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Original article

Physiological variability in three autochthonous rhythms of the Ecuadorian folkloric dance

Variabilidad fisiológica en tres ritmos autóctonos de la danza folklórica ecuatoriana

Variabilidade fisiológica em três ritmos indígenas da dança folclórica equatoriana

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ABSTRACT

The planned and systematic practice of dance can contribute to improving the physical and health status of people, and it is considered that at present the findings in this area of study are insufficient. The objective was to determine the physiological variability of three autochthonous rhythms of national folk dance, in the Yawarkanchik group of Cuenca, Ecuador. The research design was descriptive correlational, with a quantitative and cross-sectional approach. The measurement of intensity, with respect to the increase in heart rate, distance, speed, number of steps, energy expenditure and perceived effort, was analyzed by GPS- running watch (Sigma) and modified Borg scale, with the participation of eight

professional dancers. The results showed that the rhythm with the highest percentage of heart rate was the rhythm of the Mountains; regarding distance, speed and number of steps, the rhythm of the East stood out, followed by the rhythm of the Coast and finally the Mountains rhythm, with significant differences. The highest energy expenditure was the rhythm, of the Mountains followed by the rhythm of the East and the rhythm of the Coast. Regarding perceived effort, the rhythm of the Mountains was the most demanding, the rhythm of the East was the medium-demand rhythm, and the rhythm of the Coast was the low-demand rhythm, with no significant differences.

Keywords: heart rate, energy expenditure, intensity, autochthonous rhythms, physiological variables

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RESUMEN

La práctica planificada y sistemática de la danza puede contribuir a mejorar el estado físico y de salud de las personas, y se considera que en la actualidad son insuficientes los hallazgos en esta área de estudio. El objetivo fue determinar la variabilidad fisiológica de tres ritmos autóctonos de danza folklórica nacional, en el grupo Yawarkanchik de Cuenca, en Ecuador. El diseño de la investigación fue de tipo descriptivo correlacional, con un enfoque cuantitativo y de corte transversal. La medición de la intensidad, respecto al incremento de la frecuencia cardiaca, la distancia, la velocidad, el número de pasos, el gasto energético y el esfuerzo percibido, se analizó mediante GPS-running watch (Sigma) y escala de Borg modificada, con la participación de ocho bailarines profesionales. Los resultados mostraron que el ritmo de mayor porcentaje de frecuencia cardiaca fue el ritmo de la Sierra; respecto a la distancia, la velocidad y el número de pasos se destacó el ritmo del Oriente, seguido del ritmo de la Costa y al final el ritmo de la Sierra, con diferencias significativas. El mayor gasto energético fue del ritmo de la Sierra, seguido del ritmo del Oriente y el ritmo de la Costa. En cuanto al esfuerzo percibido, el de mayor demanda fue el ritmo de la Sierra, el de mediana demanda el ritmo del Oriente, y de baja demanda fue el ritmo de la Costa, sin diferencias significativas.

Palabras Clave: frecuencia cardíaca, gasto energético, intensidad, ritmos autóctonos, variables fisiológicas

RESUMO

A prática planeada e sistemática da dança pode contribuir para a melhoria do estado físico e de saúde das pessoas, considerando-se que os resultados nesta área de estudo são atualmente insuficientes. O objetivo foi determinar a variabilidade fisiológica de três ritmos indígenas da dança folclórica nacional, no grupo Yawarkanchik de Cuenca, Equador. O desenho da investigação foi descritivo-correlacional, com uma abordagem quantitativa e transversal. A medição da intensidade, quanto ao aumento da frequência cardíaca, distância, velocidade, número de passos, gasto energético e esforço percebido, foi analisada através de um relógio de corrida com GPS (Sigma) e escala de Borg modificada, com a participação de oito bailarinos profissionais. Os resultados mostraram que o ritmo com maior percentagem de frequência cardíaca foi o ritmo Sierra; Quanto à distância, velocidade e número de passos, destacou-se o ritmo do Leste, seguido do ritmo do Litoral e por último o ritmo da Serra, com diferenças significativas. O maior dispêndio energético foi ao ritmo da Serra, seguido do ritmo Leste e do ritmo Costa. Em relação ao esforço percebido, o que teve maior exigência foi o ritmo da Serra, o que teve média procura foi o ritmo do Leste, e o que teve menor procura foi o ritmo do Litoral, sem diferenças significativas.

Palavras-chave: frequência cardíaca, gasto energético, intensidade, ritmos autóctones, variáveis fisiológicas

INTRODUCTION

In different societies, folk dance is part of the cultural heritage, as it transcends in its roots the likes, ideas, beliefs and customs of the origin of its people; dance is a means that allows the expression of emotions and feelings, through the succession of organized movements dependent on a rhythm.

In this context, dance appears as a type of physical activity with several health benefits; for example, it reduces depression and anxiety, increases quality of life and interpersonal, cognitive and psychomotor skills (Barranco-Ruiz et al., 2020; Dos Santos et al., 2021; Esmail et al., 2020). The impact of dance on psychosocial well-being, including body image and self-perception, has also been documented (Chappell et al., 2021; Rodrigues-Krause et al., 2019).

The body's physiological response to dance practice is considered complex, diverse, non-stationary, intermittent, with significant differences between intensities, durations, and execution; along with a focus on technique and skill. Various studies show that dance practice can improve quality of life, cognitive and motor skills, and mental health in people (Koch et al., 2019).

Thus, dance, understood as a genuine expression of human feelings, transmitted in the form of movements, is rooted in the customs and sociocultural experiences of a certain geographical environment. Through dance, human beings are able to reflect and reconcile the complexity of the multiple dimensions of existence (Biblioteca Nacional de Chile, 2021; Britten et al., 2023; Matos et al., 2020; Sheppard & Broughton, 2020).

Folk dance is one of the most significant traditions in Ecuador, during popular festivals, due to its religious and/or cultural nature, it attracts children, young people and adults (Vega Mateo, 2015). Over the course of time until today, folk dance has evolved to a semi-professional and professional level.

In Ecuador and Latin America, studies related to determining the intensity and energy expenditure in autochthonous folk dances in their different regions are scarce, due to various factors, including a lack of interest, resources, and significant studies that allow scientific evidence of their development.

The practice of folk dance requires a greater expenditure of oxygen than classical dance, and according to some authors, it reaches the level of sports such as gymnastics and football (Morente & Calvo 2020). Thus, there is a wide range of information on contemporary dance;

however, if a more exhaustive search of the literature is carried out regarding the energy expenditure and heart rate (HR) of dancers, no significant data are found.

Therefore, to better address the issue, we must know the caloric expenditure of dancers in dance routines, measured in Metabolic Equivalent of Task (MET) is one of the most objective ways of quantifying the intensity of an exercise, with respect to the metabolic energy expenditure required by a physical activity, with the purpose of knowing, improving and establishing guidelines and recommendations for physical preparation that adapt as best as possible to the energy expenditure of dancers, so that they not only cover individual requirements and compensate for the extra wear and tear due to physical exercise, but also take into account optimal physical performance and the required body image.

Currently, in the Ecuadorian context and specifically in Azuay, most of these theoretical and methodological foundations about the analysis of physiological variability in three autochthonous rhythms of the national folk dance have been scarcely addressed by professionals in Physical Education and Sport. Therefore, the objective was to determine the physiological variability in three autochthonous rhythms of the national folk dance in the Yawarkanchik group from Cuenca, Ecuador.

MATERIALS AND METHODS

The research design was descriptive correlational, with a quantitative and cross-sectional approach, with the purpose of determining the physiological variability in three autochthonous rhythms of the national folk dance: from the Mountains, the Cayambe with the song "Fiesta de Pueblo de Cañada Inspiraciones"; from the Coast, the Andarele Esmeraldeña with the song " Andarele "; and from the Ecuadorian East, the Tushuy sacha manda with the song "Mi Bella Amazonía". The Yawarkanchik group from the city of Cuenca, Ecuador belongs to the International Council of Organizations of Folklore Festivals and Traditional Arts (CIOFF).

Eight professional folkloric dancers from the Yawarkanchik group participated in the study, four women and four men, aged between 18 and 30 years, with an average age of 24.75

(±3.73), who met the inclusion criteria and signed the informed consent. The study was carried out at the facilities of the University of Cuenca, during the period between October 2020 and January 2021.

The following methods, techniques and instruments were applied in the development of the study:

GPS running watch (Sigma): instrument used to evaluate the intensity of physical activity using an optical sensor with continuous recording of HR, distance traveled (km), speed (km/h) and number of steps; the results were analyzed on the Sigma platform, where we observed the indicators of the respective variables during the dance session.

Borg Scale modified: applied to evaluate the perception of the intensity of physical effort, on a scale of 0 to 10 with a numerical value ranging from 0 (minimum effort) to 10 (extreme effort). This scale allowed the prediction and determination of the various intensities in physical activities. Being a subjective scale, participants were instructed on how to correctly assess it, for which posters were printed with the visual image of the Borg scale .

Metabolic formula: *it was* used to record energy expenditure, through the metabolic unit called MET, formula: Kcal/min = MET x 0.0175 x weight (kg), this allowed us to know the amount of kilocalories that the body consumes for each physical activity performed, based on time and weight.

Statistical-mathematical methods: applied through descriptive and inferential statistics, which included percentage analysis, frequency distribution, mean statistics, standard deviation, normality tests, Student `s T test and level of significance with the IBM-SPSS software, v. 27 (IBM North America , New York, USA), as well as with the Excel spreadsheet (Microsoft Corp., Washington, USA).

RESULTS

Below are the main results obtained after evaluating the variables in the three autochthonous rhythms, which are presented in consolidated tables, with their analysis.

Table 1. *Demographic data*

Variable	Sex		Age		Experience		Weight (kg)		Size (cm)		BMI	
	N	%	Med.	DS	Med.	DS	Med.	DS	Med.	DS	Med.	DS
F	4	50	24.87	±4.96	9.25	±1.89	56.85	±2.53	152	±8.02	24.78	±3.51
M	4	50	23.02	±2.51	9, 25	±3.09	75.33	±8.73	167	±5.10	26.95	±1.54
Total	8	100	24.75	±3.73	9.25	±2.37	66.09	±11.53	160	±10.04	25.86	±2.77

Nomenclature: F = female; M = male; N = number; Med = mean; SD = standard deviation; BMI = body mass index

The table above shows that the participating group was homogeneous, consisting of 50% men and women; with a similar average age between 23 and 24 years, without obesity (average BMI 25.86); and with more than 9 years of experience in folkloric dance.

Table 2. *Shapiro-Wilk normality test on study variables*

	% FC		D (km)		V (Km/h)		NP		GE (k. kal)	
Next.	F	M	F	M	F	M	F	M	F	M
	0.151	0.313	0.719	0.120	0.544	0.064	0.096	0.456	0.451	0.167

Nomenclature: FC = percentage; D = distance traveled; V = speed; NP = number of steps; GE = energy expenditure.

In Table 2, it is observed that the application of the Shapiro-Wilk normality test revealed that the data had a normal distribution, since their significances (sig) are equal and greater than the value p = 0.05, it was shown that the data were parametric, to which the Student T test statistic was applied , to determine whether the dances of the rhythms of the Mountains, Coast and East presented statistically significant differences or not.

Table 3. *Statistics of physiological variables*

Variable	The Mountains Rhythm				The Coast Rhythm				The East Rhythm				Sig
	F	M	Total.	DS	F	M	Total.	DS	F	M	Total	DS	
% FC	52.11	63.17	57.64	±10.3	44.06	54.51	49.28	±15.6	42.00	63.45	52.72	±18.5	0.010
D	0.62	0.68	0.65	±0.15	0.76	0.57	0.66	±0.13	0.86	0.73	0.80	±0.15	0.180
V(km/h)	8.00	9,10	8.55	±1.13	8.95	10.27	9.61	±1.06	10.62	10.60	10.61	±0.84	0.130
NP	388.00	416.00	402.00	±62.52	499,00	425,00	462,00	±82.54	619,00	515,00	567,00	±76.3	0.220
GE (Kcal)	27.20	36.04	31.62	±5.52	23.47	31,11	27,29	±4.76	24.61	32.58	28.60	±4.35	0.000
EB	7.00	7.25	7,12	±0.64	4.25	4.25	4.25	±0.46	5.75	5.50	5.62	±0.74	1,000

Nomenclature: F = female; M = male; Tot = total; Sig = level of significance; SD, standard deviation.

Table 3 shows the means of the study variables presented by sex, the different rhythms and their level of significance; in relation to the percentage of HR and energy expenditure, the highest percentage was observed in the rhythm of the mountains (57.64; 31.62), followed by the rhythm of the East (52.72; 28.60); and the lowest, the rhythm of the Coast (49.28; 27.29).

In all rhythms, women were the ones who obtained a greater increase; however, they did not have a statistically significant difference in the two variables p value (0.01; 0.00). Regarding the variable of perception of effort (Borg Scale), it was observed that the rhythm of the Mountains (7.12) reached a greater perception of intensity, it was greater in male dancers (7.25 vs 7.00), followed by the rhythm of the East (5.62), where female dancers obtained a higher average (5.75 vs 5.50), and finally the rhythm of the Coast (4.25) with a similar average, both in male and female dancers (4.25 vs 4.25); this showed a significance level of p = 1.000.

Regarding speed, the rhythm with the highest speed was the rhythm of the East, with an average of 10.61 km/h (2.94 m/s); followed by the rhythm of the Coast (9.61 km/h (2.67

m/s)), here the men had a higher speed, and finally the rhythm of the Mountains (8.55 km/h (2.38 m/s)), likewise, the men showed a higher speed in this rhythm; this revealed statistically significant differences with a p = 0.135.

Regarding the distance traveled and the number of steps, the rhythm of the East (0.80; 567.50) was the rhythm that reached the highest value, followed by the rhythm of the Coast (0.66; 462.50), and the lowest value was the rhythm of the Mountains (0.65; 402.25); all with statistically significant differences with a p = 0.180; p = 0.220, respectively.

DISCUSSION

The results of this study allowed to determine the physiological variability in three autochthonous rhythms of the national folk dance in the Yawarkanchik group from Cuenca, Ecuador; in this context, it was observed that the averages of the dancers' demographic data showed a weight of 66.09 kg (±11.53), with a BMI of 25.86 (±2.77).

Regarding the variables percentage of FC and energy expenditure, perception of effort (Borg), the rhythm of the Mountains stood out, followed by the rhythm of the East and the lowest was the rhythm of the Coast; women were those who achieved the greatest increase in FC and with statistically significant differences, in the three rhythms in (Borg).

In the study by Morente & Calvo (2020) on caloric expenditure in contemporary dance dancers, in which ten students of the modality participated, five men with an average age of 25 ± 5.08 and five women of 21 ± 2.51 years, energy expenditure was analyzed for three consecutive days, for which the bodymedia metabolic sensor was used and it was shown that the age group of that research was similar to the one of the present study, in which eight folkloric dancers participated with an average age of 24.75 (±3.73). However, they differ in that not only caloric expenditure was analyzed, but also other physiological variables such as HR, speed, number of steps, perception of effort, in addition to cardiac output, and it was performed in autochthonous rhythms.

In this sense, Carrillo et al. (2018) conducted research with professional dancers of various musical genres from the city of Bucaramanga, Colombia, and determined that female

dancers in the folklore genre had a weight of 58.36 kg (±8.11), and male dancers, 68.58 kg (±16.7); these values are very similar to those reached by women 56.85 kg (±2.53) in the present study, and differ from those obtained by male dancers with 75.33 kg (±8.73).

Along the same lines, Yáñez et al. (2023), in their study on the intensity and level of physical activity in Diabladas of the Tirana festival in Chile, found significant differences between male and female dancers during very vigorous physical activity, values of (F=9.57; p=0.003; n2 p= 0.127) were obtained, respectively; Diabladas dancers reached high levels of physical activity during the religious festival of Tirana in Chile; in the present study, different values were observed, in which women obtained a greater increase in intensity; however, there was no statistically significant difference between men and women with a p value = 0.01.

Regarding dance variations, in relation to tempo (slow-adagio) or (fast-allegro), as well as the heart rate of a dancer, these can vary depending on the level of preparation and the level of demand of the rhythm; this is why Cohen et al.(2017) determined that the total average HR in the dances was 184 beats per minute, 94% of the maximum HR, in relation to age; thus a high peak HR of 197 beats per min was generated and it was established that ballet stage dance can be characterized or included in the plane of high intensity and short duration exercise, results that differ from the values of this study, because the dancers only reached a maximum HR percentage of 57.64 (±10.3) and a minimum of 49.28 (±15.6) of intensity.

The study conducted by Pilch et al.(2017) determined that the energy expenditure values obtained by professional dancers, in a simulated final round of a standard style dance sport competition, were higher in men of 16.60 (± 1.30) kcal x min1, than in women of 10.70 (± 1.00) kcal min1 (F = 3.67; p = 0.010), these values are in contrast to those obtained in the present study, where the highest value was in men of 36.04 kcal. (±4.18), while in women it was 24.61 kcal. (±1.03).

Regarding the study carried out, the scientific literature is scarce, regarding folk dance in general, as well as variables such as HR, perception of effort and cardiac output in each of the native dances; in addition, the small number of participants can be mentioned, since

they were the ones who systematically attended the rehearsals, considering that the study was carried out at the end of 2020 and there were still restrictions due to Covid-19.

CONCLUSIONS

The study evaluated the physiological variability in three autochthonous rhythms of Ecuadorian folklore. Thus, the highest percentage of FC and energy expenditure was found in the rhythm of the Mountains (% FC 57.64; GE 31.62), followed by the rhythm of the Eastern (% FC 52.72; GE 28.60) and the lowest in the rhythm of the Coast (% FC 49.28; GE 27.29), a greater increase was observed in the female group.

Regarding speed, the highest pace was the pace of the East with an average of (10.61 km/h (2.94 m/s)) in men and women; followed by the pace of the Coast (9.61 km/h (2.67 m/s)), which was higher in the male group; and finally the rhythm of the Mountains (8.55 km/h (2.38 m/s)), higher in men.

Regarding the distance traveled and the number of steps, the rhythm of the East (D 0.80; NP 567.50) reached the highest value, followed by the rhythm of the Coast (D 0.66; NP 462.50) and the lowest was the rhythm of the Mountains (D 0.65; NP 402.25).

In the variable scale of perception of effort (Borg), it was evident that the rhythm of the Mountains (7.12) reached the highest value of perception of intensity, followed by the rhythm of the East (5.62) and finally the rhythm of the Coast (4.25).

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The author declares that there are no conflicts of interest.

Author's contribution:

The author is responsible for writing the work and analyzing the documents.