CHANGES IN BODY COMPOSITION AND RESTING BLOOD PRESSURE
AMONG ADULTS USING WII FIT PLUS

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CHANGES IN BODY COMPOSITION AND RESTING BLOOD PRESSURE
AMONG ADULTS USING WII FIT PLUS

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CHAPTER I
INTRODUCTION

The American College of Sports Medicine (ACSM) asserts that both obesity and hypertension are positive risk factors for atherosclerotic cardiovascular disease (Thompson, Gordon, & Pescatello, 2010). In 2005 only 49.1% (less than half) of U.S. adults were meeting the CDC/ACSM recommendations for physical activity, and physical activity trends among U.S. men and women have been shown to decrease with age (Sapkota, Bowles, Ham, & Kohl III, 2005; Kruger, Ham, & Kohl III, 2005). A sedentary lifestyle is characterized as not participating in at least thirty minutes of moderate intensity (40%-60% VO\textsubscript{2} reserve) physical activity on at least three days of the week for at least three months (Thompson et al., 2010). Scientific evidence has suggested a significant relationship between a sedentary lifestyle and hypertension (Beunza et al., 2007). Individuals who do not participate in daily structured exercise are more at risk for developing obesity or hypertension, thus it is important to promote a physically active lifestyle across the lifespan.

Recommendations to increase physical activity are included in the guidelines for the primary prevention and treatment of hypertension (Beunza et al., 2007). Hypertension can be a precursor to more severe conditions such as coronary artery disease or obesity. Therefore it is extremely important for an individual to manage his or
her own blood pressure. Hypertension is controllable through both diet and exercise with substantial evidence demonstrating a reduction of resting blood pressure through the chronic use of structured exercise (Guedes, Lopes, Moreira, Cavalcante, & de Araujo, 2010).

Leading a sedentary lifestyle can promote weight gain, increased body fat, a loss of lean muscle mass, and could eventually lead to obesity (Thompson, et al., 2010). Obesity is an epidemic in today’s society and can lead to loss of self confidence, hypertension, diabetes, several types of cancer, and heart failure (Thompson et al., 2010). Ogden, Carroll, Curtin, McDowell, and Tabak (2006) estimate that 66.2% of American adults are overweight (defined as having a body mass index (BMI) ≥25-29.9) and 32.2% of these adults are considered obese (defined as having a BMI ≥30) (Sherry, Blanck, Galuska, Pan, & Dietz, 2010). Along with having medical bills $1,429 a year higher than normal weight individuals, obese individuals cost the nation an estimated $147 billion in weight-related medical bills (Flegal, Carroll, Ogden, & Curtin, 2010). Weight loss is greatly encouraged in obese populations and can lead to a happier, healthier lifestyle.

Although there is significant evidence suggesting that physical activity leads to weight loss and reduced blood pressure, many adults still do not achieve the recommended amount of daily exercise (Fagard, 2001). The Center for Disease Control and Prevention (CDC) states fewer than 50% of American adults accumulate at least thirty minutes of moderate to vigorous exercise at least five days a week (Haskell et al.,
2007). For many adults, factors associated with a public exercise facility such as time, cost, and convenience exist as an impediment to pursuing recommended levels of physical activity, thus alternative exercise methods need to be investigated.

Until recently, traditional video gaming systems have been sedentary by nature. Therefore, promoting a gaming console as an exercise alternative has not always been considered. However, there recently has been an increase in the development of physically interactive gaming systems. Initial research has shown interactive gaming systems elicited a greater caloric expenditure and oxygen consumption when compared to sedentary gaming systems (Graves, Stratton, Ridgers, & Cable, 2008).

One of the more recent releases in physically interactive gaming, The Nintendo Wii, combines player’s total body movements with motion sensitive joysticks, which in turn elicit a virtual in-game response (Barkley & Penko, 2009). The Wii Fit Plus, a follow-up to the initial Wii Fit, was released for the Nintendo Wii in North America in 2009. The Wii Fit Plus uses a combination of a balance board and joysticks to allow players to undergo different exercise protocols. The original Wii Fit is currently the third best selling console game in history, while the Wii Fit Plus is the seventh best selling (Nintendo Co., Ltd., 2010). The sales records indicate the extreme popularity of the Wii Fit franchise. If the Wii Fit Plus does in fact provide an effective means to improve body composition and blood pressure, it could be a practical alternative to traditional exercise with individuals acquiring similar health benefits. According to Clark’s (2007) article on senior fitness, physical activity does not have to be conventional exercise to provide
important physiological and psychosocial benefits. Clark (2007) asserts a complete physical fitness program must include certain training components such as cardiovascular endurance, muscular strength, flexibility, and balance. The Wii Fit Plus contains all components of Clark’s ideal physical fitness program. Users have access to a variety of exercise categories such as yoga, strength training, aerobics, and balance. Previous research has concluded that the Wii elicits a greater physiologic challenge than treadmill walking or playing sedentary video games (Barkley & Penko, 2009). Therefore, it is likely that the physiological demand of the Wii Fit Plus could prove a valid means to lowering blood pressure and weight loss. Penko and Barkley (2010) examined the acute effects of the Wii in both the adolescent and adult populations; however current research pertaining to the chronic use of the Wii Fit Plus is limited. To our knowledge there currently exists no research examining alterations in body composition and blood pressure in adults following a chronic exercise protocol using the Wii Fit Plus. Many adults lack the time to exercise in a commercial exercise setting and therefore could benefit from an enjoyable at-home exercise program such as the Wii Fit Plus. Additionally, due to its entertainment factor, certain adults could even discover the Wii Fit Plus to be a more practical and enjoyable means of physical activity. If the Wii Fit Plus elicits positive changes to body composition and resting blood pressure, adults could achieve their daily recommended amount of exercise in the comfort of their own home.
In the current investigation it was hypothesized that individuals exercising with a chronic Wii Fit Plus exercise protocol will experience a greater average reduction in resting mean arterial blood pressure, a greater average loss of fat body mass %, and a greater average loss of total body weight relative to individuals not exercising using the Wii Fit Plus.
CHAPTER II
REVIEW OF LITERATURE

Currently, few studies exist that have examined the physiological effects of the Wii Fit Plus; however research on physically active video games is becoming more widespread due to the positive outcomes of the previous studies (Barkley & Penko, 2009; Miyachi, Yamamoto, Ohkawara, & Tanaka, 2010; Penko & Barkley, 2010). Worley, Rogers, and Kraemer (2010) found that an acute play session of the Wii Fit can elicit a VO$_2$ response on the user similar to that of walking 3.5 miles per hour. This metabolic response suggests that the Wii Fit can be used as an effective activity for promoting physical health (Worley et al., 2010). An alternative method to assess the energy cost of physical activities is the metabolic equivalent (MET). The American College of Sports Medicine (ACSM) considers the guidelines for light to moderate exercise to be 3-6 METs, and vigorous exercise to be above 6 METs (Thompson et al., 2010). According to Miyachi et al. (2010), the MET level achieved playing a physically demanding video game such as the Wii Fit Plus can be used to meet the ACSM recommended exercise guidelines. The Wii Fit was also found to produce a mean metabolic response of 4.7 METS and a mean % max heart rate of 63% (Williford, Gaston, Esco, & Olson, 2010). ACSM guidelines acknowledge this level of physiological demand to be considered a light to moderate intensity level of exercise (Thompson et al., 2010). A chronic exercise
program demonstrating this level of intensity could promote weight loss and have a positive influence on blood pressure among adults. Additionally, Gokey and Odland (2010) found that a Wii Fit exercise protocol lasting just four weeks demonstrated improvements on clinical tests of balance and mobility in elderly women. In an adult population, an improvement in balance and mobility could mean an increase in self-confidence and encourage individuals to participate in more regular physical activity. Among adults, balance and mobility improvements would also greatly reduce the risk of fall-related injury.

Previous research involving the Wii Fit has also been conducted specifically on an adult population (Miyachi et al., 2010). The Wii Fit was compared to a traditional exercise program in an adult population. Among this population the Wii Fit was found to be just as effective as the traditional exercise with respect to METs generated, but further research is warranted (Rogers, Slimmer, Amini, & Park, 2010). Orsega-Smith, Smith, and Kukich (2010) measured the caloric expenditure of the Wii in an adult population. On average, individuals were found to expend 72.69 calories per 30 minute session. This 30 minute caloric expenditure indicates that the Wii Fit could provide a valid means of weight loss and suggests that the Wii Fit could provide an alternative means of physical activity (Orsega-Smith et al., 2010).

When comparing the physiological demands of walking on a treadmill or playing a sedentary video game to the physiological demands of playing the Wii, the Wii was found to elicit the greatest physiological response (Penko & Barkley, 2010). Despite this
greater physiologic demand, individuals indicated they were still more motivated to
exercise using the Wii (Penko & Barkley, 2010). This indicates that the enjoyment level
of the Wii could mentally dissolve the associated exercise intensity. In a sense, the user
could be receiving health benefits without even realizing it.

Body composition changes have been examined among middle aged women
following a ten week Wii Fit protocol. The results showed no effect on body weight or
composition, although small improvements were seen in cardiovascular fitness and
muscular strength. Odland, Adams, Woods, and Sears (2010) recommended that further
research be conducted in order to determine whether commercially available active
videogames can provide individuals with health improvements.

Current research has revealed the numerous positive health benefits associated
with the use of the Wii Fit (Barkley & Penko, 2009; Miyachi et al., 2010; Penko &
Barkley, 2010; Williford et al., 2010; Worley et al., 2010). Despite this vast
documentation of benefits, there has been no research to date conducted on the impact of
the Wii Fit Plus on an individual’s blood pressure. The health benefits demonstrated with
the use of the Wii Fit indicate the potential for a positive response on an individual’s
blood pressure. To our knowledge this was the first research conducted considering the
changes found in resting blood pressure with the use of the Wii Fit Plus.
CHAPTER III

METHODS

As mentioned previously, research has indicated that the use of the Wii Fit can elicit an acute exercise response on an individual. The Wii Fit Plus allows users access to more advanced software options than the initial Wii Fit, and virtually no research has been done on this follow-up. Numerous studies have indicated the need for further research using the original Wii Fit. This study built on previous research, and examined changes in body composition and resting blood pressure among an adult population participating in a Wii Fit Plus exercise protocol. The study was approved by The University of Akron’s Institutional Review Board for the Protection of Human Subjects (IRB) (Appendix A).

Research Hypothesis: Participants exercising with the Wii Fit Plus were believed to experience a greater average reduction in resting mean arterial blood pressure, a greater average loss of fat body mass %, and a greater average loss of total body weight relative to the control participants.

Participants: The twenty-eight individuals males (n=4) and females (n=24), aged 40 to 63 years, participated in the study. The majority of participants were recruited via email through ZipFit (Appendix B), a wellness program created by The University of
Akron. Participants were also recruited through co-workers, friends, and family. Individuals were eligible to participate in the study if they had no contraindications to exercise testing, no orthopedic injuries, and were able to commit to the time frame of the study. Prior to signing an informed consent form (Appendix C) all participants were notified of the potential risks and benefits associated with participating in the study. All participants then completed an initial Godin Leisure-Time Exercise Questionnaire (Godin & Shephard, 1997) (Appendix D), Physical Activity Readiness Questionnaire (Par-Q) (Appendix E), and a one page diet questionnaire (Appendix F). Using the results of the initial Godin Leisure-Time questionnaire (Godin & Shephard, 1997), participants were estimated as either ‘relatively active’ or ‘relatively sedentary’. Each participant was then paired with another of similar activity level. One member of each pair of participants was then randomly stratified into either a control group (14) or a Wii Fit Plus group (14). This method of stratification was done in order to best ensure that each group had a relatively similar number of active versus sedentary individuals.

Program Design: Timeframe for the study was ten weeks. Weeks one and ten consisted of both the Wii Fit Plus group and control group having their body composition and resting blood pressure measured. Body composition measurements were obtained using the air-displacement plethysmography (ADP) technology of a BOD POD. The BOD POD technique has been declared a valid and reliable method compared to the four compartment model (Aleman-Mateo et al., 2007). Air-displacement plethysmography has also been shown to place low demands on the subject and is therefore a convenient method for measuring body composition in the elderly (Aleman-Mateo et al., 2007).
Resting blood pressure was taken by a trained individual using a standard blood pressure cuff and stethoscope. In order to diagnose hypertension, ACSM’s guidelines require that two separate blood pressure measurements be taken (Thompson et al., 2010). The average of the two separate resting blood pressure measurements was recorded. Resting blood pressure was then used to indirectly estimate participant’s resting mean arterial pressure. Mean arterial pressure (MAP) is a term that can be used to describe an individual’s average blood pressure (Liqiang et al., 2008). Mean arterial pressure was estimated by taking the sum of a participant’s diastolic pressure and pulse pressure, where pulse pressure is the difference of systolic and diastolic blood pressure.

Between weeks one and ten, the Wii Fit Plus group underwent an eight week Wii Fit Plus exercise protocol. A complete physical fitness program must include certain training components such as cardiovascular endurance, muscular strength, flexibility and balance (Clark, 2007). The Wii Fit Plus includes categories such as yoga, strength training, aerobics, and balance games. In order for the Wii Fit Plus group to most accurately achieve what Clark (2007) considers a complete physical fitness program, each exercise week consisted of individuals completing fifteen minutes of Wii Fit Plus exercise in each of the four categories. The fourteen members of the Wii Fit Plus group were included in either a Monday / Wednesday group or a Tuesday / Thursday group. This was done in order to allow adequate rest time between exercise sessions. Wii Fit Plus participants received a workout schedule and list of exercises to perform during each individual session. They were then instructed to follow the on screen instructions and undergo the outlined exercises to the best of their ability. If participants completed an
exercise category in less time than expected, they were instructed to repeat the exercises outlined in the category until the required duration was reached. All exercise sessions were monitored by research investigators.

The Monday / Tuesday exercise day consisted of fifteen minutes of yoga training exercises, followed by fifteen minutes of strength training exercises. The Wednesday / Thursday exercise day was followed by fifteen minutes of aerobic activity and fifteen minutes of balance training. Each exercise day began and ended with a five minute light intensity Wii Fit Plus aerobic style warm up and cool down. At the conclusion of each exercise category as well as the warm up and cool down, participant’s heart rates and rating of perceived exertion (RPE) were recorded. Heart rate was taken by palpating the left radial pulse. The Borg Scale (Dunbar et al., 1992) (Appendix G) was used to assess RPE. The Borg Scale (Dunbar et al., 1992) allowed participants to rate their level of exertion associated with the Wii Fit Plus on a scale of six (No exertion at all) to twenty (Maximal exertion).

The duration of time spent in each exercise category remained constant throughout the eight weeks of exercise. The specific games and exercises performed during each exercise category were selected by the study coordinators (Appendix H). The first two weeks of games and exercises performed were relatively simple and selected in order to allow participants to become familiar with the Wii Fit Plus user interface. Based on observing the participants, comparing the participant’s RPE reports, and reviewing participant’s exercising heart rate levels, investigators slightly modified
the exercise schedule on a bi-weekly basis to increase the difficulty and intensity of the exercises. This was done in order to compensate for participant’s physiological adaptations. All Wii Fit Plus participants received a new workout schedule on the first day of exercise every two weeks. The bi-weekly workout schedule adjustments were the same for all participants. Different aerobic activities were selected on a bi-weekly basis for the warm up and cool down, however all warm up and cool down activities required users to perform the same total body motions as the ‘basic run’ activity. The total body motions associated with the basic run activity include the user running in place with the Wii controller being held or placed in the participant’s pocket. The levels of intensity associated with the warm up and cool down activities were always very light, and participants were encouraged to perform these activities at their own comfortable pace.

The control group did not participate in this eight week Wii Fit Plus exercise program. They were instructed to continue their standard activities of daily living and to eat and drink as they normally would for the next eight weeks.

All participants were permitted to continue their standard activities of daily living and to eat and drink as they normally would for the duration of the study. Diet and exercise activity outside of the protocol were not controlled. However, in order to best ensure that measurement variable changes were due to the Wii Fit Plus protocol and not because of alternative physical activity or diet restriction, every week the Wii Fit Plus
participants were required to complete the same Godin Leisure-Time Questionnaire (Godin & Shephard, 1997) and one page diet questionnaire that they completed on week one.

The data from one member of the Wii Fit Plus group was not considered due to lack of attendance. Additionally, two members of the control group were unable to return for post-test measurements due to time constraints. Results were concluded based upon the remaining twelve control participants and thirteen Wii Fit Plus participants.

Statistical Design: Pre-Post test differences in body fat %, body weight, and mean arterial blood pressure were analyzed using an independent samples t-test. Pre-Post test differences between groups were analyzed using a Repeated Measures ANOVA with statistical analysis software (SPSS). Statistical significance was set at a priori at $p < .05$. 
CHAPTER IV
RESULTS

The purpose of the present investigation was to examine the effectiveness of an eight week Wii Fit Plus exercise program on an adult’s body composition and resting blood pressure. Participants were assigned to either a Wii Fit Plus group or control group based upon the results of their week one Godin Leisure-Time questionnaire (Godin & Shephard, 1997). The Wii Fit Plus group performed an eight week, two sessions per week, Wii Fit Plus exercise protocol. The control group continued their activities of daily living for eight weeks without participating in the Wii Fit Plus exercise protocol. Pre and Post intervention assessments were collected for the following dependant variables: Body weight, body fat %, mean arterial pressure.

There were a total of twenty-five male \((n = 3)\) and female \((n = 22)\) participants. The Wii Fit Plus group consisted of 2 male and 11 female participants, and the control group consisted of 1 male and 11 female participants. Participant’s ages ranged from 40 to 63 with a mean age of \(51.6 \pm 5.89\). No significant differences were observed between groups regarding participant’s age \(F (1, 23) = 2.78, p = 0.12\), gender \(F (1, 23) = 0.27, p = 0.61\), and activity level \(F (1, 23) = 0.00, p = 1.00\). Descriptive statistics are presented in Table 1.
<table>
<thead>
<tr>
<th>Group</th>
<th>Body Fat (%)</th>
<th>Body Weight (lbs)</th>
<th>Mean Arterial Pressure (mmHg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre</td>
<td>Post</td>
<td>∆</td>
</tr>
<tr>
<td>Control</td>
<td>24.3</td>
<td>27.1</td>
<td>2.8</td>
</tr>
<tr>
<td>Control</td>
<td>8.9</td>
<td>16.2</td>
<td>7.3</td>
</tr>
<tr>
<td>Control</td>
<td>43.2</td>
<td>40.5</td>
<td>-2.7</td>
</tr>
<tr>
<td>Control</td>
<td>36.7</td>
<td>36.7</td>
<td>0</td>
</tr>
<tr>
<td>Control</td>
<td>39.6</td>
<td>38.6</td>
<td>-1</td>
</tr>
<tr>
<td>Control</td>
<td>19.2</td>
<td>17.7</td>
<td>-1.5</td>
</tr>
<tr>
<td>Control</td>
<td>36.7</td>
<td>34.9</td>
<td>-1.8</td>
</tr>
<tr>
<td>Control</td>
<td>39.2</td>
<td>36.5</td>
<td>-2.7</td>
</tr>
<tr>
<td>Control</td>
<td>33.2</td>
<td>33.5</td>
<td>0.3</td>
</tr>
<tr>
<td>Control</td>
<td>33.7</td>
<td>34.9</td>
<td>1.2</td>
</tr>
<tr>
<td>Control</td>
<td>40.6</td>
<td>37.7</td>
<td>-2.9</td>
</tr>
<tr>
<td>Control</td>
<td>31.5</td>
<td>33.4</td>
<td>1.9</td>
</tr>
<tr>
<td>Wii Fit Plus</td>
<td>31.1</td>
<td>31.3</td>
<td>0.2</td>
</tr>
<tr>
<td>Wii Fit Plus</td>
<td>32.8</td>
<td>29.8</td>
<td>-3</td>
</tr>
<tr>
<td>Wii Fit Plus</td>
<td>55.0</td>
<td>55.6</td>
<td>0.6</td>
</tr>
<tr>
<td>Wii Fit Plus</td>
<td>38.1</td>
<td>39.0</td>
<td>0.9</td>
</tr>
<tr>
<td>Wii Fit Plus</td>
<td>51.7</td>
<td>50.1</td>
<td>-1.6</td>
</tr>
<tr>
<td>Wii Fit Plus</td>
<td>43.7</td>
<td>47.5</td>
<td>3.8</td>
</tr>
<tr>
<td>Wii Fit Plus</td>
<td>52.5</td>
<td>52.5</td>
<td>0</td>
</tr>
<tr>
<td>Wii Fit Plus</td>
<td>21.5</td>
<td>18.3</td>
<td>-3.2</td>
</tr>
<tr>
<td>Wii Fit Plus</td>
<td>40.3</td>
<td>41.6</td>
<td>1.3</td>
</tr>
<tr>
<td>Wii Fit Plus</td>
<td>41.9</td>
<td>39.8</td>
<td>-2.1</td>
</tr>
<tr>
<td>Wii Fit Plus</td>
<td>37.6</td>
<td>35.7</td>
<td>-1.9</td>
</tr>
<tr>
<td>Wii Fit Plus</td>
<td>18.6</td>
<td>18.9</td>
<td>0.3</td>
</tr>
<tr>
<td>Wii Fit Plus</td>
<td>47.3</td>
<td>46.1</td>
<td>-1.2</td>
</tr>
</tbody>
</table>
One-way ANOVA revealed significant differences between groups regarding participant’s pre-intervention body weight $F (1, 23) = 6.21, (p = 0.02)$, and mean arterial pressure $F (1, 23) = 8.13, (p = 0.01)$. The Wii Fit Plus group exhibited greater average body weight $(185.0 \pm 29.2)$ and mean arterial pressure $(95.4 \pm 6.2)$ when compared to the control group $(158.2 \pm 24.1), (89.1 \pm 4.6)$, respectively. There were no significant differences between groups in pre-intervention body fat % $F (1, 23) = 2.78, (p = 0.11)$.

Independent samples $t$-tests were conducted to evaluate the change in body weight, body fat %, and mean arterial pressure from week one to week ten between the Wii Fit Plus and control group. Mean body fat %, body weight, and mean arterial pressure changes are presented in Table 2. No significant differences in weight changes $t (23) = 0.71, p = 0.49$, body fat % changes $t (23) = 0.53, p = 0.60$, and mean arterial pressure changes $t (23) = 0.91, p = 0.37$, were observed between groups although the Wii Fit Plus group did exhibit a greater total loss in weight, body fat %, and mean arterial pressure.

Mean body fat %, body weight, and mean arterial pressure changes are illustrated in Figure 1 (Mean Change in Body Fat % for Each Group), Figure 2 (Mean Change in Total Body Weight for Each Group), and Figure 3 (Mean Change in Mean Arterial Pressure for Each Group), respectively.
Table 2

Average Increase or Decrease in Body Fat Percent, Body Weight, and Mean Arterial Pressure

<table>
<thead>
<tr>
<th>Group</th>
<th>Body Fat Percent</th>
<th>Body Weight</th>
<th>Mean Arterial Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wii Fit Plus</td>
<td>-0.5 %</td>
<td>-1.4 lbs</td>
<td>-4.5 mmHg</td>
</tr>
<tr>
<td>Control</td>
<td>+0.08 %</td>
<td>0.9 lbs</td>
<td>-2.6 mmHg</td>
</tr>
</tbody>
</table>

Figure 1. Mean Change in Body Fat % for Each Group
Figure 2. Mean Change in Total Body Weight for Each Group

Figure 3. Mean Change in Mean Arterial Pressure for Each Group
The total changes in body fat %, body weight, and mean arterial pressure are presented in Table 3 (Overall Increase or Decrease in Body Fat Percent, Body Weight, and Mean Arterial Pressure).

Table 3

*Overall Increase or Decrease in Body Fat Percent, Body Weight and Mean Arterial Pressure*

<table>
<thead>
<tr>
<th>Group</th>
<th>Body Fat Percent</th>
<th>Body Weight</th>
<th>Mean Arterial Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wii Fit Plus</td>
<td>-5.9 %</td>
<td>-18.4 lbs</td>
<td>-58.7 mmHg</td>
</tr>
<tr>
<td>Control</td>
<td>+0.9 %</td>
<td>+0.1 lbs</td>
<td>-31.3 mmHg</td>
</tr>
</tbody>
</table>
The purpose of this study was to examine the effectiveness of an eight week Wii Fit Plus exercise program on an adult’s body composition and resting blood pressure. Although the Wii Fit group showed a greater average change in body fat %, body weight, and mean arterial pressure, no significant changes were seen. The results may be due to flaws and limitations such as population size, participant gender considerations, overall physical activity level / health status of participants, protocol design flaws, potential equipment failure and participants’ exercise activity and nutritional intake during the intervention period. The sample size associated with the study may have been too small to notice significant changes among variables. An aim of future research should be to target a larger sample size.

In order to promote a healthy lifestyle, The American College of Sports Medicine recommends that individuals achieve a weekly amount of three to five days of cardiovascular activity, two to three days of resistance training, and at least three days of flexibility training (Thompson et al., 2010). Due primary to lack of funding and lack of exercise monitoring assistance, our specific Wii Fit Plus exercise protocol did not follow ACSM guidelines for frequency and duration. The protocol only required Wii Fit Plus participants to achieve fifteen minutes in each category of aerobic exercise, balance
exercise, flexibility training, and resistance training per week. The intensity of the protocol was increased on a bi-weekly basis simply by increasing the level of difficulty of the exercises and games. However, participant’s weekly recorded heart rate responses and RPE values suggested that this increase in difficulty may not have been enough. Combining a gradual increase in frequency and duration of the Wii Fit Plus protocol along with increasing the difficulty setting of the individual games could elicit a greater caloric expenditure, which could promote a more significant loss in body weight and body fat %. Increasing the frequency and duration could also induce a more elevated acute heart rate response and lead to a more significant change in mean arterial blood pressure. Future studies should employ both a greater frequency and duration of Wii Fit Plus exercise per week in order to maximize the benefits capable through use of the game. The increase in frequency could be achieved by increasing the number of Wii Fit Plus exercise sessions per week. The increase in duration could be achieved by increasing time spent exercising with each individual Wii Fit Plus exercise category, or by increasing the total time of each exercise session.

The initial Godin Leisure-Time Exercise Questionnaire (Godin & Shephard, 1997) results indicated no significant difference in activity level between the Wii Fit Plus group and control group. Considering a 7 day period, the majority of participants indicated that they ‘sometimes’ engage in regular activity long enough to work up a sweat (heart beats rapidly). These results coupled with the fact that the majority of participants were recruited through ZipFit, indicated that participants were physically active or at least interested in exercise activity prior to the initiation of the protocol.
Throughout the eight week exercise program, RPE levels and heart rates were recorded four times per exercise session for each Wii Fit Plus participant. Despite the progressive increase in intensity of the exercise sessions, RPE measurements as well as acute heart rate levels seemed to remain relatively low throughout the entirety of the protocol. This could indicate that the intensity levels associated with our specific Wii Fit Plus protocol may have not been demanding enough to elicit a response on physically active participants. Due to the seemingly low intense nature of our specific Wii Fit Plus protocol, a more significant change in results could have potentially been observed in a less active population. Future studies are recommended to observe and compare changes with the use of the Wii Fit Plus separately in both a sedentary and active population.

Future research involving the use of the Wii Fit Plus on an active population is also recommended to increase the exercise intensity levels beyond what was outlined in the present investigation. In addition, the low physical requirements needed to use the Wii Fit Plus indicate its potential for use in rehabilitation and special population settings. Future studies analyzing the benefits of the Wii Fit Plus could observe considerably more changes among a special population versus a healthy, active population.

Dietary intake and additional exercise activity beyond what was performed using the Wii Fit Plus were documented throughout the intervention period, however these variables were not controlled. Measurements were simply a means to ensure that any significant changes observed in body fat %, body weight, and mean arterial pressure were
due to the Wii Fit Plus protocol and not outside influences. Recommendations for future research should include dietary guidelines as well as exercise restrictions for all participants for the duration of the study.

Although no significant differences were observed between groups regarding participant’s gender, the number of male participants ($n = 3$) relative to female participants ($n = 22$) could have impacted the results of the study. Gender has a direct influence on body composition, and women have traditionally been shown to have more body fat when compared to men (Stevens, Katz, & Huxley, 2009). Due to the large number of female participants, body composition results could have been impacted and skewed. Gender also has a direct influence on cardiovascular endurance, which would involve an individual’s blood pressure (Brooks, Fahey, & Baldwin, 2005). Changes associated with body fat %, body weight, and mean arterial pressure could have been directly influenced by the large total number of women among the participants. Therefore it is recommended that further research involving the Wii Fit Plus involve a more balanced distribution of gender among the participants to maximize the accuracy of the results.

Although no significant changes were observed regarding the mean arterial pressure and body composition of the Wii Fit Plus group, this group still showed a greater overall improvement when compared to the control. This finding indicates the potential for the Wii Fit Plus to provide physiological benefits to an adult population, but more research is warranted.
The following recommendations are based on the current investigation’s outcome, and are proposed for future research:

1. Adjust the frequency, intensity, and time of the Wii Fit Plus exercise protocol in order to adhere as best as possible to ACSM guidelines. This may increase demands on participants and elicit a more significant physiological response.

2. Increase the population size, and compare variables among participants from a more diverse population. Certain populations (sedentary, rehabilitation) may achieve greater health benefits from the Wii Fit Plus than a more healthy, physically active sample.

3. Create dietary guidelines as well as exercise restrictions for participants to follow while outside of the protocol. These additions would more ensure significant results came exclusively from the Wii Fit Plus.

4. Balance the number of male and female participants in each group to best eliminate gender considerations with exercise.
REFERENCES


APPENDIX A

HUMAN SUBJECTS APPROVAL FORM
NOTICE OF APPROVAL

November 30, 2010

Brandon Pollock
876 Mt. Pleasant Road
Clinton, Ohio 44216

From: Sharon McWhorter, IRB Administrator

Re: IRB Number 20101111 "Physiological Effects and Practicality of the Wii Fit Plus as an Exercise Program for Adults"

Thank you for submitting an IRB Application for Review of Research Involving Human Subjects for the referenced project. Your protocol represents minimal risk to subjects and has been approved under Expedited Categories #4/7.

Approval Date: November 29, 2010
Expiration Date: November 29, 2011
Continuation Application Due: November 15, 2011

In addition, the following is/are approved:

☐ Waiver of documentation of consent
☐ Waiver or alteration of consent
☐ Research involving children
☐ Research involving prisoners

Please adhere to the following IRB policies:

• IRB approval is given for not more than 12 months. If your project will be active for longer than one year, it is your responsibility to submit a continuation application prior to the expiration date. We request submission two weeks prior to expiration to insure sufficient time for review.
• A copy of the approved consent form must be submitted with any continuation application.
• If you plan to make any changes to the approved protocol you must submit a continuation application for change and it must be approved by the IRB before being implemented.
• Any adverse reactions/incidents must be reported immediately to the IRB.
• If this research is being conducted for a master’s thesis or doctoral dissertation, you must file a copy of this letter with the thesis or dissertation.
• When your project terminates you must submit a Final Report Form in order to close your IRB file.

Additional information and all IRB forms can be accessed on the IRB web site at:
http://www.uakron.edu/research/orrsp/compliance/IRBHome.php

Cc: Judith A. Juvancic-Heitzel- Advisor
Cc: Renee DeSalvo/Nick Potenzini - Co PI's
Cc: Stephanie Woods - IRB Chair

☐ Approved consent form/s enclosed

Office of Research Services and Sponsored Programs
Akron, OH 44325-2102
330-972-7666 • 330-972-6281 Fax
The University of Akron is an Equal Education and Employment Institution

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APPENDIX B
ZIPFIT EMAIL
Greetings participants of ZipFit!

The graduate assistants in UA’s Sport Science and Wellness Education Department in coordination with Student Recreation and Wellness Services (SRWS), who sponsor ZipFit, are seeking your help to identify individuals such as yourself who have been part of ZipFit and may be interested in participating in a study involving the Nintendo Wii Fit Plus interactive game system. This purpose of this study is for the Master’s Thesis for three graduate assistants in the Sport Science and Wellness Department. The Wii Fit Plus is an exciting new follow-up to the original Wii Fit released in 2009. The Wii Fit Plus is a video game system that makes exercise fun! Players will use a combination of the Wii’s joysticks and balance board as a means to exercise, while at the same time enjoying the fun on-screen aspects of a video game. Currently, little research exists pertaining to the Wii Fit Plus, so participants will be among the first to study the fun and fitness capabilities of the Wii Fit Plus.

For more information regarding the Nintendo Wii Fit Plus, please visit:

http://www.wiifit.com/

The Wii Fit Plus Study:

The purpose of the study is to evaluate the WiiFit Plus as a practical alternative to traditional exercise. The study will begin the week of January 3rd, 2011 and progress through early March (10 Weeks). The intensity of exercise associated with the Wii Fit Plus is light. All qualifying participants will be given 2 FREE assessments from SSWE graduate assistants at InfoCision Stadium 407 (once at the beginning and once at the end of the study). The tests will be conducted using advanced laboratory equipment. Note that these tests will provide you with valuable information regarding your overall health and risk factors for related conditions/diseases. Here is a list of the tests that you will be receiving:

- Body Composition
- Resting Blood Pressure
- Leg Strength
- Balance Capability
- Flexibility
- Bone Density

Participant Qualifications:

In order to participate in the study, individuals must meet the following criteria:

- Aged 45 or above.
- **Have no contraindications to exercise such as diagnosed heart disease, osteoporosis, osteopenia uncontrolled metabolic disease, neuromuscular disease, current musculoskeletal or rheumatoid disorders that are exacerbated by exercise.**

- **Can commit just 40 minutes a day, two scheduled days a week (Further details below).**
Upon admittance into the study you will be required to sign an informed consent form, a Physical Activity Readiness Questionnaire (PAR-Q), Godin Leisure Time Physical Activity Questionnaire and a weekly dietary log.

Participants will be placed into the experimental (exercise) group or the control group. **During weeks one and ten both groups will have the following assessed:** body composition, resting blood pressure, balance, leg strength, flexibility and bone mineral density.

If you are in the experimental group you will then be assigned to either a Monday / Wednesday group or a Tuesday / Thursday group. During weeks 2 – 9 participants in the experimental group will report to the 4th floor of InfoCision Stadium and participate in 40 minutes of Wii Fit Plus activity on your assigned days. We will try to accommodate your schedules. During week 10, the experimental group will have repeat measurements of the six variables. If you are assigned to the control group, the following will be measured during weeks one and ten: body composition, resting blood pressure, balance, leg strength, flexibility and bone mineral density. The control group will not participate in the Wii Fit Plus protocol during weeks 2 – 9.

**Participants in both groups are PERMITTED to continue normal daily activities including regular exercise or physical activity. NO dietary or exercise restrictions will be imposed.**

**The Schedule:**

Week 1: January 3rd 2011. (Pre-test data collection for both groups)

Week 2: January 10th 2011.

Week 3: January 17th 2011.

Week 4: January 24th 2011.

Week 5: January 31st 2011.

Week 6: February 7th 2011.

Week 7: February 14th 2011.

Week 8: February 21st 2011.

Selection:

The Wii Fit Plus study has IRB approval and is currently enrolling qualifying participants. Study participation is limited; participants will be recruited on a first-come first serve basis. The study requires 40 participants (20 per group). We will be taking the names of the first 60 individuals who contact us; the first 40 individuals who qualify for the study will be contacted with further information.

What a great way to start that the New Year! If you are interested please contact:

Brandon Pollock  
bsp12@zips.uakron.edu  
330 – 575 – 9348

‘Wii’ would love your help, and thank you!
APPENDIX C
INFORMED CONSENT FORM
Informed Consent Form – Wii Fit Plus Study

Title of Study: “Physiological Effects and Practicality of the Wii Fit Plus as an Exercise Program for Adults”

Introduction: Welcome to the Wii Fit Plus Study conducted by graduate assistants of the Sport Science and Wellness Department!

Purpose: The purpose of the study is to determine if the Wii Fit Plus can be used to show improvements in the fitness of an adult population following a 10-week exercise program.

Procedure: You will be assigned to either the exercise group or the control group. On your initial visit we will perform a variety of tests to obtain baseline information so that we will be able to compare the results from before the exercise protocol to the results after the exercise protocol. Upon arriving at the laboratory, your body composition will be assessed using a tool called the BOD POD. This machine is very simple and uses air displacement to estimate body composition. Once inside the body composition machine you will be sitting for two short 45 second tests as motionless as you can sit. Blood pressure and heart rate will be assessed just like in a doctor’s office. Blood pressure will be measured using sphygmomanometer and stethoscope on your arm. Your resting heart rate will be assessed using a stopwatch and wrist pulse. Flexibility will be assessed using a test called the Sit-and-Reach. All you will be doing is simply sitting on the ground and placing your feet up against the back of the equipment with your knees in a locked position you will bend forward from the hips moving a metal piece forward as far as you can to measure flexibility. Bone mineral density will be measured using the QUS-2 Calcaneal Ultrasonometer. The QUS-2 uses ultrasound technology to measure and determine the bone strength in the calcaneus (heel bone). Leg strength will be measured using the Biodex Multi-Joint System Pro; static contractions of the lower leg will be performed. Balance will be measured using the Biodex Balance System SD. You will be asked to perform the designated test while stabilizing yourself on a balance plate. The balance plate is an unstable surface and there will always be a technician and a balance bar in case you experience loss of balance and added support is needed. All assessments will be performed by qualified technicians. These measurements will be assessed during Week 1 and Week 10 of the program. If you are assigned to the experimental group, you will complete two 40 minute exercise sessions per week (Group 1 will be Monday/Wednesday and Group 2 will be Tuesday/Thursday). If you are assigned to the control group, you will not be performing the exercise sessions. You will be permitted to continue your regular exercise and daily activities outside of the study. If you are in the exercise group you may continue your regular exercises in addition to the Wii Fit Plus.

You are eligible for this study if you are ≥ age 45, have no contraindications to exercise such as heart disease, uncontrolled metabolic disease, neuromuscular, current musculoskeletal, or rheumatoid disorders that are exacerbated by exercise. Additionally,
you must be able to commit just 40 minutes a day, two scheduled days a week. You will also be required to complete a Par-Q and Godin Leisure Time Physical Activity questionnaire. The Par-Q is simply used for assessing your ability to participate in physically demanding activities. The Godin Leisure Time Physical Activity questionnaire is used for determining your current physical activity level and will be completed weekly. During each exercise session you will be required to where a heart rate monitor, which consists of a strap under your chest and a transmitter on your wrist. At the conclusion of each exercise session we will ask you how much you enjoyed it and how tired you feel.

Risk and Discomfort:

If at anytime you feel uncomfortable while having your body composition measured let us know, we will take all the steps possible to ensure your comfort in this process. Minimal, skin tight clothing is required while undergoing the body composition protocol. This will occur twice throughout the study (week one and week ten). You may also feel a little discomfort if you are uncomfortable in small spaces.

There is a small risk for muscle soreness or muscular injury with flexibility testing and strength testing, if the test is not performed correctly. With proper instruction, injury is unlikely. Both tests take place during week one and week ten of the study.

When testing for bone mineral density you will be at no risk for any injury of any kind. This is primarily because you will be in a sitting position for the duration while a machine takes ultrasound measurements of your ankle.

The Wii Fit Plus exercise protocol poses a small risk of injury among the experimental group. You may experience mild muscular soreness or muscle injury. The chance of injury is unlikely considering the exercise intensity associated with the Wii Fit Plus is low.

Benefits: Information will be gathered about your flexibility, bone mineral density, strength, balance, body composition, and blood pressure. These variables are very important for maintaining a healthy lifestyle. These components are especially important in the adult population to diagnose risks for specific conditions such as: osteoporosis, cardiovascular disease and orthopedic injuries of the lower body. If you are planning to begin an exercise program these components are also helpful to establish a baseline and help you identify areas that need improvement.

Payments for Participation: There will be no payment for participation.

Right to refuse or withdraw: You may withdraw from the study at any time. There is no penalty if you decide to withdraw.

Anonymous and Confidential Data Collection: Data will be password protected and stored/accessed electronically only by the study investigators. Any hardcopy form of data such as measurement print-outs will be stored in a locked cabinet in InfoCision Stadium, 307E. Only the study investigators have access to this information.
Confidentiality of records: Your records will be password protected and stored / accessed electronically only by the study investigators. Any hardcopy form of your records will be stored in a locked cabinet in InfoCision Stadium, 307E. Only the study investigators have access to this information. If you agree to have your information used as part of the research data, you will be asked to sign this informed consent document.

Who to contact with questions: If you have any questions at any time, you may contact any of the following:

Brandon Pollock: (330) – 575 – 9348 or bsp12@zips.uakron.edu

Renee DeSalvo: (440) – 781 – 1689 or rmd18@zips.uakron.edu

Nick Potenzini: (740) – 317 – 5250 or ntp2@zips.uakron.edu

Judith A. Juvancic-Heltzel, Ph.D.: (330) – 972 – 6273 or jaj52@uakron.edu

Thesis advisor

This study has been reviewed and approved by The University of Akron Institutional Review Board (IRB). If you have any questions about your rights as a research participant, you may call the IRB at (330) 972-7666 or 1-888-232-8790.

I have read the information provided above and all of my questions have been answered. I voluntarily agree to participate in this study. I will receive a copy of this consent form for my records.

Signature: ________________________ Date:____________________
APPENDIX D

GODIN LEISURE TIME PHYSICAL ACTIVITY QUESTIONNAIRE
Godin Leisure Time Physical Activity Questionnaire

Considering a 7-Day Period (a week), how many times on the average do you do the following kinds of exercise for more than 15 minutes during your free time? (write on each line the approximate number)

<table>
<thead>
<tr>
<th>Exercise Type</th>
<th>Times Per Week</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Strenuous Exercise</td>
<td>_____________</td>
</tr>
<tr>
<td>a. (Heart beats rapidly)</td>
<td></td>
</tr>
<tr>
<td>b. Examples: running, jogging, hockey, football, soccer, squash, basketball, cross country skiing, judo, roller skating, vigorous swimming, vigorous long distance bicycling</td>
<td></td>
</tr>
<tr>
<td>2. Moderate Exercise</td>
<td>_____________</td>
</tr>
<tr>
<td>a. (Not Exhausting)</td>
<td></td>
</tr>
<tr>
<td>b. Examples: fast walking, baseball, tennis, easy bicycling, volleyball, badminton, easy swimming, alpine skiing, popular and folk dancing</td>
<td></td>
</tr>
<tr>
<td>3. Mild Exercise</td>
<td>_____________</td>
</tr>
<tr>
<td>a. (Minimal Effort)</td>
<td></td>
</tr>
<tr>
<td>b. Examples: yoga, archery, fishing from river band, bowling, horseshoes, golf, snow-mobiling, easy walking</td>
<td></td>
</tr>
</tbody>
</table>

4. Considering a 7-Day period, during your leisure-time, how often do you engage in any regular activity long enough to work up a sweat (heart beats rapidly)?
   a. Often
   b. Sometimes
   c. Never/Rarely
APPENDIX E

PHYSICAL ACTIVITY READINESS QUESTIONNAIRE (PAR-Q)
PAR-Q FORM Please mark YES or No to the following: YES NO

Has your doctor ever said that you have a heart condition and recommended only medically supervised physical activity? ____

Do you frequently have pains in your chest when you perform physical activity? ____

Have you had chest pain when you were not doing physical activity? ____

Have you had a stroke? ____

Do you lose your balance due to dizziness or do you ever lose consciousness? ____

Do you have a bone, joint or any other health problem that causes you pain or limitations that must be addressed when developing an exercise program (i.e. diabetes, osteoporosis, high blood pressure, high cholesterol, arthritis, etc.)? ____

Are you pregnant now or have given birth within the last 6 months? ____

Do you have asthma or exercise induced asthma? ____

Do you have low blood sugar levels (hypoglycemia)? ____

Do you have diabetes? ____

Have you had a recent surgery? ____

If you have marked YES to any of the above, please elaborate below:
________________________________________________________________________
________________________________________________________________________

Do you take any medications, either prescription or non-prescription, on a regular basis? Yes/No
What is the medication for?
How does this medication affect your ability to exercise or achieve your fitness goals?
________________________________________________________________________
________________________________________________________________________

Please note: If your health changes such that you could then answer YES to any of the above questions, tell your trainer/coach. Ask whether you should change your physical activity plan.

I have read, understood, and completed the questionnaire. Any questions I had were answered to my full satisfaction.
Name: ___________________________ Date: ___________________________
APPENDIX F

WEEKLY DIET QUESTIONNAIRE
Check any of the following foods if they have been consumed in the past week:

<table>
<thead>
<tr>
<th>Foods (Include servings for all checked foods)</th>
<th>Servings</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ ] Skim Milk</td>
<td></td>
</tr>
<tr>
<td>[ ] Whole Milk</td>
<td></td>
</tr>
<tr>
<td>[ ] Yogurt</td>
<td></td>
</tr>
<tr>
<td>[ ] Feta Cheese</td>
<td></td>
</tr>
<tr>
<td>[ ] Tofu</td>
<td></td>
</tr>
<tr>
<td>[ ] Soy Beans</td>
<td></td>
</tr>
<tr>
<td>[ ] Instant Oats</td>
<td></td>
</tr>
<tr>
<td>[ ] Roasted Almonds</td>
<td></td>
</tr>
<tr>
<td>[ ] Almond Butter</td>
<td></td>
</tr>
<tr>
<td>[ ] Broccoli</td>
<td></td>
</tr>
<tr>
<td>[ ] Orange Juice</td>
<td></td>
</tr>
<tr>
<td>[ ] Sardines</td>
<td></td>
</tr>
<tr>
<td>[ ] Lasagna</td>
<td></td>
</tr>
<tr>
<td>[ ] Pizza w/cheese</td>
<td></td>
</tr>
</tbody>
</table>

Has your diet undergone any dramatic changes within the past week? 
(Such as: deciding to become a vegetarian, consuming an unusually high / low amount of food relative to a typical week (maybe an eating contest), become ill or injured restricting nutritional capabilities, restricting any macronutrient (carbohydrate, fat, protein), starting a diet plan, etc.)

Yes / No

If you circled yes, please provide a brief explanation with regards to how:
APPENDIX G

THE BORG SCALE
<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>No exertion at all</td>
</tr>
<tr>
<td>7</td>
<td>Extremely light</td>
</tr>
<tr>
<td>8</td>
<td>Very light</td>
</tr>
<tr>
<td>9</td>
<td>Light</td>
</tr>
<tr>
<td>10</td>
<td>Somewhat hard</td>
</tr>
<tr>
<td>11</td>
<td>Hard (heavy)</td>
</tr>
<tr>
<td>12</td>
<td>Very hard</td>
</tr>
<tr>
<td>13</td>
<td>Extremely hard</td>
</tr>
<tr>
<td>14</td>
<td>Maximal exertion</td>
</tr>
</tbody>
</table>
Exercise Log (Weeks 2 – 3)

<table>
<thead>
<tr>
<th>Exercise Category</th>
<th>Day</th>
<th>Warm Up (5 Minutes)</th>
<th>Yoga (15 Minutes)</th>
<th>Strength Training (15 Minutes)</th>
<th>Cool Down (5 Minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Monday / Tuesday</td>
<td>5 Minutes of ‘Basic Run’ Activity.</td>
<td>1) Half-Moon Pose  2) Palm Tree Pose  3) Standing Knee Pose  4) Chair Pose  5) Sun Salutation Pose</td>
<td>1) Single Leg Extension  2) Lunge  3) Sideways Leg Lift  4) Rowing Squats  5) Torso Twists</td>
<td>5 Minutes of ‘Basic Run’ Activity.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Exercise Category</th>
<th>Day</th>
<th>Warm Up (5 Minutes)</th>
<th>Aerobics (15 Minutes)</th>
<th>Balance (15 Minutes)</th>
<th>Cool Down (5 Minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Wednesday / Thursday</td>
<td>5 Minutes of ‘Basic Run’ Activity.</td>
<td>1) Basic Step (5 Minutes)  2) Hula Hoop (5 Minutes)  3) Rhythm Boxing (5 Minutes)</td>
<td>1) Soccer Heading (2 Rounds)  2) Tightrope Walk (2 Rounds)  3) Ski Slalom / Snowboard Slalom (2 Rounds of either)</td>
<td>5 Minutes of ‘Basic Run’ Activity.</td>
</tr>
</tbody>
</table>

*Instructions:*
- Perform each Wii Fit Plus activity to the best of your ability.
- You MUST spend the noted time limit performing each specific category of exercises. Study conductors will be monitoring time.
- If you happen to finish the list of exercises in a certain category before the required time limit, you should continue to exercise until the study conductor notifies you that time has been reached. At this point you may choose what exercises you wish to perform, however they must fall under your current exercise category.
# Exercise Log (Weeks 4 – 5)

## Exercise Category

<table>
<thead>
<tr>
<th>Day</th>
<th>Warm Up (5 Minutes)</th>
<th>Yoga (15 Minutes)</th>
<th>Strength Training (15 Minutes)</th>
<th>Cool Down (5 Minutes)</th>
</tr>
</thead>
</table>
| **Monday / Tuesday** | 5 Minutes of ‘FREE RUN’ Activity. | 1) Sun Salutation Pose  
2) Chair  
3) The Warrior’s Pose  
4) Standing Knee Pose  
5) The Tree Pose | 1) Torso Twists  
2) Lunge  
3) Side Lunge  
4) Single-Leg Twists  
5) Plank | 5 Minutes of ‘FREE RUN’ Activity. |

<table>
<thead>
<tr>
<th>Day</th>
<th>Warm Up (5 Minutes)</th>
<th>Aerobics (15 Minutes)</th>
<th>Balance (15 Minutes)</th>
<th>Cool Down (5 Minutes)</th>
</tr>
</thead>
</table>
| **Wednesday / Thursday** | 5 Minutes of ‘FREE RUN’ Activity. | 1) Rhythm Kung Fu (1 round)  
2) Advanced Island Cycling (Get as many flags possible in 5 minutes)  
3) Rhythm Boxing (1 round) | 1) Segway Circuit (1 round)  
2) Tilt City (1 round)  
3) Table Tilt Plus (5 minutes)  
4) Tightrope Walk (5 Minutes) | 5 Minutes of ‘FREE RUN’ Activity. |

### Instructions:
- Perform each Wii Fit Plus activity to the best of your ability.
- You MUST spend the noted time limit performing each specific category of exercises. Study conductors will be monitoring time.
- If you happen to finish the list of exercises in a certain category before the required time limit, you should continue to exercise until the study conductor notifies you that time has been reached. At this point you may choose what exercises you wish to perform, however they must fall under your current exercise category.
Exercise Log (Weeks 6 – 7)

<table>
<thead>
<tr>
<th>Exercise Category</th>
<th>Day</th>
<th>Warm Up (5 Minutes)</th>
<th>Yoga (15 Minutes)</th>
<th>Strength Training (15 Minutes)</th>
<th>Cool Down (5 Minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Monday / Tuesday</strong></td>
<td></td>
<td>5 Minutes of Obstacle Course Activity.</td>
<td>1) Sun Salutation Pose 2) Chair 3) The Warrior’s Pose 4) Standing Knee Pose 5) The Tree Pose 6) Sun Salutation Pose</td>
<td>1) Torso Twists (6 REPS) 2) Lunge (15 PER LEG) 3) Side Lunge (15 PER LEG) 4) Single-Leg Twists (20 PER LEG) 5) Plank</td>
<td>5 Minutes of Obstacle Course Activity.</td>
</tr>
<tr>
<td><strong>Wednesday / Thursday</strong></td>
<td></td>
<td>5 Minutes of Obstacle Course Activity.</td>
<td>1) Birds Eye Bulls Eye 2) Rhythm Kung Fu (ADVANCED setting) 3) Rhythm Boxing (ADVANCED setting) 4) Island Cycling (ADVANCED setting)</td>
<td>1) Big Top Juggling (2 ROUNDS) 2) Penguin Slide (2 ROUNDS) 3) Tilt City (ADVANCED SETTING – 2 ROUNDS) 4) Table Tilt Plus</td>
<td>5 Minutes of Obstacle Course Activity.</td>
</tr>
</tbody>
</table>

**Instructions:**
- Perform each Wii Fit Plus activity to the best of your ability.
- You MUST spend the noted time limit performing each specific category of exercises. Study conductors will be monitoring time.
- If you happen to finish the list of exercises in a certain category before the required time limit, you should continue to exercise until the study conductor notifies you that time has been reached. At this point you may choose what exercises you wish to perform, however they must fall under your current exercise category.
Exercise Log (Weeks 8 – 9)

<table>
<thead>
<tr>
<th>Exercise Category</th>
<th>Day</th>
<th>Warm Up (5 Minutes)</th>
<th>Yoga (15 Minutes)</th>
<th>Strength Training (15 Minutes)</th>
<th>Cool Down (5 Minutes)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Exercise Category</th>
<th>Day</th>
<th>Warm Up (5 Minutes)</th>
<th>Aerobics (15 Minutes)</th>
<th>Balance (15 Minutes)</th>
<th>Cool Down (5 Minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Wednesday / Thursday</td>
<td>1 Round Rhythm Parade. 2 Minutes Island Cycling (Advanced).</td>
<td>1) 5 Minutes Obstacle Course. (ADVANCED setting) 2) 2 Rounds Rhythm Kung Fu (ADVANCED setting) 3) Super Hula Hoop. (ADVANCED setting)</td>
<td>1) 5 Minutes Bubble Balance Plus. 2) 2 Rounds Penguin Slide. 3) 1 Round Big Top Juggling. (ADVANCED setting) 4) Table Tilt Plus.</td>
<td>1 Round Rhythm Parade. 2 Minutes Basic Run.</td>
</tr>
</tbody>
</table>

Instructions:
- Perform each Wii Fit Plus activity to the best of your ability.
- You MUST spend the noted time limit performing each specific category of exercises. Study conductors will be monitoring time.
- If you happen to finish the list of exercises in a certain category before the required time limit, you should continue to exercise until the study conductor notifies you that time has been reached. At this point you may choose what exercises you wish to perform, however they must fall under your current exercise category.