
Original

**EFECTOS DE LA INTERVENCIÓN MATUTINA AERÓBICA SOBRE LOS CAMBIOS DE COMPOSICIÓN CORPORAL EN MUJERES JÓVENES DE MAÑANA Y SIN CRONOTIPOS**

EFFECTS OF AEROBIC MORNING INTERVENTION ON BODY COMPOSITION CHANGES IN YOUNG WOMEN OF MORNING AND NEITHER CHRONOTYPES

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RESUMEN
Este estudio tuvo como objetivo comparar el efecto de una intervención física matutina sobre la composición corporal de mujeres jóvenes (n = 8, edad media ± D.T. = 23,1 ± 1,0 años, altura media ± D.T. = 168,9 ± 5,8 cm, peso medio ± D.T. = 66,2 ± 6,8 kg) del cronotipo matinal (tipos M) vs. mujeres jóvenes (n = 25, edad media ± D.T. = 21,4 ± 1,5 años, altura media ± D.T. = 167,1 ± 5,4 cm, peso medio ± D.T. = 65,6 ± 7,8 kg) de ninguno de los dos cronotipos (tipos I). Utilizamos análisis de bioimpedancia para detectar cambios en los siguientes indicadores: peso, índice de masa corporal, masa grasa (FM%), masa libre de grasa (FFM), masa muscular (MM), agua corporal total (TBW), agua corporal total y extracelular (ECW/TBW), proporción de masa celular extracelular y corporal (ECM/BCM) y ángulo de fase (PA). Los efectos de la intervención en los grupos se compararon y evaluaron mediante la d de Cohen dentro del procedimiento estadístico de prueba t de muestras apareadas, que no mostró diferencias significativas en todos los indicadores, excepto AF, entre el pretest y el postest (p > 0,05). Se denotó y examinó una mejora estadística en la PA de los tipos N. La diferencia más significativa se encontró en el indicador ECM/BCM, que se estimuló de forma más eficaz en los tipos M después de la intervención de la mañana en comparación con los tipos N. Los participantes de tipo M mejoraron en ECM/BCM (d = 0,62) y AF (d = 0,70) con un efecto medio, pero puntuaron peor en FM% (d = 0,47) con un efecto pequeño, FFM (d = 0,00), 43, MM (d = 0,42) y TBW (d = 0,40), mientras que no se encontró ningún efecto en ECW/TBW (d = 0,15). Los participantes de tipo N mejoraron en AF (d = 0,60) con un efecto medio, FFM (d = 0,29), MM (d = 0,28) y ECW/TBW (d = 0,28) con un efecto pequeño; no se observó ningún efecto en ECM/BCM (d = 0,01), FM% (d = 0,03) y TBW (d = 0,04). Los resultados mostraron que los parámetros ECM/BCM y PA fueron más sensibles que los otros parámetros. Nuestros hallazgos indican la importancia de una mayor exploración y examen del problema del examen del efecto del tiempo en cronotipos particulares.

Palabras clave: Aerobic; Cronotipo matutino; Ejercicio mañanero; Aptitud física;
ABSTRACT
This experimental study aimed to compare the effect of an aerobic intervention on the body composition (BC) of young women (n = 8, mean age ± SD = 23.1 ± 1.0 years, mean height ± SD = 168.9 ± 5.8 cm, mean weight ± SD = 66.2 ± 6.8 kg) of the morning chronotype (M-types) vs. young women (n = 25, mean age ± SD = 21.4 ± 1.5 years, mean height ± SD = 167.1 ± 5.4 cm, mean weight ± SD = 65.6 ± 7.8 kg) of the intermediate chronotype (I-types). We used bioimpedance analysis (BIA) to detect changes in the following indicators: body weight (BM), body mass index (BMI), fat mass (FM%), fat free mass (FFM), muscle mass (MM), total body water (TBW), extracellular and total body water ratio (ECW/TBW), extracellular and body cell mass ratio (ECM/BCM), and phase angle (PA). Normality rozdelenia dát bola v rámci štatistickej analýzy overovaná by Shapiro-Wilk test. Intervention effects in groups were compared and evaluated by Cohen’s d within the statistical procedure of paired samples t-test, which did not show any significant differences in all indicators, except PA, between the pre-test and post-test (p>0.05). Statistical improvement was denoted and examined in the PA of the I-types. The most significant difference was found in the ECM/BCM indicator, which was stimulated more effectively in M-types after the aerobic intervention compared with the I-types. M-type participants improved in ECM/BCM (d = 0.62) and PA (d = 0.70) with a medium effect, but scored worse in FM% (d = 0.47) with a small effect, FFM (d = .43), MM (d = 0.42), and TBW (d = 0.40), whereas no effect was found in ECW/TBW (d = 0.15). I-type participants improved in PA (d = .60) with a medium effect, FFM (d = 0.29), MM (d = 0.28), and ECW/TBW (d = 0.28) with a small effect; no effect was observed in ECM/BCM (d = 0.01), FM% (d = 0.03), and TBW (d = 0.04). The results showed that the ECM/BCM and PA parameters were more sensitive than the other parameters. Our findings indicate the importance of further exploration and examination of the problem of time effect examination on particular chronotypes.

Keywords: aerobics; composite scale of morningness; morning chronotype; intermediate chronotype; university students.
INTRODUCCIÓN
People face constant requirements to increase the effectiveness of processes in many spheres, such as work, education, training, and physical programs. The modern lifestyle is characterised by a focus on business, a rushed schedule, and a lack of physical activity. People eat unhealthy products and foods with high calorie content. One consequence of such a lifestyle is obesity, which is a problem not only in adulthood but also in childhood. Body composition (BC) analysis is a high-quality method for assessing the state of the components of the body in detail. Bunc et al. (2015) reported that BC is the main predictor of physical fitness and also play an important role in physical performance (Mala et al., 2015). Current scientific and clinical tasks are aimed at finding optimal forms, methods, and programs with targeted interventions. The importance of the positive impact of aerobic exercise on human health is highlighted by many studies (Mersy, 1991; Guiney & Machado, 2013; Swift et al., 2014; etc.). In previous years, the COVID-19 pandemic caused a major problem. The COVID-19 pandemic situation was characterised by limitations and restrictions with respect to physical activities, as people are compelled to work at home. Reduced physical activity during the COVID-19 pandemic has been confirmed by research (Castañeda-Babarro et al., 2020; Luciano et al., 2021; Violant-Holz et al., 2020).

Chronobiology offers many options in which aerobic physical interventions can be effective. Knowledge of the optimal time for physical interventions for each person can present the potential for more effective intervention. The division of the biological day (the circadian day) into a morning and an afternoon part prompted the emergence of the perception of personality in a chronobiological context into two chronotypes: i) morning chronotype is the type of person who is more active, or more inclined to the morning part of the diurnal period, i) the evening chronotype is the type of person who is more active predominantly in the afternoon to evening part of the diurnal period. In chronobiology, we can also distinguish a neutral (intermediate) chronotype, which does not dominantly prefer a particular phase of the day. The basic difference between chronotypes is also the different circadian and diurnal oscillations and phases of physiological markers. The most commonly studied marker in relation to chronotype is body core temperature. Baehr et al. (2000) in a sample of young people (n = 172) found that the minimum body temperature during the circadian period was recorded first for morning chronotypes (3.50 ±m), followed by neutral (5.02 ±m) and evening (6.01 ±m) chronotypes, indicating the best readiness in the morning hours for morning chronotypes. Thus, individuals must exercise according to their particular chronotype, which is one of the optimisation elements. Studies (e.g. Henst et al., 2015; Vitale & Weydahl, 2017) have confirmed lent support to the theory on the relation of chronotype and time precondition of the best performance. A significant benefit of physical programs whose effectiveness is connected with chronotypes is that optimisation respects biorhythms, which are important from the point of view of health. Many studies that have focused on chronotype and diurnal performance problems have suggested the creation of time stereotypes and chronotype preference (e.g. Rae et al., 2015; Montaruli et al., 2017). The time of work or intensive activities impacts the creation of chronotype preferences. Lastella et al. (2016) and Roveda et al. (2020) examined the relation between the identified chronotype and diurnal performance. They detected a relation between chronotype and the best performance at the time of the training process. Kentiba et al. (2020) found that chronotype and training time are not related in the majority of students of the intermediate and morning chronotypes at an African university (Ethiopia). However, they recommended that the time of training and chronotype should be in harmony. Mulé et al. (2019) examined the better dispositions for physical activities among morning chronotype university students in the morning hours, whereas evening chronotype students tend to feel better in the evening hours. Other studies (e.g. Sedliak et al., 2009; Blonc et al., 2010) have compared the effects of morning and evening exercises on the stimulation of strength components. They did not find any significant differences in the five- and ten-week interventions between the morning and evening exercises on the selected strength components. Pivovarniček et al. (2021) did not find any significant differences (p>0.05) between the impact of morning and evening physical interventions on BC indicators in young women of the intermediate chronotype. Several studies (Kütüsmaa et al., 2015; Korman et al. 2019;
Sedliak et al., 2019; Smit et al., 2020, etc.) show that morning time is specific for the implementation of sports and physical activities and problematic without prior temporal adaptation. Morning chronotypes are best adapted at this time. Based on these indications, we hypothesized that better effects of aerobic intervention in terms of body composition indicators may occur in young women of the early morning chronotype compared to young women of the neutral chronotype.

**MATERIAL Y MÉTODOS**

**Study setting**

The study was conducted in the Slovak Republic in 2017.

**Sample selection**

We recruited a sample of young women (n = 41) from a population of young women (university students) who did not engage in regular and planned physical activities, which meant that they did not do any physical activity more than 2 times a week. Six participants did not observe the rule of minimum attendance in the intervention program (22 of 31 training units, 70% attendance); accordingly, they were not included in the analysis. Two participants were classified as evening chronotype and were not included in the research.

**Participants**

The sample was divided into the morning (M-type: n = 8, mean age ± SD = 23.1 ± 1.0 years, mean height ± SD = 168.9 ± 5.8 cm, mean weight ± SD = 66.2 ± 6.8 kg) or intermediate chronotype (I-type: n = 25, mean age ± SD = 21.4 ± 1.5 years, mean height ± SD = 167.1 ± 5.4 cm, mean weight ± SD = 65.6 ± 7.8 kg). Ethical approval was obtained from the ethical committee at the Charles University under project number UNCE/HUM/032. The participants agreed to have their data used for scientific purposes and a future publication and signed an informed consent form. Measurements were carried out in accordance with the ethical standards of the Declaration of Helsinki, the ethical standards in sport and exercise science research (Harriss & Atkinson, 2015).

**Study design**

The aerobics program as intervention (Table 1) was performed for 77 days (11 weeks) in a sports hall, three times a week (Mondays, Wednesdays, Thursdays) in the morning hours from 7:15h to 8:15h. The minimal and optimal number of attended training intervention load was 31 from the 77 available. Each training unit lasted 60 minutes (minimal 31 days = 1860 minutes of the total intervention volume).

The training unit followed the pattern in Skopova & Berankova (2008), which lasted for 60 minutes with approximate intensity of 65% max of heart rate (HR, bpm: Warm up, 5 min; Preparatory part: Pre-stretching (induction cardio training), 5 min; Main part: 1. Workout, 20 min; 2. Choreography, 20 min; final part: static stretching, 10 min. All participants were equipped an HR monitor device Polar M400 (Polar Electro Oy, Kempele, Finland).

**TABLE 1. Indicators of chosen volume and content indicators of the physical intervention**

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weeks</td>
<td>11</td>
</tr>
<tr>
<td>Calendar days of intervention program (study period)</td>
<td>77</td>
</tr>
<tr>
<td>Number of loading days</td>
<td>31</td>
</tr>
<tr>
<td>Number of training units</td>
<td>31</td>
</tr>
<tr>
<td>Week volume load, in minutes</td>
<td>180</td>
</tr>
<tr>
<td>Total volume load, in minutes</td>
<td>1860</td>
</tr>
<tr>
<td>Total warm-up volume in the introduction part, in minutes</td>
<td>155</td>
</tr>
<tr>
<td>Total volume of pre-stretching part, in minutes</td>
<td>155</td>
</tr>
<tr>
<td>Total volume load of workout parts, in minutes</td>
<td>620</td>
</tr>
<tr>
<td>Total volume load of choreographies, in minutes</td>
<td>620</td>
</tr>
<tr>
<td>Total volume of static stretching in the final part, in minutes</td>
<td>310</td>
</tr>
</tbody>
</table>

**Chronotype identification**

We employed the questionnaire for chronotype identification, which is known as the CSM (Composite Scale of Morningness) (Smith et al.,...
1989). Each response (A, B, C, D, and, in some cases, E) had a definite and fixed point for all 13 questions. Finally, a particular chronotype was assigned to each participant according to the total score in the questionnaire.

Dotazník spätej väzby

Po skončení aeróbnej intervencie bol mladým ženám distribuován dotazník spätej väzby, zameraný na zisťovanie prípadných zmien stravovacích návykov počas intervencie, ktoré sú významným faktorom v súvislosti so zmenami BC.

Feedback questionnaire

A feedback questionnaire was distributed to the participants after the aerobic intervention, aimed at identifying any changes in dietary habits during the intervention that should be a significant factor in relation to changes in BC.

Anthropometric and body composition assessment

Body height (BM) was measured using a stadiometer (Medihum, Slovakia). BC and multi-frequency bioimpedance segmental analysis were performed using the following devices: Tanita MC-780MA (Tanita, Japan) in cooperation with Nutriguard-MS (Data Input, Germany). A study by Verney et al. (2015) confirmed the high reliability of the Tanita MC-780MA analyzer with the reference method dual-energy X-ray absorptiometry (DXA) on a sample of university male and female students (n = 71, age = 19 to 30 years). Currently, it is a sufficiently valid and reliable method of detecting body composition quality in clinical research (Brener et al., 2021; Mala et al., 2023). The participants were barefoot and wearing only their underwear during measurement. We conducted the diagnostics in the morning (7:00h–10:00h). The participants did not engage in any physically demanding activities and did not eat or take any drugs or other narcotics (alcohol or caffeine) that could impact BC results (Mala et al., 2020).

The following indicators of BC were measured in selected groups: Body weight (BM), body mass index (BMI), fat mass (FM%), fat free mass (FFM), muscle mass (MM), total body water (TBW), extracellular and total body water ratio (ECW/TBW), extracellular and body cell mass ratio (ECM/BCM), and phase angle (PA). The conditions used for bioimpedance measurement were kept constant (Kyle et al., 2004).

Statistical analysis

The mean (M) was used in the exploratory analysis, and the standard deviation (SD) was used within the level of variation or dispersion. In addition to absolute values and their differences, we used percentage ratio as a relative indicator of the amount of change in the effects of the intervention program on the monitored groups. Changes in the chosen parameters were detected by paired samples t-test (pre-test vs. post-test). Differences in parameters before the intervention between groups were confirmed by an independent samples t-test. Normality rozdelenia dát bol overená Shapiro-Wilk testom vo všetkých skúmaných indikátoroch telesného zloženia v pre-testoch aj posttestoch v súbore M-types aj I-types. P-hodnoty v rámci procedúry overenia normality boli v súbore M-types v intervale p = 0.07 až p = 0.96 a v súbore I-types p = 0.28 až p = 0.97. The error size of I type (α) was considered at the α level, where α = 0.05 in all statistical analyses. The effect size of the applied intervention was considered by Cohen’s d with the following criteria for effect size: d = 0.20, small effect; d = 0.50, medium effect; d = 0.80, large effect (Cohen, 1988). Effect size was also computed by Cohen “d” coefficient due to lower sample size of M-types participants. Statistical analyses were performed using IBM SPSS Statistics for Windows, Version 25.0 (Armonk, NY: IBM Corp.).

RESULTADOS

We found no statistical differences in the pre-test values between both groups (M-type vs. I-type) in the following parameters: BM, BMI, FM%, TBW, ECW/TBW, ECM/BCM, and PA. The pre-test comparison between the monitored groups showed significant differences (p<0.05) in FFM and MM (FFM: M-types: 49.4 ± 3.8 kg vs. I-types: 46.6 ± 3.1 kg; MM: M-types: 46.8 ± 3.6 kg vs. I-types: 44.2 ± 2.9 kg). The effects comparison of the aerobic intervention between M-types and I-types showed the largest difference in ECM/BCM (M-types PRE-POST d = 0.62 vs. I-types PRE-POST d = 0.01) (Tables 2, 3). Differences from the point of view of effects were not significant in other BC indicators; however, changes in indicators showed that the aerobic
intervention was more effective for M-types than for I-types. Meanwhile, we observed a significant improvement (p<0.05) between the pre-test and post-test the PA that was monitored and examined for I-types. We did not find any significant effect between pre-test and post-test in the BM and BMI in any monitored group.

**TABLE 2.** Changes in body composition parameters after physical intervention in M-types (n = 8)

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Measurements</th>
<th>Statistical analysis</th>
<th>Change (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-test</td>
<td>Post-test</td>
<td>Paired Samples</td>
</tr>
<tr>
<td>BM (kg)</td>
<td>M (SD)</td>
<td>M (SD)</td>
<td></td>
</tr>
<tr>
<td>BMI (kg.m⁻²)</td>
<td>23.3 (2.9)</td>
<td>23.3 (2.8)</td>
<td>0.17</td>
</tr>
<tr>
<td>FM% (%)</td>
<td>25.2 (4.6)</td>
<td>26.1 (5.3)</td>
<td>1.33</td>
</tr>
<tr>
<td>FFM (kg)</td>
<td>49.4 (3.8)</td>
<td>48.7 (3.8)</td>
<td>1.21</td>
</tr>
<tr>
<td>MM (kg)</td>
<td>46.8 (3.6)</td>
<td>46.3 (3.6)</td>
<td>1.19</td>
</tr>
<tr>
<td>TBW (%)</td>
<td>53.9 (3.3)</td>
<td>53.3 (3.8)</td>
<td>1.14</td>
</tr>
<tr>
<td>ECW/TBW (ratio)</td>
<td>41.4 (0.9)</td>
<td>41.5 (1.1)</td>
<td>0.42</td>
</tr>
<tr>
<td>PA (°)</td>
<td>5.66 (0.53)</td>
<td>5.81 (0.57)</td>
<td>1.74</td>
</tr>
</tbody>
</table>

BM: body weight; BMI: body mass index; FM%: body fat; FFM: fat free mass; MM: muscle mass; TBW: total body water; ECW/TBW: extracellular and total body water ratio; ECM/BCM: extracellular and body cell mass ratio; PA: phase angle; M: Sample Mean; SD: Sample standard deviation; d: Cohen coefficient effect size

**TABLE 3.** Changes in body composition parameters after physical intervention in I-types (n = 25)

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Measurements</th>
<th>Statistical analysis</th>
<th>Change (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-test</td>
<td>Post-test</td>
<td>Paired Samples</td>
</tr>
<tr>
<td>BM (kg)</td>
<td>M (SD)</td>
<td>M (SD)</td>
<td></td>
</tr>
<tr>
<td>BMI (kg.m⁻²)</td>
<td>23.5 (2.9)</td>
<td>23.7 (2.8)</td>
<td>0.90</td>
</tr>
<tr>
<td>FM% (%)</td>
<td>28.0 (6.1)</td>
<td>27.9 (6.0)</td>
<td>0.15</td>
</tr>
<tr>
<td>FFM (kg)</td>
<td>46.6 (3.1)</td>
<td>46.9 (2.9)</td>
<td>1.44</td>
</tr>
<tr>
<td>MM (kg)</td>
<td>44.2 (2.9)</td>
<td>44.6 (2.8)</td>
<td>1.42</td>
</tr>
<tr>
<td>TBW (%)</td>
<td>51.7 (4.2)</td>
<td>51.7 (4.1)</td>
<td>0.22</td>
</tr>
<tr>
<td>ECW/TBW (ratio)</td>
<td>42.1 (1.3)</td>
<td>41.9 (1.3)</td>
<td>1.38</td>
</tr>
<tr>
<td>PA (°)</td>
<td>5.89 (0.09)</td>
<td>5.89 (0.10)</td>
<td>0.04</td>
</tr>
</tbody>
</table>

BM: body weight; BMI: body mass index; FM%: body fat; FFM: fat free mass; MM: muscle mass; TBW: total body water; ECW/TBW: extracellular and total body water ratio; ECM/BCM: extracellular and body cell mass ratio; PA: phase angle; M: Sample Mean; SD: Sample standard deviation; d: Cohen coefficient effect size
DISCUSIÓN

ECM/BCM fue el principal indicador BC en el que encontramos un significativo mejoramiento en M-tipo. Este parámetro es significativo no sólo en jugadores de deportes (Bandyopadhyay et al., 2020; Mala et al., 2020) pero también en la población general (Bunc, 2018a), niños (Bunc, 2018b, et al.), y en grupos de pacientes (Malecka-Massalska et al., 2014; Ruperto et al., 2020). No encontramos ningún significativo diferenciación en el indicador BC en M-tipo (d = 0.01, 0%) en I-tipo pero confirmamos una diferenciación significativa en ECM/BCM en M-tipo con eficacia media (d = 0.62, 6.4%).

Importante cambio fue examinado en el nivel de PA, en el que detectamos mejoramiento con eficacia media en ambos grupos (M-tipo: d = 0.70, 2.7%; I-tipo: d = 0.60, 3.2%). El objetivo de nuestro trabajo fue determinar el cambio que se produjo tras el programa de intervención. También buscamos determinar cómo el entrenamiento aéreo cambió los indicadores BC en diferentes cronotipos. No encontramos ningún significativo diferencia en la mayoría de los monitoreados indicadores entre la pre-test y post-test. Para este motivo, no podíamos monitorizar y observar los efectos del entrenamiento físico en diferentes cronotipos. Estadística y diferencias significativas (<1%) no fueron encontradas en indicadores antropométricos (BM y BMI), pero podrían ser expresadas y mostradas en pequeños cambios en indicadores BC. El indicador BC es uno de los factores más significativos relacionados con un estilo de vida saludable y proporción metabólica en BC. Nuestro entrenamiento aéreo de 11 semanas no estímulo y nos animó a detectar los cambios en el BC del grupo de la muestra para examinar y monitorizar cualquier significativo efecto o mejora, especialmente pérdida de peso. Un potencial importante razón por la que estos resultados puedan ser fact, que después del entrenamiento, jóvenes mujeres reportado en el cuestionario de feedback mayor ingestión calórica aumentó durante periodo de intervención, especialmente ellos comenzaron a comer más en la noche. Este es un posible razón por la que podría afectar el peso corporal y otros BC variables.

Sin embargo, es necesario destacar que muchos factores podrían haber afectado los resultados de nuestro estudio, como la falta de un control de la ingesta calórica, un estilo de vida que puede no ser saludable (falta de sueño, la vida noturna de estudiantes, situaciones estresantes relacionadas con exámenes, y horarios y tablillas irregulares). Kim & Park (2006) implementaron un programa de intervención de 12 semanas en un grupo de estudiantes universitarios femenino cuyo peso corporal total fue >30%. No encontraron ningún significativo diferenciación entre el experimental (n = 20, intervención) y tratamiento de control (n = 24, sin intervención) desde el punto de vista de la pérdida de peso corporal y aumento de masa muscular. El programa de intervención incluyó cinco sesiones de entrenamiento (cada una duró 60 minutos). Mientras tanto, Yamazaki et al. (2013) encontraron diferencias significativas entre los indicadores BC después de ocho semanas de intervención física con baja intensidad y baja intensidad en un grupo de estudiantes universitarios femeninos. Total masa corporal disminuyó de 26.8 ± 0.5% a 24.9 ± 0.5% (p<0.01) y masa muscular aumentó de 69.1 ± 0.5% a 70.8 ± 0.4% (p<0.01). En su estudio, el tiempo dedicado a ejercicios por los estudiantes aumentó de 6.6 ± 0.7 horas antes de la intervención a 9 ± 0.2 horas a la semana durante la intervención (p<0.0001), equivalente a más de seis sesiones de entrenamiento semanales (cada sesión de entrenamiento tenía 60 minutos).

Nuestros resultados mostraron cambios en ciertos indicadores BC (ECM/BCM en M-tipo; PA en I-tipo). Significativo para la detección es el hecho de que algunos indicadores BC son más sensibles a cambios durante el regular entrenamiento físico comparado con otros indicadores. El valor de ECM/BCM del entrenamiento es interesante porque el valor de la BC ha sido reportado como uno de los mejores predictores de la eficiencia muscular, que puede predecir la performance en los atletas (Andreoli et al., 2003). Cuando se compara la BC con ECM (con una parte del cuerpo metabólicamente inactiva del cuerpo humano), el porcentaje de BC en individuos sanos debería ser más alto, y un descenso en ECM/BCM en la mayoría de los casos indica un mejoramiento de BC (Mala et al., 2010). En nuestro estudio, ambos grupos alcanzaron valores más altos de BC comparado con ECM. El 6.4% disminución en ECM/BCM en M-tipo después del entrenamiento reveló un efecto positivo del entrenamiento aplicado para este grupo.

A pesar de nuestros esfuerzos para cumplir con el objetivo del trabajo, nuestro estudio tiene algunas limitaciones, que debería ser tomado en consideración en el futuro similar a investigaciones. Recomendamos incluir dos más parámetros que son significativos desde el punto de vista de la precisión. El entrenamiento’s efectos podría ser explicado de manera más precisa con la adición de los siguientes parámetros: muestra más de “cronotipo de la mañana” participantes, respeto de zonas individuales de...
This study aimed to determine the effects of a regular aerobic intervention in the morning and intermediate chronotypes from the point of view of changes in BC indicators. The results showed that the largest effect difference was in ECM/BCM in the M-type group, in which we confirmed an improvement with a medium effect size. Meanwhile, we did not observe any change in the I-type group in this indicator. We also did not find any significant difference in the other BC indicators between M-types and I-types, which may be because of the possible slight and minor effects between the pre- and post-tests. Nonetheless, the PA indicator showed significant improvement (p<0.05) in the I-type group. The results also indicated that some BC indicators (ECM/BCM and PA) may be more sensitive to regular aerobic intervention programs compared with other parameters. These results can contribute to further research on the effects of aerobic interventions in various parts of the day on particular chronotypes. Our findings are primarily related to young women aged 18 to 30 years. Our data are not able to generalize, due to limitation related to the low number of M-type participants. Validation of the effectiveness of intervention programmes will require additional methods and tools in future research, such as: assessment of physiological and biochemical parameters and also controlling the calories intake. Our study showed a low effectiveness of the program (3 x week) at light moderate intensity on changes in body fat in young women regardless chronotype. The results of our study can serve as data for meta-analyses and systematic reviews.

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