The Journal of Sports Medicine and Physical Fitness 2018 January-February;58(1-2):113-9
DOI: 10.23736/S0022-4707.17.06835-9

ORIGINAL ARTICLE
EPIDEMIOLOGY AND CLINICAL MEDICINE

Differences in energy expenditure, amount of physical activity and physical exertion level during a Zumba fitness class among adult women who are normal weight, overweight and obese

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ABSTRACT

BACKGROUND: One of the most popular expressions of massive group classes of aerobic physical activity is Zumba fitness. The aim of the study was to compare and relate the energy expenditure and the amount and intensity of physical effort during a Zumba fitness class in women with different Body Mass Index (BMI).

METHODS: Body displacements of 61 adult women who performed a one-hour Zumba session were evaluated with triaxial accelerometers. In order to observe the effect of BMI women were divided into normal weight (N.=26), overweight (N.=21) and obese groups (N.=14).

RESULTS: The average number of steps was 4533.3±1351 and the percentage of total class time of moderate to vigorous intensity (% MVPA) was 53.8±14.4%. The metabolic intensity average was 3.64±1.1 MET, with an energy expenditure by total body mass of 3.9±1.6 kcal/kg. When analyzing groups, the normal weight group had a greater number of steps (5184.2±1561.1 steps/class) compared to overweight (4244.8±1049.3 steps/class) and obese women (3756.9±685.7 steps/class) with P<0.05. Also, the normal weight group spent a lower percentage of class time at the lower levels of intensity (sedentary and lifestyle activity levels) and more time at the highest levels (vigorous and very vigorous) compared to obese women (P<0.05). Participants with a normal weight obtained a higher % MVPA (62.1±15%) compared to overweight (50.1±9.4%) and obese (44.1±11.9%) groups with P<0.05. A metabolic intensity of 4.6±1.9 MET in the normal weight group was higher compared to 3.5±1.0 MET in the overweight (P<0.05) and 3.1±1.2 MET in the obese group (P<0.05), was observed. The subjective perception of effort was 7.84±0.9 (Borg CR 10), no differences between groups. Also we observed in all participants that at higher BMI values, there were lower energy expenditure values per kilo of weight (r=-0.40; P<0.001), metabolic intensity (r=-0.39; P<0.001), step counts (r=-0.43; P<0.001) and % MVPA (r=-0.50; P<0.001).

CONCLUSIONS: These results show that a higher BMI is associated with a lower intensity of effort, energy expenditure and amount of physical activity during a one-hour Zumba class, restricting to overweight and obese women to achieving the effort parameters recommended to control weight and improve cardiovascular fitness.

(*Cite this article as:* Yáñez-Sepúlveda R, Barraza-Gómez F, Báez-San Martin E, Araneda OF, Zavala JP, Hecht GK, *et al.* Differences in energy expenditure, amount of physical activity and physical exertion level during a Zumba fitness class among adult women who are normal weight, overweight and obese. J Sports Med Phys Fitness 2018;58:113-9. DOI: 10.23736/S0022-4707.17.06835-9)

Key words: Exercise - Energy metabolism - Nutritional status.

Physical inactivity increases the risk of obesity, cardiovascular disease, type II diabetes mellitus and cancer.[1] That is why World Health Organization promotes adherence to a healthy lifestyle through regular physical activity.[2] Scientific evidence is comprehensive regarding the benefits of regular practice of aerobic exercise on weight control [3] and reduced risk of contracting chronic non–communicable diseases,[4] either in traditional activities such as jogging as well as in aerobic dance classes.[3] These have proven to be effective in increasing energy consumption and improving cardiovascular condition according to the recommendations given by the American College of Sport Medicine (ACSM).[5] Because of its popularity, massive group classes, such as aerobox, Spinning, aerobics in water, Bodypump, Step or BodyCombat, emerge as being more suitable than traditional methods for encouraging an increase in the practice of aerobic physical activity and adherence to a healthy lifestyle. It is worth stressing that these classes have shown a high energy expenditure during their sessions, reaching values of ~ 490-600 kcal/hour.[6] According to the ACSM, health benefits are associated with a weekly energy expenditure >1000 kcal, which is obtained with varied exercises in terms of volume and intensity of work.[7] Even exercises performed at a low intensity, such as walking for one hour, reduce the risk of cardiovascular disease in women.[8] For the ACSM, a woman is considered as physically active when she performs at least 150 minutes of moderate exercise or 75 minutes of vigorous exercise within a week, with an energy consumption greater than or equal to 300 kcal per each performance.[9]

Nowadays, one of the most popular expressions of massive group classes of aerobic physical activity is Zumba fitness. It was created in the mid-90s and is known as a fitness class guided to the rhythm of Latin music, mainly rumba, salsa and merengue. Apparently, its popularity lies in the type of music used and its easy choreography. Currently, more than 12 million people, from 110,000 locations in 125 countries around the world practice Zumba.[10] Even though there is evidence that Zumba classes have a moderate intensity and energy expenditure within the expected ranges in order for those who practice it often to improve aerobic capacity,[11] controlling the cardiovascular risk factors, most these results have been observed in populations of healthy young and adults people, who usually have no overweight and obesity.[12-14] Indeed, a higher BMI is associated with low levels of intensity of physical activity.[15, 16] The scene for a healthy lifestyle is even more complex for overweight or obese subjects, as they maintain a lifestyle dominated by sedentary behaviors.[17] Likewise, scientific evidence has shown an association between high intensity of exercise with low adiposity and with decreased risk factors arising from obesity.[18] In this sense, it is possible that during a Zumba class, the desired values of intensity, energy expenditure and amount of exercise that allow adequate control of body mass and improved cardiovascular fitness are not reached in people who have a higher BMI.

The aim of our study was to compare the amount, intensity and energy expenditure of performed physical effort in a group of adult women during a one-hour Zumba group class, and relate them to their higher BMI.

Materials and methods

Participants

Adult women (N.=61; age= 23-49 years) who regularly attended to one-hour Zumba classes for the last month (one class per week) were randomly selected. In order to avoid possible effects of previous knowledge, participants should have not practiced Zumba or similar guided aerobics class prior to this month. Data obtained were measured during a community-based class with voluntarily performed efforts. In order to observe the effect of BMI, women were divided into normal weight (N.=26; BMI= 18.5-24.9 kg/m^2), overweight (N.=21; BMI= 25-29.9 kg/m^2) and obese (N.=14; BMI>30 kg/m^2) groups. Participants were not allowed to be consuming any drug or to present any injury or illness; similarly, those that did not complete the activity in a continuous way or presented physical discomfort during the class were excluded. After providing them all the relevant information of the study, participants had to sign a written informed consent prior to its start. The study was conducted following the general recommendations outlined in the declaration of Helsinki for human studies and approved by the Ethics Committee of the Faculty of Education, Andres Bello University.

Anthropometry

Before starting, weight and height of participants were measured with a scale with stadiometer (model

BC-520, Tanita Corporation, Tokyo, Japan); participants should not have previously consumed any diuretic (*i.e.* alcohol, coffee, etc.) or performed any sort of moderate or intense physical exertion during the previous 48 hours. In addition, their personal data was collected. This procedure was performed in a room heated at 18-22 °C with the subjects wearing light clothing (ideally sportswear).

Measurement and characteristics of physical activity

In order to quantify the physical activity carried out during a community-based Zumba class of one hour, a small (3.8 x 3.7 x 1.8 cm) and lightweight (27 g) triaxial accelerometer (GT3X model, Actigraph) was placed in the dominant side hip of each participant, which has been previously validated to record the body acceleration in the anteroposterior, vertical and medial–lateral planes of motion.[19, 20] Then, a 12-bit analog-to-digital converter converts the signal into digital, which is filtered to eliminate movements other than human and stored at intervals (epoch) as defined by the user. The epoch period was set to 10 seconds and the sampling frequency to 30 Hz.

The information downloaded from the accelerometer through ActiLife software (version 6.9.0; ActiGraph LLC, Pensacola, FL, USA) allowed us to know the following variables related to physical activity: 1) amount of physical activity (steps/class); 2) metabolic intensity (MET); 3) energy expenditure (kcal or kcal/kg) and 4) part of class time in different intensities of effort (%). In addition, the subjective sensation of effort was obtained during Zumba class through the Borg Rating of Perceived Exertion (RPE) modified (CR 10).[21] The latter corresponded to the percentage of class time in which the subject was at different ranges of counts per minute (CPM). For this purpose, intensity classification for adults according to Freedson *et al.*[22] was used: sedentary (0-99 CPM), light (100-760 CPM), lifestyle (760-1951 CPM), moderate (1952-5724 CPM), vigorous (5725-9498 CPM) and/or very vigorous (≥9499 CPM). In addition, the classification of moderate to vigorous physical activity (MVPA) was used when the counting was greater than 1952 CPM.

Briefly, Zumba class began with a 5-minutes warm-up with low intensity movements. Then, the intensity of effort progressively increased as the routine progressed. Finally, 5-minutes of cool-down were performed, adding stretching.

Statistical analysis

All recorded data are presented in mean±standard deviation (SD). Homogeneity of variances was checked by the Shapiro-Wilk Test. To compare the differences among the amount of physical activity, intensity and energy expenditure during a Zumba class according to the BMI of participants, a one-way ANOVA was used, and subsequently the Tukey's multiple comparison test, then statistical significance was set at $P<0.05$. To observe the association between the variables, a Pearson's correlation test was performed and statistical significance was set at $P<0.001$. All analyses were performed using the statistical program Graph Pad Prism 6.01 for Windows (GraphPad Software Inc., La Jolla, CA, USA).

Results

Data collected from 61 out of 65 evaluated women were used for the analysis of the amount of physical activity, energy expenditure and intensity of effort during the Zumba class. The four women, two overweight and two obese, who withdrew from the study reported being "uncomfortable" during the effort and did not complete the class.

Table I shows general characteristics of total partici-

TABLE I.—*General and physical characteristics of participants.*

Variables	All (N.=61) Mean±SD	Normal weight (N.=26) Mean±SD	Overweight (N.=21) Mean±SD	Obese (N.=14) Mean±SD
Age (years)	35.3±7.7	34.2±7.5	36±8.4	36.1±7.4
Weight (kg)	67.3±11.8	57.1±4.0	68.2±4.6 †	84.4±7.8 †‡
Height (m)	1.58±0.04	1.6±0.04	1.59±0.04	1.59±0.04
BMI (kg/m²)	26.8±4.4	22.9±1.2	27±1.4 †	33.5±2.5 †‡

BMI: Body Mass Index; N.: number of subject in each group.
†P<0.05 compared to normal weight group; ‡P<0.05 compared to overweight group using One-Way ANOVA Test.

TABLE II.—*Amount of physical activity, energy expenditure, metabolic and effort intensities carried out during a one-hour Zumba fitness class.*

Variables	All Mean±SD	Normal weight Mean±SD	Overweight Mean±SD	Obese Mean±SD
Amount of physical activity in steps (steps/class)	4533.3±1351	5184.2±1561.2	4244.8±1049.3 †	3756.9±685.7 †
Energy expenditure (kcal/kg)	3.9±1.6	4.6±1.9	3.5±1.0†	3.1±1.2 †
MVPA (% of class time)	53.8±14.4	62.1±15.0	50.1±9.4 †	44.1±11.9 †
Metabolic intensity (MET)	3.9±1.6	4.6±1.9	3.5±1.0 †	3.1±1.2 †
Rating of perceived exertion (Borg Scale CR-10)	7.84±0.9	7.88±0.9	7.95±1.0	7.57±0.9

MVPA: moderate to vigorous physical activity; MET: metabolic equivalent.
†P<0.05 compared to the normal weight group using One-Way ANOVA Test.

pants and also by group according to their BMI. Significant differences for weight and body mass index between normal weight group with overweight and obese groups for were observed (Table I). The amount of physical activity, part of class time to intensity of MVPA, energy expenditure and the metabolic intensity are presented in Table II in total and by each group of participants. Here, a smaller amount of physical activity, energy expenditure, % MVPA and metabolic intensity in overweight and obese participants compared to normal weight (P<0.05) was observed, with a higher average difference between the obese and normal weight group. The effort perception was 7.84±0.9 according to Borg's Scale (CR 10), with no differences between groups (Table II).

In Figure 1, the differences between the percentages of time Zumba class for each intensity, according to the BMI, are observed. Here, the obese group spent a longer period of the class at low intensities, such as sedentary and lifestyle activity levels, compared to the

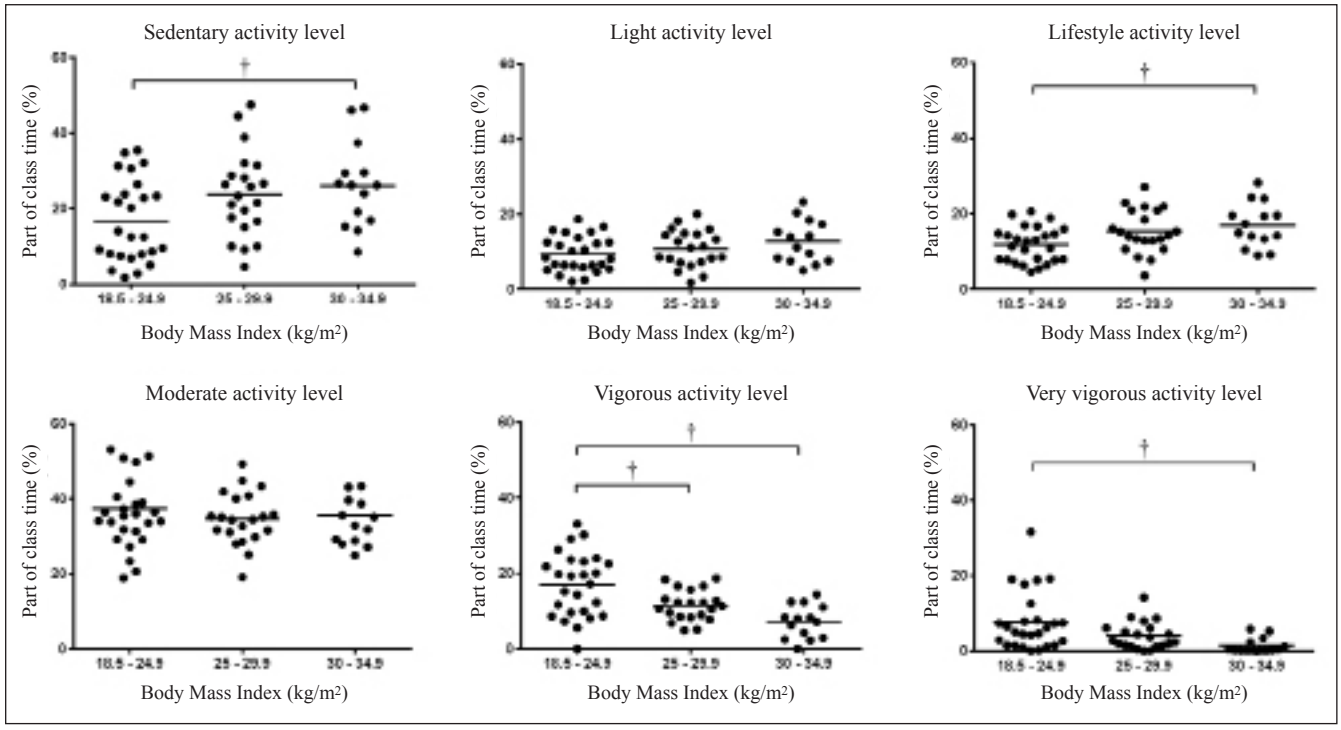

Figure 1.—Part of class time at different levels of intensity of effort, according to Freedson [18] classifications, during a one-hour Zumba fitness class regarding to Body Mass Index.

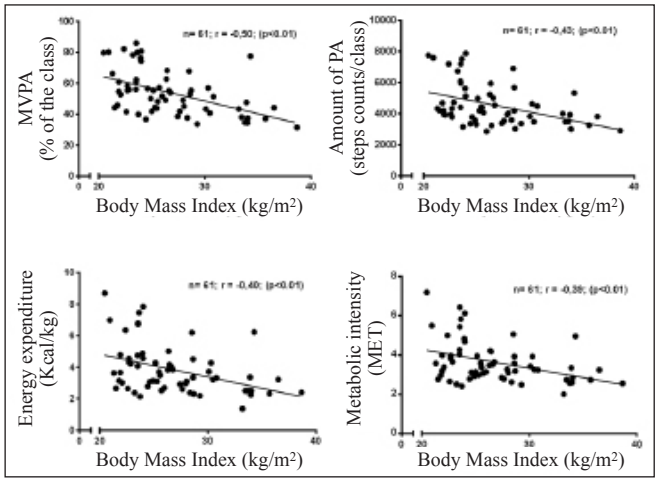

Figure 2.—Association between MVPA, amount of physical activity, metabolic intensity and energy expenditure with Body Mass Index.

normal weight group (P<0.05). On the other hand, this same group spent significantly less time of the Zumba class at very vigorous intensity level compared to the normal weight group and less time than both groups (overweight and normal weight) at vigorous intensity (P<0.05).

When relating the variables, we obtained that, at a higher BMI, participants showed lower values of energy expenditure per kilo of body mass, metabolic intensity, steps count and % MVPA (Figure 2), with P<0.001.

Discussion

Energy expenditure as well as the amount and intensity of physical activity during Zumba class is influenced according to BMI of each participants, which is lower for overweight and obese groups compared to participants of normal weight (Table II). Likewise, higher values of BMI in participants were associated with lower values of physical activity (Figure 2). However, the sensation of effort perceived by the participants did not change according to BMI.

The number of steps during one-hour Zumba class was significantly higher for the normal weight group compared to the overweight and obese groups (Table II). Similarly, this group spent a larger part of the class at a moderate to vigorous intensity of effort (Figure 1), which is closer to the daily exercise recommendations to maintain a healthy lifestyle, *i.e.* 3000 steps/day for 30 minutes of moderate–vigorous intensity on the activities of daily living.[23] There is little scientific evidence which had assessed the number of steps and level of effort during a group Zumba class. Schneekloth *et al.*[24] observed the levels of physical activity of 8 adult women (36.6±10.4 years) during a one-hour Zumba class guided by a video game or instructor. The average number of steps (5900.3±563.9 steps/class) and energy expenditure (327.8±153.6 kcal) for the video game group were higher than those observed in the normal weight group in our study with 5184.2±1561.2 steps/class and 262.6±110.1 kcal, respectively. However, the average percentage of body fat in women from the study conducted by Schneekloth *et al.*[24] was 34.8±8.1% of body weight, which suggests that some women were overweight. It is possible that this group has spent more time with regular physical activity with Zumba and with a higher weekly class attendance volume than the normal weight women in our study (time from the start= ~ one month; volume= one class per week). This suggests that with training time, those who practice Zumba regularly, despite being overweight, increase their level of effort executed for a one-hour class. Nevertheless, one of the conclusions of the study conducted by Schneekloth *et al.*[24] was the difference in the vigorous intensity carried out by each group. The class with an instructor remained at a vigorous intensity more than the class with video game, stressing the importance of supervision and motivation that the instructor makes to keep subjects at higher intensities of effort. It is worth recalling that higher intensities of effort are related to a higher promotion of cardiovascular health [25, 26] and weight control.[18] In our study, the percentage of vigorous physical activity decreased significantly as the BMI of participants increased (≥30 kg/m^2), therefore, we believe it will be necessary to improve the regularity of the weekly classes and control intensity during them, if health recommendations are to be achieved.

By maintaining adequate levels of body mass, the risk of contracting chronic non-communicable diseases is reduced; one of the strategies to control the body mass gain is performing exercise determined by an energy expenditure higher than or equal to 300 kcal per session.[27] In our study, no group reached these values. However, by using the ratio between energy and body weight, we note that the normal weight group spent significantly more energy than the overweight and obesity groups (Table II). It is possible that the body composition of the normal weight group contains a higher percentage

of muscle mass and lower adiposity than the others, promoting energy expenditure in this group. In addition, as discussed above, it is possible that the lack of regularity and previous history of exercise in the participants evaluated in our study have limited a higher total energy expenditure during the one-hour Zumba class.

Intensity and execution time of physical activity has been used by several authors to determine the beneficial effects of exercise on cardiovascular fitness.[25, 28, 29] Indeed, high-intensity exercise performed for 30 seconds, with a recovery interval of 3 to 5 minutes, produces significant health benefits.[30] According to the ACSM,[7] these can be achieved with aerobic exercise for 20 to 60 minutes of MVPA with a frequency of 3 to 5 days per week using intensities between 3 and 6 MET (50-85% VO_{2max}, 60-95% HR_{max}). In this regard, several studies have confirmed the health benefits that regular practice of Zumba has in young people,[31] healthy adults,[12] adults with metabolic disorders,[32] and older adults.[33] Using another aerobic training, Sutherland *et al.*[34] demonstrated that 40 minutes of step class reached the ACSM recommendations for the improvement of cardiovascular fitness. However, 50 minutes of Yoga [35] failed to demonstrate this effect. These confirm the importance of training with activities that allow a global displacement of the body to high intensities (moderate to vigorous) to reach healthy goals, previously mentioned.

Authors have also studied the physiological effects of a Zumba fitness class during a single session;[13, 14, 33, 34] however there are no studies in adult women according to BMI. For example, Dalleck *et al.*[33] concluded that 45 minutes of exercise with Zumba Gold in 9 older women (age= 63±8.7 years, body weight= 60.8±5.7 kg and height= 1.64±0.04 cm) meets the requirements for improving and maintaining cardiorespiratory fitness, by limiting the loss of functional capacity in this population, in this group, metabolic response and energy expenditure were 4.1±0.5 MET and 191.5±11.9 kcal/session, respectively.

A recent study of women who participated in a one-hour Zumba class showed higher levels of MVPA (51.2±3.1 min or 85.3±5.17%), absolute and relative energy expenditure (411±66 kcal and 6.21±0.32 kcal/kg/hour) and steps count (6773±556 steps/class) than all groups of our study.[34] Although the normal weight group general characteristics (Table I) were similar with Zumba group in Domene *et al.*[34] (age= 36±11 years; body mass= 62.2±8.7 kg; BMI= 23.1±2.8 kg/m^2), the results differ considerably (Table II). The discrepancy may be explained by a likely difference in cardiorespiratory fitness of participants, as it is recognized its decisive role on physiological responses during an aerobic dance activity.[35]

Another study, a master's thesis conducted by Okonkwo,[2] showed the metabolic and physiological intensity and energy expenditure of 15 healthy adult women (age= 26±3.2 years; body weight= 59.19±12.5 kg; height= 1.62±0.1 m; VO_{2max}= 36.9±8.8 mL/kg/min and HR_{max}=194±3.2 lpm) performing a Zumba class for 1 hour. Although the duration of the class was the same as in our study, the metabolic intensity (5.9±1.5 MET) and energy expenditure (363±98.1 kcal/session) were higher compared to all our study groups. It is likely that the participants in the study conducted by Okonkwo [2] performed a greater amount of exercise at a higher intensity (moderate to vigorous), which was partly influenced by the lower age range of its participants (18-40 years) than in our study (23-49 years).

Involving young women in a Zumba fitness class, Luettgen *et al.*[10] showed that a moderate to vigorous intensity allows them to control body weight and improve cardiovascular fitness. In this point, we note that participants of the normal weight group showed a larger % MVPA and with a higher average metabolic intensity compared to the overweight and obese groups (Table II). Therefore, in order to maintain or improve health in adult women aged 18 to 65 years, the recommendation of weekly exercise volume is 30 min/day for 5 days/week at moderate intensity (3-5.9 MET) or 20 min/day of vigorous intensity (≥6 MET) for 3 days/week.

Conclusions

In our study, Zumba class promoted high-intensity movements (moderate to vigorous), increasing the energy expenditure in adult women with normal weight compared to overweight and obese. In fact, to achieve health benefits recommended by the ACSM through the Zumba practice in adult women who are overweight or obese, it will be advisable to gradually increase the amount of exercise per session (1 hour) and/or the weekly frequency (ideally 2-3 days per week), favoring the regularity of the Zumba fitness practice, considering their body mass index, cardiorespiratory fitness and physical activity level.

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Authors' contributions.—Rodrigo Yáñez-Sepúlveda, Marcelo Tuesta and Fernando Barraza-Gómez carried out design of the work, experimental protocols, statistical analysis, interpretation of data and writing paper; Oscar F. Araneda and Eduardo Báez-San Martin carried out statistical analysis and interpretation of data. Juan P. Zavala and Gernot K. Hecht carried out experimental protocols and interpretation of data.

Conflicts of interest.—The authors certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

Acknowledgments.—We want to thank the voluntary disposal of participants to the evaluation of their movements during Zumba fitness class.

Article first published online: 8 February, 2017. - Manuscript accepted: 6 February, 2017. - Manuscript revised: January 30, 2017. - Manuscript received: July 10, 2016.