



# Affects on Heart Rate, $VO_2$ , Energy Expenditure, and Rate of Perceived Exertion Using the Wii Interactive Gaming Console

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## Abstract

**INTRODUCTION:** Previous experiments indicate in numerous ways that an active video game gives substantially greater health benefits than an inactive video game. The Wii console can be a good contribution to a person's workout routine, especially if they are incapable of performing other forms of exercise. Using a Wii or other form of active video gaming can result in high  $VO_2$  and HR levels for all age groups, and can be beneficial to a person's health to keep them active and moving. Many of the studies performed using the Nintendo Wii have used Wii Boxing, with significantly high results in many physiological areas, including  $VO_2$ . However, studies have not been performed to test the reliability of other Wii video games in changing the physiological factors of its user.

**PURPOSE:** The purpose of this research study was to determine the physiological effects of other Wii interactive games, such as Just Dance 3, in comparison to the Wii Sports Boxing game.

**METHODS:** Nine men (M; age  $24.0 \pm 9.84$  yrs) and twenty-six women (W; age  $28.5 \pm 3.41$  yrs) of the UTA Kinesiology department, volunteered to participate in this study. Each subject completed a questionnaire including age, height, weight and physical activity level. Each subject was fitted with a Polar heart rate monitor and face mask with SensorMedics sensor connected to the front. The subject participated in playing the Wii Just Dance 3 game for five minutes. During the five minutes, heart rate (HR) was recorded each minute, while the rate of perceived exertion (RPE) with ratings from 6 (rest) to 20 (maximal exercise) was recorded at the end of the five minutes. The oxygen consumption ( $VO_2$ ) was recorded through the SensorMedics machine and evaluated every minute. The energy expenditure (EE) was calculated using the ACSM guidelines of  $VO_2$  in  $L/min$  times five. After the five minutes of activity with the Wii Just Dance 3 game, the subjects rested in the seated position for five minutes to allow the heart rate to return to resting values. After the five minutes of rest, the subjects performed five minutes of game play using Wii Sports Boxing. The data was recorded in the same manner as during the first exercise bout.

**RESULTS:** The HR for dancing and boxing were  $121.6 \pm 18.95$  bpm and  $122.84 \pm 32.11$  bpm. The results indicated no significant difference ( $p = 0.090$ ) for HR between dancing and boxing. The  $VO_2$  for dancing and boxing were  $12.4 \pm 4$  mL/kg/min and  $12.6 \pm 5.4$  mL/kg/min. The results indicated no significant difference ( $p = 0.830$ ) for  $VO_2$  between dancing and boxing. The RPE for dancing and boxing were  $8.03 \pm 1.93$  and  $10.46 \pm 2.33$ . The results indicated large significant difference ( $p = 1.009 \times 10^{-7}$ ) for RPE between dancing and boxing. The EE for dancing and boxing were  $4.39 \pm 2.13$  kcal/min and  $4.59 \pm 2.93$  kcal/min. The results indicated no significant difference ( $p = 0.471$ ) for EE between dancing and boxing.

**CONCLUSION:** The results of this study indicate that Wii games other than Wii Sports Boxing still reached similar activity levels. The RPE values indicate that subjects felt boxing was more difficult than dancing. However, values for HR,  $VO_2$ , and EE indicate similar activity levels were achieved during both exercise bouts. RPE values could also be an indication of familiarity with each game.

## Purpose

The purpose of this research study was to determine the physiological effects of other Wii interactive games, such as Just Dance 3, in comparison to the Wii Sports Boxing game.

## Methods

The subjects completed a brief questionnaire asking for their name, age, height, weight, general activity level, and contact information. The subjects met in the Mavericks Activity Center Cardiovascular Laboratory. Upon arriving at the lab, a heart rate monitor was attached to their chest to allow measurement of heart rate. This signal was sent to a watch and the heart rate was read from there. The subject was fitted with a rubber mask and head piece in which the SensorMedics sensor was attached. The mask allowed the nose and mouth to be fully covered to ensure that exhaled air can be collected in the SensorMedics machine during the exercise. During each minute of the exercise, heart rate (HR), oxygen consumption ( $VO_2$ ), and energy expenditure (EE) was recorded along with a rate of perceived exertion score (RPE) with ratings from 6 (rest) to 20 (maximal exercise) being recorded at the end of each five minutes of exercise. The SensorMedics machine was be calibrated prior to each subject's arrival. The subject first participated in a five minute bout of exercise using the Wii interactive gaming console and the game Just Dance 3. The remote was placed in the right hand, and the Speed Shuffle option was chosen. The subjects continually danced throughout each song, following the choreography on the screen, and would stationary march during the brief song changes. Some of the choreography encountered was arm and leg movements such as shuffling their feet, lifting and lowering their arms, moving their torso side to side, and other such movements to incorporate full body motion. If the dance choreography included spinning, they were instructed to shift slightly to the side, but not completely spin around due to the equipment they were attached to.

## Methods (cont'd)

Once the five minutes was up, the subject rested in the seated position for 5 minutes to allow their heart rate to return to resting levels. After the rest period, they participated in another bout of exercise for five minutes, using the same Wii game console and the Wii Sports Boxing game. The subject selected the boxing icon on the screen and competed in a competition lasting three rounds. During the activity, the controller was placed in the right hand, and the nunchuck in the left, allowing the game system to sense movement of both hands. The motions incorporated with the boxing game included punching with either hand, dodging hits from the computer opponent, shuffling around the floor to simulate movement in the ring, and other such competitive movements. If the subject achieved a "knockout", they selected the boxing game again to enter the competition once more until the five minutes was reached. During pauses in between each round or next competition, they stationary marched to maintain movement. At the end of the boxing game, they had concluded the duration of the experiment and were free to leave.

## Results

Table 1: Demographics for male (M) and female (F) test subjects, totaling 46 subjects.

	M Mean	M SD	F Mean	F SD
Age (yrs)	25	9.61	20.4	3.11
Height (m)	1.79	0.08	1.63	0.08
Weight (kg)	90.47	18.59	63.57	13.33
Physicality (Sessions per month)	8.73	4.10	4.71	4.08

The HR for dancing and boxing were  $117.6 \pm 18.1$  bpm and  $129.5 \pm 28.8$  bpm. The results indicated a significant difference ( $p = 0.003$ ) for HR between dancing and boxing.

## Results (cont'd)

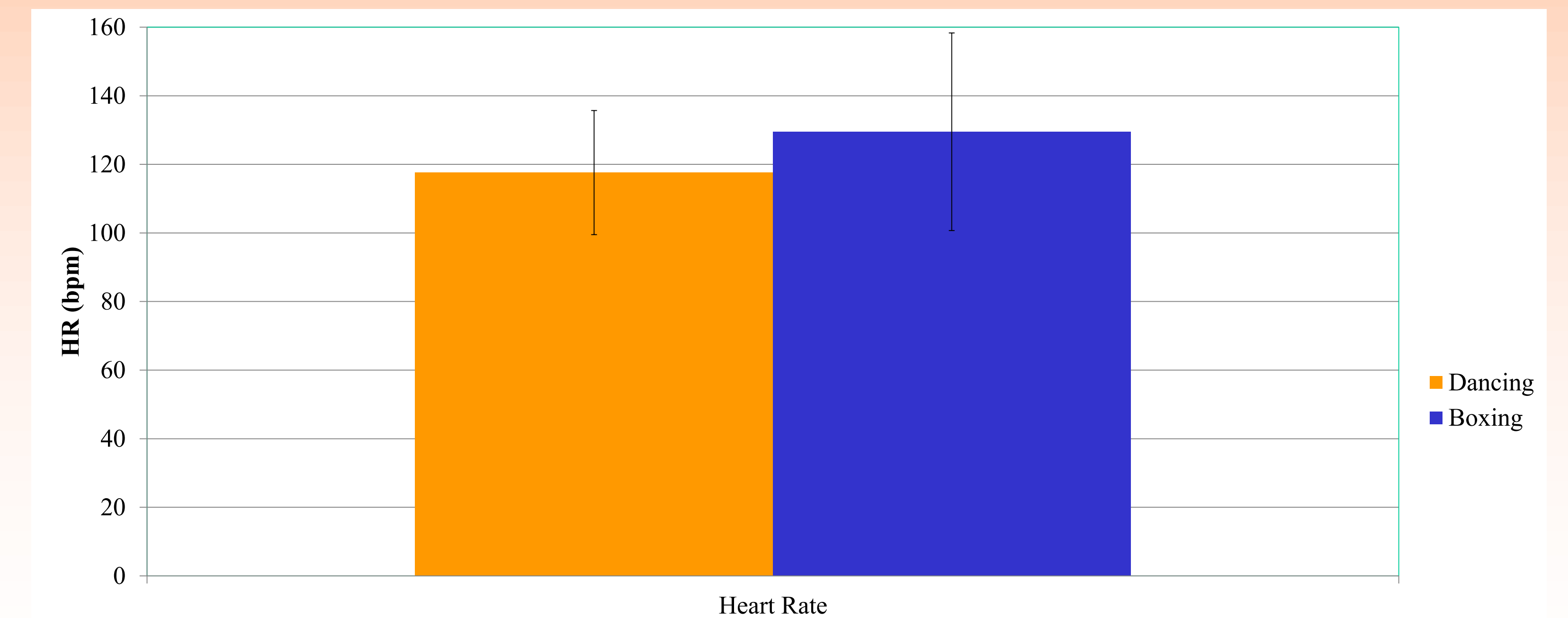


Figure 1: The Relationship of Heart Rate Between Dancing and Boxing Using the Wii During Five Minute Bouts of Exercise.

The  $VO_2$  for dancing and boxing were  $11.5 \pm 4.5$  mL/kg/min and  $12.4 \pm 5.2$  mL/kg/min. The results indicated no significant difference ( $p = 0.197$ ) for  $VO_2$  between dancing and boxing. The RPE for dancing and boxing were  $8.7 \pm 1.8$  and  $10.5 \pm 2.1$ . The results indicated a large significant difference ( $p < 0.001$ ) for RPE between dancing and boxing.

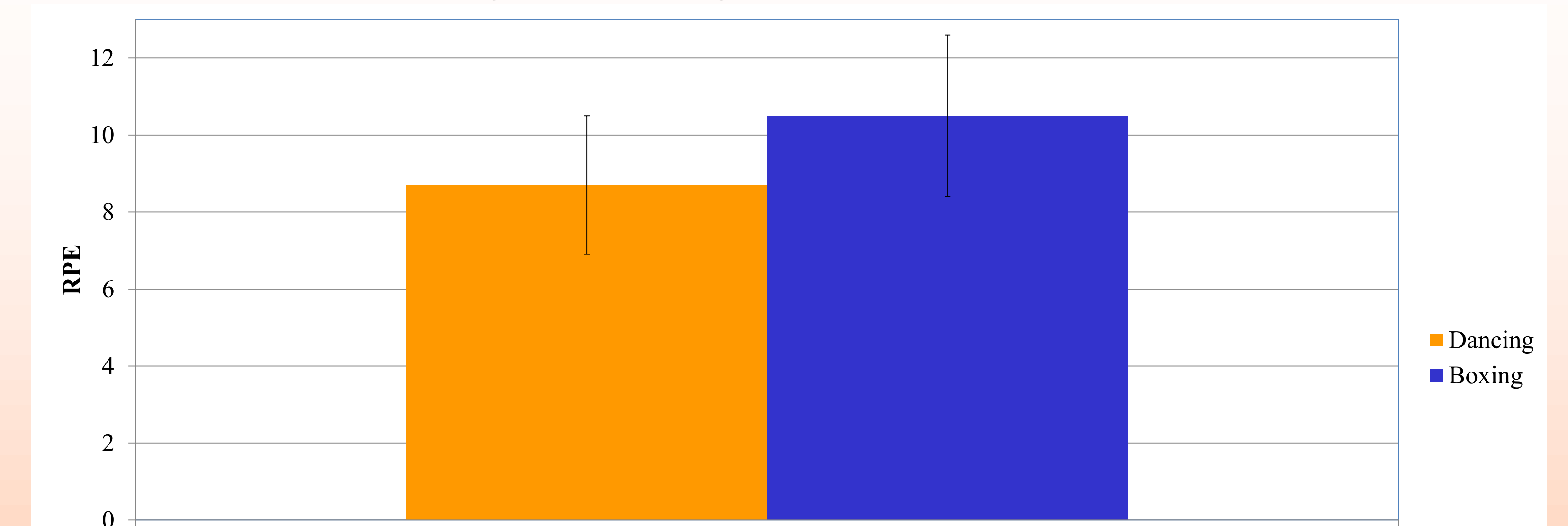


Figure 3: The Relationship of Rate of Perceived Exertion Between Dancing and Boxing Using a Wii During Five Minute Bouts of Exercise

The EE for males dancing and boxing were  $5.5 \pm 2.8$  kcal/min and  $6.7 \pm 3.8$  kcal/min. The results indicated no significant difference ( $p = 0.086$ ) for male EE between dancing and boxing. The EE for females dancing and boxing were  $3.6 \pm 1.5$  kcal/min and  $3.8 \pm 1.6$  kcal/min. The results indicated no significant difference ( $p = 0.428$ ) for female EE between dancing and boxing.

## Conclusions

The results of this study indicate that Wii games other than Wii Sports Boxing still reached similar activity levels. The RPE values indicate that subjects felt boxing was more difficult than dancing, also resulting in higher HR during the boxing bout of exercise.