

Motives for Physical Activity and Physiological Variables as Predictors of Exercise Intentions Following a High Intensity Interval Training Protocol in College-Age Females

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ABSTRACT

International Journal of Exercise Science 9(2): 121-135, 2016. More females are classified as insufficiently active and may have little time for physical activity than males (28). Sufficient activity for adults includes a minimum of 30 minutes of moderate intensity aerobic exercise, five days per week or 20 minutes of vigorous intensity exercise three days per week, or a combination of these, in addition to the resistance training recommendation of training each muscle group two times per week (14). High intensity interval training (defined as very short intense intervals, usually above 85% maximum heart rate accompanied by alternated passive recovery periods; HIIT) has become a popular alternative to the more traditional continuous training utilized by individuals due to its time efficiency. In fact, HIIT has been shown to induce many of the same physiological changes as moderate intensity training with less training time. It is possible that college-aged females may benefit from HIIT and its inherent time-saving qualities. To test this hypothesis, this study sought to determine the influence of a HIIT protocol on general motives for being physically active and intentions for future HIIT participation. Participants included sixty-five female students between the ages 18 and 25 who were enrolled in a physical activity class that included HIIT as a part of the curriculum. Physiological responses to the HIIT protocol were measured via exercise intensity and calories burned, while motives and intentions were measured through questionnaires. Results revealed no changes in any variables over the course of the study with the exception of blood pressure. Fitness was the only variable that significantly predicted intentions for exercise and thus future HIIT participation. These psychologically oriented results show some promise for the use of HIIT in this population. In order to promote long-term adherence to exercise programs, the nature of the relationship between motives and intentions call for future studies to determine why more intrinsic motives, including competence, were not related to intentions to HIIT.

KEY WORDS: Feasibility, motivation, exercise intensity

INTRODUCTION

Steady state continuous exercise (CT) is commonly utilized as a method of physical activity as it induces improvements in

cardiovascular factors and includes increased fatty acid utilization, especially among obese populations (46). However, such exercise can be time consuming. In

fact, research has consistently reported “lack of time” as a barrier to participation in physical activity and exercise (27). Among barriers that emerged in a study examining the perceived benefits and barriers to exercise adoption in young adults (32), time-effort, defined as exercise being too much work or taking up too much time, as well as social factors, including lack of encouragement from friends or family in addition to disliking exercise when done alone, were both identified. Among undergraduate females these are common barriers, coupled with lower levels of engagement in strength training exercises when compared to males (36).

High intensity interval training (HIIT), defined as very short intense intervals of exercise (above 85% maximum heart rate), alternated with less intense active or passive recovery periods, has recently garnered more attention, as it has been shown to produce comparable muscular biomechanical adaptations to CT, cutting total exercise time by approximately 75% (17). Talanian and colleagues noted that HIIT was a compromise between supramaximal HIIT (exercises completed at maximum effort for a short period of time coupled with complete rest in between), which could be difficult for the untrained, and moderate intensity exercise, which could be time consuming. The time-efficient property of HIIT lends itself well to combating the insufficient activity present in 37% of undergraduate females. (12). As such, this investigation focuses on the psychological and physiological characteristics of female undergraduate students as predictors of intentions to participate in HIIT in the future.

Self-determination theory (10) posits that satisfaction of basic needs, such as demonstrating competence, has the power to influence participation in and adherence to regular physical activity. Using the tenets of SDT, Ryan et al. (40) examined five motives towards physical activity that were associated with intrinsic or extrinsic motivation. Extrinsic motives such as fitness, (being active due to the desire to be healthy and energized); appearance (physical activity participation to improve self-image perception); and social (exercising in hopes of interacting with others); as well as intrinsic motives such as competence/challenge (engaging in activity to become more proficient at it); and enjoyment (exercising because it causes an internal feeling of happiness). Results from Ryan et al. (40) suggest that Tae Kwon Do participants demonstrated competence and enjoyment motives for the task. Being that these are more intrinsic motives, they were related to better adherence to the activity, which contrasted with the higher extrinsic motives associated with aerobics class participants. Similarly, a study comparing cyclist and general exerciser motives towards exercise found that though both competitiveness towards cycling and exercise were related to higher interest and enjoyment scores, there was no relationship between competitiveness and adherence in the exercising group (13). Nevertheless, findings from these studies supported those of Ryan and Deci (40), who noted how sports are more likely to be played for intrinsic enjoyment. It is important to note that although intrinsic motives were more likely to lead to adherence to exercise, the interplay of intrinsic and extrinsic (fitness, health) motives need to be considered together in determining motivation quality

(39). Other studies have indicated that certain social motives (including building relationships and meeting people) and positive views of body image improvement via exercise were also regarded as a benefit to exercise adoption (32).

With regards to better explaining exercise adherence, the theory of planned behavior (TPB) has been used in conjunction with SDT because it utilizes attitudes, subjective norms, and perceived behavioral control to predict intentions to engage in and future exercise behaviors (23). Research in this area has shown that rewards, deadlines, and surveillance may be some factors that cause a lack of control over engaging in the behavior and decrease individual autonomy. In connecting the two theories, Chatzisarantis et al. (5) emphasize the importance of autonomy because intention is correlated with exercise participation only when intentions are viewed as autonomous. In this regard, there may be unique qualities of HIIT that manipulate perceived ease of participation, thus contributing to motives for activity and future participation.

Eighty-seven percent of women who exercise on a daily basis despite non-exercise commitments opt for traditional moderate intensity aerobics. A potential reason for this is that they feel more comfortable with this exercise mode and its consistent results (2). However, similar results have been realized with HIIT, especially with regards to changes in body composition, blood pressure, heart rate, and rate of perceived exertion (RPE). With regards to body composition, HIIT has been shown to increase whole body fat oxidation among recreationally active women (46).

This is important because increasing whole body fat oxidation can improve the potential for muscle to utilize lipids (or fat) as a substrate for energy, as well as improve insulin sensitivity. Increasing fat oxidation during exercise may help to spare the use of glycogen, and over time could aid in fat loss. Trapp et al. (51) reported an average fat loss of 4.3% among HIIT participants. Both this study and the Talanian et al. study were relatively brief in duration, indicating the potential benefits of HIIT in the short-term. Similar results were found by Tremblay et al. (52), who after adjusting for the variation in energy expenditure by individuals of differing body composition, found that HIIT produced a six-fold decrease in subcutaneous skin folds measurements than endurance training.

With regards to blood pressure, mixed evidenced has emerged. Many of the discrepancies in observation of results are due to the duration of study interventions. For example, several studies less than 10 weeks in duration were not able to observe any changes in blood pressure after a HIIT protocol (37, 54). However, studies lasting 12 to 16 weeks seem to demonstrate significant reductions in blood pressure in a variety of populations utilizing HIIT (41, 50). This collection of evidence suggests that HIIT can induce significant improvements in BP in many populations given adequate time is allotted for the adaptations to take place. This is potentially significant as both systolic and diastolic blood pressure measures are important factors in overall heart health.

Related to this, HIIT may induce favorable changes in resting heart rate and average

heart rate values, leading to a lower perception of effort during exercise. Gearhart et al. (15) compared high resistance and low resistance high intensity intervals in recreationally trained males utilizing the rate of perceived exertion scale (RPE) to determine the participants' subjective feelings of effort. Results indicated that force production (the amount of work completed in a given moment), not total accumulated work, predicted RPE. Still, the amount of muscle tension was also associated with increased RPE.

These data provide evidence that those with time constraints could benefit from the cardiovascular and fat reductive properties of HIIT. Unfortunately, there is little research that closely ties these physiological benefits to psychological variables, such as rate of perceived exertion and motivation for exercise, which can all contribute to exercise adherence. By simultaneously considering physiological and psychological factors, it may be possible to gain a better understanding of the usefulness of HIIT among college-age females. These measurements, in addition to mean average heart rate percentage and mean maximum heart rate percentage, allow an analysis to determine existing correlations between high effort ratings, actual high effort levels, motivation of young adult females for HIIT and how likely these participants are to continue HIIT based on their intentions. Those likely to respond with the intent to continue HIIT may also exhibit intrinsic motivation or inherent enjoyment and curiosity toward the task according to self-determination theory (38).

Research has demonstrated the many physiological benefits of HIIT and previous studies in motivation and exercise adherence indicate that more intrinsic motives will influence future exercise behavior. Additionally, HIIT may provide quick adaptations and improve long-term adherence in those who get discouraged quickly. It is likely their enjoyment of HIIT and intentions will also increase due to increased competence or skill towards the exercise task, and improved self-image (39, 43).

Despite numerous studies that demonstrate the efficiency of HIIT to improve cardiovascular factors, there is a lack of research concerning potential relationships between these factors, RPE, motives for exercise and adherence towards HIIT. Therefore, the purpose of this study is to identify motives for HIIT as well as to determine if these motives, along with physiological measures, predict exercise intentions among a population that is at an increased obesity risk due to lack of time for exercise (6). A secondary purpose is to examine the change in physiological variables and motives for HIIT over the course of the protocol. We hypothesize that both motives and physiological measures will predict intentions to continue HIIT. We also hypothesize that physiological measures will change over time and that motives for HIIT will become more intrinsic.

METHODS

Participants

The sample consisted of 57 undergraduate students at a university in the Southeastern US, including Caucasian ($n=27$), African

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American ($n=27$), Hispanic ($n=2$) and multiracial ($n=1$) female participants between ages 18 and 25. These participants included all years in college (first year =9, second year =22, third year = 17, fourth year=7, five or more years = 2). At the start of the study three participants were underweight, 29 were normal weight, 16 were overweight, and 9 were obese according to BMI categories (4). Exclusion criteria included pregnancy, any risk of cardiovascular problems as identified in the Health History Questionnaire, or any disability that would hinder ability to perform intense body weight exercises. Regarding sample size, an estimate of 10 participants per predictor variable was used to determine the proper number of participants for the study.

Protocol

Health History Questionnaire. A Health History Questionnaire (HHQ) was administered as described in *ACSM's Guidelines for Exercise Testing and Prescription* to screen for cardiovascular risk factors (48).

Heart Rate: A class set of Polar Team 2 heart rate monitors (Polar Inc., Lake Success, NY) were used to record the maximum, minimum, and average heart rate as well as kilocalories expended for each participant and relayed the data to a base station connected to a laptop computer which collected the data for future upload and analysis.

Blood Pressure: An Omron (Omron, Novi, MI) automated blood pressure cuff was utilized.

Height/Weight: Anthropometric testing included measurement of height and weight on a Seca scale (Seca, Chino, CA).

RPE: The Borg CR-10 scale was utilized to understand the subjective feeling of intensity during the workout. The CR-10 scale is a culmination of ratio and categorical scales (3). The CR-10 scale allowed participants to rate their exertion with fractions and has no upper limit. A rating of "10" indicates an "extremely strong" exertion. Additionally, the standard one to ten range may be somewhat more comprehensible for participants. This scale has reliability coefficients of 0.96, (perceived exertion) and 0.97 (heart rate) and demonstrated construct validity, with coefficients of 0.85 (29).

Motives for Physical Activity: The Motives for Physical Activity Measure-Revised (MPAM-R) (40) contains 23 items assessing reasons for participating in an exercise activity, rated on a seven-point Likert scale. These items comprise 5 constructs: interest/enjoyment, competence, social, fitness, and appearance, which were scored by taking an average of the participants' scores on the items pertaining to each subscale. Internal consistency has been reported as 0.93 (interest/enjoyment), 0.93 (competence), 0.84 (social), 0.74 (fitness) and 0.74 (appearance), which is comparable to values found in the original scale.

Intentions for Future Participation in HIIT: A measure adapted from Chatzisarantis et al. (5) was used to assess participants' intentions of future HIIT participation. This three-item questionnaire was constructed with responses on a 7-point Likert scale and indicated how likely participants would be

in participating in HIIT in the next month. More specifically, the three questions asked “After taking this class, I **intend** to do HIIT at least 3 times a week during the next month”, “After taking this class, I am **determined** to do HIIT at least 3 times a week during the next month”, and “After taking this class I **plan** to exercise at least 3 times a week during the next month”. Internal consistency of this measure was comparable to previous studies, with the three items being highly correlated (Cronbach’s $\alpha = 0.83$). Overall scores were calculated by averaging question responses.

The study was performed in aerobics classes instructed by the principal investigator. Such 1-credit activity courses are offered by the university in fulfillment of a requirement to participate in 2 credits of physical activity during the undergraduate experience. This occurs regardless of major. IRB approval was obtained for this study. Informing participants that their grade in the course was not contingent upon their participation in the study minimized coercion of the participants. Those who chose not to participate in the study completed the same exercise protocol as those participating in the study. Codes were assigned to participants to ensure confidentiality by allowing each student to pick random number out of a bag. All information was kept in password-protected files on the principal investigator’s computer and in locked office cabinets. Only the investigators had access to the files and records of these data. The key for coding was only available to the principal investigator and was kept in a password-protected file. Questionnaires were completed while the principal investigator

was not in the room to avoid pressuring participants to respond in a certain way.

On the first day of data collection, the HHQ screening was taken to satisfy inclusion criteria, and written and verbal informed consent was obtained by participants who met the criteria. Then, a demographic survey was given, blood pressure screening was conducted, and height and weight were collected. Height and weight measurements were utilized to calculate BMI. All items were kept in separate folders (one for each participant). The first administration of the MPAM-R was also completed during this time. Participants were instructed to consider HIIT specifically, completely read each statement, and select the appropriate level of the Likert scale. Participants were asked to distance themselves from other participants to avoid socially desirable results. If a participant felt pressured to participate, they were reminded they could withdraw from the study without penalty. Once all participants completed their MPAM-R questionnaire, they were given the opportunity to ask questions regarding their involvement in the study.

Twice a week for nine weeks the participants engaged in body weight muscular endurance and cardiovascular HIIT in the group fitness room at a Southeastern university’s recreational center. Upon entering the classroom, participants placed their uniquely numbered heart rate monitor (which corresponded to their randomly chosen number) one inch below their sternum and assured that the monitor was flush against the body. The chest strap was tightened to secure the monitor in place.

Prior to each exercise session, participants were briefed on the Borg CR-10 scale and verbally cued on the meaning of each of the levels. The participants engaged in a five minute warm up consisting of dynamic stretching and light cardiovascular activity that mimicked the workout. Fifteen to twenty minutes of body weight interval training ensued. The HIIT workout consisted of work intervals ranging between 20 seconds and 50 seconds with rest periods equal to or less than the work duration. More complex exercises were completed during the longer work periods. For example, regular pushups were conducted during a short interval while a renegade pushup (where the participant completes a push up and rows the arm back) was completed in a longer interval. Participants were informed that they could stop at any time if needed but to try to complete the warm up, workout, and cool down to the best of their ability. During each training session RPE was recorded immediately after the HIIT portion of the workout. At the end of each class, a light cardiovascular cool down, in addition to stretching was performed. Heart rate monitors were returned after each class, washed, and prepared for the next group.

After the last workout, participants took a second MPAM-R, had their blood pressure taken, and anthropometric testing was repeated. Participants also responded to the survey measure adapted from Chatzisarantis et al. (5) to assess intentions to participate in HIIT after the end of the course.

Because many interval training studies with females are conducted at lower intensities, the participants were asked to try to

complete as many repetitions as their physical capacity allowed during the given work interval (20). The age-predicted heart rate formula was utilized to determine maximum heart rate. Their workout was not classified as "high intensity" unless their heart rate was between 85 to 100% maximum heart rate, consistent with previous research on HIIT (9). Nineteen training sessions took place over the course of the study. Participants must have completed 16 sessions to be included in the analysis.

Statistical Analysis

Statistical analysis was conducted using SPSS v.19. A formula was created to calculate total exercise volume based on self-reported responses of exercise participation prior to the start of the study to determine whether participants were already meeting minimum ACSM recommendations for cardiovascular exercise and resistance training. This formula considered number of minutes per day of light, moderate, and vigorous intensity exercise reported by the participants. A dependent *t*-test was conducted on each of the subscales of the MPAM-R (interest/enjoyment, competence, fitness, appearance, and social), resting heart rate, blood pressure, blood pressure category, weight, weight-category and BMI to determine if there were changes over the course of the study on these variables. A stepwise multiple regression analysis was conducted to determine if subscales of the MPAM-R, BMI, blood pressure, resting heart rate, and average workout RPE predicted exercise intentions. The alpha level was set at 0.05.

RESULTS

Descriptive analyses were performed to generate an accurate understanding of the population studied, as well as determine the means of variables that were entered into the dependent *t*-test and multiple regression analyses (see Table 1).

Table 1. Descriptive statistics for pre/ post intervention measurements.

	Pre	Post
N	57	52
Systolic (mmHg)*	119.09±12.14	111.50±9.70
Diastolic (mmHg)	73.74±8.08	69.44±7.00
BMI <i>kg/m²</i>	24.91±5.46	25.34±5.39
RHR (beats per minute)	68.95±8.58	66.56±13.60
Enjoyment	4.23±1.81	4.22±1.86
Competence	4.67±1.70	4.78±1.76
Appearance	5.89±1.31	5.70±1.48
Fitness	6.30±1.10	6.33±0.92
Social Intentions	2.98±1.78	2.93±1.97
		3.95±2.70

* *p* < 0.05. BMI- measure of disease risk based on height and weight. RHR- heart rate taken following five minutes rest prior to exercise.

Approximately 33% responded with a 4 out of 5 on their intentions to participate in HIIT and 31.3% responded with a 5 out of 5. The average BMI of all participants (*n* = 57) was 24.91 at the onset of the study and 25.34 at the end of the study (*n* = 52). These averages verge on the overweight BMI category. In addition, only 51.7% of participants met minimum exercise recommendations at the start of the study. Table 1 shows that many of the individual scores for motivation were already higher than the midpoint on a seven point Likert-type scale.

For example, the fitness related item on the MPAM-R that stated, “Because I want to maintain my physical strength” had an average score of 6.55 ± .67. In contrast, the social related item, “Because my friends want me to” scored an average of 1.65 ± 1.09. The RPE scores reported following each workout seem to be relatively consistent from the workout on day one (*m* = 6.37 ± 1.29) to day 19 (*m* = 7.68 ± 1.53). These values are associated with a rating of “very hard” on the Borg CR-10 scale. Still, the range on these values was very large suggesting that some participants did not exert themselves as much as others.

Physiological variables, in addition to the MPAM-R were measured at week one and again at week nine. Dependent *t*-tests revealed significant differences only on blood pressure variables. Results indicated a significant decrease in systolic blood pressure from week 1 (*m*= 119.37 mmHg ± 11.78) to week 9 (*m* = 111.54 mmHg ± 9.74; *t* (51) = 5.23, *p* < 0.001). Diastolic blood pressure also dropped from an average of 73.73 ± 8.28 mmHg to 69.44 ± 7.00 mmHg, (*t* (51) = 4.13, *p* < 0.001). All other variables including resting heart rate (RHR), weight, BMI, and motivational constructs were not statistically different across time. As a result, the post measurement variables were used for the regression with the exception of blood pressure in which both pre and post measurements were included in the analysis.

A stepwise multiple regression analysis was performed to determine which variables contribute to a person’s intentions for HIIT. Based on a correlation analysis of significant relationships, interest/enjoyment, competence, and

fitness motives were entered into the regression as predictors. Among these variables, fitness motives were the only significant predictor of intentions to participate in HIIT. The analysis revealed that 32.5% of the variance in intentions to engage in HIIT could be explained by the participant's fitness motives ($F(1, 46 = 22.11, p < 0.001)$). Standardized beta coefficients for all included variables are shown in Table 2. A post-hoc power calculation indicated a value of 0.86 (7, 8).

Table 2. Predictors of intentions for HIIT.

Variable	β	t	Sig.
Interest/Enjoyment Motives	0.20	1.54	0.13
Competence Motives	0.28	1.94	0.06
Fitness Motives	0.57	4.70	< 0.001

DISCUSSION

The purpose of this study was to determine if there is a relationship between physiological measures, motives for HIIT, and intention for exercise behavior of HIIT in young healthy women. The hypothesis that the motives associated with more intrinsic motivation would predict HIIT intentions was partially supported. Approximately 65% of participants had the intention to engage in HIIT in the future and fitness was the only variable that contributed to the regression equation. In contrast, appearance was a more externally motivated construct and did not contribute to intentions to engage in HIIT. This is not surprising as the appearance item "Because I want to be attractive to others" involves an external reward (10).

Furthermore, none of the physiological variables contributed to predicting

intentions to continue HIIT. There are a variety of possible reasons for this. For instance, percentage of maximum heart rate was utilized to estimate exercise intensity, however, maximum heart rate has a genetic component to it and is related to fitness level (21). Those who are cardiovascularly fit may experience increased plasma volume, increased contractility, alteration of sinoatrial node function and decreased beta adrenergic receptor number resulting in decreased maximum heart rate (55). As such, utilizing the age predicted maximum heart rate equation may not ideal for this population. Percentages of maximum heart rate were based off of this model for convenience reasons, as the Polar Team 2 Software utilized this calculation as a preset setting. Similarly, it was more difficult for fit individuals to elevate their heart rates to the higher intensities due to improved recovery abilities. This may have resulted in variability of heart rate measurements. Others had reduced average heart rate percentages simply because they were not exerting themselves as much.

The lack of exertion was not necessarily reflected in RPE as this is a subjective measure. Participants were prompted as to the meaning of the levels but may have interpreted them differently based on prior exercise experience, for example. Resting heart rate measurements were also subject to variability because they were not true resting heart rates taken upon waking. Similarly, blood pressure could have been influenced by emotional or physical exertion prior to measurement though there was a fifteen-minute rest time prior to measurement. Despite the potential for variability, a dependent t-test revealed a significant difference from pre levels to post

levels. At the start of the study 42.95% of the participants were classified as prehypertensive and 2.9% were classified as hypertensive while only 21.2% of participants at the end of the study were classified as prehypertensive and no one was classified as hypertensive. This finding was unexpected because training only took place twice per week. This suggests that if HIIT can be performed, it can be more cardioprotective than moderate activity even when exercise volume is controlled for (19).

Additionally, the researchers predicted that motives for HIIT would increase over the course of the study; however, no change was demonstrated. It is important to note that mean values for interest, competence, appearance, and especially fitness, were already elevated at the start of the study. This may demonstrate some participant bias of those who volunteered to participate in the study.

The enjoyment motive may not have significantly contributed to the regression because despite the positive correlation between enjoyment and intentions, it is possible that some may respond negatively to items such as "Because it's fun" but still have high intentions for HIIT due to their high fitness motives. The fitness motives, though not strictly intrinsically motivated, would be considered as identified regulation, or integrated regulation of extrinsic motivation, which is characterized by demonstrating a sense of personal importance, or self-awareness with an internal perceived locus of causality (38). This becomes evident with examination of the questionnaire items. For example, scoring higher on the fitness item "Because

I want to maintain my physical health and well-being" demonstrates an internally regulated notion, thus likely contributing to increased intention to participate in HIIT. HIIT may offer faster adaptations than traditional modalities of training, which may lead to increased satisfaction with outcomes. Knowledge that HIIT may offer faster training adaptations than other exercise modes among this population possibly contributed to higher motivation scores for fitness motives, and the relationship between fitness scores and intentions (16).

SDT suggests that physical activity participation is influenced by the opportunity to demonstrate competence for the task (39). Along with competence, long-term behavior change requires consideration of what the population values, what activity program will provide those results as well as supports their basic needs, otherwise they will be likely to quit. Because only the fitness motive contributed to future intentions and falls under the integrated regulation category of extrinsic motivation, it is possible that extrinsic motivations of the classroom setting influenced future HIIT participation.

This course took place during the spring semester and the high appearance motives at the beginning of the study may be a product of upcoming spring and summer breaks. Despite these higher motive scores in the sample, only 47.4% of the participants were meeting minimum physical activity recommendations prior to the start of the HIIT protocol. This is an example of the disconnect between motives and intentions to exercise. For example, previous research has suggested that a

possible reason for this is an inadequate understanding of not only competence but the qualitative breadth of perceived autonomy (47). Nevertheless, these findings seem to diverge from the majority of SDT research demonstrating that intrinsic motivation typically relates to increased exercise participation (25, 47).

Though there were only nine training weeks and 18 sessions, the study spanned the duration of 12 weeks, two of which the participants were still participating in the two-days-per-week HIIT protocol. These two weeks were not included in the analysis due to an equipment malfunction. The third week that was not accounted for in the analysis was spring break and the protocol did not take place. It is possible that the time period over which the study took place, in addition to potential outside activity induced reductions in BP (33, 50). Research indicates that study duration of at least 12 weeks may be necessary to observe significant reductions in BP.

As expected, two HIIT sessions per week was not a strong enough stimulus to influence RHR, weight, or BMI. Other studies that have documented health and fitness improvements within this time frame have failed to produce any body composition changes (46, 53). Considering that body composition is greatly affected by both diet and exercise, it is possible that the regular diets of the participants in the current study did not allow for substantial changes to BMI. Alternatively, it is possible that BMI remained unchanged due to an increase in lean body mass over the course of the 12-week period study, but only if participants improved diet and exercise behaviors outside of the classroom. A

systematic review and meta-analysis of the ability of BMI to identify obesity revealed that this measure does not identify half of the people with excess adiposity (34). As a result, directly measuring lean body mass might better predict disease risk and health. Consequently, it is recommended that future studies measure changes in body composition using more detailed measures.

The generalizability of these results is restricted to a disease-free young female population in a mandatory physical activity course. This is due to influences on young females in a class setting that might not exist in an independently prescribed HIIT program or a regular group fitness setting. The fact that this study took place during a mandatory physical activity class as opposed to a voluntary group fitness class may have contributed to the lower social related scores. Social motives may not be crucial because compliance for all groups was particularly high.

The results of this study support these findings because HIIT was not perceived as a highly socially supportive activity, yet, intentions to engage in it in the future were favorable. Still, the classroom setting might have negatively influenced the 35.4% of participants that did not score high on future intentions. The progressive nature of the workouts had the potential to improve competence for the task; nevertheless, this had no bearing on competence motives. The lack of change in social motives may also demonstrate no change in the basic need of relatedness. The instructor of the HIIT program attempted to support autonomy by offering modifications, relatedness by encouraging a judge free

classroom, and competence by progressively adding challenge to exercise. This lack of structured autonomy support is a limitation to the study. In a previous study conducted by Moustaka et al. (31), differences emerged between an autonomy supportive group fitness situation and one that lacked autonomy support. Autonomy, competence, intrinsic motivation, attendance during the program, and adherence five weeks following the program were all increased with the autonomy support condition. Based on this information, if structured autonomy support training was instituted, difference in motives may have emerged in the current study.

Subject mortality was a limitation in this study. The study started with 67 participants and ended with 57 participants. An inherent issue with college courses is the attrition rates of students who decide to drop classes or no longer attend. This was the case with some of the participants in the current study. Others chose to complete an alternative extra credit project instead of participating in the study for extra credit. It is possible that the data was collected from more highly motivated individuals than the general population. On another note, this study was longer than other HIIT feasibility studies which may also have contributed to the increased subject mortality.

The ACSM states that moderate intensity exercise is more enjoyable and better tolerated and it is more likely to be continued than high intensity activities (18). Still, little research exists concerning feasibility and enjoyment related to HIIT. It is known that self-efficacy and self-

regulatory behaviors contribute to exercise adherence (32). For example, a person's perceived ability to complete a 20-minute body weight HIIT training session would demonstrate his/her self-confidence. The present study did not demonstrate any relationship between competence motives and HIIT intentions however; prior research found that self-efficacy played a larger role in exercise adherence than outcome expectations (11). This suggests that during volitional and thus autonomous exercise it is imperative to encourage the participant to consider their self-regulation, and self-efficacy for the task in order to complete it more frequently. The most powerful way to increase self-efficacy is to increase the participant's number of mastery experiences (1). It is possible that each interval acted as a mastery experience and a bolster to self-efficacy. Although CT allows for mastery experiences as well, the number of individual experiences is increased in HIIT.

Additionally, self-efficacy will increase much more if a challenging yet achievable activity is performed, as opposed to engaging in a task of mediocre challenge (42). Therefore, if HIIT is more challenging than CT, then it may lead to higher levels of self-efficacy for those experiencing repeated mastery experiences. In addition, enjoyment of the activity is somewhat based on the amount of challenge provided. Future research should compare the two exercise forms for self-efficacy, competence to tasks and satisfaction/enjoyment with outcomes in order to determine whether people will adhere to HIIT. This may be achieved by monitoring individuals for a longer period of time following HIIT interventions, continuing integrated

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research, and performing these tests in a wide variety of populations to increase generalizability.

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