THE ACUTE PHYSIOLOGICAL RESPONSES OF YOUTH TO AN INTERACTIVE VIDEO GAME

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THE ACUTE PHYSIOLOGICAL RESPONSES OF YOUTH TO AN INTERACTIVE VIDEO GAME

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ABSTRACT

PURPOSE: The purpose of this investigation was to determine the acute physiological responses of the Nintendo Wii Fit video game system compared to maximal treadmill testing and to determine the exercise intensity of this form of training in youth subjects. **METHODS**: Ten youth participants (5 boys and 5 girls) with the following characteristics (mean ± SD): age (10.30 ± 1.06 yrs.), height (142.0 ± 10.6 cm), weight (34.7 ± 9.6 kg) were examined during two separate exercise testing sessions: maximal treadmill test to determine VO_2 peak ($ml \cdot kg^{-1} \cdot min^{-1}$) and Nintendo Wii Fit exercise test (18 min.). During the Nintendo Wii Fit exercise test, 3 games were evaluated; hula hoop, basic run, and basic step aerobics. Each condition was played for a total of 6 minutes with 2.5 min. rest intervals between each condition. Participants also performed a maximal treadmill test (modified Bruce test). Their physiological responses for both maximal treadmill testing and Wii Fit were determined by indirect calorimetry (Cosmed $K4b^2$). Heart rate was monitored with a polar heart rate monitor. **RESULTS**: The results of maximal treadmill testing were VO_2 peak = 53.60 ± 6.24 ($ml \cdot kg^{-1} \cdot min^{-1}$), maximal HR = 201.00 ± 8.30 $bts \cdot min^{-1}$, RER = 1.27 ± 0.11. The responses to the Wii Fit hula hoop were kcal = 3.16 ± 0.86 $kcal \cdot min^{-1}$, VO_2 = 18.24 ± 4.95 $ml \cdot kg^{-1} \cdot min^{-1}$, HR = 137.00 ± 16.32 $bts \cdot min^{-1}$. The responses to the Will Fit basic run were kcal= 3.45 ± 0.71 $kcal \cdot min^{-1}$, VO_2 = 19.92 ± 4.07 $ml \cdot kg^{-1} \cdot min^{-1}$, HR = 134.00 ± 18.90 $bts \cdot min^{-1}$. The responses to the Wii Fit basic step aerobics were kcal = 2.01 ± 0.37 $kcal \cdot min^{-1}$, VO_2 = 11.57 ± 2.16 $ml \cdot kg^{-1} \cdot min^{-1}$, HR = 112.00 ± 10.59 $bts \cdot min^{-1}$. The metabolic responses for the all three Wii Fit games were 31 percent of VO2 max and 63 percent of HR_{max}. **CONCLUSION**: This investigation found that Wii Fit produced a mean energy cost of 4.7 METS, a mean % HR_{max} = 63%, and a mean %HRR max = 44%. According ACSM's

Guidelines for Exercise Prescription the intensity level would be classified as light to moderate intensity exercise.

INTRODUCTION

Physical inactivity has become a major health concern for both adults and children in the United States. The lack of physical activity along with a number of other factors has contributed to the rise of obesity and various chronic diseases, such as cardiovascular disease. It is estimated that approximately 15% of all children, are obese and 30% are overweight in the United States (14). Obesity is an ever-growing concern, which has prompted many individuals to consider options to combat this public health issue. Research shows that over time sedentary behavior has increased in children, in part related to behaviors, like watching television or playing video game (5, 16). Due to this increase, a number of new ways to combat childhood obesity have been researched, including the use of interactive gaming systems.

An interactive game experience is perceived as a viable option in bridging the gap between physical activity and sedentary lifestyles by making the gaming experience fun and entertaining. The Wii Fit interactive game system combines traditional gaming with a physically active component, to offer the user an interactive movement experience. This game console provides the opportunity to make physical activity fun and enjoyable (3, 9).

Interactive gaming or exergaming consists of video games that require the use of the whole body to play. Over the years, a number of studies have been conducted regarding various interactive video games, such as Dance Dance Revolution (DDR), Sony EyeToy, as well as the Nintendo Wii Sports game. Research studies have shown an increase in energy expenditure while playing interactive video games as compared to sedentary video games (7,8,17,18,19). Different variables such as energy expenditure, heart rate, oxygen consumption, motivational levels and other conditions have been analyzed.

Recently, the Nintendo Wii Fit game system has become extremely popular in today's video game market. Since its inception, consumers have flocked to this new age gaming system in hopes of motivating physical activity, specifically in young people. Shortly after the Nintendo Wii's emergence on the gaming market in 2006, the Nintendo Wii Fit, a game designed to offer fitness and fun to users, followed two years later in 2008. This game system can play sedentary video games or active video game such as Wii boxing or Wii tennis. There are various types of games that can be played using this game system and the Wii Fit is one of these active games. The Wii Fit is a game that focuses more on health and fitness components. It features four main categories: Strength Training, Aerobics, Yoga and Balance Games. Within each category, are various games that may be played.

Currently, there are a number of studies that have analyzed the physiological and metabolic responses of interactive games on adults and youth, however there is limited evidence analyzing the Nintendo Wii Fit with regards to energy expenditure in youth. This scientific research study is unique in the fact that it is one of the first to do such that. Therefore, the purpose of the study is to determine the effect the Nintendo Wii Fit game has on youth's energy expenditure, maximal oxygen consumption and heart rate.

METHODS

Experimental Approach to the Problem

This investigation involved three test sessions on three separate days. Test sessions were separated by a 48 hour period. The first test session involved collecting baseline measurements at rest, conducting a modified maximal treadmill test (for determining maximal oxygen consumption), and a Nintendo Wii Fit familiarization period. The second test session involved the Nintendo Wii Fit test. Three aerobic Wii Fit games were tested using oxygen uptake and heart rate as measures of physiological responses. Each participant was asked to refrain from intense exercise for at least two hours prior to testing. The third test session involved another Nintendo Wii Fit test exactly like the second test session however a cross-sectional design was used to alter the testing order.

During all exercise tests, the Cosmed K4b^2 portable metabolic system (Rome, Italy) was used to measure physiological measures of oxygen consumption (VO_2), ventilation ($V_{E)}$, and respiratory exchange ratio (RER) on a breath-by-breath basis (4). A Polar T31 heart rate monitor was used to track heart rate (Kempele, Finland). All data was recorded on a computer using the Cosmed K4b^2 software.

Energy expenditure (EE) was calculated during both test sessions. During each test session, caloric expenditure was calculated using the average VO_2 measurements adjusted for RER.

Subject

A sample of 10 children (5 males and 5 females) aged 8-12 participated in the study (10.30 ± 1.06 yrs.). Descriptive data of the participants are presented in Table 1. The overall

BMI reveals that participants were within the normal range. Participant's height was measured to the nearest 0.05 cm using a fixed stadiometer and weight to the nearest 0.05 kg. using a calibrated digital flat scale. Body Mass index was calculated by weight in kg/ height m^2. The test population consisted of individuals with various levels of Nintendo Wii Fit experience, ranging from first time players to skilled players.

Participants were considered eligible after completing a health history questionnaire, an exercise and physical activity readiness assessment, along with baseline assessments indicating that subjects were free from any underlying physical or health risk factors. The study was approved by the Auburn University Montgomery Institutional Review Board for research involving human subjects. Verbal and written assent was obtained from the participants and written informed consent was obtained from the parent or guardian.

Maximal Treadmill Test

A modified Bruce treadmill protocol was used to determine $VO_{2\ peak}$ (1). The following physiological measures of Vo_2, V_E, RER were assessed using the $K4b^2$ portable metabolic system. Participants warmed-up at a speed of 2.74 km/hr (1.7 mph) for three minutes. The test began at a speed of 2.74 km/hr (1.7 mph) with an incline of 10%. At two minute intervals, the incline of the treadmill was increased by 2%, and the speed was incrementally increased until a maximal value was reached. $Vo_{2\ peak}$ was reached when two of the following occurred: respiratory exchange ratio (RER) of ≥ 1.10, a peak heart rate of 200 bts·min^{-1}, or observation of volatile signs of fatigue (14). During the test, heart rate (HR) and ratings of perceived exertion (RPE) were assessed during the last minute of each stage. The Borg's 10 point scale was used to measure RPE (5).

Nintendo Wii Fit

Following the maximal treadmill test, participants were allowed to practice the Nintendo Wii Fit game system for one hour to become familiar with the games. Participants were only allowed to play the following aerobic games: hula hoop, basic step aerobics, and basic run. Instruction was given on how to play and operate the game system.

During the second test session, participants played on the Nintendo Wii Fit for an 18-minute period. This session was at least 48 hours after the first test session. Prior to the Wii Fit test session, baseline measurements of height, and weight were collected. The test session began with a 12-minute familiarization period of the Nintendo Wii Fit game. Following this initial step, the Wii Fit test session was conducted. Three aerobic games were assessed; hula hoop, basic step aerobics, and basic run. A randomized test protocol was used to alter the testing order. Participants played the Nintendo Wii Fit while physiological measures of V_{O_2}, V_E, and RER using the K4b^2 portable metabolic system. Participants played each aerobic game for 6 minutes with a two and a half minute rest period between each game. Participant's RPE was assessed at the conclusion of each 6-minute aerobic game using the Borg's 1-10 scale. After the test session, EE was calculated based on oxygen consumption values. The third test session, participants conducted another Nintendo Wii Fit test as exactly described above. The second Wii Fit test session was used to compare the results of this test session with the results of the previous Wii Fit test session for validity and reliability purposes.

Statistical Analyses

Descriptive data (mean ± SD) were calculated for age, height, weight, BMI, energy expenditure, oxygen consumption, and heart rate values for the three aerobic Wii Fit games. A one-way repeated measures analysis of variance ANOVA was used to determine the differences between Vo_2, HR, and EE of the Nintendo Wii Fit basic run, hula hoop and basic step aerobics games. The significance level was set at $p \leq 0.05$.

RESULTS

As shown in Table 2, the Wii Fit basic run game had the highest EE, VO_2, and HR values of all of the three games tested; kcal= 3.45 ± 0.71 kcal·min^{-1}, VO_2 = 19.92 ± 4.07 ml·kg^{-1}·min^{-1}, HR = 134.00 ± 18.90 bts·min^{-1}. Total EE for the 18- minute Wii Fit game session was 51.73 ± 4.57 kcal/session. The average EE of all three aerobic Wii Fit games was 2.89 kcal·min^{-1}.
The second Wii Fit test session results: The responses of the Wii Fit basic run were kcal = 3.49 ± 0.70 kcal·min^{-1}, VO_2 = 19.35 ± 5.31 ml·kg^{-1}·min^{-1}, HR = 135.38 ± 20.91 bts·min^{-1}. The responses to the Will Fit hula hoop were kcal= 2.78 ± 0.80 kcal·min^{-1}, VO_2 = 16.05 ± 4.64 ml·kg^{-1}·min^{-1}, HR = 130.67 ± 17.28 bts·min^{-1}. The responses to the Wii Fit basic step aerobics were kcal = 2.00 ± 0.32 kcal·min^{-1}, VO_2 = 11.57 ± 1.83 ml·kg^{-1}·min^{-1}, HR = 114.00 ± 14.08 bts·min^{-1}.

Table 2 shows the Wii Fit hula hoop game had lower EE, VO_2, and HR values than the Wii Fit basic run game; kcal = 3.16 ± 0.86 kcal·min^{-1}, VO_2 = 18.24 ± 4.95 ml·kg^{-1}·min^{-1}, HR = 137.00 ± 16.32bts·min^{-1}. The responses to the Wii Fit basic step aerobics game were the lowest of all three games examined; kcal = 2.01 ± 0.37 kcal·min^{-1}, VO_2 = 11.57 ± 2.16 ml·kg^{-1}·min^{-1}, HR = 112.00 ± 10.59 bts·min^{-1}. There was not a significant difference in EE, VO_2, and HR values between the Wii Fit basic run and hula hoop games ($p \geq 0.05$). There was however a significant

difference between the Wii Fit basic run and Wii Fit basic step aerobics game EE, VO_2, and HR values (p=.008) (table 2). Additionally, there was a significant difference between the Wii Fit hula hoop and Wii Fit basic step aerobics game EE, VO_2, and HR values (p=.02). The mean metabolic responses for the total 18-minute Wii Fit game session were 31 % of $VO_{2\,max}$ and 63 % of HR_{max}.

DISCUSSION

The present study revealed that the Nintendo Wii Fit aerobic games, hula hoop, basic run, and basic step aerobics produced an EE of 51.73 ± 4.57 kcal/session during game play. This is one of the first studies that has assessed the physiological responses of the Nintendo Wii Fit aerobic games on youth. There have been many studies concerning the Wii, however few have assessed the responses in youth using the Wii Fit game. The mean EE while playing the Nintendo Wii Fit aerobic games was 51.72 kcal for an 18-minute period of game play. The total EE of game play on the Nintendo Wii Fit aerobic games indicated a mean of 4.7 METS, which is comparable to light to moderate exercise intensity levels according to the ACSM (5). This MET level is equivalent to performing activities such as walking at a 4 mph pace, playing doubles tennis, or playing badminton (5). The mean % HR_{max} = 63% and %HRR max = 44%. These results promising in representing the positive effects the Nintendo Wii Fit game can have on physiological responses in youth.

A recent study by Graves et. al. (7) assessed the metabolic and physiological responses in adolescents while playing the Nintendo Wii Sports games: bowling, boxing and tennis compared to non-interactive video games. The study revealed that there were higher levels of EE, VO_2, and HR values associated with playing the Wii game system as compared to a non-interactive video

game. The EE was 51% greater with the Wii group than in the group that included subjects playing the sedentary video game (7). The mean energy expenditure for the three Wii Sports games were: Wii bowling, 2.80 kcal·min^{-1}, Wii tennis, 2.99 kcal·min^{-1}, and Wii boxing, 2.89 kcal·min^{-1}. This study revealed energy cost values comparable to those of the current study.

Another study by Lanningham-Foster, et.al. (8) found that children aged 8 to 12 years expended significantly higher levels of energy playing activity-based video games when compared to watching television, and playing seat-based video games (8). In this study the EyeToy and the Dance Dance Revolution Ultramix2 (DDR2) games were assessed. For the Eyetoy video game, EE increased 1.09 kcal·min^{-1} over resting EE and 1.52 kcal·min^{-1}over resting for the DDR2 video game.

An earlier study examined a dance simulation game in 22 overweight and non-overweight children and adolescents aged 11 to 17 years (mean age, overweight, 13.5 ± 3.3/ non-overweight, 12.3 ± 1.5 yrs.). The study found that the mean energy cost during this interactive game was 4.6 kcal·min^{-1} in the overweight (OW) group and 2.9 ± 0.7 in the non-overweight (NO) group. This study found higher EE in the overweight group when compared to the non-overweight group, however when fat free mass was normalized, there was no significant difference between the two groups EE (18). The current study's mean EE of all three aerobic Wii Fit games of 2.89 kcal·min^{-1} is closely related to the EE values found in the OW and NO groups.

PRACTICAL APPLICATIONS

In a society driven by technology and plagued by an epidemic of obesity and inactivity, many have hypothesized that interactive video games may be an effective way to encourage

physical activity. As a result, interactive games have become an extremely popular way to promote exercise and to be an important component of an active lifestyle. A number of recent studies have been conducted to examine the effects of these various interactive games on EE, exercise motivation, and the health benefits that may come from these games (7,8,9,10,17,18).

The present study shows that interactive video games can indeed produce increased measurable physiological exercise responses in children. Furthermore, it shows that the activity is effective in producing light to moderate intensity exercise according to the ACSM recommendations for exercise intensity. The results of this study and others investigating interactive video games and their health benefits are promising, however further investigation is required to account for sample size, varying fitness levels, interactive video game skill levels, age, and gender.

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TABLES

TABLE 1. Descriptive Data (mean ± SD)

Measurements	Entire Sample	Males	Females
Age (yrs)	10.30 ± 1.06	10.4 ± 1.14	10.2 ± 1.10
Height (cm)	142.0 ± 10.6	142.8 ± 7.95	141.2 ± 13.75
Weight (kg)	34.7 ± 9.6	36.34 ± 7.33	33 ± 12.08
Body Mass Index ($kg \cdot m^{-2}$)	16.89 ± 2.40	17.7 ± 2.40	16.08 ± 2.36

TABLE 2. VO_2, Energy Expenditure, Heart Rate for each condition (mean ± SD)

Condition	VO_2 ($ml \cdot kg^{-1} \cdot min^{-1}$)	HR ($bts \cdot min^{-1}$)	EE ($kcal \cdot min^{-1}$)
Basic Run	19.92 ± 4.07	134 ± 18.90	3.45 ± 0.71
Hula Hoop	18.24 ± 4.94	137 ± 16.32	3.16 ± 0.86
Basic Step Aerobics	11.57 ± 2.15	112 ± 10.59	2.01 ± 0.37

Significance ($p \leq 0.05$)

Note. Vo_2 = volume of expired oxygen (oxygen consumption); EE = energy expenditure; HR= heart rate.

FIGURES

FIGURE 1 VO2 ($ml \cdot kg^{-1} \cdot min^{-1}$)

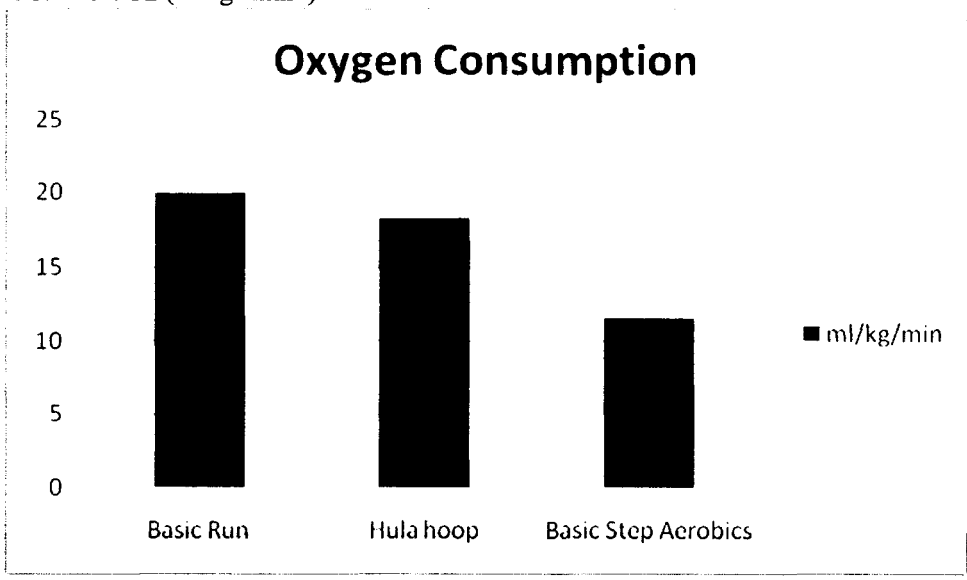


FIGURE 2 HR (bpm)

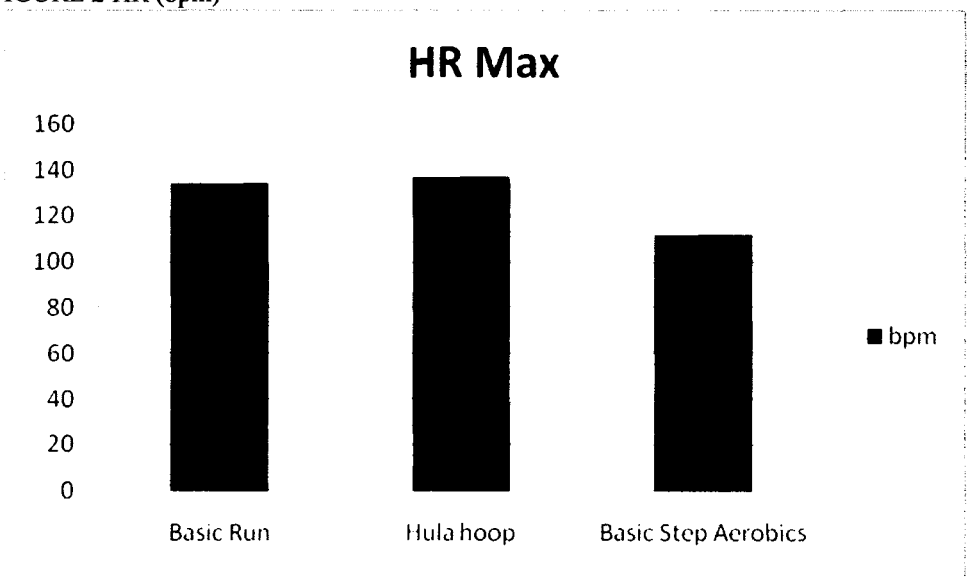
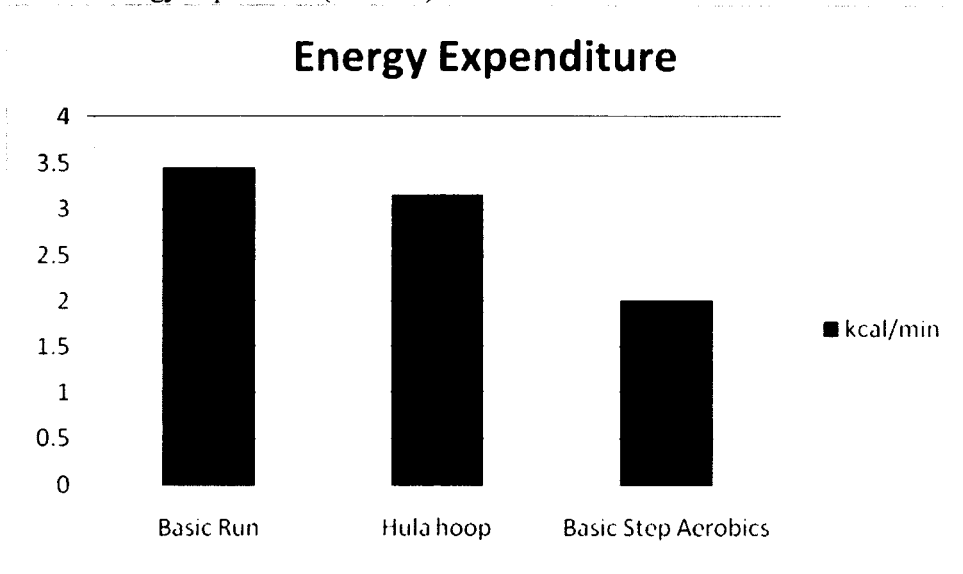


FIGURE 3 Energy Expenditure (kcal/min)



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Review of Literature

Currently, in the United States 30% of children and adolescents, six to 11 years old are overweight, about three times the rate 30 years ago (15). Physical inactivity and sedentary behavior are big causes of obesity in the United States. Through the years, children have become less active and more consumed with watching television, playing video games and surfing the internet to pass the time. These statistics illustrate how much children engage in sedentary behavior. According to Rideout, Roberts, and Foehr children spend, on average, nearly four hours a day watching television, DVDs, and playing video games (12).

Another study found that children in the U.S. were spending 75% of their waking hours being inactive and were logging in only about 12 minutes of vigorous activity per day (2). In a society driven by technology, many have questioned how to use these devices to combat this problem. As a result, interactive gaming has become extremely popular in motivating people to engage in physical activity, and as a result, elicit positive health benefits. Recent studies have been conducted to examine the effects of these various interactive games on energy expenditure, exercise motivation, and the health benefits that may come from these games (7, 8, 9, 10, 17, 18). There have been promising findings regarding interactive video games and health benefits.

Straker and Abbott conducted a study on the effect of screen based media on energy expenditure and heart rate (16). The researcher's defined screen based media in terms of television, computer, and electronic games. The study compared traditional screen based media to active input screen based media. Twenty adolescences, nine to 12 years old, were used in this study. Researchers used five different devices which made up the traditional screen based devices and compared them to watching a DVD. Examples of the electronic devices included a handheld game device, a keyboard computer game and a car racing game. The Sony EyeToy

device was used for the active input screen based media device. Researchers found that there was little difference in heart rate or energy expenditure while playing traditional screen based media, however evidence showed positive benefits for the active-input game. Results concluded that there was 59% increase in heart rate and a 224% higher energy expenditure as compared to the traditional screen based media devices (16).

Two similar studies comparing seated and active gaming in children reported positive findings in terms of the amount of energy expenditure. The study conducted by Lanningham-Foster et al. examined the energy expenditure while engaging in sedentary behavior like watching television and playing handheld video games and active movement games. The Sony EyeToy was used in this study for the interactive video game. Results showed a 108 -172% increase in energy expenditure while engaging in the active video games (8). Similarly, the study conducted by Mellecker and McManus showed that energy expenditure and heart rate was increased as compared with the seated screen based environment (10). These findings generated new knowledge about the benefits that active games can have on increasing physical activity levels and spurred further interest in the subject.

Mhurchu et al. conducted research to study the effects that active video games had on physical activity levels in children (11). This pilot study used 20 children and divided them into experimental and control groups. The instruments used were the Sony EyeToy, a dance mat, and the Playstation 2 game console. Participants in the experimental group substituted sedentary game play with active game play, while the control group only played sedentary video games. The results demonstrated that the children engaging in the active game play were more physically active and played fewer video games than those who played the traditional sedentary

games. A decrease in waist circumference measurements was found in the experimental group (11).

Interactive dance games are other types of games that have been studied to determine their health benefits. In 1998, Dance Dance Revolution (DDR), the first dance simulation arcade game was released. In a study by Tan, Aziz, Chua, and Teh, researchers examined the aerobic demands placed on individuals playing this active video game (17). The 40 adolescent subjects that were selected to participate had a low level of previous experience playing this type of gaming system. Participants had two weeks to familiarize themselves with the game, and during the testing session subjects danced a pre-determined level of difficulty for 10 minutes, while metabolic measurements were taken. The results of the study were favorable. Researchers found that the subjects' heart rates reached an intensity level of 70% of their maximum heart rate, which is comparable to that of medium-intensity aerobic dance, and this number met the American Colleges of Sports Medicine's minimum recommendations for developing and maintaining cardio-respiratory fitness (17).

Unnithan, Houser, and Fernhall conducted a similar study as the aforementioned study, however their research examined the energy cost of playing the Dance Dance Revolution game in overweight versus non-overweight children and adolescents (18). During the 12-minute dance protocol, the subjects' caloric expenditure was calculated. Results determined that the overweight children expended more calories than that of the non-overweight children. It was reported that all subjects had an average heart rate corresponding to an intensity of 64% heart rate maximum whilst playing the lowest difficulty level. This study suggested that this interactive game can improve cardio-respiratory fitness which can elicit greater cardiovascular health benefits (18).

An additional study using the Dance Dance Revolution game system studied the differences in energy expenditure in males with varying playing experience. In the study conducted by Sell, Lillie, and Taylor, 19 male college students played on the DDR gaming system continuously for 30 minutes at a self selected difficulty level (13). Of the 19 subjects, 12 were experienced in playing the DDR system and seven were inexperienced. Throughout the video game testing, numerous metabolic measurements were recorded and analyzed. From these measurements, researchers found that 150 kcal were expended in the experienced group. The inexperienced group expended considerably less energy than their more experienced counterparts. Both groups however met the American College of Sports Medicines minimum physical activity requirements. The experienced group achieved a moderate-intensity physical activity level and the inexperienced group reached a light-intensity level in terms of VO2 reserve (13).

A study by Warburton et al. evaluated how interactive video games contributed to health related physical fitness in young males (19). Only participants engaging in low physical activity were chosen to take part in this six-week study. An experimental and a control group were used. The experimental group played on an interactive bicycle, Gamebike, in conjunction with the Playstation 2 video game console. Participants were asked to ride the bike while playing a Playstation 2 video game of their choosing. The control group exercised using a recommended exercise regimen using a standard bicycle. As a result, the experimental group participated in more interactive video games than the control group as well as showed larger improvements in health related fitness. Thus, this study determined that there was an increased number of health benefits attained while playing the interactive video game.

Another interesting study concerning interactive video games, examined the metabolic requirements of an active cycling game to traditional cycling. This study conducted by Warburton et al. used an electronic cycle ergometer that was fitted with the GameBike video game system for the interactive session and an identical electronic cycle ergometer for the traditional cycling session (20). Subjects performed three five-minute stages of play at a constant workload. The same protocol was used for both test sessions. The results were significantly in favor of the interactive cycle game. These participants had a higher energy expenditure, increased heart rate, and higher oxygen consumption, concluding that there was an increased metabolic demand while playing the interactive cycling game.

A more recent study examining the popular gaming system, Nintendo Wii, was conducted by Graves et al. (7). Researchers compared Nintendo Wii sports games to that of the XBOX 360 game console. Eleven subjects participated with age ranges from 13 -15 years of age. Participants played equal times of the active Wii tennis, bowling and boxing games as well as the sedentary XBOX 360, Project Gotham Racing 3 game. Results concluded that energy expenditure was higher than resting values in all the games studied, however the active Wii Sports game elicited 51% greater energy expenditure than the sedentary game. Researchers were enthusiastic about their findings, but understood the limitations of the active game in meeting the daily recommended physical activity levels for children (7).

The research findings discussed in this review of literature makes a strong point for the positive health benefits that can be elicited while playing active video games. However, since this technology is relatively new, more research needs to be conducted regarding the new games being introduced to the public to determine their health benefits. Despite the great findings of the

research mentioned above, this review of literature demonstrates the lack of information and research pertaining to the Nintendo Wii Fit, which reinforces the need for such a study.

AUBURN
MONTGOMERY

RESEARCH PROTOCOL REVIEW FORM

INSTITUTIONAL REVIEW BOARD for RESEARCH INVOLVING HUMAN SUBJECTS
OFFICE OF SPONSORED PROGRAMS(OSP)
132 Library Tower 334-244-3249

ONLY TYPEWRITTEN FORMS WILL BE ACCEPTED

1. **PROPOSED DATES OF STUDY:** FROM 03/15/2009 TO 12/18/2009 Review Type: ☑ Full Board ☐ Exempt ☐ Expedited

2. **PROJECT TITLE:** The effects the Nintendo Wii Fit has on energy expenditure

3.

Kelly Gaston	GTA	PHED	(344) 244-3472	kgaston1@aum.edu
PRINCIPAL INVESTIGATOR	TITLE	DEPT	PHONE	E-MAIL

4. **SOURCE OF FUNDING / PROJECT SUPPORT:** ☐ Internal ☑ External:(List) Nintendo Corp. ☐ N/A

5. **STATUS OF FUNDING / PROJECT SUPPORT:** ☐ Received ☐ Approved ☑ Pending ☐ N/A

6. **GENERAL RESEARCH PROJECT CHARACTERISTICS**

A. Research Content Area

Please identify the descriptors that best apply to this proposed research project.

School of Education

Other

Physiology

☐ Other (Please list:) _____

Please list 3 or 4 keywords to identify this research project: _____

B. Research Methodology

Please identify the descriptors that best apply to the research methodology.

Data collection will be: ☑ Prospective ☐ Retrospective ☐ Both

Data will be recorded so that participants can be directly or indirectly identified: ☑ Yes ☐ No

Data collection will involve the use of:

- ☐ Educational Tests (cognitive, diagnostic, aptitude, achievement)
- ☑ Surveys / Questionnaires
- ☑ Private Records / Files
- ☐ Interview / Observation
- ☐ Audiotaping and / or Videotaping
- ☑ Physical / Physiologic Measurements or Specimens

C. Participant Information

Please check all descriptors that apply to the participant population.

- ☑ Males ☑ Females

Vulnerable Populations

- ☐ Pregnant Women ☐ Children
- ☐ Prisoners ☑ Adolescents
- ☐ Elderly ☐ Physically Challenged
- ☐ Economically Challenged ☐ Mentally Challenged

Do you plan to recruit Auburn Montgomery Students? ☐ Yes ☑ No

Do you plan to compensate your participants? ☐ Yes ☑ No

D. Risks to Participants

Please identify all risks that may reasonably be expected as a result of participating in this research.

- ☑ Breach of Confidentiality ☐ Coercion
- ☐ Deception ☑ Physical
- ☐ Psychological ☐ Social
- ☐ None ☐ Other (please list): _____

will the test be in division or in group

DATE RECEIVED IN OSP: 2/26/09 by DgT PROTOCOL # 2009-13

DATE ASSIGNED IRB REVIEW: 3/3/09 by DgT REVIEW TYPE: ___ Exempt _1_ Full ___ Expedited

DATE of IRB APPROVAL: 4/27/09 by DgT INTERVAL FOR CONTINUING REVIEW: 4/27/2010

7. **PROJECT ASSURANCES**

PROJECT TITLE: The effects the Nintendo Wii Fit has on energy expenditure

A. PRINCIPAL INVESTIGATOR'S ASSSURANCE

1. I certify that all information provided in this application is complete and correct.
2. I understand that, as Principal Investigator, I have ultimate responsibility for the conduct of this study, the ethical performance for this project, the protection of the rights and welfare of human subjects, and strict adherence to any stipulations imposed by the Auburn Montgomery IRB.
3. I certify that all individuals involved with the conduct of this project are qualified to carry out their specified roles and responsibilities and are in compliance with Auburn Montgomery IRB policies regarding the collection and analysis of the research data.
4. I agree to comply with all Auburn Montgomery IRB policies and procedures, as well as with all applicable federal, state, and local laws regarding the protection of human subjects, including, but not limited to the following:
   a. Conducting the project by qualified personnel according to the approved protocol
   b. Implementing no changes in the approved protocol or consent form without prior approval from the Office of Sponsored Programs (OSP) (except in an emergency, if necessary to safeguard the well-being of human subjects)
   c. Obtaining the legally effective informed consent from each participant or their legally responsible representative prior to their participation in this project using only the currently approved, stamped consent form
   d. Promptly reporting significant adverse events and/or effects to the Office of Sponsored Programs (OSP) in writing within 5 working days of the occurrence.
5. If I will be unavailable to direct this research personally, I will arrange for a co-investigator to assume direct responsibility in my absence. This person has been named as co-investigator in this application, or I will advise OSP, by letter, in advance of such arrangements.
6. I agree to conduct this study only during the period approved by the Auburn Montgomery IRB.
7. I will prepare and submit a renewal request and supply all supporting documents to the Office of Sponsored Programs (OSP) before the approval period has expired if it is necessary to continue the research project beyond the time period approved by the Auburn Montgomery IRB.
8. I will prepare and submit a final report upon completion of this research project.

Kelly Gaston	Kelly Gaston	2/24/09
Principal Investigator (Please Print)	Principal Investigator's Signature	Date

B. FACULTY SPONSOR'S ASSSURANCE

1. By my signature as sponsor on this research application, I certify that the student or guest investigator is knowledgeable about the regulations and policies governing research with human subjects and has sufficient training and experience to conduct this particular study in accord with the approved protocol.
2. I certify that the project will be performed by qualified personnel according to the approved protocol using conventional or experimental methodology.
3. I agree to meet with the investigator on a regular basis to monitor study progress.
4. Should problems arise during the course of the study, I agree to be available, personally, to supervise the investigator in solving them.
5. I assure that the investigator will promptly report significant adverse events and/or effects to the OSP in writing within 5 working days of the occurrence.
6. If I will be unavailable, I will arrange for an alternate faculty sponsor to assume responsibility during my absence, and I will advise the OSP by letter of such arrangements.
7. I have read the protocol submitted for this project for content, clarity, and methodology.

Dr. Hank Williford		2/24/09
Faculty Sponsor (Please Print)	Faculty Sponsor's Signature	Date

C DEPARTMENT HEAD'S ASSSURANCE

By my signature as department head, I certify that every member of my department involved with the conduct of this research project will abide by all Auburn Montgomery policies and procedures, as well as with all applicable federal, state, and local laws regarding the protection and ethical treatment of human participants.

Dr. Hank Williford		2/24/09
Department Head (Please Print)	Department Head's Signature	Date

8. **INVESTIGATORS. Identify each individual involved with the conduct of this project and describe his or her roles and responsibilities related to this project.**

Investigator: Kelly Gaston **Title:** GTA **Dept/ Affiliation:** PHED

Roles / Responsibilities:

Primary Investigator. Roles and responsibilities of the primary invesigator include subject recruitment, consenting and screening of all partcipants, and collecting and analyzing the data. The primary investigator is a graduate student in the physical education, a graduate teaching assitant in the human performance laboratory , and CPR/AED certified.

Investigator: Dr. Hank Williford **Title:** Professor **Dept/ Affiliation:** PHED

Roles / Responsibilities:

Co-Investigator. Roles and responsibilities will to include recruitment, consenting and screening of all participants, and collecting and analyzing data. Dr. Williford is the Department Head of Physical EducationExercise Science. He is CPR/AED certified, a Fellow of the American College of Sports Medicine. He is the Director of the Human Performance Laboratory and has been invovled in research within the laboratory since 1983.

Investigator: Mike Esco **Title:** Instructor **Dept/ Affiliation:** PHED

Roles / Responsibilities:

Currently, Mr. Esco is an instructor in the School of Education and is a doctoral candidate in exercise physiology. He is CPR/AED certified, and American College of Sports Medicine Certified Health and Fitness Instructor, and a national Strength and Conditioning Association Certified Strength and Conditioning Specialist. He will be assisstng in collecting and analyzing data.

Investigator: Angela Russell **Title:** Student **Dept/ Affiliation:** PHED

Roles / Responsibilities:

Currently, Angela is an undergraduate student assistant in the Department of Physical Education/Exercise Science. Beginning the Summer of 2009 semester. Angela will be a graduate teaching assistant in the Human Performance Laboratory. SHe will be assisting with the data collection process.

9. **LOCATION OF RESEARCH. List all locations where data collection will take place. Be as specific as possible.**

The study will be conducted in the Human Performance Laboratory at Auburn University Montgomery. The lab is located within the Physical Edication complex of AUM, room 201.

10. **BACKGROUND: Briefly discuss the relevant literature and research findings that lead to the development of this project.** ***Please cite relevant sources and include a "Reference List" as Appendix A.***

Since the inception of the interactive Nintendo Wii, many have flocked to this new age gaming system in hopes of motivating physical activity, specifically in young people. This virtual gaming experience is leading the way in bridging the gap between physical activity and sedentary lifestyles by incorporating the use of technology. The Nintendo Wii overcomes the challenges faced when motivating kids and adults to exercise by making the experience fun and entertaining. Only a few studies have come out regarding the use of active video gaming systems. These studies examined the differences in energy expenditure between active video games to sedentary games to see how many calories and how much more exercise people get when playing active video gaming systems like the Nintendo Wii. These studies have determined that there is a greater increase in energy expenditure using the active video gaming systems. A resent study, published in the British Journal of Sports Medicine compared the use of the Nintendo Wii Sport active games to an Xbox 360 sedentary game. The results showed that there was an increase in energy expenditure when playing the active video game as compared to the sedentary game. However the active game was not of high enough intensity to contribute to the recommended daily amount of exercise in children. Additional studies published examined the energy expenditure in other gaming systems such as Dance Dance Revolution, Eye-toy beach volleyball, Xerbike. Currently, no studies have examined the effects of the Nintendo Wii Fit in regards to energy expenditure. Therefore, the purpose of the study is to determine the effect that playing the Nintendo Wii Fit gaming system has on an individual's energy expenditure, oxygen consumption, and overall physical fitness.

Wii games

— Wii obstacle adventure is better exercise

11. **PURPOSE & SIGNIFICANCE.**

a. **Clearly state the objectives, goals, or aims of this project.**

To determine the energy expenditure while using the Nintendo Wii Fit. A second objective is to evaluate the use of a virtual gaming system regarding exercise prescription.

b. **How will the results of this project be used? (e.g., Presentation? Publication? Thesis? Dissertation?)**

The results of this study will be used to fulfill the Master's thesis requirement. The results will also be presented at professional meetings like the American College of Sports Medicine.

12. **PARTICIPANTS.**

a. **Describe the participant population you have chosen for this project.**

Sol'n. selected

Participants for this study will include approximately20 adolescents between the ages of 8 and 12. The sample will be taken from the student population in Montgomery, AL. Participants need not have previous Nintendo Wii Fit experience. The participants will be given an informed consent and assent agreement, ACSM questionnaire, and Physical Awareness Readiness Questionnaire (PAR-Q) that must be signed and returned before beginning the study. Individuals under the age of 18 must be accompanied by a parent/guardian during all testing procedures.

What is the minimum number of participants you need to validate the study? 15

What is the maximum number of participants you will include in the study? 20

b. **Describe the criteria established for participant selection. (If the participants can be classified as a "vulnerable" population, please describe additional safeguards that you will use to assure the ethical treatment of these individuals.)**

Define

Participants must meet the following criteria in order to be used in the study. Participants must be in good overall health, with low risk for disease. Participants will be excluded from the study should any risk factors be present of cardiovascular, pulmonary, orthopedic, or metabolic disease.

c. **Describe all procedures you will use to recruit participants.** ***Please include a copy of all flyers, advertisements, and scripts and label as Appendix B.***

Participants will be recruited through verbal communication with parents or teachers present.

What is the maximum number of potential participants you plan to recruit? 20

d. **Describe how you will determine group assignments (e.g., random assignment, independent characteristics, etc.).**

No grouping. This is a descriptive study.

e. **Describe the type and amount and method of compensation for participants.**

Participants will not receive any monetary compensation.

13. **PROJECT DESIGN & METHODS. Describe the procedures you will plan to use in order to address the aims of this study. (NOTE: Use language that would be understandable to a layperson. Without a complete description of all procedures, the Auburn Montgomery IRB will not be able to review protocol. If additional space is needed for #13, part b, save the information as a .pdf file and insert after page 6 of this form.)**

a. **Project overview. (Briefly describe the scientific design.)**

This study will use a sample of adolescents to determine the effects the Nintendo Wii Fit has on energy expenditure. Each eligible participant will visit the lab on three separate occasions. The first visit will be to assess descriptive data and the conduct the VO2 Max exercise test. During the next two visits, participants' will be giving time to familiarize themselves with the gaming system and the Nintendo Wii Fit exercise test will be conducted. A cross-over design will be used to alter the testing order. Different Wii Fit modules will be evaluated. = which ones?

b. **Describe all procedures and methods used to address the purpose.**

Eligible participants will report to the Human Performance Laboratory on three separate occasions in which data will be collected which involve a baseline assessment, VO2 max test, familiarization with the Nintendo Wii Fit and data testing. The first visit, participants will complete the health questionnaires, (Appendix ***) and provide written informed consent and assent (Appendix ***). The following descriptive data variables will be assessed for each participant during this visit: Height; body weight; body mass index (BMI); waist and hip circumferences; waist to hip ratio (WHR); resting blood pressure; and body composition. In addition, the participants will complete a maximal graded treadmill exercise test (GXT) to determine their VO2 Max.

For this test, the workload will be incrementally increased every 3 minutes until a maximal value is reached. Expired gas (oxygen and carbon dioxide) fractions will be continuously sampled at the mouth using a pneumotach, mixing chamber, and gas analyzers from Applied Electrochemistry (Ametek, Pittsburg, PA). All data will be recorded on an on-line computer every 30 seconds using AEI software. During the test, heart rate will be assessed continuously, and blood pressure will be measured during the last 45 seconds of each stage. The test will be terminated when two of the following occur: a plateau in VO2 occurs with increasing workload; respiratory exchange ratio (RER) of > 1.10; heart beat within 10 beats of age predicted maximum. At the termination of the GXT, the subject be allowed a "cool-down" period that consists of a light intense exercise for 3-minutes. The test will be symptom limited and the subject may stop the test at any time because of personal feelings of exhaustion or discomfort associated with exercise.

During this test, oxygen consumption is measured which is directly related to energy expenditure. It has been established that for every liter of oxygen consumed, 5 kilocalories are burned, thus the amount of energy a participant expends can be determined using published energy expenditure equations.

The second visit (at least 48 hours after the initial visit) will consist of familiarization with the Nintendo Wii Fit. Participants will be given 12 minutes to play and experiment with the gaming system to get acquainted with the controls and games. After such time, the Nintendo Wii Fit exercise test will be conducted. Participants will play the Nintendo Wii Fit for 2, 15-minute periods while their energy expenditure is being measured with a metabolic gas analyzer. Participants will be given a 5-minute break after the first 15-minute playing period. Heart rate and blood pressure will be measured during each 15 minute playing period. Energy expenditure will be measured using specific software that will analyze participants oxygen consumption and based on this data, calculations will be performed to determine how much energy was expended.

The third and last visit, participants will conduct the Nintendo Wii Fit exercise test as exactly described above.

Heart rate will be monitored during each exercise test using a Polar heart rate monitor (Polar Electro Oy, Kempele, Finland). Before each exercise test, subjects will be asked the following: to wear exercise clothing for testing; to not eat food or consume caffeinated beverages 3 hours before testing; to not exercise for at least 24 hours before testing.

How? PE

Which games on the fit?

Will they all use the same

some are aerobic, some balance

Define

c. **List all instruments used in data collection. (e.g., surveys, questionnaires, educational tests, data collection sheets, outline of interviews, scripts, audio and/or video methods etc.)** ***Please include a copy of all data collection instruments that will be used in this project and label as Appendix C.***

The following questionnaires and data collection sheets are attached (Appendix C)

d. **Data Analysis: Explain how the data will be analyzed.**

Data will be analyzed with SPSS statistical software. Descriptive data will consist of means and standard deviations. A repeated measures ANOVA will be used to evaluate the significance between testing sessions. The data from the Wii Fit exercise test will be compared to the maximal data in order to determine percent maximum data.

14. **RISKS & DISCOMFORTS: List and describe all of the reasonable risks that participants might encounter if they decide to participate in this research.** ***If you are using deception in this study, please justify the use of deception and be sure to attach a copy of the debriefing form you plan to use and label as Appendix D.***

Participants will consist of approximately 20 adolescences between the ages of 8 and 12 years with no known health problems. Participants will be screened by use of an AHA/ACSM Health/Fitness Facility Pre-participation Screening Questionnaire and Physical Activity Readiness Questionnaire (Appendix A). Risks involved include those associated with exercise fatigue: sore muscles, strained muscles, and nausea. In addition, fainting or light headedness may occur. If injury does occur as a result of the experiment, it will be the participants' responsibility to seek medical attention.

Do you see that Warning about Seizures w/ games

15. **PRECAUTIONS. Describe all precautions you have taken to eliminate or reduce risks that were listed in #14.**

by whom

All participants will be notified of all potential risks involved in the study. The participants will be properly screened to determine if they have any health problems t that would prevent them from participating in the study. Participants will be excluded from the study should any risk factors be present of cardiovascular, pulmonary, orthopedic, or metabolic disease. All personnel have been trained in CPR and AED procedures. Emergency procedures are posted in the Human Performance Laboratory at all times. Participants may stop the exercise test at any time and remove themselves from the study. If any health problems are observed, participants will be advised to seek medical assistance from their personal physician.

The emergency action plan calls for at least two people to be in the laboratory during testing. The principle investigator will be involved in data collection at all times. The second person will be either, Hank Williford, Mike Esco, and/or Angela Russell.

16. **BENEFITS.**

a. **List all realistic benefits participants can expect by participating in this study.**

Benefits include the basic understanding of one's level of physical fitness as well as information regarding their physiological responses to exercise. The participants will be able to gather valuable information from the variable measures in this study such as BMI, heart rate, and the energy cost of physical activity.

Not really a HW measurement = might need to add some education regarding these measurements

b. **List all realistic benefits for the general population that may be generated from this study.**

The benefits generated from this study for the general population will give a better understanding of the fitness impact that the Nintendo Wii Fit can have on energy expenditure and physical fitness. They will be able to evaluate the energy cost using the Wii Fit gaming system.

17. **PROTECTION OF DATA.**

a. **Will data be collected as anonymous?** ☐ Yes ☑ No *If "YES", go to part "g".*

b. **Will data be collected as confidential?** ☑ Yes ☐ No

c. **If data is collected as confidential, how will the participants' data be coded or linked to identifying information?**

Participants will be identified by an assigned number rather than by name and only the investigator and co-investigator will have access to data.

d. **Justify your need to code participants' data or link the data with identifying information.**

The data will be coded to ensure participant confidentiality.

e. **Where will code lists be stored?**

The data will be held in a computer and a locked in file cabinets in the Human Performance Laboratory.

f. **Will data collected as "confidential" be recorded and analyzed as "anonymous"?** ☐ Yes ☑ No

g. **Describe how the data will be stored (e.g., hard copy, audio cassette, electronic data, etc.), where the data will be stored, and how the location where data is stored will be secured in your absence.**

Electronic data will be recorded and stored on a computer in the Human Performance Laboratory. Hard copy data will be stored in file cabinets in the Human Performance Laboratory. In my absence, all data will be locked within the Human Performance Laboratory. Only the investigator and co-investigators will have access to the data.

h. **Who will have access to participants' data?**

Only the investigator, co-investigator, participant, and/or parent/guardian will be present for performance testing which will take place in a laboratory setting. Two student graduate assistants in the Human Performance Laboratory may also be

i. **When is the latest date that the data will be retained?**

Data will be retained for 3 years after the last date of the participant tested.

j. **How will the data be destroyed? (NOTE: Data recorded and analyzed as "anonymous" can be retained indefinitely.)**

Coded data will be recorded and analyzed as anonymous and will be retained indefinitely.

Exercise and Physical Activity Readiness Assessment for Children and Adolescents

This is a medical history questionnaire to be completed prior to your exercise test at Auburn University Montgomery, Human Performance Lab. All information will be kept confidential. Please fill out the form carefully and thoroughly, and then review it to be certain you have not left anything out.

Child's Name _____

Address _____

City _____ State _____

Age _____ Birthdate _____

Race: _____

Contact phone number(s) _____

In case of an emergency who should we call? Name _____

Relationship to you _____ Phone number(s) _____

Address _____

City/State _____

Primary Health Care Provider _____

Provider's Phone _____

Address _____

City/State _____

May I send a copy of your exercise test to your primary health care provider? _____

Heart-Lung-Other Systems

Does your child have or has had:

A heart condition (please specify) _____

Diabetes (type 1 or 2 - please specify) _____

Cystic Fibrosis _____

High blood pressure _____

High cholesterol _____

Breathing problems or shortness of breath (eg: asthma) _____

Coughing during or after exercise _____

Other (please specify) _____

Does your child experience or have ever experienced:
Epilepsy or seizures/convulsions _____
If yes, is it at rest or during exercise? _____
Fainting Dizzy spells _____
Heat stroke/heat related illness _____
Increased bleeding tendency/ haemophilia _____
Other (please specify) _____
None of the above _____

If your child is taking any medication, please state if there are any side effects experienced as a result of taking this medication: _____

Muscle – Bone System
In the past 6 months, has your child had any muscular pain while exercising? _____
If yes, please explain and indicate where the pain has occurred (eg "pain in the back of right heel" or "pain on the inside of the right elbow")_____
_____
Has a doctor or physiotherapist treated this pain? _____

In the last 6 months, has your child experienced joint pain in the bones? _____
If yes, please explain and indicate where the pain has occurred (eg: "front of right leg" or "behind my knee") _____
_____

Special Conditions
Does your child suffer from any allergies? _____
If yes, please list allergies and any special requirements:
Does your child use a "puffer" or "ventilator" for asthma? _____
Does your child have any chronic disability or chronic illness? _____
If yes, please indicate condition:

Cerebral Palsy ADHD Hypermobility Intellectual impairment
Are you aware of any medical reason/condition that might prevent your child from participation in an exercise program? _____
If yes, please explain:
Is your child participating in any organized sports or extracurricular activities? _____
If yes, what are they? _____

Is there anything else that we should know about your child that has not been addressed above? _____

Appendix C

INFORMED CONSENT

The Effects the Nintendo Wii Fit has on Energy Expenditure

Auburn University Montgomery
Department of Physical Education and Exercise Science

Your child has been invited to participate in a study called the effects the Nintendo Wii Fit has on energy expenditure. Kelly Gaston is the principal investigator. Your child has been selected as a possible participant because he/she has volunteered to apply and fits the criteria of an adolescent between the ages of 8 and 12 years.

If you decide to allow your child to participate, your child will be asked to report to the Human Performance Laboratory at Auburn University Montgomery on three separate occasions. Each occasion should last no longer than 2 hours. During the first visit, the following variables will be collectedfor your child: Race; height; body weight; body mass index (BMI); waist to hip ratio (WHR); resting blood pressure; resting heart rate; and body composition. VO_{2max} on a maximal graded exercise test (GXT); blood pressure and heart rate during the GXT. The second visit will be scheduled at least 48 hours after the first visit. During this visit, your child will perform a 10 minute familiarization period with the Nintendo Wii Fit gaming system, and then perform 2, 15 minute bouts of game play on the Wii Fit. During the exercise session, energy expenditure will be measured through a metabolic gas analyzer. In addition, heart rate and blood pressure measures will be taken. The third visit will be scheduled 48 hrs. after the second visit. During the exercise session, your child will perform 2, 15 minute bouts of game play on the Nintendo Wii Fit. Energy expenditure will be measured through a metabolic gas analyzer. In addition, heart rate and blood pressure measures will be taken.

Every effort will be made to minimize risks through preliminary screenings and observations during the test. Some discomforts and inconveniences are possible. Musculoskeletal injury (strain or sprains) could occur. There is a possibility of nausea, dizziness, fainting, and/or fatigue as a result of exercise. Muscle soreness could also occur 24 to 48 hours after the test. Should injury occur as a result of the experimental protocol it would be your responsibility to seek medical attention for your child.

Personnel in charge will attempt to minimize all risks. Your child will be screened to determine if they have any health problems that would prevent them from performing exercise. The test will be terminated if your child experiences any of the following: chest pain, fatigue, shortness of breath, wheezing, leg cramps, claudication, dizziness, syncope, cyanosis or pallor. All personnel involved in testing are CPR/AED certified. Emergency procedures are posted in the Human Performance Laboratory.

By participating in this study, you and your child will gain a better understanding of the effects the Nintendo Wii Fit has on energy expenditure. In addition, your child will obtain body composition and maximal aerobic test measurements.

Any information obtained in connection with this study that can be identified to your child, will remain confidential and will be disclosed only with your permission. By signing this document, you give me permission to disclose your child's information to Dr. Henry Williford and Mike Esco only for the purpose of assisting with statistical analysis. Your child's information will be coded numerically and stored in private filling cabinets in the Human Performance Laboratory.

Your decision whether to allow your child to participate will not prejudice your future relations with Auburn University Montgomery. If you decide to give permission to allow your child to participate, you are free to withdraw consent and discontinue participation at any time without penalty. If you decide later to withdraw from the study, you are free to do so and any information that has been collected about your child will be destroyed or released to you.

If you have questions, please feel free to ask me directly or contact me at (334) 244-3472.

If you (or your child) have questions about this study, *please ask them now or* contact *Kelly Gaston* at *334-244-3472* or kgaston1@aum.edu. A copy of this document will be given to you to keep.

If you have any concerns regarding the approval of this research, please contact Debra Tomblin, Administrator of Institutional Review Board, at (334) 244-3250.

If you have questions regarding your child's rights as a research participant, please contact Debra Tomblin, at (334) 244-3250.

HAVING READ THE INFORMATION PROVIDED, YOU MUST DECIDE WHETHER OR NOT YOU WISH FOR YOUR CHILD TO PARTICIPATE IN THIS RESEARCH STUDY. YOUR SIGNATURE INDICATES YOUR WILLINGNESS TO ALLOW YOUR CHILD TO PARTICIPATE.

_____ _____

Parent's Signature Date

_____ _____

Investigator's Signature Date

Auburn Montgomery
Institutional Review Board
has approved this document for use
from 4/23/09 to 4/22/2010
Protocol # 2009-13

I hereby acknowledge that:

- The information provided above regarding my child's health is, to the best of my knowledge, correct.
- I will inform you immediately if there are any changes to the information provided above.

Parent/Guardian Signature: _____ Date: _____

Investigator Signature: _____ Date: _____

Assent Form
Appendix C

NINTEDNO WII FIT EXERCISE STUDY

My name is Kelly Gaston. I am a physical education student at Auburn University Montgomery.

I am asking you to take part in a research study because I am trying to learn more about the exercise benefits of the Nintendo Wii Fit. As most of you know active video games are very popular and the Nintendo Wii Fit is one of the newest gaming systems on the market. I want to learn how much exercise you really get when you are playing on the Nintendo Wii Fit.

If you agree, you will be asked to complete a survey. Then your vital statistics, your heart rate blood pressure, height, weight, and body composition measurements will be taken. You will be asked to perform 2 different exercise tests; one on a treadmill and one playing the Nintendo Wii Fit. Each exercise test should take no longer than 1 hour.

You do not have to participate in this study. No one will be upset with you if you decide not do this study. Even is you start the study, you can stop at anytime.

I you decide to be in this study I will not tell anyone else what you say or do in the study. Everything you say will be kept confidential.

Signing here means that you have read this form and have had it read to you and that you are willing to be in this study.

Subject's printed name: _____

Subject's signature: _____ Date _____

Signature of investigator: _____ Date: _____

Appendix C
Maximal VO2 Exercise Test

Name: _____ Date: _____

Gender: _____ Age (y): _____

Height: _____ Body Weight: _____

Date of Birth: _____

Skinfold Measurements

Chest: _____ Waist Circumference: _____

Triceps: _____ Hip Circumference: _____

Supscapular: _____ BMI: _____

Suprailliac: _____

Thigh: _____

Abdominal: _____

Pre-Ex HR: _____ BP: _____ Pred Max HR: _____ 85% Max HR: _____

Time	Speed	Grade	HR	BP	RPE	Comments
0-3	1.7	10				
3-6	2.5	12				
6-9	3.4	14				
9-12	4.2	16				
12-15	5	18				
15-18	5.5	20				
18-21	6	22				

Maximal Exercise Summary

Max Time: Peak HR: Peak BP: VO2 Max: