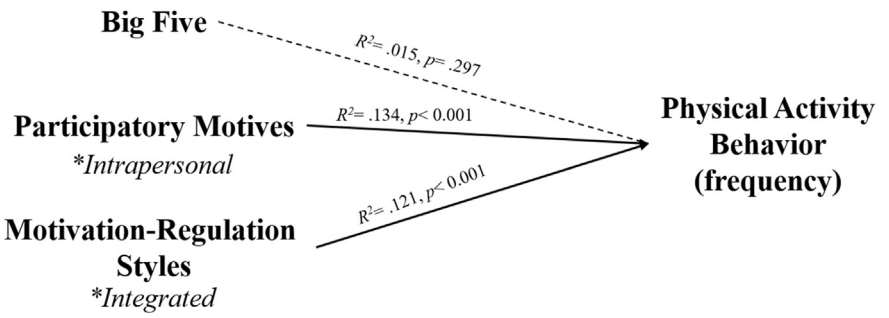

Fig. 2. Individual Differences Influence Physical Activity Behavior. Note: Solid lines represent significant predictor-outcome relationship. These significant participatory motives/motivation regulation styles and physical activity behavior relationships were driven by intrapersonal motives and integrated regulation styles, respectively (see text for specifics). As these variables were measured concomitantly, caution should be used when interpreting this predictor-outcome relationship, as it is a correlational regression model.

not provide significant unique variance ($R^2 = .011$, $F(5, 397) = 5.502$, $p = .420$), while motivation themes explained 13.4% unique variance ($R^2 = .134$, $F(10, 392) = 12.331$, $p < .001$), and regulation-motivation explained an additional 4.1% variance ($R^2 = .041$, $F(16, 386) = 7.551$, $p < .001$) in exercise behavior frequency. See Fig. 2 for simple linear relationship models between individual difference measures and behavior. The variance in physical activity frequency was driven by intrapersonal motives ($r = .32$, $\beta = .355$, $p < .001$, $\lambda = .241$) from the participatory motive themes and integrated regulation ($r = .34$, $\beta = .274$, $p < .001$, $\lambda = .023$) from the motivation-regulation styles. After taking intrapersonal motives and integrated regulation into account, none of the other factors explained additional variance ($r_s = \pm .01 - .27$, $\beta_s = \pm .006 - .117$, $p_s \geq 0.10$) in frequency of physical activity behavior.

4. Discussion

The twofold purpose of this study was to examine differences in personality, participatory motives, and regulation-motivation styles in individuals engaged in various exercise modalities (i.e., CrossFit® training, Aerobic training, Resistance training, Group exercise, and Sport) and the extent to which these factors predict frequency behavior. We hypothesized that those participating in physical activity modes typically done in a group setting (i.e., Group exercise, CrossFit training, and Sport) would have greater Extraversion, while more individual-based exercise modes would have greater Neuroticism and Conscientiousness. Contrary to this hypothesis, the present results indicated little variance in the Big Five personality factors across PMAs. Furthermore, we hypothesized that those who selected Aerobic and Resistance training would be more motivated by intrapersonal (e.g., enjoyment, stress management), fitness-related (e.g., strength and endurance), and body-related (e.g., weight management, appearance) motives compared to other exercisers, while those participating in Group

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exercise, CrossFit training, and Sport would be more motivated by interpersonal (e.g., social recognition, affiliation) motives. In general, interpersonal motives were greater among those engaging in CrossFit® training and Sport, but not Group exercise, while fitness-, body-, and intrapersonal motivation was more variable across PMAs. Overall, it seemed that those who selected CrossFit® training as their PMA reported stronger motivation across the majority of participatory motives in comparison to the other PMAs. This may be a result of the encompassing nature of CrossFit training, that is, it may fulfill motives for participation more broadly than other exercise modes. Additionally, we hypothesized that those engaging primarily in Aerobic and Resistance training modalities would report greater intrinsic motivation compared to those engaging in more interpersonal exercise modalities (i.e., Group exercise, CrossFit training, and Sport). In general, a trend was observed across PMAs where individuals indicated low amotivation/external regulation and greater internal regulation. However, and consistent with our hypothesis, while Group exercise and Sport resulted in less intrinsic motivation compared to Aerobic and Resistance training, CrossFit® training participants reported the greatest levels of intrinsic motivation. Lastly, in support of our hypothesis that physical activity behavior (i.e., frequency of engagement) could be predicted by individual difference measures (i.e., personality and motivation), these findings suggest that individual differences in exercise motivation and regulation are predictive of some variance (17%) in participation frequency.

4.1. Personality and exercise mode

Although personality has been extensively examined in the context of exercise behavior (Rhodes and Smith, 2006; Wilson and Dishman, 2015), there has been minimal exploration into the differences of personality traits across different modes of physical activity engagement. The majority of cases in the existing literature confine comparisons between Aerobic and Resistance training. As such, this study sought to examine whether (and to what extent) personality differences exist in individuals participating in more traditional exercise modes (i.e., Aerobic and Resistance training), Group exercise (e.g., Zumba, Yoga, Spin), Sports, and CrossFit® training. Courneya and Hellsten (1998) examined personality differences (using the Five Factor Model) across various exercise behaviors, including exercise type (i.e., mode). Similar to the present findings, they did not observe any differences in indices of Extraversion, Neuroticism, or Conscientiousness when examining exercise type, but did find that those who performed resistance training reported less Agreeableness than those completing more aerobic style exercise. Although some patterns exist illuminating the role of Extraversion in physical activity choice (Howard et al., 1987), it was not an important factor in this study for current exercisers across various exercise modes. Extraversion, Conscientiousness, and Neuroticism differences are typically greater when comparing exercisers to non-exercisers (Rhodes and Smith, 2006). Exercisers typically indicate greater Extraversion,

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Conscientiousness, and exercise engagement (e.g., frequency), while non-exercisers report greater Neuroticism (Wilson and Dishman, 2015). Overall, these results indicate a greater tendency for Extraversion ($d = .371$), Conscientiousness ($d = .431$), and Emotional stability ($d = .747$) in comparison to an average population ($N = 318$ non-clinical, 67% female, 31.4 ± 14.1 years; Alansari, 2016).

4.2. Motivation and exercise mode

The concept of exercise motivation has been rigorously studied, with various theoretical frameworks to explain behavior patterns. These studies tend to examine participatory motives and behavioral regulation as a predictor of behavior (Teixeira et al., 2012). That is, specific participatory motives (e.g., enjoyment) and/or distinct regulatory behaviors (e.g., intrinsic) are hypothesized to lead to greater engagement in physical activity (e.g., frequency, adherence). Self Determination Theory posits three basic needs (Autonomy, Mastery, and Relatedness) as necessary for continued physical activity behavior, and behavioral regulation can be considered a means of measuring autonomous behavior, or self-determination. As such, researchers have sought to determine which participatory motives most influence behavior regulation patterns (Ingledew and Markland, 2008), and how behavior regulation directly influences behavior (Standage et al., 2008; Teixeira et al., 2012). Numerous relationships have been reported between participatory motives and exercise behavior (Fisher et al., 2016; Heinrich, Patel, O'Neal and Heinrich, 2014; Kilpatrick et al., 2005). However, less is known about the motivational differences between various physical activity modes. Fisher and colleagues (2016) examined motivational differences between individuals participating in various forms of resistance training (e.g., CrossFit®, group or individual resistance training), and, consistent with the present findings, found that those engaging in CrossFit® reported greater intrapersonal motives (e.g., enjoyment, challenge), while those who trained alone were motivated by health reasons. Another cross-mode motivation study reported those engaging in CrossFit® training experienced greater enjoyment compared to more traditional (aerobic and resistance training) exercise modes (Heinrich et al., 2014). In a study comparing exercise motivation in college-age men and women, significant differences were found between participatory motives and interest in exercise or sport engagement (Kilpatrick et al., 2005). More specifically, those who indicated interest in sport involvement were motivated more by interpersonal (e.g., affiliation, competition) and intrapersonal motives (e.g., challenge, enjoyment), while being less motivated by health- and body-related motives. These participatory motives do not directly relate to behavior regulation patterns, thus not fully examining the construct of self-determined physical activity behavior. However, while growing evidence suggests more internal regulation is related to greater behavior (Teixeira et al., 2012), how regulatory patterns differ between physical activity mode choice has not been examined.

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4.3. Individual differences and physical activity behavior

It has been suggested that personality directly influences participatory motives and indirectly influences behavior regulation, which then influences engagement behavior (Ingledew and Markland, 2008). For the current findings, personality did not differ across PMAs, but participatory motives and behavior regulation did. Thus, for this sample of adults currently engaged in regular physical activity, personality did not appear to moderate the relationship between motivation/regulation and physical activity participation. Conversely, previous literature has suggested that the personality factors of extraversion, conscientiousness, and neuroticism directly influence exercise behavior (Wilson and Dishman, 2015). Moreover, enjoyment, a participatory motive, has been directly linked to increased exercise engagement (Hagberg et al., 2009). Not only did the present findings suggest differences in various participatory motives across PMAs, but these differences resulted in significant variability in exercise behavior. Similarly, as more autonomous regulation leads to a greater likelihood of exercise behavior (Standage et al., 2008), these findings support the idea that a trend toward intrinsic regulation is associated with greater exercise frequency. Overall, in agreement with previous literature, individual differences play a vital role in physical activity behavior.

4.4. Limitations and future directions

Although the purpose of this study was to target a broad range of individuals, it excluded individuals who were not currently engaged in a physical activity behavior (i.e., sedentary). Thus, generalizing these findings related to individual difference measures as predictive for future exercise may be limited. Additionally, this study examined broad physical activities modalities and, subsequently, may have missed important individual differences within more specific physical activity/exercise modes; such as, individuals who chose aerobic/resistance training as their PMA, primarily exercise alone or in a group. It is possible that including this information in future studies may provide additional individual difference information to optimize physical activity prescriptions. Lastly, although a standard way of measuring personality and participation motives, caution should be used for the accuracy of self-report data.

Future investigations should seek to include inactive individuals in order to further elucidate the role of individual differences in physical activity intention, initiation, and adherence or drop-out. It is possible personality and motivation play a more significant moderating role in bridging behavior intention and initiation, and, further, initiation and adherence/drop-out in individuals who struggle to adopt physical activity behavior. Additionally, this study was designed to target current "exercisers", thus potentially excluding individuals who participate primarily in physical activity that is not considered structured exercise (e.g., rock climbing, kayaking). As a potential for individual differences exist across physical activity forms (not just structured

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exercise), a need for more extensive physical activity mode differentiation and analysis is needed.

5. Conclusions

This study builds upon previous personality and motivation literature as it reaffirms the importance of individual differences in physical activity choice (i.e., mode), but also portrays the importance of individual differences in engagement (i.e., frequency). Interestingly, these findings suggest that the Big Five personality dimensions are relatively similar across physical activity modes. As most literature compares inactive versus active individuals, these findings suggest individuals engaging in various modes of physical activity have similar personalities. Perhaps more importantly, these findings are suggestive of some variability in participatory motives across physical activity modes. On average, and regardless of reported primary mode, individuals were motivated for health-related, body-related, fitness-related, and intrapersonal reasons, with those who selected CrossFit® training and sport also indicated high interpersonal motives. More specifically, individuals engaging in CrossFit® training, group-exercise, and sport are more motivated by fitness-related reasons, while those primarily engaging in aerobic and resistance training are more motivated by intrapersonal reasons. Regardless of primary physical activity mode choice, a trend was observed for greater intrinsic motivation-regulation styles (i.e., identified, integrated, and internal). This was expected as greater internal regulation has been positively associated with exercise behavior, and all of these participants had been engaging in exercise at time of survey completion. As physical inactivity is a prominent public health concern, identifying an individual's reasons for exercise (i.e., motivational drive) and suggesting modalities based on these differences may aid in exercise interest and adherence.

Declarations

Author contribution statement

Allyson G. Box: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Wrote the paper.

Yuri Feito: Conceived and designed the experiments; Performed the experiments; Wrote the paper.

Chris Brown: Conceived and designed the experiments; Wrote the paper.

Steven J. Petruzzello: Analyzed and interpreted the data; Wrote the paper.

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Competing interest statement

The authors declare no conflict of interest.

Additional information

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