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Journal of Sport and Health Science 5 (2016) 190–196

www.jshs.org.cn

Original article

Salsa dance and Zumba fitness: Acute responses during community-based classes

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Received 13 May 2014; revised 23 September 2014; accepted 15 December 2014

Available online 30 April 2015

Abstract

Background: Research interest in both partnered Latin dance and non-partnered Latin-themed aerobic dance has increased in recent years, likely a result of the gaining popularity of these types of instructor-led group classes among the mainstream dance and fitness audiences; however, the efficacy of these activities for the purposes of health promotion currently remains unclear. The purpose of this study was to simultaneously assess the physiological responses and psychological experiences during salsa dance and Zumba fitness in a community sample of physically inactive women.

Methods: Twenty-four participants, aged 22–56 years, visited the laboratory to perform a graded exercise test for determination of maximal oxygen uptake and maximal heart rate. The participants then attended 2 partnered salsa dance and 2 non-partnered Zumba fitness classes each in a counterbalanced order over a 2-week period. The 1-h classes were taught by certified instructors in established venues in the Royal Borough of Kingston and the surrounding communities of London, UK. Physiological data were collected using a wrist-worn ActiGraph wGT3X+ accelerometer with accompanying heart rate monitor and were processed using previously validated dance-specific techniques. Psychological experiences were measured via the Subjective Exercise Experiences Scale.

Results: There was a significantly higher ($p < 0.001$) total time spent in moderate-to-vigorous physical activity (51.2 ± 3.1 *vs.* 32.6 ± 5.9 min), total energy expenditure (411 ± 66 *vs.* 210 ± 46 kcal), and total step count (6773 ± 556 *vs.* 4108 ± 781 steps) during Zumba fitness when compared to salsa dance. Significant pre- to post-class improvements in positive well-being ($p < 0.01$, partial $\eta^2 = 0.41$) and psychological distress ($p < 0.001$, partial $\eta^2 = 0.72$) were simultaneously observed for both salsa dance and Zumba fitness.

Conclusion: The acute responses to classes of partnered Latin dance and non-partnered Latin-themed aerobic dance suggest that in physically inactive women participation is indeed efficacious in terms of community-based physical activity and psychosocial health promotion.

Keywords: Accelerometry; Aerobics; Cultural dance; Exercise; Physical activity

1. Introduction

Physical inactivity has a prevalence in high-income nations of 48% and 41% for women and men, respectively.[1] Adults who decrease sedentary time while increasing moderate-to-vigorous physical activity (MVPA) reap the rewards of a reduced likelihood for chronic non-communicable disease.[2] Furthermore, physical activity (PA), especially leisure pursuits undertaken in socially rich environments, can benefit mental health in adults[3] as engagement has been shown to be inversely associated with depressive-[4,5] and anxiety-related symptoms.[6] PA has also been posited to be an efficacious strategy for the enhancement of psychological well-being, in part, due to the relationship between PA and positive affect.[7]

With respect to physical and psychosocial health promotion, one particular activity, Latin dance, has been examined for its potential as a community-based health-enhancing PA for adults.[8–10] It has been suggested that this genre of dance could play a viable role in the engagement of individuals in physically active pursuits that are not necessarily thought of as traditional exercise *per se*.[11] Research interest in both partnered Latin dance (i.e., salsa)[12] and non-partnered Latin-themed aerobic dance (i.e., Zumba fitness)[13] has increased in recent years, likely a result of the gaining popularity of these types of instructor-led

Peer review under responsibility of Shanghai University of Sport.

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http://dx.doi.org/10.1016/j.jshs.2015.04.004

group classes among the mainstream dance and fitness audiences.[11,14] However, despite these activities being seemingly divergent, in many countries around the world both salsa dance and Zumba fitness are popular leisure pursuits engaged in by members of both the Latin and non-Latin communities. Moreover, organizations in the health and arts sectors continue to promote dance as a potentially practical and sustainable way of enhancing health in adults through non-traditional modalities of PA engagement.[15]

We recently undertook 2 investigations using objective measurement techniques to assess the physiological parameters of Latin dance in novice to advanced non-professional Latin dancers.[12,16] It was found that performance in a real environment involves being engaged in dance for only two-thirds of the total time spent during social dancing.[12] Thus, the time effectiveness of this activity could be called into question if investigating this particular genre of dance in the context of PA promotion. Furthermore, it is imperative to evaluate the responses to dance in a community sample of physically inactive adults, as these individuals are targeted most often in PA campaigns. PA type is also an important consideration in the selection of a health-oriented leisure pursuit as adherence is likely maintained only when participation is perceived to be enjoyable,[17] offers opportunity for skill mastery, fosters a self-regulated experience, and provides a sense of connectedness with others.[18] Both Latin dance and Latin-themed aerobic dance, arguably, address each of these elements of the self-determination theory[18] well.

Despite awareness of the likely physical and mental health-promoting properties of dance, no investigations have yet explored the simultaneous physiological responses and psychological experiences during community-based classes of salsa dance and Zumba fitness using validated dance- and exercise-specific instruments. Moreover, potential relationships between physical and mental health-related outcomes, which may indeed exist in both salsa dance and Zumba fitness and be relevant for a holistic understanding of these activities, remain largely unexplored. Hence, the purpose of this study was to simultaneously assess the physiological responses and psychological experiences during instructor-led group classes of Latin dance and Latin-themed aerobic dance in a community sample of physically inactive women. We sought to determine differences between classes of salsa dance (partnered and attended primarily for the development of dance technique) and Zumba fitness (non-partnered and attended primarily for exercise purposes) in order to establish the efficacy of these activities for the purposes of community-based PA and psychosocial health promotion.

2. Methods

2.1. Participants

Recruitment was undertaken using poster advertisements placed in the Royal Borough of Kingston and the surrounding communities of London, UK. Twenty-four women (age 36 ± 11 years, body mass 62.2 ± 8.7 kg, body fat 28.1% ± 5.5%, body mass index 23.1 ± 2.8 kg/m^2, maximal oxygen uptake 30.5 ± 4.7 mL/kg/min) volunteered to participate in this study, which had been approved by the Faculty Ethics Committee at Kingston University and was conducted in accordance with the Declaration of Helsinki. All participants were novice to intermediate non-professional performers of Latin dance and/or Latin-themed aerobic dance. The participants gave their informed consent in writing before the commencement of the study and after the experimental procedures, risks, and benefits of participation had been explained. Inclusion criteria stated that the participants must be female, aged 18–64 years, physically inactive (≤1 day/week of MVPA engagement for no more than 30 min), free from musculoskeletal injury, and able to adhere to the study protocol safely. Although a total of 26 women consented to enroll in the study, 2 were not able to complete the research due to unavoidable work commitments and were therefore excluded from the data analysis.

2.2. Laboratory procedure

Instructions were given to the participants to arrive at the laboratory euhydrated and at least 2 h postprandial. Following 15 min of seated rest, resting heart rate (HR) was measured using an automated monitor (Elite 7300IT; Omron Healthcare Inc., Lake Forest, CA, USA). Stature was determined with a stadiometer (213; Seca Ltd., Birmingham, UK), and body mass and percent body fat were assessed using a multifrequency bioelectrical impedance analyzer (MC 180MA; Tanita Europe BV, Amsterdam, the Netherlands). The participants performed a graded exercise test, as described previously,[12] for determination of maximal oxygen uptake and maximal HR. The participants were then familiarized with the instruments for the study and instructed on their proper usage.

2.3. Instruments

A triaxial accelerometer (wGT3X+ 2.2; ActiGraph LLC, Pensacola, FL, USA) worn on the right wrist[16] was initialized using the manufacturer's software (Actilife 6.5; ActiGraph LLC) for data recording on the vertical, anteroposterior, and mediolateral axes at a sampling frequency of 100 Hz. Additionally, the manufacturer's accompanying chest strap monitor, worn at the level of the xiphoid process of the sternum, was utilized for recording of HR. The monitor permits measurement of HR and telemetry of data via the ANT+ protocol to the accelerometer for recording. Downloading of the HR and vector magnitude (VM) acceleration data was undertaken using the manufacturer's software with 1-s epochs selected and the low frequency extension enabled. The utility of this equipment for dance has been described in detail elsewhere.[12]

Psychological experiences were measured via the 3-factor Subjective Exercise Experiences Scale (SEES)[19] immediately before commencement and after completion of each class. The questionnaire uses a Likert-type scoring system ranging from 1 (*not at all*) to 7 (*very much so*) with a midpoint anchor at 4 (*moderately*). Internal consistency has been reported to be high, with Cronbach coefficient α values of 0.86 and 0.85 for positive well-being (PWB; great, positive, strong, terrific; a preponderance of positive affect and high life satisfaction, or flourishing[20,21]) and psychological distress (PD; awful, crummy, discouraged, miserable), respectively. Items pertaining to

fatigue were not scored. The wording of the instrument was slightly altered to reflect the class types (i.e., salsa dance and Zumba fitness) and time points being investigated.

2.4. Latin dance and Latin-themed aerobic dance classes

The participants attended 2 partnered salsa dance and 2 non-partnered Zumba fitness classes each in a counterbalanced order over a 2-week period. The instructor-led group classes were taught by certified salsa dance and Zumba fitness teachers. Each class was 1 h in length and a recovery period of at least 48 h was taken between classes. Instructions were given to perform euhydrated and at least 2 h postprandial. The classes were attended at the same time of day (±1 h). The participants were given specific instructions to treat the classes as normal dance sessions and to not alter their behavior in any way due to attachment of the accelerometer and HR monitor.

In a typical salsa dance class, development of dance technique is the primary emphasis. About half of each class is spent in partner work, with men being taught how to lead the figures and women being instructed on appropriate following and styling skills. A warm-up song and 3 to 4 practice songs are typically played during a 1-h session. Class structure and selection of music, including song tempo, which affects dance intensity,[16] are determined by the instructor. Zumba fitness classes, in contrast, typically focus on larger upper and lower body movements as the primary purpose is aerobic exercise. Less attention is placed on correct execution of the formal dance steps. Song selection (both Latin and international) is again at the discretion of the instructor. A typical 1-h Zumba fitness class consists of 1 to 2 warm-up songs, followed by 8 to 10 main songs choreographed to elicit both low and high intensities of dance. Sessions conclude with 1 to 2 songs used for cool-down and stretching.

2.5. Data analysis

Calculations of energy expenditure (EE), step count (SC), HR, HR reserve (HRR), maximal HRR, VM acceleration, and time spent in sedentary, light, moderate, and vigorous intensity PA during salsa dance and Zumba fitness were undertaken using the mean of the data collected during the respective classes. Mean values were used to minimize intraindividual variability. Sedentary time was established by summing the VM acceleration data that corresponded to a PA intensity of ≤1.49 metabolic equivalents (MET) using the dance-specific wrist location cut-point of ≤74 count/s.[16] EE, SC, and time spent in light, moderate, and vigorous intensity PA were computed from the combined HR and VM acceleration data using the previously validated dance-specific wrist location equations of Domene and Easton:[16] EE (kcal/kg/h or MET) = 1.363757 + (0.010282 × VM acceleration of the wrist in count/s) + (0.017040 × HR in beat/min); and SC (step/min) = 97.614892 + (0.072519 × VM acceleration of the wrist in count/s) + (0.051282 × HR in beat/min). Laboratory-measured resting and maximal HR were used to formulate HRR and maximal HRR via the Karvonen method.[22] SEES ratings for salsa dance and Zumba fitness were averaged between the respective classes before analysis.

All statistical analyses were conducted using the programming language R (R 3.0; The R Foundation for Statistical Computing, Vienna, Austria). Differences between class types in EE, SC, HRR, maximal HRR, and time spent in sedentary, light, moderate, and vigorous intensity PA were determined using dependent t tests. Reliability of HR and VM acceleration between classes was also established using dependent t tests. Relationships between the psychological experiences and total EE, total SC, and total time spent in MVPA were assessed with Spearman's correlation coefficients, ρ. A 2-way (class type (salsa dance, Zumba fitness) × time point (pre-class, post-class)) repeated measures analysis of covariance was used to explore each SEES factor. The average pre-class SEES score was used as the covariate in the models and dependent t tests were used to ascertain differences between pre-class psychological experience ratings. α was set at 0.05. Centrality and spread are presented as mean ± SD with 95% confidence intervals (CI) reported where appropriate. Non-normally distributed data were assessed using non-parametric methods. Effect sizes are shown as partial η^2; a magnitude of ≥0.14 indicates a large effect.[23]

3. Results

3.1. Psychological experiences during Latin dance and Latin-themed aerobic dance

There was no difference (all $p > 0.05$) in pre-class ratings of PWB and PD between class types. However, a significant main effect of time point was obtained for both PWB ($F(1, 22) = 15.50$, $p < 0.01$, partial $\eta^2 = 0.41$) and PD ($F(1, 22) = 55.15$, $p < 0.001$, partial $\eta^2 = 0.72$). For both SEES factors, neither the main effect of class type nor the interaction reached significance (all $p > 0.05$) (Table 1).

Table 1
Psychological experiences during and physiological responses to 1-h instructor-led group classes of salsa dance and Zumba fitness ($n = 24$) (mean ± SD).

	Salsa dance	Zumba fitness
Psychological experiences		
Positive well-being		
Pre-class	16.35 ± 3.69	15.56 ± 3.29
Post-class	20.73 ± 3.03	20.46 ± 3.04
Psychological distress		
Pre-class	7.54 ± 3.68	8.92 ± 4.69
Post-class	5.98 ± 1.98	6.33 ± 2.42
Physiological responses		
Time engagement		
Sedentary	27.2 ± 6.0	8.6 ± 3.0*
Light intensity PA	0.3 ± 0.5	0.3 ± 0.6
Moderate intensity PA	22.5 ± 4.2	14.7 ± 5.5*
Vigorous intensity PA	10.2 ± 4.3	36.5 ± 7.5*
EE (kcal/kg/h or MET)	5.50 ± 0.28	6.21 ± 0.32*
SC (step/min)	119 ± 2	122 ± 2*
HRR (%)	34.5 ± 9.2	57.0 ± 12.5*
Maximal HRR (%)	63.7 ± 13.0	86.6 ± 12.0*

* $p < 0.001$, compared with salsa dance.
Abbreviations: EE = energy expenditure; HRR = heart rate reserve; MET = metabolic equivalents; PA = physical activity; SC = step count.

3.2. Physiological responses to Latin dance and Latin-themed aerobic dance

A significantly lower ($t(23) = -13.27$, $p < 0.001$) amount of sedentary time was observed during Zumba fitness when compared to salsa dance. During light intensity PA engagement no difference ($t(23) = -0.50$, $p = 0.62$) was observed between class types. The amount of time engaged in moderate intensity PA was also significantly lower ($t(23) = -6.25$, $p < 0.001$) during Zumba fitness in comparison with salsa dance. In contrast, vigorous intensity PA time was significantly greater ($t(23) = 14.67$, $p < 0.001$) during Zumba fitness when compared to salsa dance (Table 1).

When examining the instructor-led group classes for MVPA, both EE and SC were significantly higher ($z = -4.29$, $p < 0.001$) during Zumba fitness in comparison with salsa dance (Table 1). Measures of HRR and maximal HRR were also both significantly higher ($z = -4.08$, $p < 0.001$ and $t(23) = -6.30$, $p < 0.001$, respectively) in Zumba fitness when compared to salsa dance. Measures of total EE and total SC for salsa dance and Zumba fitness are presented in Fig. 1. There was a significantly higher ($z = -4.29$, $p < 0.001$) total EE and total SC revealed during Zumba fitness, by an average of 201 kcal (95%CI: 173–229) and 2665 steps (95%CI: 2244–3086) steps, respectively, in comparison with salsa dance. The HR response and VM acceleration of a representative individual participant during salsa dance and Zumba fitness are presented in Fig. 2.

3.3. Correlation of Latin dance and Latin-themed aerobic dance psychological experiences

During Zumba fitness, a significant relationship ($\rho = 0.39$, $p < 0.05$) was found between the change score in PWB and total EE. Similarly, a significant negative relationship ($\rho = -0.63$, $p < 0.01$) was revealed between the PD change score and total EE during Zumba fitness. No further associations (all $p > 0.05$) were observed between the SEES factor change scores and total SC and total time spent in MVPA during Zumba fitness. For salsa dance, there were no relationships (all $p > 0.05$) between the psychological experiences and physiological responses recorded.

3.4. Reliability of accelerometry and HR for Latin dance and Latin-themed aerobic dance

Results of the reliability analysis are presented in Table 2. There was no difference (salsa dance: $t(23) = -1.28$, $p = 0.21$; Zumba fitness: $t(23) = -1.14$, $p = 0.27$) in VM acceleration between classes. There was no difference (salsa dance: $z = 0.72$, $p = 0.48$; Zumba fitness: $t(23) = 1.15$, $p = 0.26$) in HR between classes either.

4. Discussion

The current work used validated dance- and exercise-specific methods to compare the HR response, caloric output, steps taken, and activity engagement time of salsa dance and Zumba fitness in a community-recruited cohort of physically inactive individuals, while concurrently exploring short-term change in levels of distress and well-being. For both types of

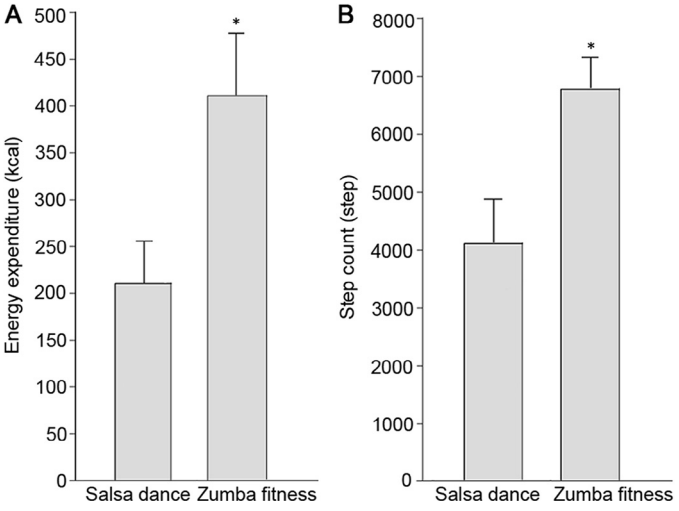

Fig. 1. Total energy expenditure (A) and total step count (B) during 1-h instructor-led group classes of salsa dance and Zumba fitness ($n = 24$). Data are presented as mean ± SD. * $p < 0.001$, compared with salsa dance.

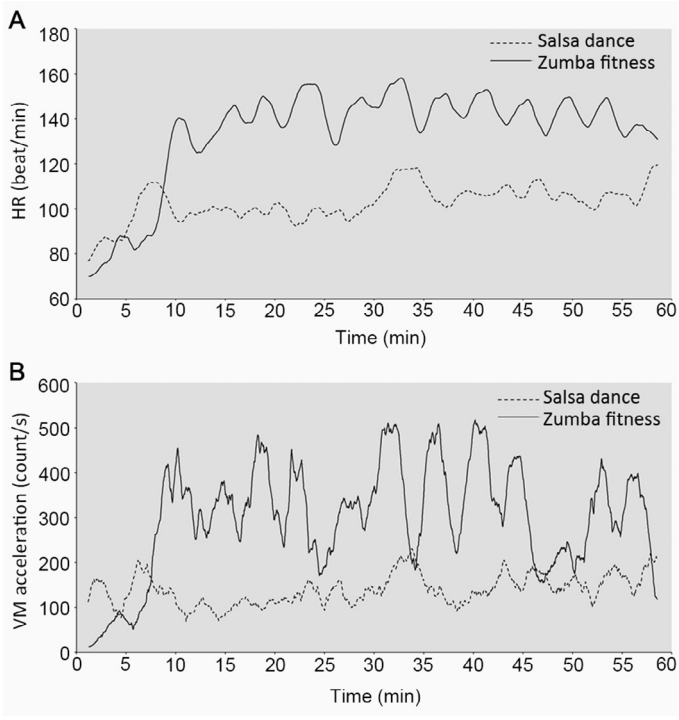

Fig. 2. Smoothed heart rate (HR) response (A) and smoothed vector magnitude (VM) acceleration (B) of a representative individual participant during 1-h instructor-led group classes of salsa dance and Zumba fitness.

Table 2
Reliability of accelerometry and HR for salsa dance and Zumba fitness ($n = 24$) (mean ± SD).

	Salsa dance		Zumba fitness	
	Class 1	Class 2	Class 1	Class 2
VM acceleration (count/s)	127 ± 28	132 ± 36	317 ± 67	325 ± 58
HR (beat/min)	107 ± 16	106 ± 17	139 ± 18	137 ± 17

Abbreviations: HR = heart rate; VM = vector magnitude.

dance classes, more than half of the total time was spent in MVPA with Zumba fitness yielding a total EE almost double that of salsa dance. Improvements in PWB and PD of a large magnitude[23] were observed pre- to post-class. We also report, in Zumba fitness, medium to large strength[24] relationships between caloric output and increased well-being and reduced distress.

This investigation demonstrated that PWB increased acutely during dance, irrespective of whether the class type was intended principally for exercise purposes or development of dance technique. Similarly, in an 8-week Zumba fitness study[25] it was shown that women improved in measures of well-being from pre- to post-intervention. The effect size (0.45) was marginally greater than that reported in this study. Kim and Kim[26] administered the SEES to evaluate the exercise experiences of 277 adults and found comparable pre- to post-class improvements in both PWB (increase = 3.10) and PD (decrease = 2.70) for participants randomly assigned to aerobic dance. Intriguingly, no significant improvements in these factors were observed in the traditional exercise (weight training, jogging, and flexibility) group. In a systematic review using meta-analytic methods, Chida and Steptoe[27] revealed that well-being was associated (hazard ratio = 0.82, 95%CI: 0.76–0.89) with reduced mortality in 36,000+ healthy individuals. Hence, it is likely that psychosocially-oriented PA campaigns would benefit from incorporation of well-being enhancing activities, for example, dance.

In a randomized controlled trial of adults experiencing depressive- or stress-related symptoms, it was revealed that partnered Latin dance reduced levels of depression (effect size = 0.50) and psychological stress (effect size = 0.45) post-intervention.[10] The results of the current work, similarly, indicated that partnered Latin dance lowered PD in physically inactive, but otherwise healthy, adults. Experiencing an acute reduction in distress after attending a dance class may facilitate activity adherence, which is likely especially important for physically inactive individuals. Currently, however, a lack of consensus exists regarding the exact mechanisms by which exercise and leisure activities, such as dance, exert their mental health-enhancing effect, although evidence suggests that numerous psychological, physiological, and biochemical processes are likely involved.[5,28,29]

It was demonstrated that 6 months of attendance in community-based Latin dance classes increased vigorous intensity PA in women.[8] As these data were estimated via self-report questionnaire, our own investigation lends support to the findings of Hovell and colleagues[8] as we present objectively measured time spent at each individual PA intensity for both salsa dance and Zumba fitness. Furthermore, accelerometer-determined MVPA during 1 h classes of Latin dance has previously been reported to be 8.5 ± 6.4 min.[9] This value is substantially lower than what was found in the present study. The discrepancy may be explained by the fact that the cut-point system used by Lee and colleagues[9] was not developed specifically for the activity of dance, or that the 10-s accelerometer epochs selected were not responsive enough for this particular genre of dance.

The HR response during instructor-led group classes of Zumba fitness was shown to be 136 ± 17 beat/min in women aged 46 ± 10 years,[13] a result marginally lower than that found in the present study. This difference is likely attributable to the age of the individuals who took part in our research, as the women were 10 years younger (and of a similar cardiorespiratory fitness) than those recruited by Barene and colleagues.[13] The age-related decline in the HR response to physical work is well established[30] and likely plays a role in why exercise intensity (and therefore EE) during instructor-led group classes of aerobic dance has been shown to vary dramatically between individuals.[31] Moreover, it is already known that both previous experience and cardiorespiratory fitness affect the physiological responses during aerobic dance.[31,32] Thus, inferences to a general population (i.e., untrained and older) should be made cautiously when examining the effects of Zumba fitness measured in samples of professional instructors (experience = 2–6 years)[33] or young adults (age = 19 ± 1 years).[34]

When the participants in the current research undertook the classes of salsa dance, no relationships were established between the physiological responses and psychological experiences measured. A possible explanation for this may be the fact that the intentions or goals of the participants at the time were oriented towards improvement of dance technique, as opposed to being exercise-related. As salsa dancing is usually performed as a partnered dance between a leader and follower,[35] inherently, a strong social element exists when taking part. As the psychosocial benefits of salsa dance have been rated higher by women than the physical benefits,[12] it is plausible that the participants in this study may not have considered the salsa dance classes to be actual exercise sessions *per se*. An improved post-class affective state would therefore not necessarily be expected to be related to caloric output or vigorous activity. In contrast, the principal purpose of instructor-led group classes of aerobic dance for women likely is to do with exercise. Patel and Kasiram[36] reported that women engage in aerobic dance for exercise-related benefits more so than they do for the psychosocial reasons. Accordingly, it is not surprising that associations were found between total EE and increased PWB, and total EE and decreased PD, in the Zumba fitness condition only. These correlations may, in part, be due to Zumba fitness being perceived to be formal exercise,[37] which is not the case for salsa dance.[15] Consequently, the participants may have expected physically demanding Zumba fitness classes and it is plausible that these expectations were fulfilled as a result of the vigorous intensity elicited. Those who felt they had a high caloric output may in turn have experienced feelings of satisfaction or goal attainment, hence the observed concomitant improvement in affective state. It should be noted, however, that the interindividual differences in dance class expectations are likely to be considerable when sampling from a population of non-professional dancers, as was the case in this study.

Although this investigation is the first research we are aware of that concurrently explored both physiological and psychological aspects of salsa dance and Zumba fitness using activity-specific methods within an ecologically valid environment,

there are 2 important limitations worth noting. Firstly, as we did not make use of a control group, it is therefore difficult to make inferences from our findings regarding causality. It would be prudent for researchers in the future to further assess the efficacy of Latin dance and Latin-themed aerobic dance by utilizing true experimental (i.e., randomized controlled trial) designs, objective measurement techniques validated specifically for the activity of dance, and naturalistic settings in which to undertake data collection. Secondly, it should be acknowledged that as no follow-up measures were taken in the present study, it is impossible to discern the time course over which the improvements in affective state lasted.

5. Conclusion

The physically inactive women who took part in this research expended ~200–400 kcal, took ~4000–7000 steps, spent >30 min in MVPA, and markedly improved measures of both well-being and distress during attendance in 1-h classes of dance. As such, we suggest that engagement in either partnered salsa dance for the improvement of dance technique or non-partnered Zumba fitness for the purposes of aerobic exercise is indeed efficacious in terms of community-based PA and psychosocial health promotion. The Zumba fitness classes yielded a higher EE, SC, MVPA, and HR response and VM acceleration (Fig. 2) when compared to the salsa dance classes of comparable session time. We would further argue that Zumba fitness can be characterized as an intermittent and higher intensity activity than salsa dance. Hence, at least from an exercise-oriented perspective, it would seem that classes of Zumba fitness likely confer greater physiological benefit than classes of salsa dance.

Acknowledgment

The authors wish to thank all the participants who volunteered their time for this project and in doing so made the completion of this research possible. No financial support was sought.

Authors' contributions

PAD designed the study, undertook the data collection and analysis, and prepared the manuscript. HJM and EP assisted in preparation of the manuscript. CE assisted in the design of the study and preparation of the manuscript. All authors have read and approved the final version of the manuscript and agree with the order of presentation of the authors.

Competing interests

None of the authors declare competing financial interests.

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