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Exercise Adherence: Strategies and Motivational Factors that Affect Adherence in Women

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EXERCISE ADHERENCE:
STRATEGIES AND MOTIVATIONAL FACTORS
THAT AFFECT ADHERENCE IN WOMEN

by

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B.A., Southern Illinois University, 2008

A Research Paper
Submitted in Partial Fulfillment of the Requirements for the
Masters of Science in Education.

Department of Kinesiology
in the Graduate School
Southern Illinois University Carbondale
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RESEARCH PAPER APPROVAL

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Approved by:

Dr. Phil Anton, Chair

Graduate School
Southern Illinois University Carbondale
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CHAPTER 1

INTRODUCTION

In recent years, there has been a growing interest in exercise adherence rates in women (Smits, 2010). Laboratory and home-based studies concerning strength training have demonstrated that this type of exercise can provide an individual with numerous health benefits, particularly for women as they age (Seguin et al., 2010). If these exercises are performed regularly, Seguin et al. (2010) suggests that this practice will improve glucose control and body composition, build bone and muscle, and help preserve strength, independence, and vitality with age in women. Research has also shown that physical activity in general can help with weight management, as well as other physiological aspects including: maximum oxygen uptake, quantity of free fat mass vs. fat mass, resting heart rate and blood pressure, flexibility, orthopedic spinal problems, and cholesterol and triglyceride levels in the blood (Carron, Hausenblas, & Mack, 1996).

Despite all of the evidence for the positive role of regular physical activity and exercise in long-term health management, it remains unclear why such a low percentage of individuals seeking a healthy lifestyle are able to successfully integrate activity behaviors into their lifestyles and achieve long-lasting improvements in fitness (Carron et al., 1996). It has been reported that only 15-20% of older women participate in regular aerobic activity that meets the recommended quantity set forth by the U.S. Department of Health and Human

Services (U.S. Department of Health and Human Services, 2009). The data also shows that 50% of individuals who start an exercise program will drop out within the first six months (Lippke, Knauper, & Fuchs, 2003). These facts have increased interest in the development of exercise strategies that can best elicit higher levels of exercise adherence, as well as research into the intrinsic and extrinsic motivational factors that may contribute to increased adherence.

There have been struggles in identifying effective promotional strategies at the societal level and intervention strategies at the group level to enhance adherence, compliance, or both in exercise programs (Carron et al., 1996). From our review of the literature on maintenance of physical activity, it can be concluded that interventions to enhance long-term adherence to physical activity and exercise regimens are at an early stage. In general, very few individuals maintain their physical activity level after the conclusion of an intervention (Morey et al., 2003). While many view physical activity programs as an important part of health and weight management, many individuals know little about what specific types of programs can be successful in promoting significant long-term changes in behavior (McClaran, 2003).

Research on the motivational model proposed by the Self-Determination Theory (SDT) provides theoretically sound insight into the many reasons why individuals adopt and maintain consistent exercise patterns and other health behaviors (Carron et al., 1996). The SDT model is categorized by circumstances of internal factors (feeling of accomplishment, physique, etc.) and those of external factors (recognition from a peer, trophy, money, etc.). SDT also allows

for a meaningful analysis of the motivational processes involved in behavioral self-regulation (Silva et al., 2008). If a correlation between adherence and the SDT model can be determined, this information may help to explain the low rate of exercise adherence in women.

Studies have shown that women are more likely to adhere to an exercise program if they are intrinsically motivated to take part in the activity (Silva et al., 2010). It is also suggested that it is equally important to think about how the exercise can be related to an individual's needs, and how this exercise and its benefits can contribute to the individual both internally and externally (Ryan et al., 2008). As stated earlier, many studies suggest that activities such as physical activity and exercise can play a contributing factor to one's health (Silva et al., 2008); however, being motivated to participate in these activities becomes a challenge for many individuals. Being motivated to accomplish a task, whether it is living a healthier lifestyle or adhering to an exercise program, can contribute to a more positive outlook on life. The internal factor of being motivated to exercise becomes essential to providing long-term commitment to exercise. There has been a significant amount of research on the different strategies that affect exercise adherence (Carron et al., 1996; Rhodes et al., 1999; Seguin et al., 2010); however, very few investigations have examined the influence of motivation on exercise adherence.

Purpose Statement

The purpose of this study was to examine different strategies of exercise adherence, and to determine which of these strategies produces the most

significant changes in anthropometric variables. The Self-Determination Theory was used to determine how strongly participants felt that intrinsic or extrinsic factors contribute to exercise adherence.

Statistical Hypothesis 1:

We hypothesized that individuals who are provided with hands-on learning about exercise techniques will have greater improvement in anthropometric measurements than those individuals who are only given literature on the importance of exercise or no information at all.

Statistical Hypothesis 2:

We hypothesized that having a greater knowledge of exercise technique and its importance will provide for a greater understanding of why physical activity is important, therefore positively influencing an individual's desire to increase physical activity on a daily basis.

Statistical Hypothesis 3:

We hypothesized that there would be a significant increase in intrinsic motivational responses compared to extrinsic motivational responses based upon the intervention group. This significance was used to determine the extent to which the Self-Determination Theory contributes to an individual's perception of exercise.

CHAPTER 2

METHODS

Participants

For this study, eight women, ranging in age from 26 to 58, were selected from a group of women (N=30) who had attended the 2009 Women's Health Conference (WHC 2009) at John A. Logan College and had participated in the fitness screening that occurred at the conference. For this study, the only requirement for participation was that each subject must be female and within the age range of 20 and 80. All procedures were approved by the Human Subjects Committee at Southern Illinois University Carbondale.

Fitness Parameters

All eight participants participated in data collection on three separate occasions: baseline (WHC 2009), at the beginning of the intervention (5 weeks before the 2010 Women's Health Conference – WHC 2010), and end of the 5 week intervention (WHC 2010). Participants were tested on four fitness parameters including: 1) estimated VO₂max (cardiovascular capacity); 2) grip strength; 3) low back and hamstring flexibility; 4) body fat percentage.

For VO₂max estimation, the Rockport 1-Mile Walk Test was used. The Rockport 1-Mile Walk Test has been shown to produce a relatively accurate estimate of an individual's VO₂max (Kline et al., 1987). The Rockport test

measures the total time taken to complete a 1-mile course. This value is used along with several other variables to compute the VO₂max estimate:

$$\text{VO}_2\text{max} = 88.768 - (0.0957 \times \text{W}) + (8.892 \times \text{G}) - (1.4537 \times \text{T}) - (0.1194 \times \text{HR})$$

The values for the formula are as follows: 1) W: body weight in kg; 2) G: gender (female = 0, male = 1); 3) T: time (in minutes) taken to complete 1 mile; 4) HR: post-test heart rate.

The Rockport 1-Mile test was conducted in a small gym at either John A. Logan Community College (WHC 2009 & WHC 2010) or Davies Hall on the campus of Southern Illinois University Carbondale (pre-intervention). During this test, participants were asked to walk as fast as they could without running for 1 mile. All participants walked in the same direction (counterclockwise) around the outer line of the court 28 times. During the test, the researcher counted the laps around the gym, and asked all participants at laps 10 and 20 for any signs of discomfort. A heart rate monitor (RS-100 Polar Electro, Lake Success, NY) was used to assess heart rate in participants immediately following the test (HR monitor was worn by the participant throughout the test).

A one-hand grip strength test was used to estimate upper body strength in the participants. This test was conducted using a hand-grip dynamometer (HS-005 Handsome Industrial; China) that correlates well with a 1-RM testing (Caterisano et al., 2001). Participants performed the test using the right hand first, and then performed the test again in the left hand. Participants were given a trial test in each hand to determine how comfortable the test would be.

Low back and hamstring flexibility was assessed using a modified sit and reach box (ACF001 Acuflex, Kansas City, MO). The sit and reach testing was conducted with the participants sitting with their backs up against a flat wall and their legs extended in front of them. They were then asked to reach forward as far out as they could towards their toes. Participants were also asked to complete this motion in a slow, smooth movement. If any activity from the legs was noted, the participant was asked to repeat the test. One practice trial was conducted to ensure understanding of the protocol.

The use of a Bioelectrical Impedance device (HBF-306C Omron, Bannockburn, IL) was used to determine body fat percentage in the study participants.

Questionnaires

Two questionnaires were distributed at the beginning of the intervention period and at the final testing session conducted at the WHC 2010. The first survey that was used was the Global Physical Activity Questionnaire (Department of Chronic Diseases and Health Promotion Surveillance and Population-Based Prevention World Health Organization, 2002). The purpose of this questionnaire was to assess physical activity on a daily basis in participants. This questionnaire has been deemed to have a high degree of reliability and validity (Department of Chronic Diseases and Health Promotion Surveillance and Population-Based Prevention World Health Organization, 2002). Participant responses were categorized into four sections: physical exercise performed at work (At Work), physical activity performed while traveling to work (Travel),

recreational activity performed at home (Recreational), and how much time an individual is sedentary throughout the day (Sedentary).

The second survey distributed in this study was the Exercise Enjoyment Questionnaire (Manning & Morrison, 1992). This questionnaire consisted of 20 questions that relate to how the participants view exercise, how exercise has an impact on their lives, activity level at that time, etc. The main purpose of this questionnaire was to determine how much the Self-Determination Theory contributes to exercise adherence. This questionnaire provided intrinsic and extrinsic motivation questions that could be used to examine how participants view different motivational factors. The questionnaire included questions that asked about feelings of accomplishment, factors that influence transportation to an exercise facility, how an individual feels if they miss a day of exercise, etc. This instrument has been determined to have high reliability and validity (Frederick, Morrison, Manning, 1996).

Intervention Procedures

Following their WHC 2009 fitness screening, all participants received a brief consultation regarding their results. During this consultation, fitness screening staff members compared their results with normative values for the four fitness parameters measured. The staff member offered suggestions on how they might improve their scores on these parameters and they were given a copy of their fitness screening score sheet that included information on the benefits of a high level of fitness in these four areas.

After the pre-intervention testing was completed (5 weeks prior to WHC 2010), all participants were randomly assigned to one of three intervention groups: 1) Home Exercise (HE; n=3); 2) Supervised Exercise (SE; n=2); 3) Control Group (CG; n=3). Group HE was provided with literature on the importance and benefits of exercise every 2 weeks via email or mail (2 times total during the 5-week intervention). This mailing included information on the importance of physical activity, as well as how to achieve a higher level of physical fitness using the FITT model (frequency, intensity, time, and type). This was the only means of communication with this group throughout the 5-week study. Group SE was asked to participate in active, hands-on workshops every 2 weeks at Davies Hall (2 total sessions during the 5-week intervention). During these sessions, participants participated in several activities that would familiarize them with resistance, balance/agility, flexibility, and aerobic exercise training techniques to use at home. These sessions lasted approximately 1 hour. Intensity level was gauged by measuring the participants' heart rate during the exercise sessions. This target intensity was set based upon the Karvonen Formula, which is a mathematical formula that determines target heart rate range during exercise (maximum heart rate minus the participants age). The SE participants targeted a heart range of 60-75% of heart rate max during the sessions and averaged a heart rate of 161. Group CG did not participate in any of the previously listed protocols and there was no contact with these individuals during the 5-week intervention period. At the end of the 5-week period, five of the study participants attended the WHC 2010 and once again participated in the

fitness screening (same fitness parameters measured). These participants included all from the SE group, two from the HE group, and one from the CG group. Three participants were unable to participate at WHC 2010 and were tested again at Davies Hall. These included one participant from the HE group and two participants from the CG group.

Data Analysis and Design

Within subjects parameters were tested using the repeated analysis of variance (ANOVA) to examine differences between the measured fitness parameter variables. The Global Physical Activity Questionnaire scores were evaluated using paired t-test analysis. To test significant differences between internal and external motivational factors, the Exercise Enjoyment Questionnaire values were evaluated using independent t-test analysis. Hypothesis testing for all statistical methods utilized a p-value of 0.05 to evaluate significance.

CHAPTER 3

RESULTS

Adherence Strategies

A repeated-measures analysis of variance (ANOVA) determined that no significant differences existed across the time course of the entire study (WHC 2009 to WHC 2010) between the three intervention strategies. When percent change values were compared, from WHC 2009 to WHC 2010, all groups showed a decline in at least two of the four variables being measured (Table 1). The majority of this decline appeared to occur from WHC 2009 to the pre-intervention measurement point, as the groups experienced a slight improvement from pre-intervention to WHC 2010 in the majority of the fitness parameters (Table 1). It is worth noting that the SE group had improvement in grip strength (5.2%) and flexibility (increase of 8.1%) from WHC 2009 to pre-intervention. The HE group had an improvement in VO₂max (11.2%) from WHC 2009 to pre-intervention, while the other two groups had a decline in this parameter. The SE and HE groups showed a significant increase in body fat percentage (15.5% and 11.8% respectively); however, the CG showed a slight improvement (decrease of 3.3%) in body fat percentage from WHC 2009 to pre-intervention. From pre-intervention to WHC 2010, the SE group also had the greatest change for VO₂max (increase of 2.1%) and flexibility (increase of 4.5%). The HE group had the greatest improvement for body fat percentage (decrease of 1.3%) from pre-

intervention to WHC 2010, while the CG group had the greatest improvement for grip strength (increase of 9.0%) in this same time period.

Table 1: *Comparison of Fitness Parameter Scores*

Group/ Variable	<u>1</u>	<u>2</u>	% Change <u>1→2</u>	<u>3</u>	% Change <u>2→3</u>	% Change <u>1→3</u>
SE						
VO2max	35.7±1.1	29.1±9.0	-18.5	29.7±8.9	+2.1	-16.8
Grip	61.9±31.6	65.1±26.5	+5.2	68.9±21.7	+5.8	+11.3
Flexibility	12.4±0.5	13.4±2.3	+8.1	14.0±1.4	+4.5	+12.9
Body Fat %	33.5±2.1	38.7±5.1	+15.5	39.2±4.1	+1.3	+17.0
HE						
VO2max	34.7±1.5	38.6±3.8	+11.2	39.0±6.2	+1.0	+12.4
Grip	69.1±12.5	67.00±11.8	-3.0	71.4±14.7	+6.6	+3.3
Flexibility	17.2±4.0	13.7±7.6	-20.3	13.9±7.7	+1.5	-19.2
Body Fat %	27.1±4.6	30.3±76.2	+11.8	29.9±7.2	-1.3	+10.3
CG						
VO2max	39.5±13.3	33.1±9.5	-16.2	33.5±6.9	+1.2	-15.2
Grip	51.3±8.6	52.4±6.1	+2.1	57.1±14.6	+9.0	+11.3
Flexibility	14.0±1.5	13.6±4.2	-2.9	13.7±3.7	+0.7	-2.1
Body Fat %	36.3±5.1	35.1±6.6	-3.3	38.2±5.3	+8.8	+5.2

NOTE: 1 = WHC 2009; 2 = Pre-intervention; 3 = WHC 2010
Units: VO2max = ml/kg/min; Grip Strength = kg; Flexibility = inches

Daily Physical Activity

A paired-samples t-test showed that there were no significant differences in any of the physical activity categories with any of the intervention strategies when the pre-intervention measurements were compared to the WHC 2010 measurements. When percent change values were compared for this time frame, there was a noteworthy change in physical activity at work (increase of 12.5%), amount of physical activity when going to work (increase of 47.2%), and the amount of sedentary activity at home (decrease of 14.1%) in the SE group (Table 2). It should also be noted that the HE had a 50.0% increase in the amount of physical activity performed when going to work (Table 2), while having declines in the other categories of physical activity. The CG group had a decline

in three of the four measured variables. As stated above, the SE and HE groups had a significant increase in the percentage of change in physical activity while going to work, while the CG group only had a slight percentage change (increase of 7%). The SE group was the only intervention group to show improvement across all physical activity categories during the intervention.

Table 2: *Comparison of Physical Activity Categories from Pre-Intervention to WHC 2010*

Group/Variable	Pre-intervention	WHC 2010	%Change
SE			
At Work	4.0±0.0	4.5±0.7	+12.5
Travel	3.6±2.3	5.3±1.7	+47.2
Recreational	8.9±1.7	9.3±1.7	+4.5
Sedentary	8.5±7.8	7.3±5.3	-14.1
HE			
At Work	6.8±4.9	6.7±4.7	-1.5
Travel	2.0±0.0	3.0±1.0	+50.0
Recreational	12.9±3.3	12.5±0.3	-3.1
Sedentary	5.7±4.0	6.3±1.5	+10.5
CG			
At Work	5.7±2.9	5.3±2.3	-5.9
Travel	2.0±0.0	2.8±1.4	+7.0
Recreational	7.9±3.6	7.5±3.1	-5.1
Sedentary	6.2±2.7	6.4±3.3	+3.2

Self-Determination Theory

The paired-samples t-test comparing questions that examined intrinsic factors and extrinsic factors from the Exercise Enjoyment Questionnaire did not reveal any significant differences between the three intervention strategies.

When percent change values were compared for this time frame, the SE group showed a slightly higher percentage of increase in intrinsic scores (1.5%), along with a much higher change in extrinsic motivation (13.3%) compared to the other intervention groups.

Table 3: *Comparison of Intrinsic and Extrinsic Scores from Pre-Intervention to WHC 2010*

Group/Variable	Pre-intervention	WHC 2010	%Change
SE			
Intrinsic	34.0±0.0	34.5±0.7	+1.5
Extrinsic	30.0±7.1	34.0±1.4	+13.3
HE			
Intrinsic	38.7±2.5	36.7±3.8	-5.2
Extrinsic	31.3±4.0	30.3±3.2	-3.2
CG			
Intrinsic	31.3±3.2	31.7±8.1	+1.3
Extrinsic	30.7±3.5	30.0±3.3	-2.3

CHAPTER 4

DISCUSSION

The aim of this research was to determine if there is a relationship between different exercise strategies and adherence to exercise in women. We predicted that the more an individual is educated about different exercise techniques, the more an individual is likely to adhere to an exercise program. Also, we looked at how the Self-Determination Theory can be used to describe what motivates an individual to adhere to an exercise program. We predicted that strong intrinsic and extrinsic factors would provide a positive exercise experience, therefore motivating an individual to adhere to an exercise program. These hypotheses were based upon work that Seguin et al. (2010), who suggested that behavioral intervention studies have identified factors associated with catalyzing and sustaining change in an individual. Seguin et al. (2010) goes on to state that facilitating an environment that supports and reinforces the behavior such as physical activity is essential for an individual to adhere to an exercise program.

We hypothesized that individuals with a higher knowledge of exercise and its benefits would have greater improvement on anthropometric measures than individuals with a lower knowledge of exercise. Our results showed no significant differences between the three adherence strategies that we studied. We speculate that the length of the study and the number of participants per group

contributed to the lack of significance in our findings. With a small time frame to conduct the study, our intervention did not provide enough opportunity to elicit significant changes in the anthropometric measurements. Our low participant numbers contributed to a lack of statistical power in our analysis.

Although our results did not provide us with a statistical significance, there appeared to be a trend that occurred during the intervention period (pre-intervention and WHC 2010). When the percent change values were compared, all groups had at least three measured variables that showed improvement. The SE group had the greatest change for VO₂max and flexibility variables, while the HE group had the greatest improvement for body fat percentage and the CG group had the greatest improvement for grip strength. We speculated that because both the SE and HE groups were provided with the most information about physical activity and its importance, this contributed to a slightly higher percentage of change in more of the measured variables than the CG group. The SE group received face-to-face contact and hands-on experience and this may have contributed to the fact that they had the highest percent change on 2 of the 4 variables.

The groups were not exceptionally well-matched on the fitness parameters at the outset of the intervention, and this fact could have affected the percent change values. For example, the SE group had the lowest VO₂max at the outset of the intervention, thus creating the greatest potential for improvement. It is possible that other disparities in initial fitness values may have contributed to

potential change in a similar manner. This issue is again potentially compounded by the low group numbers and short intervention period.

We hypothesized that individuals in the SE group would have greater improvement in increasing the amount of physical activity that is performed throughout the day. Our results found that there were no statistically significant differences between the three intervention strategies. These findings are consistent with previous findings, especially from studies with women and older adults (Wilson, 2009). Although there was no statistical significance demonstrated, the SE group showed improvement in all of the physical activity categories. We speculate that this group was provided with more ways to increase their physical activity levels than the other groups; therefore, a greater desire to increase physical activity throughout the day was created in these participants. The overall increase in the physical activity category scores reflects a greater overall increase in physical activity adherence in this group when compared to the other groups.

The HE group showed a significant increase in physical activity when going to work, but also showed a significant increase in the amount of sedentary activity at home. It is possible that because the HE group was provided with some information on the importance of exercise, these participants were able to improve some of their scores; however, because the depth of information was greater in the SE group (plus the fact that they had hands-on experience), the percent change was not as high. The CG group showed a percent change in physical activity when going to work, but all of their values in the other physical

activity categories declined. It is possible that their overall decline in scores reflected the fact that they received no information or contact throughout the intervention period.

We hypothesized that there would be a higher level of intrinsic motivational responses compared to extrinsic motivational responses from the participants in the SE intervention group. Our results did not indicate statistically significant differences with either motivational factor. Wilson (2009) suggested that focusing on the exercise behavior itself via process goals (e.g., “keep heart rate above 140 beats per minute for 20 minutes for a 40 minute workout”) elevates an exercisers’ intrinsic motivation compared to focusing on outcome goals (e.g., “to lose four kilograms in six weeks”) or no goals at all. Having a strong intrinsic motivation towards exercise gives an individual an internal sense of accomplishment because they feel for themselves the benefits of exercise, whereas external factors are given by other individuals. Since our results failed to provide a statistical significance between the two factors, it is possible that the survey used to address the Self-Determination Theory was too broad. Questions on the survey were not specific enough to determine which form of motivation was being asked. To fully understand what type of motivation determines how an individual exercises, a stronger survey must be used in the future. Also, the emphasis of intrinsic motivation was not stressed to participants during the study. Wilson (2009) suggested putting emphasis on the process itself, and our study did not focus on providing an internal sense of accomplishment. While we measured motivation via the survey, we did not discuss with the participants how

they can improve one's motivation towards exercise. The study relied on measuring intrinsic factors from a survey instead of emphasizing it throughout the course of the study and this may have contributed to the results.

Although there was no statistical significance between the groups, the SE group showed a higher percentage of change in both intrinsic and extrinsic factor improvement than the other two groups. We speculated that because there was more information provided to participants in the SE group, there was an increased level of desire to improve their physical activity and their anthropometric variables. Even though our study did not provide any statistical support for this finding, we are able to speculate that there was at least a trend toward a greater increase in both intrinsic and extrinsic factors in the SE group.

Limitations

A limitation that was determined after the study was concluded was the overall knowledge of research techniques of the individuals administering the fitness parameter assessments during the Women's Health Conference data collection periods. Since initial testing and final testing was conducted at the conferences for a majority of the participants, the fitness tests were administered by a variety of individuals. All of these individuals were trained on proper testing protocol, but it is possible that there were differences in testing technique that may have occurred and this may have had an impact on the results. At both the 2009 and 2010 WHC, a large amount of women participated in the fitness screening and it may be possible that the fitness screening staff may have

missed details during the testing sessions, and this limitation could have easily altered the data.

Conclusion

Although this research is important for the overall implication of exercise adherence strategies, the results are inconclusive in determining which strategy is most effective in ensuring adherence. To fully understand the implications of this study, future research needs to be conducted on the testing protocol. As stated previously, the limitations that occurred in this study must be addressed in order to strengthen the impact that this study could provide. Despite the limitations that occurred, the results were able to provide a trend of improvement in participants of the SE group. If the limitations of this study are addressed, the implications of effective exercise adherence may be improved. With more individuals developing health related problems because of physical inactivity, researchers must determine more effective strategies to ensure that individuals stay with a prescribed exercise program.

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Bachelor of Science, History, August 2008

Research Paper Title:

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