

Exergaming Comparison: Nintendo Wii vs. Xbox 360 Kinect



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Introduction

- Active video gaming, also known as “exergaming” has become a means to counteract traditional sedentary video games.
- Studies have shown that exergaming uses more energy than sedentary activities and may be an effective way to engage youth and adults in physical activity.



Background

Author, Year	Sample	Measured	Results
Haddock et al., 2010	N = 37 ages: 12.4 ± 1.0 yrs	EE	Exergaming could increase EE if replacing SA, but not replacing TE
Graf et al., 2009	N = 23 ages: 10-13 yrs	EE, HR, SR, RPE, VO ₂	EE during active gaming is comparable to moderate intensity walking
Maddison et al., 2007	N = 21 ages: 12.4 ± 1.1 yrs	EE, HR, VO ₂ , SR	Replacing SA with active gaming could have an impact on body weight
Kraft et al., 2011	N = 37 ages: 23.2 ± 8.1 yrs	HR and RPE	Active gaming could be used as motivation to exercise
Jordan et al., 2010	N = 15 males ages: 29 ± 4 yrs	EE, HR, VO ₂	Lower limb activation increases EE in exergaming

EE= energy expenditure; HR= heart rate; SA= sedentary activity; TE= traditional exercise, SR= step rate, RPE= rate of perceived exertion, VO₂= oxygen consumption

Purpose

- The purpose of the investigation was to compare the energy cost of identical interactive video games on two different systems, Nintendo Wii (NW) and XBOX 360 Kinect (XK).



Method

- **Study Participants:**
 - Seventeen apparently healthy females (ages 19-24 yrs) with no known cardiovascular, pulmonary, or metabolic disease were recruited for the investigation.
 - The following descriptive measurements were collected: height, weight, BMI, and body fat percentage.

Method



- Subjects completed a graded exercise test (GXT) on a cycle ergometer
- This served as the criterion for VO_{2max} and maximal heart rate

Method

- Oxygen consumption (VO_2) values were measured using a portable metabolic analyzer (COSMED K4b², Rome, Italy).



Method

Descriptive Data

Variable		Mean \pm SD
Age	<i>years</i>	21.10 \pm 1.95
Height	<i>cm</i>	164.16 \pm 7.84
Weight	<i>kg</i>	69.50 \pm 14.88
BMI	<i>kg/m²</i>	25.65 \pm 4.65
BF	<i>%</i>	23.12 \pm 5.03
VO _{2peak}	<i>ml·kg⁻¹·min⁻¹</i>	34.68 \pm 7.96
HR _{peak}	<i>beats · min</i>	181.47 \pm 8.72

BMI= body mass index, BF= body fat, VO₂= oxygen consumption, HR= heart rate

Method

- **Independent Variable**

- **Exergaming** - The subjects performed seven dances on both the NW and XK consoles.

Dance Title	Time	Difficulty	Intensity
1. Venus	3:27	*	**
2. Land of 1000 Dances	2:22	*	***
3. Giddy On Up	3:18	**	*
4. Barbara Streisand	3:07	**	**
5. Gonna Make U Sweat	3:21	**	***
6. Dance All Nite	3:24	***	*
7. Apache (Jump On It)	4:02	***	**

Method

■ Dependent Variables

- Metabolic Equivalents of Tasks (METs): A physiological measure that expresses the energy cost of physical activity.
- Kilocalories (Kcals): A unit of measurement used to express energy expenditure.
- Oxygen Consumption (VO₂): The volume of oxygen consumed and utilized per minute. This measure is used to calculate the metabolic cost of activity.
- Heart Rate (HR): The number of heartbeats per minute.

Video clip: NW



Video clip: XK



Results

■ Analysis

- A paired T-test was used to evaluate significant differences between the two systems for the following variables:
 - METs
 - Kcals
 - Average VO_2
 - Average HR

Results

- Comparison of the average metabolic cost of each console:

Variable		NW	XK
METs		3.66 ± 0.97	3.82 ± 0.90
Kcals	<i>kcal/min</i>	4.45 ± 1.45	4.55 ± 1.09
VO ₂	<i>ml·kg⁻¹·min⁻¹</i>	12.80 ± 3.03	13.36 ± 3.14
HR	<i>beats · min</i>	123.00 ± 17.00	127.00 ± 21.00

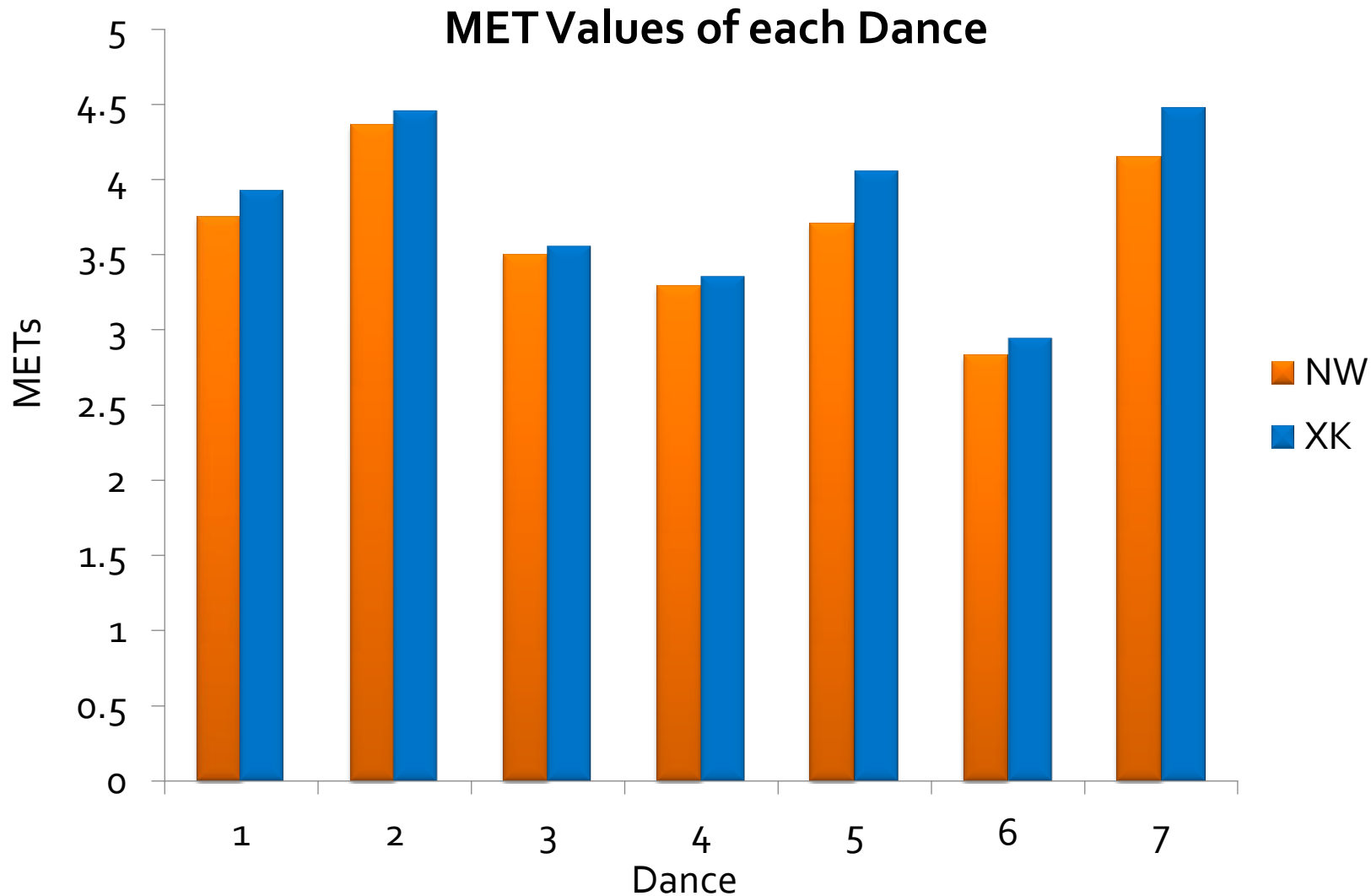
- There was no significant difference between systems for any of the measured variables ($p > 0.05$); although, the XK had greater values.

Results: METs

- MET values between NW and XK

Dance	NW METs	XK METs
1. Venus	3.75 ± 0.96	3.92 ± 0.92
2. Land of 1000 Dances	4.36 ± 1.11	4.45 ± 1.13
3. Giddy on Up	3.50 ± 0.88	3.55 ± 0.78
4. Barbara Streisand	3.29 ± 0.86	3.35 ± 0.79
5. Gonna Make U Sweat	3.71 ± 0.97	4.05 ± 1.06
6. Dance All Nite	2.83 ± 0.72	2.94 ± 0.82
7. Apache (Jump On It)	4.15 ± 1.07	4.47 ± 1.24

Results: METs

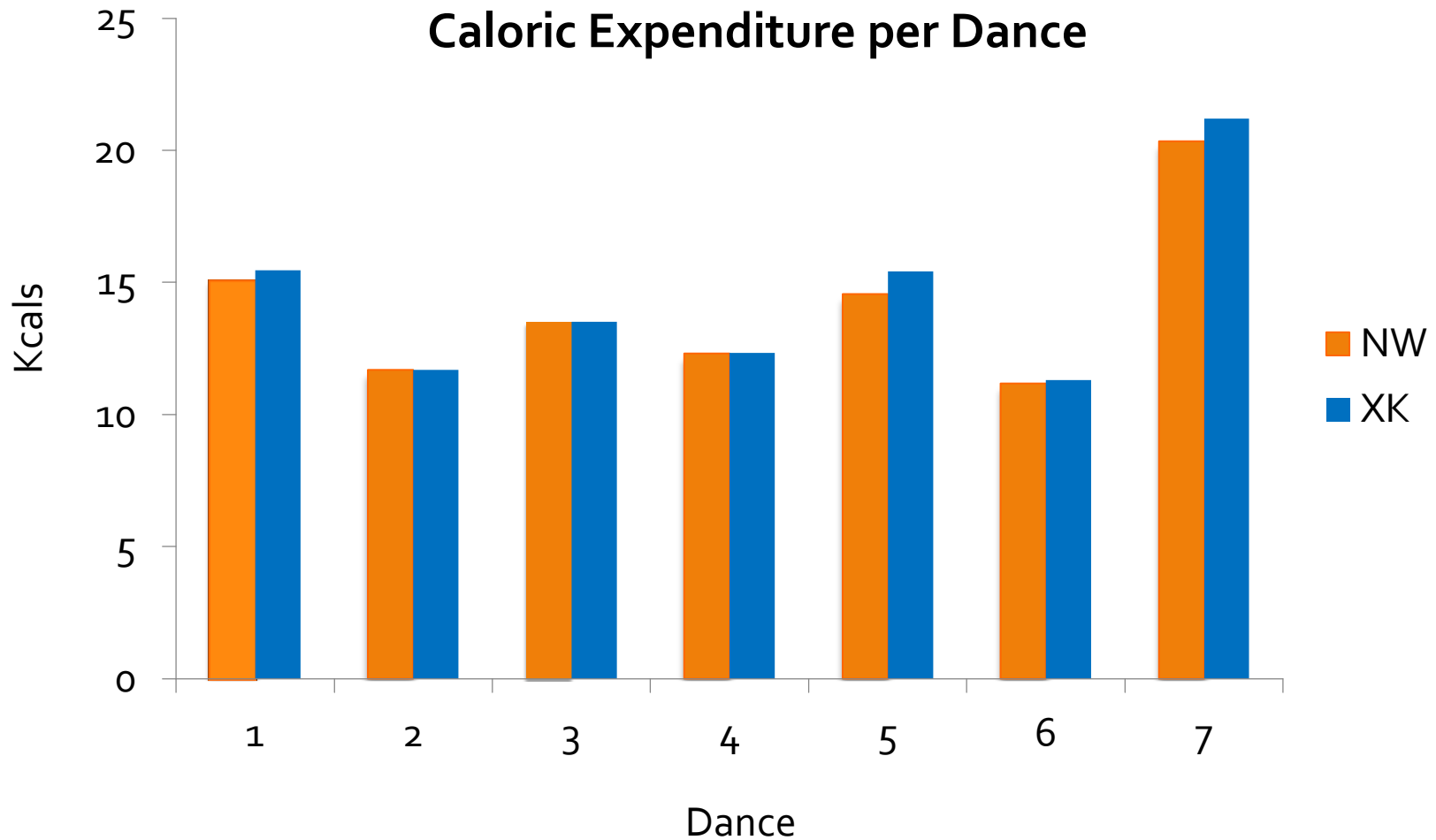


Results: Kcals

- Kcal values between NW and XK

Dance	NW Kcals	XK Kcals
1. Venus	4.60 ± 1.65	4.73 ± 1.42
2. Land of 1000 Dances	5.27 ± 1.64	5.27 ± 1.16
3. Giddy on Up	4.25 ± 1.40	4.25 ± 1.08
4. Barbara Streisand	4.01 ± 1.38	4.02 ± 1.11
5. Gonna Make U Sweat	4.54 ± 1.63	4.80 ± 1.19
6. Dance All Nite	3.45 ± 1.17	3.49 ± 0.94
7. Apache (Jump On It)	5.06 ± 1.74	5.27 ± 1.29

Results: Kcals

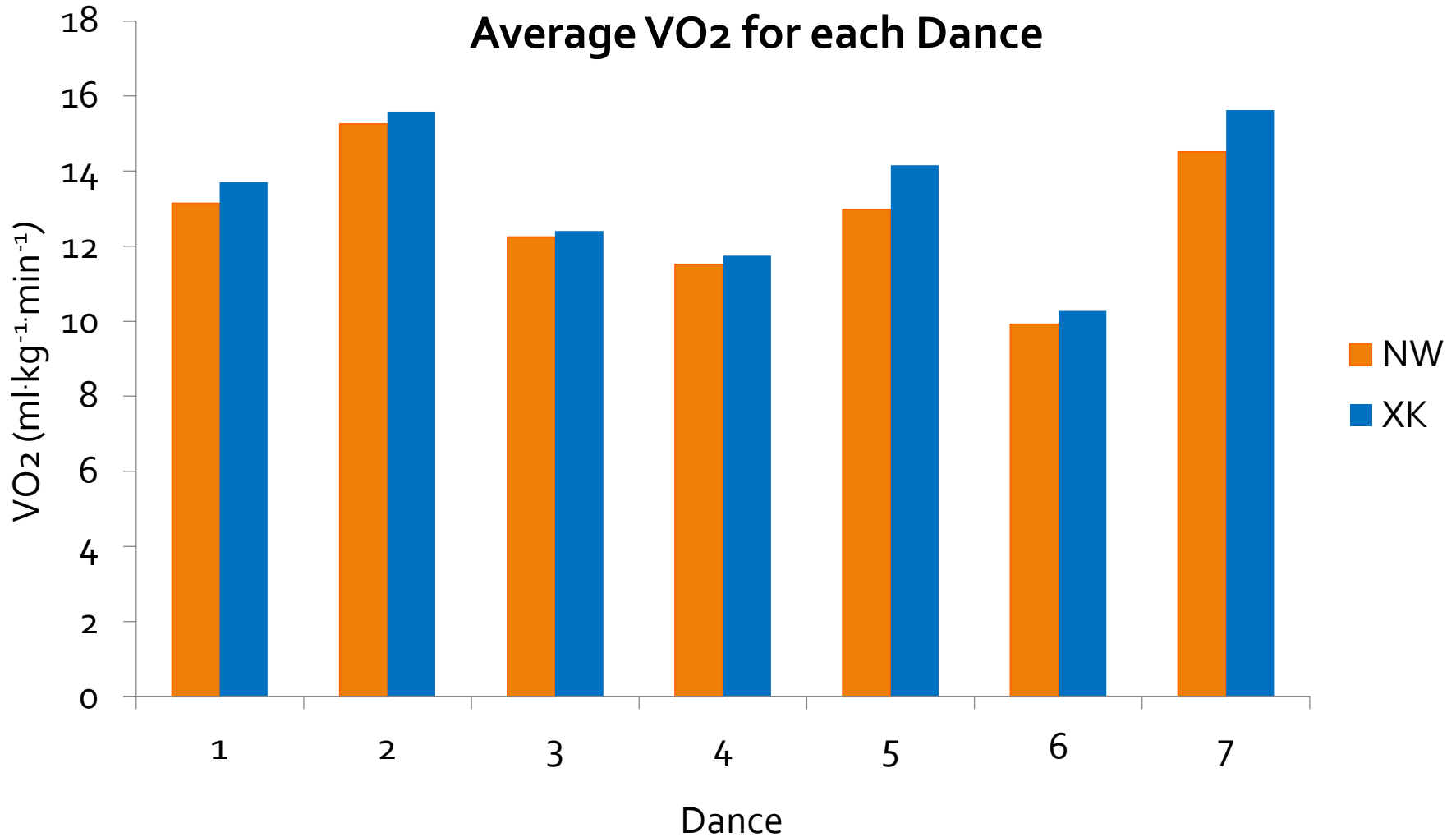


Results: Average $\dot{V}O_2$

- $\dot{V}O_2$ values between NW and XK

Dance	NW $\dot{V}O_2$	XK $\dot{V}O_2$
1. Venus	13.14 \pm 3.35	13.71 \pm 3.21
2. Land of 1000 Dances	15.26 \pm 3.90	15.59 \pm 3.97
3. Giddy on Up	12.24 \pm 3.08	12.41 \pm 2.74
4. Barbara Streisand	11.51 \pm 2.99	11.74 \pm 2.76
5. Gonna Make U Sweat	12.97 \pm 3.39	14.16 \pm 3.72
6. Dance All Nite	9.92 \pm 2.51	10.27 \pm 2.88
7. Apache (Jump On It)	14.52 \pm 3.70	15.63 \pm 4.34

Results: Average $\dot{V}O_2$

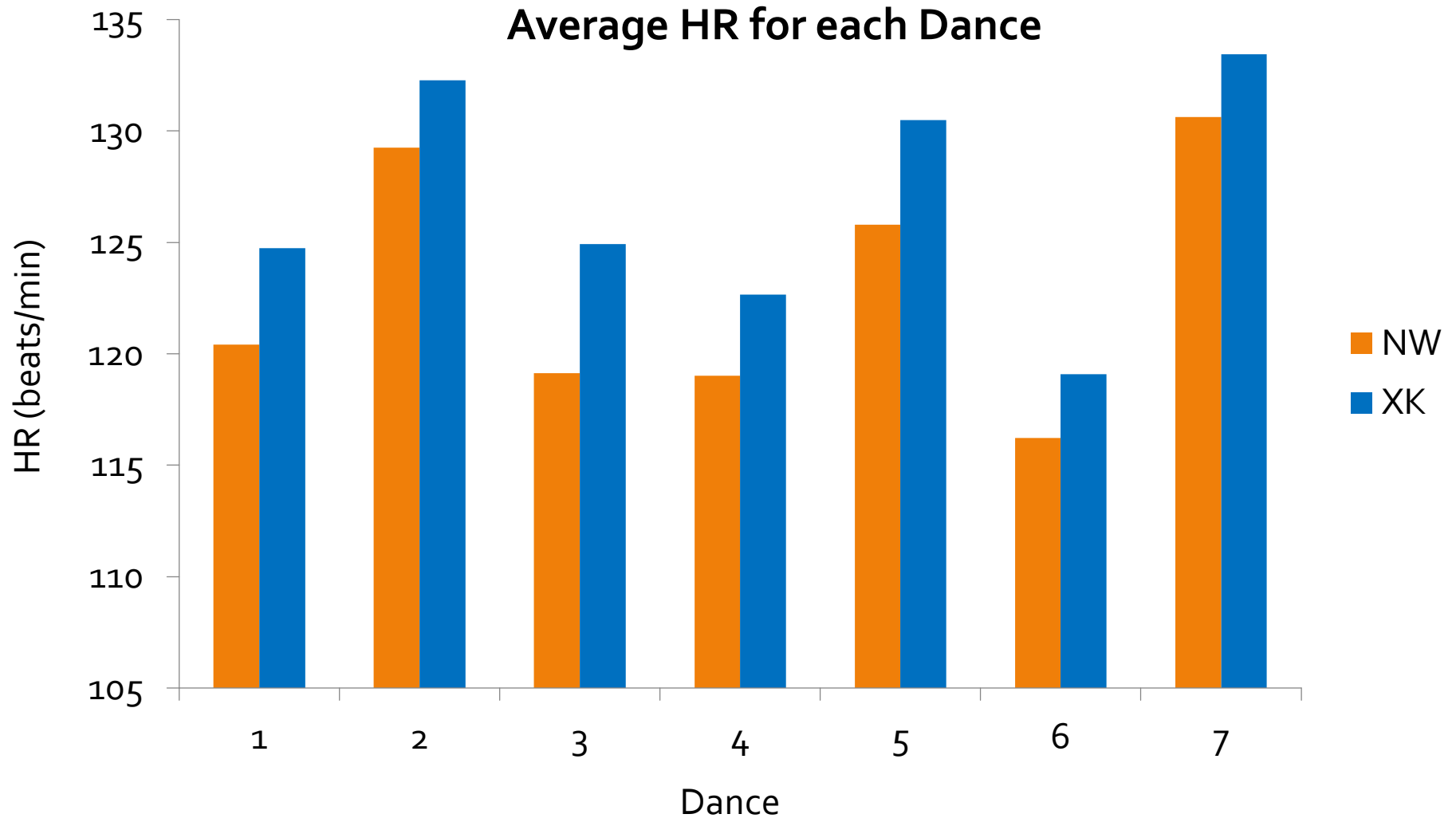


Results: Average HR

- HR values between NW and XK

Dance	NW HR	XK HR
1. Venus	120.41 ± 17.86	124.74 ± 19.70
2. Land of 1000 Dances	129.26 ± 16.81	132.27 ± 20.51
3. Giddy on Up	119.13 ± 13.72	124.93 ± 21.40
4. Barbara Streisand	119.02 ± 15.32	122.66 ± 20.47
5. Gonna Make U Sweat	125.79 ± 21.19	130.50 ± 21.49
6. Dance All Nite	116.23 ± 21.40	119.08 ± 22.88
7. Apache (Jump On It)	130.62 ± 19.69	133.45 ± 23.18

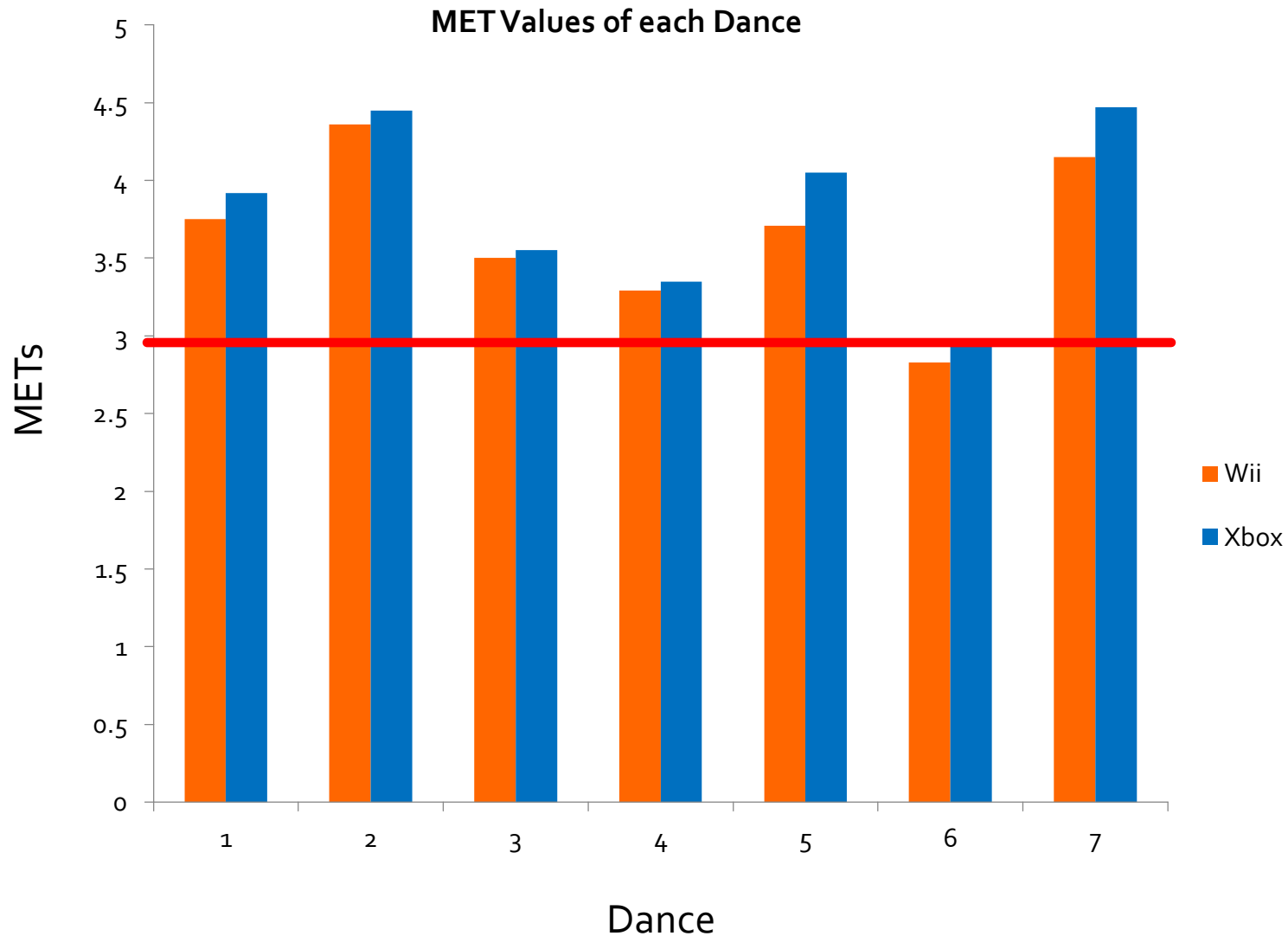
Results: Average HR



Discussion

- American College of Sports Medicine (ACSM) classification of Physical Activity Intensity
 - METs
 - **Light:** < 3 METs
 - **Moderate:** 3-6 METs
 - **Vigorous:** > 6 METs

Discussion: METs



Discussion: Exercise Prescription

- Oxygen Consumption Reserve (VO₂R): A method used to prescribe exercise intensity based on the maximal and resting VO₂.
- Heart Rate Reserve (HRR): A method used to prescribe exercise intensity based on maximal and resting HR.

Discussion

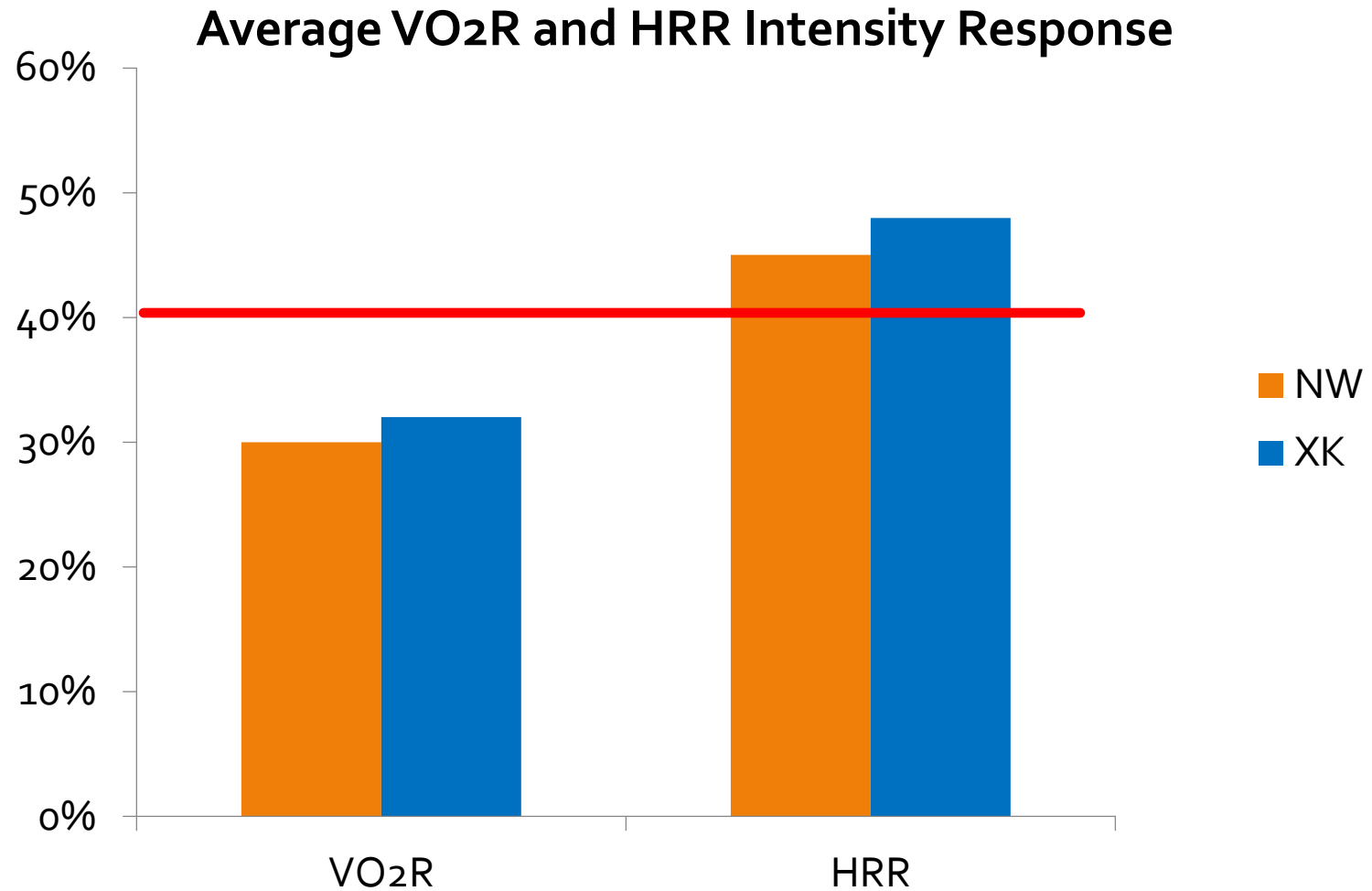
- ACSM classification of Physical Activity Intensity
 - VO_2R (%) and HRR (%)
 - **Very light:** <20%
 - **Light:** 20-39%
 - **Moderate:** 40-59%* Minimal intensity recommended for health and fitness benefits
 - **Vigorous:** 60-84%
 - **Very Hard:** $\geq 85\%$
 - **Maximal:** 100%

Discussion

- Did the results meet the minimal guidelines for health and fitness benefits?

	VO ₂ R	Intensity Level	HRR	Intensity Level
NW	30%	Light	45%	Moderate
XK	32%	Light	48%	Moderate

Discussion



Discussion

- Based on the results of the seven dances tested, it can be presumed that Just Dance 3 exergaming is not sufficient for achieving health and fitness benefits
- Further research is warranted to determine if other dance intensive games would elicit a higher intensity response

Discussion

- In total, the 7 dances burned an average of 98.66 calories using the Wii, versus 100.94 calories using the Xbox in 23 minutes of dance.
- This is comparable to walking 3.5 miles/hour for 23 minutes for a 70 kg person.



Pedagogical Implications

- Approximately 17% (or 12.5 million) of children and adolescents aged 2—19 years are obese.
- Since 1980, obesity prevalence among children and adolescents has almost tripled.
- In the State of Alabama, 15% of children and adolescents are obese.
- At age 9, children average roughly three hours of MVPA on weekdays and weekends. By age 15, they average only 49 minutes per weekday, and 35 minutes per weekend.

Pedagogical Implications

- **No safe and appealing place, in many communities, to play or be active.**
 - Many communities are built in ways that make it difficult or unsafe to be physically active. For many children, safe routes for walking or biking to school or play may not exist. Half of the children in the United States do not have a park, community center, and/or sidewalk in their neighborhood.
 - Only 27 states have policies directing community-scale design.
 - Latchkey Children
 - Technology –Based Generation

Pedagogical Implications

- **Lack of daily, quality physical activity in all schools.**
 - Most adolescents fall short of the Physical Activity Guidelines for Americans recommendation of at least 60 minutes of aerobic physical activity each day, as only 18% of students in grades 9—12 met this recommendation in 2007.
 - Daily, quality physical education in school can help students meet the *Guidelines*. However, in 2009 only 33% attended daily physical education classes.
 - Daily Physical Education is required in Alabama, but teachers face larger class sizes due to a variety of reasons.

Pedagogical Implications

- **Exergaming, as part of the Curriculum**
 - Provides Moderate Activity Levels
 - 6 of the 7 dances provided Moderate Physical Activity levels of 3.0 METs and above
 - Provides Activity for the Masses
 - Allows for multiple students to participate in lesson activity instead of sitting and waiting on a turn in large classes.
 - Provides Maintenance Enhancing Motivation
 - Participants were motivated by some dances more than others.
 - Number one reason children and adolescents participate in an activity is for the enjoyment.

Take Home Message

- No significant difference in energy expenditure was found between the two systems
- Both systems did not meet the minimal guidelines recommended by the ACSM for health and fitness benefits
- However, exergaming is an enjoyable way to do physical activity
 - Expend approximately 100 kcals in 23 minutes
 - Great for large groups

Apache (Jump On It)



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