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ORIGINAL ARTICLE

# Effects of "Your Shape" Virtual Reality Gaming on the Physical Activity of Young Adults

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*[1-2] Conception and design, Collection and assembly of data, [2-4]Analysis and interpretation of the data, [4]Critical revision of the article for important intellectual content, Statistical expertise [1-4] Final approval and guarantor of the article.*

**Article Info.**

*Received: Sep 07, 2022*
*Acceptance: March 15, 2023*

*Conflict of Interest: None*
*Funding Sources: None*

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Cite this article as: Naeem M, Sultan N, Afzal R, Javed A. Effects of "Your Shape" Virtual Reality Gaming on the Physical Activity of Young Adults. JRCRS. 2023; 11(3):160-163.
DOI:https://doi.org/10.53389/JRCRS.2023110306

## ABSTRACT

Background: A virtual reality (VR) environment gives the user the impression that they are completely engrossed in their surroundings. A video game played with virtual reality (VR) equipment is referred to as a virtual reality game or VR game. The majority of virtual reality (VR) games focus on player immersion, generally using controllers. With these games, one can "accidentally" acquire a lot of physical activity.

Objective: To determine the effects of Your Shape virtual reality gaming on the VO2 max of healthy young adults using Xbox 360 Kinect.

Methodology: The quasi experimental study where 20 young adults were enrolled according to the inclusion criteria; being 18 to 30 years of age with VO2 max with the average range 31.0 to 41.9 ml/kg/min. Non probability convenient sampling technique was used. The participants performed total 9 cardio session on Xbox 360 with 48-hour interval between each session. Every session included 4-minute warm-up and 3-4-minute cool-down. The aerobic session was 30 minutes long. Heart rate, VO2 max, Metabolic equivalents and energy expenditure were measured before and after the intervention. The number of drop outs were 3.

Results: The analysis was conducted through SPSS version 21. VO2 max, Metabolic equivalents and energy expenditure of the total 17 participants during the 9 sessions of cardio exercise through "your shape" virtual reality exercise gaming statistically increased from pre to post exercise gaming sessions, and P value was 0.001 which is considered statistically significant.

Conclusions: The results showed that "Your Shape" virtual reality exercise gaming is effective for improving the physical activity by increasing the VO2 max of healthy young adults.

Keywords: Energy Expenditure, Metabolic equivalent, Oxygen consumption, physical activity, virtual reality, VO2 max.

## Introduction

The virtual reality gaming is a potentially active way of indulging the player or the patient in the game while minimizing the external influence.[1,2] In November 4,2010 Microsoft released the kinetic sensor for the Xbox 360 video game console which is similar to a webcam, typically allowing an individual to interact with Xbox 360 or a computer in three dimensional space. This device uses infrared finding camera and a standard RGB camera.3 Xbox 360 is a Microsoft device that has different options of operating the games to increase body's overall physical fitness. Participant operates the device in a way that sensor detects the motion of body and reflects it on the LED (light emitting diode) screen.[4] It is gradually and vastly spreading its wings in some rehabilitation spaces for the patients/clients who want to improve their physical fitness through a more useful and engaging technique.[5] The games offered through the Xbox are comparatively enjoyable than the rehabilitation programs or the community exercise training program. Unique gaming strategies are used to engage the players towards the game and make them involved in a virtual reality world giving maximal advantages.[6] 30 minutes of exercise gaming is proven to have greatest effect on the heart rate, blood pressure and perceived exertion.[7]

The Xbox 360 Kinect enables the participant to control the device without any physical touch between the participant and the monitor. It senses the body motions and receives commands through gestures and voice control. There is a standard recommended distance at which the user has to stand for whole-body scanning. any reduction in that distance might lead to no detection of the participant by the Kinect sensor.[8] The kinetic sensor for the Xbox 360 video game console was released on November 4, 2010. It is similar to a webcam and allows the participant to be detected by the Xbox 360 using a standard RGB (Red, green, blue) camera. It is easily available, lesser market price and stronger in detection than other depth sensing technology applications.[3] The RGB camera is capable of capturing the colored images and the detectors are capable of mapping the depth with the help of in-built light. It has programmed artificial intelligence software by Microsoft to allow real-time gesture recognition. It also enables Kinect to be used as hands-free through a natural user interface medium to interact with computer.[9]

There are thousands of other games that can be played on an Xbox 360 through different consoles but as we are focusing on the physical activity of the participants so we chose the "Your shape fitness evolved 2012" which is considered a sought after game to calculate the $VO_2$ max (oxygen uptake capacity) and the fitness levels of the participants.[8] It is an infamous and recognized fitness game which uses whole body tracking sensor systems and focuses on different small muscle groups or targets the whole body. It engages the participant with aerobics and other exercises which focus on specific muscle groups and their movements to deliver a full body workout that helps to increase $VO_2$ max of a person.[1] It also calculates the energy expenditure with the help of the given calorie burn calculator on the top-most corner of the screen. $VO_2$ max is the body's capability to uptake oxygen during incremental exercise.[10] Metabolic equivalents are the manifestation of physical activity in the form of energy that we can categorize and calculate. The standard 1 MET value of 3.5 ml $O_2$ $kg^{-1}$ $min^{-1}$ was derived from the resting $VO_2$ of a person.[11] It can be calculated by dividing the relative oxygen consumption of an activity by 3.5.[12] Energy expenditure is basically the measure of how much calories one has given out during an exercise session. It can be calculated through various ways but the calculation through $VO_2$ max is said to be the most usable and feasible to use in the absence of a maximal aerobic test.[13] As previous studies on virtual reality utilizing three-dimensional environments had been done, the primary goal of our study was to interpret the effect of "Your shape" virtual reality exercises and protocols on the cardiorespiratory fitness. Our study's primary objective was to compare the VO2 max, energy expenditure, and metabolic equivalents of healthy young adults before and after participating in the Your Shape virtual reality game to ascertain the effects on their physical activity.

## Methodology

This Quasi experimental study was carried out from September 2020 to January 2021 and the study setting was Shifa Tameer-e-Millat University, Islamabad. Ethical Approval (IRB# 360-1180-2020) was taken from Institute review board & ethics committee, shifa international hospital/ Shifa Tameer-e-Millat University. Participants who were between 18 to 30 years of age with $VO_2$ max with the average range 31.0 to 41.9 ml/kg/min were included. Individuals having any cardiopulmonary co morbidity balance or cognitive issues were not included in the study. The sample size was calculated through G power with margin of error being 0.05 and confidence interval of 95% was 20. Participants were selected through non probability convenient sampling. They were given a consent form to fill for the permission and availability of the participants. They were added in a 3-week exercise program with 9 sessions in total. There were 3 drop-outs in the study and the total participants were 17 at the end of the study.

In the familiarization session which was performed before the aerobic session, the heart rate(b/m) through radial pulse and oxygen consumption $VO_2$ max (ml/kg/min) through the formula $VO_2$ max = (15.0 ml. min.-1 kg-1) (HRmax / HRrest) were measured in accordance with the International Journal for Scientific Research & Development.[14] Energy expenditure was calculated through the formula $VO_2$ max×5. While Metabolic equivalents METs were calculated through the formula, mean value of $V0_2$max/3.5.[15] After the familiarization session, every participant took 3 aerobic sessions per week.

There was a minimum 48 hour gap between each session to avoid delayed muscle soreness and to optimize the capacity. There was a 4 min warm-up session before every session of aerobic exercise which was followed by an aerobic session having different exercises in the Your Shape game in the XBOX Kinect, which involved both the upper limbs and the lower limbs. Participants performed "Break a sweat A", "Break a sweat B" and "Break a sweat C" for the first half of the exercise program which is first 4-5 sessions. They were gradually transitioned towards "Break a sweat D" and "Break a sweat C" in the second half of the program which are the last 4-5 sessions. Every session was followed by a 2-minute cool down at the end which included stretching and low intensity walking. After 3-weeks, we calculated every participant's Heart rate and $VO_2$max again and derived the energy expenditure and METs at the end of the program again.

The data analysis was done through SPSS version 21. The normality tests were run and Shapiro-wilk value was >0.05 for all variables so Paired T test was used for within group analysis.

## Results

Mean age of participants was 24.76±4.0 years. There were 20 participants enrolled in the study, 3 subjects dropped out so analysis was done for 17 subjects. Occupation of participants 23.5% were teachers and 76.5% were students. According to the results, it has been found out that $VO_2$ max of the total 17 participants increased from an average of 35.88 ± 4.04 ml/kg/min to 38.63 ± 3.89 ml/kg/min, Metabolic equivalents (ml/kg/min) increased from the mean of 10.36 ± 1.196 to 11.00 ± 1.061 and the P value is 0.004. Energy expenditure (kcal/kg/min) increased from 0.18 ± 0.020 to 0.19 ± 0.020 and the P value is 0.002 during the 9 sessions of cardio exercise through "your shape" virtual reality exercise gaming, and P value is 0.001 which is considered statistically significant. Table I describes the within sample comparison for all the outcomes.

**Table I: Within Group analysis – Paired T test.**

| | Pre-program Mean± SD | Post-program Mean± SD | P-value |
|---|---|---|---|
| Heart Rate(b/m) | 82.40 ± 9.494 | 76.24 ± 7.496 | 0.001 |
| $VO_2$ max | 35.88 ± 4.04 | 38.63 ± 3.89 | 0.001 |
| METs | 10.36 ± 1.196 | 11.00 ± 1.061 | 0.004 |
| Energy expenditure | 0.18 ± 0.020 | 0.19 ± 0.020 | 0.002 |

## Discussion

As indicated by the results of this study there was a significant impact of the exercise gaming on the physical activity of the participants. It has been seen that following 3 weeks of cardio through your shape gaming directed in 9 sessions of 30 minutes each with 4 minutes of warm up and 2 minutes of cool down has been demonstrated to give significant increase in the VO2 max of the members. Participants likewise detailed a more dynamic approach towards physical activity and huge lessening in sedentary way of life and in general better personal satisfaction. The resting HR was reduced after the entire 9. Your Shape gaming sessions which further affirmed the significance of the VO2 max as a lower resting pulse and a higher VO2 max indicates to cardiorespiratory fitness and increased oxygen consuming limit.

According to Pei-Tzu-Wu in 2015, the Xbox 360 Kinect may deliver moderate to vigorous intensity physical activity and can be a viable substitute for conventional physical activity. The participants were able to exercise at a moderate to high intensity using the Xbox 360, as seen by the rising METs with each exercise game. Although it was more correlated with the enjoyment component, the energy expenditure was also determined to be significant. According to another study it was reported that due to greater indulgence and enjoyment in the game, male participants experienced a more noticeable rise in energy expenditure during the game than female players. This may be a sign to look into if increased energy expenditure is related to gender or enjoyment further.[4]

Robert D. Cimball put forward a study that compared the energy expenditure in "your shape" fitness evolved calorie counter with indirect calorimetry. The results revealed a significant difference between the calories count obtained through your shape and those obtained through indirect calorimetry. Additionally, the calories obtained through the virtual reality game your shape increased significantly. However, the calories varied depending on the body mass of the participants.[16]

According to an interventional study done in July 2016, exergaming can be a way of enjoying high-intensity interval training. The heart rate response during the exercise games was similar to the heart rate response during the traditional kind of exercises. The participants also enjoyed it, and they tended to favor this cutting-edge form of exercise more than others. The study's play and walk intensities were both self-selected by the participants, and they were carried out on three different days to prevent scheduling conflicts. For practical purposes, the heart rates were measured by wearing a heart rate band on their arms. Due to the enjoyment element, the players voluntarily continued playing the games for an additional 30 minutes. It was discovered that exercising caused the heart rate to increase more dramatically.[14]

The sample size of our study was small due to low turnover of the participants for follow-ups. Research was conducted during Covid-19 phase which affected our sample in many ways. Resources were limited so we would further want the researchers to enlighten this topic with various extended researches as the literature on this topic was very limited and the research was conducted under restricted resources.

## Conclusion

This study concludes that there is a significant effect of Xbox 360 Kinect "your shape" virtual reality gaming on the physical activity of young adults by increasing the $VO_2$ max of the participants and tends to insert a significant effect on the energy expenditure during the exercise and the METs post-exercise.

Also, the exercise gaming can be an efficient alternative to the conventional physical activity.

Conflict of interest: None
Funding Source: None

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