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SHORT COMMUNICATION

# Zumba® Fitness workouts: are they an appropriate alternative to running or cycling?

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## Introduction

A sedentary lifestyle (i.e., physically inactive) has been associated with a variety of diseases such as: obesity, type II diabetes, and heart disease. Chronic aerobic exercise can be used as a prophylactic against these diseases. However, the challenges for individuals, prior to engaging in a training program for disease prevention, include the selection of an appropriate aerobic exercise as well as long-term compliance.

Running or cycling is the traditional modes of aerobic exercise used to minimize the risk of disease and maintain a healthy body weight. In this regard, the American College of Sports Medicine recommends a caloric expenditure of 300 kcal per exercise session [1]. Numerous studies examining running and cycling have reported caloric expenditures well above 300 kcal per exercise session [4–8]. Running and cycling have also been reported to elicit increases in plasma beta (β) endorphin levels [4–8, 12, 13]. β endorphin can be released by the pituitary gland in response to exercise of sufficient intensity and duration and has been associated with euphoria and exercise addiction in what has been referred to by the fitness community as "runner's high" [2, 10]. An exercise-induced elevation in β endorphin would provide additional support for the efficacy of the aerobic activity (in the prevention of disease) by increasing the likelihood of long-term compliance.

While running and cycling have been the traditional activities to engage in aerobic activity, fitness classes and home exercise DVDs have become an attractive alternative. In this regard, dance fitness DVDs, as employed by Zumba® Fitness, have become extremely popular. Originating in Columbia, South America, Zumba® Fitness was created as a Latin-inspired dance fitness program that combines various types of dance elements (e.g. hip-hop, samba, etc.) to music as a method to engage in aerobic exercise as an alternative to running or cycling. To date, only one study has specifically examined the efficacy of Zumba® Fitness as an appropriate workout for health benefits. Luettgen et al. [9] used exercise heart rates to predict the oxygen consumption expended during a Zumba® class that lasted an average of 39 min. Specifically, with use of an incremental treadmill test, they employed a linear regression equation between heart rate and oxygen consumption ($VO_2$). Based upon a subject's heart rate during a Zumba® class, they estimated the oxygen consumption to determine caloric expenditure [9]. They reported an average exercise heart rate of 154 bpm (79 % of HR max) and an average caloric expenditure of 370 kcal per class [9] suggesting that a Zumba® Fitness workout may be an appropriate alternative to running or cycling.

Estimates of $VO_2$ via exercise heart rates and the subsequent determination of caloric expenditure, as employed by Luettgen et al. [9], would seem appropriate given the difficulty in measuring $VO_2$ during aerobic dance exercises. Given the differences in movements between running on a treadmill and dance, there may be limitations with the use of treadmill heart rates to predict $VO_2$ during a dance workout. Currently, no one has actually measured oxygen consumption during dance exercises to substantiate the

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caloric expenditure. Therefore, the purpose of the current study was to determine whether the use of two Zumba® Fitness workouts that differed in aerobic training goals were sufficient to evoke high amounts of caloric expenditure via the measurement of oxygen consumption. We hypothesized that both dance fitness workouts would be sufficient in exercise intensity and duration to evoke high amounts of caloric expenditure (i.e., >300 kcal/exercise bout) indicating that it would be an appropriate alternative to running or cycling as an exercise mode to lower the risk of disease. We also measured the blood for pre-exercise and post-exercise β endorphin levels and hypothesized that the two Zumba® Fitness workouts would elevate β endorphin.

## Methods

The protocol and study were approved by the Chapman University Institutional Review Board. Written informed consents were obtained from all subjects prior to the collection of data. Twenty healthy subjects (11 females and 9 males) participated in the study. All subjects were licensed Zumba® Fitness instructors with 2–6 years of experience. Testing was performed in the morning to minimize intra- and inter-subject variability attributable to diurnal variation. Upon reporting to the laboratory, the subject's age, height, body mass, body mass index (BMI), body composition, and waking heart rates were either reported (i.e., age and heart rate) or measured (i.e., height, body mass, BMI, and body composition). Body composition was assessed via skinfolds [1] using the three-site formula for men (chest, abdomen, and thigh) and women (tricep, suprailiac, and thigh). All subjects were free of acute or chronic injury prior to the study and all subjects were instructed on how to properly perform each 60 min Zumba® workout prior to data measurements, since they were limited by the range of the sampling line attached to the oxygen analyzers.

Pre- and post-exercise blood samples (for the measurement of β-endorphin) were drawn 30 min prior to initiation of the exercise and immediately upon completion of the 1-h workout. Subjects were sequestered for 3 h prior to activity testing and refrained from eating for at least two-and-a-half hours prior to the pre-exercise blood draw.

The Zumba® Fitness DVD was played and projected onto a big screen and the subjects followed the instructions for each specific workout. During the 1-h Zumba® Fitness workout, subjects were monitored for heart rate, oxygen consumption, and caloric expenditure. Twelve subjects (six males and six females) performed the Zumba® Fitness Exhilarate workout (moderate to high intensity), while eight subjects (three males and five females) participated in the Zumba® Fitness Ripped workout (low to moderate intensity). For the Zumba® Fitness Ripped workout, subjects utilized one or two-and-one-half-pound Zumba® Fitness Toning Sticks and folding chairs during selected segments of the workout. The females used the 1-pound Toning Sticks, while the males used the two-and-one-half pound Toning Sticks.

Gas analysis for the measurement of oxygen consumption ($VO_2$) was performed using standard open-circuit, indirect calorimetry via CardioCoach $CO_2$ (KORR™ Medical Technologies, Inc., Salt Lake City, UT), Medical Graphics CPXpress, or Medical Graphics Cardi$0_2$ (Medical Graphics, Inc., St. Paul, MN) gas system analyzers. A prior study confirmed the validity between the CardioCoach $CO_2$ system and Medical Graphics system for the measurement of oxygen consumption [3]. For heart rate, subjects wore a Polar RS400 heart rate monitor. Each watch was preprogrammed with the subject's date of birth, gender, height, and weight. The heart rate monitor strap was placed over their chest at the level of the xiphoid process of the sternum. Each subject's heart rate was recorded every 2 s throughout each workout. All subjects completed the 60 min of workout.

Plasma beta-endorphin levels were determined from blood samples taken pre- and immediately post-exercise. Antecubital blood ($\sim$7 ml) was collected from all subjects in Vacutainer tubes containing EDTA. The blood was centrifuged in tubes containing aprotinin at $1600\times g$ for 15 min at 4 °C for the collection of plasma. The plasma extract was then frozen at −70 °C until its analysis for β-endorphin levels. Within 2 weeks of the collection of plasma and prior to the measurement of β-endorphin, the peptide was extracted from the plasma with use of buffers containing trifluoroacetic acid and SEP-columns. The extract was then subjected to freeze-drying. Following lyophilization, a competitive enzyme immunoassay was employed (MD Bioproducts, St. Paul, MN) to measure β-endorphin. Standards and a positive control were run (to ensure quality) along with the samples from the subjects. All standards, controls, and samples were assayed in duplicate. A microplate reader (MaxLine, Molecular Devices Corp., Sunnyvale, CA) was used to measure the absorbance set at 450 nm.

To assess exercise intensity and caloric expenditure, exercise heart rate and oxygen consumption were measured during each Zumba® Fitness workout. Caloric expenditure was the product of the absolute volume of oxygen consumed (in L/min) and a caloric equivalent of 5 kcal/l, whereas the Karvonen formula was used to assess exercise intensity via heart rate and expressed as a percentage of heart rate reserve (%HRR). An unpaired Student's *t*-test was employed for comparisons between Zumba® Fitness workout groups, whereas a paired Student's t-test was used for within-group comparisons. The level of statistical

significance was set at $P < 0.05$ for all comparisons and the results are presented as the mean ± standard deviation (SD).

## Results

There were no significant differences in any physical characteristics (e.g., age, BMI, etc.) between the subjects that participated in the Zumba® Fitness Exhilarate compared to the Zumba® Fitness Ripped workout. The subjects' mean (± SD) age, height, body mass, body mass index, and waking heart rate were: 31.9 ± 7.6 years old, 65.9 ± 4.7 inches tall, 155.8 ± 43.6 weight in lb, BMI of 24.9 ± 4.5 kg/m$^2$, and resting heart rate of 60.0 ± 7.9 bpm, respectively. The subjects' mean (± SD) percent body fat was 13.2 ± 1.1 %.

The average heart rate response to the Zumba® Fitness Exhilarate workout was 79.7 ± 9.1 % of HRR as calculated using the Karvonen formula and the average caloric expenditure was 817 ± 168 kcal/h (Table 1). The average heart response to the Zumba® Fitness Ripped workout was 62.1 ± 8.5 % of HRR and the average caloric expenditure was 637 ± 107 kcal/h (Table 1).

Post-exercise plasma β-endorphin levels were significantly elevated following both Zumba® Fitness workouts. The β-endorphin levels increased ~38 % from pre-exercise levels for the Zumba® Fitness Exhilarate workout (pre-exercise = 59.4 ± 20.6 pg/ml, post-exercise = 81.7 ± 29.5 pg/ml), whereas the β-endorphin levels increased ~27 % from pre-exercise levels for the Zumba® Fitness Ripped workout (pre-exercise = 45.1 ± 15.7 pg/ml, post-exercise = 57.1 ± 17.7 pg/ml).

## Discussion

Exercising for 1 h using the Zumba® Fitness Exhilarate and Zumba® Fitness Ripped workouts elicited caloric expenditures above 300 kcal as well as elevations in β-endorphin levels. These results were consistent with our initial hypotheses. The exercise intensity was greater for the Zumba® Fitness Exhilarate compared to the Zumba® Fitness Ripped workout as supported by the higher elevation in exercise: heart rate reserve, caloric expenditure, and β-endorphin. Nevertheless, both workouts were of sufficient duration and intensity to elicit elevations in caloric expenditure suggesting that dance workouts can be used as an appropriate alternative to running or cycling in the maintenance of a healthy body weight and the prevention of disease.

**Table 1** Exercise responses to Zumba® workouts

| Zumba® fitness exhilarate workout | Mean (±SD) | Range |
|---|---|---|
| % Heart rate reserve (%) | 79.7 ± 9.1 | 65.6–92.5 |
| Caloric expenditure (kcal/h) | 817 ± 168 | 588–1090 |
| **Zumba® fitness ripped workout** | **Mean (±SD)** | **Range** |
| % Heart rate reserve (%) | 62.1 ± 8.5 | 51.8–79.1 |
| Caloric expenditure (kcal/h) | 637 ± 101 | 480–766 |

% Heart rate reserve was calculated using the Karvonen formula [(maximum heart rate – resting heart rate) × % training sensitive zone] + resting heart rate = mean exercise heart rate, where the resting heart rate (RHR) was the subjects' waking RHR and % training sensitive zone was the percent the subjects' heart rate was elevated, due to the workout, relative to their heart rate reserve

In prior studies involving running or cycling [5–8], the exercise intensity was sufficient to elevate $VO_2$, caloric expenditure, as well as plasma β endorphin levels. Extrapolating from the results of Farrell et al. [5], running at 60 % $VO_2$ max evoked a caloric expenditure of ~830 kcal/h and a ~3 fold elevation in β-endorphin levels after 30 min of exercise. In a like manner, extrapolating from the result of Goldfarb et al. [6], an exercise intensity of 70 % $VO_2$ max yielded a caloric expenditure of ~850 kcal/h where plasma β-endorphin levels increased ~5 fold after 15 min of exercise. Goldfarb et al. [6] also demonstrated greater caloric expenditures and β-endorphin levels cycling at a higher exercise intensity of 80 % $VO_2$ max. All these prior studies employed a bicycle ergometer or treadmill running as the mode of exercise to increase caloric expenditure as well as β-endorphin levels. However, any exercise that involves large muscle groups of sufficient intensity and duration (like aerobic dance) should similarly elevate caloric expenditure and β-endorphin.

To date, only the study by Pierce et al. [13] examined aerobic dance as an exercise mode to increase β-endorphin. Similar to our findings, they reported exercise-induced β-endorphin elevations of 38 %, but failed to determine exercise intensity [13]. While the specific Zumba® Fitness workout examined by Luettgen et al. [9] was unknown, the exercise intensity they reported was similar to our results. However, they did not measure β-endorphin. The limited number of studies examining aerobic dance may be attributable to the difficulty in measuring oxygen consumption. Further, the variability in choreography between subjects due to the motivation and enthusiasm of participants, as well as the different types of Zumba® Fitness workouts, are factors that can contribute to discrepancies in caloric expenditure between studies. It should be noted that we recruited certified Zumba® Fitness instructors as subjects. Due to some of the complex dance choreography during the workout, the use of certified Zumba® Fitness instructors ensured continual activity rather than periodic stoppages to follow the dance movements during transitions in music and/or exercise intensity. Thus, we recognize that our results may be more comparable to

individuals who are experienced with Zumba® workouts rather than a beginner. Nevertheless, our results are the first to support, with quantitative measurements of oxygen consumption, that dance fitness workouts, as employed in the current study, were sufficient in exercise intensity and duration to elicit a high amount of caloric expenditure as well as a significant elevation in β-endorphin. However, we concede that results from beginners who lack the experience with Zumba® workouts remain to be determined.

Finally, we acknowledge several limitations in our study. First, we note the small sample size in each of our groups. Our low subject participation could be attributable to the study requirements of two blood draws, travel to the facility, and the 1-h workout during the morning hours (to name a few). In partial support, several subjects were absent for their scheduled test pertaining to the Zumba® Fitness Exhilarate workout that contributed to the unequal number of males and females. Further, compared to prior studies [4–8] where the exercise intensity (via running or cycling) was kept constant, dance workouts incorporate fluctuating intensities throughout the exercise session. The variations in exercise intensity during the dance workout, where the lowest exercise intensities were near the end of the 1-h bout (i.e., cool down), could contribute to the difference in β-endorphin elevation in our study (i.e., 27 and 38 % elevation, respectively) and Pierce et al. [13] compared to prior reports with use of the treadmill and bike (i.e. 300 and 500 % elevation, respectively) where the blood was drawn immediately during the exercise via indwelling catheters [5, 6]. In this regard, the β-endorphin levels in the current study were most likely higher than reported due to clearance of the opioid, given the cooldown period and the time delay it took to withdraw the blood. Next, we made an attempt to recruit an equal number of men and women; however, a majority of our subjects were females. In addition, all the subjects were in good physical condition and certified as Zumba® Fitness instructors. We already acknowledged the variability in choreography as a factor in the caloric expenditure with dance fitness workouts. We now recognize gender and training status as potential factors in the β-endorphin response to exercise. However, Goldfarb et al. [7] demonstrated that women have similar β-endorphin responses to men independent of their menstrual cycle. It should be recognized that for women who regularly engage in fitness, trained females could have a greater β-endorphin response to exercise that would contribute to menstrual disturbances [11], thereby impacting the current results since our female subjects were trained and licensed Zumba® Fitness instructors. However, Howlett et al. [8] demonstrated that β-endorphin secretion was not altered by training status in women. In a like manner, trained men could have a training-adaptive β-endorphin response to exercise. This is unlikely since both Farrell et al. [5] and Petraglia et al. [12] demonstrated significant exercise-induced elevations in plasma β-endorphin secretion in trained men similar in magnitude to untrained male subjects as reported by Donevan and Andrew [4]. Thus, the results from our study of exercise-induced β-endorphin secretion to dance fitness workouts would most likely apply to all participants achieving the same exercise intensity as in the current study, irrespective of fitness status and gender.

In summary, subjects who engaged in a 1-h Zumba® Fitness Exhilarate and Zumba® Fitness Ripped workout demonstrated a significant elevation in caloric expenditure and plasma β-endorphin after the exercise. The exercises incorporated in these fitness workouts were consistent with previous studies involving bicycle ergometry and treadmill running as it pertains to exercise intensity, caloric expenditure, and the general exercise-induced elevation in β-endorphin. Further, to the extent that increases in β-endorphin are associated with euphoria and exercise addiction, as associated with running or cycling, the elevated plasma levels of β-endorphin with dance fitness workouts, as observed in the current report, has the potential to contribute to long-term compliance. Thus, dance fitness workouts are an appropriate alternative to running or cycling and could help to minimize the risk of disease and assist in the maintenance of a healthy body weight.

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**Conflict of interest** The authors declare that they have no conflict of interest.

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