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EFFECTIVENESS OF ZUMBA EXERCISE ON MAXIMUM OXYGEN VOLUME, AGILITY, AND MUSCLE POWER IN FEMALE STUDENTS

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Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection

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Abstract

The study purpose was to prove the effectiveness of zumba exercise on VO_2max, agility, and muscle power in students at Universitas Nusantara PGRI Kediri, East Java, Indonesia.

Materials and methods. This research is a pre-experimental research design with One group Pretest-Posttest Design. A total of 15 female students from the Student Activity Unit aerobic dance exercise at Universitas Nusantara PGRI Kediri, East Java, Indonesia, aged 19-24 years, body mass index (BMI) 19.0-24.0 kg/m^2, normal blood pressure, resting heart rate normal, normal oxygen saturation (SpO_2), voluntarily participated in the study. Zumba exercise was carried out for 30 minutes/session with an intensity of 80% HRmax with a frequency of 3x/week for 8 weeks. The measurement of maximum oxygen volume (VO_2max) used the Multi-Stage 20-m Shuttle Run Fitness Test. The measurement of leg muscle power used the vertical jump test, while the arm muscle power was evaluated using the medicine ball throw test. Data analysis used Paired Sample t-Test with a significance level of 5%.

Results. The results obtained: mean VO_2max between pretest vs post-test (26.64±4.25 vs. 30.76±4.20 mL/kg/min; $p \leq 0.001$), average agility between pretest and post-test (15.76±1.24 vs. 14.55±1.27 seconds; $p \leq 0.001$), average limb muscle power between pretest vs posttest (394.21±66.36 vs. 411.09±67.45 joule; $p \leq 0.001$), and the average arm muscle power between pretest vs posttest (123.45±17.12 vs. 138.21±13.92 joule; $p \leq 0.001$).

Conclusions. Based on the results of the study, it was concluded that Zumba exercise carried out for 30 minutes/training session, with an intensity of 80% HRmax, frequency 3x/week for 8 weeks increased VO_2max, agility, and muscle power in students at Universitas Nusantara PGRI Kediri, East Java, Indonesia.

Keywords: VO_2max, muscle power, agility, zumba exercise.

Introduction

Sports and physical activity have a good role in improving the quality of health (Granero-Jiménez et al., 2022; Pranoto et al., 2020). In addition to the good health benefits of physical activity, exercise can also provide a forum for engagement in challenging matters, exploration, skill-building, and social integration (Barber & Weichold, 2007). Zumba is a physical exercise adapted from Latin dance which was first developed in Columbia by a fitness trainer named Alberto "Beto" Perez. Zumba is a combination of salsa, cumbia, reggaeton, mambo, chachacha, soca, bhangra, belly dance, flamenco, hip hop, tango and samba dances (Suminar et al., 2018). Zumba exercises are very effective in the teaching

and learning process of physical, of adults and adolescents of school and university age are not sufficiently active (Soleiman et al., 2021).

Zumba exercises combine many sports steps that are easy to apply and help a person move many body muscles, such as arms, back, legs, and chest. This includes aerobic exercise that can increase energy expenditure (Packyanathan & Preetha, 2020). Zumba exercises help stimulate the heart and lungs, improve overall fitness, and move circulation faster. In addition, Zumba exercises can also increase the amount of oxygen sent to muscles and other body organs (Soleiman et al., 2021).

Zumba exercises do not follow traditional training methods but use all elements of essential fitness during training modules. Zumba exercises use physical strength, and all parts of the body are moved from head to toe (Parial et al., 2022). Therefore, Zumba exercises are quite important for students because regular Zumba exercises can affect psychological and social outcomes, reduce body weight and increase movement strength and blood flow to muscles. Zumba exercises positively affect the development of attributes and skills, muscle strength levels, cardiovascular endurance, and weight management (HajGhanbari et al., 2013). Several studies have stated that a motor training program accompanied by music (Zumba) has a positive contribution to weight loss (Rossmeissl et al., 2016). Zumba exercises have a positive impact on psychological and social outcomes. Based on the studies that have been carried out, higher scores were found on several physical elements (periodic respiratory endurance, motor balance, flexibility, leg strength, and neuromuscular compatibility) in students who participated in Zumba training compared to students who did not participate. Zumba exercise intervention improves health and physical fitness in women (Krishnan et al., 2015).

One way to assess a person's cardiorespiratory endurance is to measure the maximal oxygen volume level (VO_2max) to measure the capacity of the heart, lungs, and blood to carry oxygen to working muscles and measure the use of oxygen by muscles (Nugraheni et al., 2017). The most common measurement for VO_2max prediction is the Multi-Stage 20-m Shuttle Run Fitness Test (Paradisis et al., 2014; Sugiharto et al., 2022). This test is widely used by exercise scientists, teachers, coaches, and fitness advisors because it requires limited equipment, is relatively easy to perform, and is suitable for the assessment of a large number of subjects. As with all tests and measurements used to assess the components of physical fitness, critical questions must be asked regarding the repeatability and validity of the Multi-Stage 20-m Shuttle Run Fitness Test (Cooper et al., 2005). Maximum oxygen uptake is assessed by establishing an oxygen recovery curve based on the results of the Multi-Stage 20-m Shuttle Run Fitness Test (Paradisis et al., 2014). On this basis, this study aims to prove the effectiveness of Zumba exercise on VO_2max, agility, and muscle power in students at the Universitas Nusantara PGRI Kediri, East Java, Indonesia.

Materials and Methods

Study participants

This research is a pre-experimental research design with One group Pretest-Posttest Design. A total of 15 women students from the Student Activity Unit (UKM) aerobic exercise at Universitas Nusantara PGRI Kediri, East Java, Indonesia, aged 19-24 years, body mass index (BMI) 19.0-24.0 kg/m^2, normal blood pressure, resting heart rate normal, normal oxygen saturation (SpO_2) voluntarily participated in the study. All respondents received information both orally and in writing before conducting the research and respondents also stated that they were willing to participate in the research by signing informed consent. All procedures performed in our study complied with the Declaration of the World Medical Association of Helsinki on the ethical conduct of research involving human subjects.

Study organization

The Zumba exercise program is implemented and supervised by professional officers from the Faculty of Health and Sciences, Universitas Nusantara PGRI Kediri, East Java, Indonesia. Zumba exercise was carried out for 30 minutes/session with an intensity of 80% HRmax with a frequency of 3x/week for 8 weeks. Monitoring heart rate during zumba exercise using a polar heart rate monitor (Polar H10 Bluetooth Heart Rate Sensor & Fitness Tracker, Polar, Kempele, Finland) (Andarianto et al., 2022).

Data collection for measuring body height using a Stadiometer (Seca Corporation, CHINO, California, USA) (Rejeki et al., 2021). Bodyweight was measured using a digital scale (OMRON HN-289, Osaka, JAPAN) (Sugiharto et al., 2022). BMI is calculated using body weight (kg) divided by body height (m^2) (Raharjo et al., 2021). Measuring blood pressure using a digital sphygmomanometer (OMRON Model Deluxe HEM-8712 BASIC, JAPAN) on the non-dominant arm 3 times in a row with a 2-minute rest interval between the two measurements, then the average value of the three measurements was taken (Andarianto et al., 2022; Raharjo et al., 2021). Measurement of heart rate rest (HR-rest) and oxygen saturation (SpO_2) using the Beurer Pulse Oximeter PO-30 (Rejeki et al., 2021). Measurement of maximum oxygen volume (VO_2max) using the Multi-Stage 20-m Shuttle Run Fitness Test (Paradisis et al., 2014). Measurement of leg muscle power using the vertical jump test (García-Ramos et al., 2017; Cuk et al., 2014), while arm muscle power was evaluated using the medicine ball throw test (Leite et al., 2020). Measurements of VO_2max, agility and muscle power were carried out pretest and 1x24 hours posttest for 8 weeks of zumba exercise intervention.

Statistical analysis

Data analysis used Statistical Package for Social Science (SPSS) version 21 software. Shapiro-Wilk test was used for normality test analysis with a significant level ($p \geq 0.05$). Paired Sample t-Test was used to compare the average VO_2max, agility, and muscle power between the pretest and post-test. The data is displayed with Mean ± Standard Deviation (SD). All statistical analyzes use the significant level ($p \leq 0.05$).

Results

The results of the descriptive analysis of research respondents' characteristics which include demographics, and anthropometry are presented in Table 1.

Table 1. The results of the descriptive analysis of the characteristics of research respondents

Parameters	n	Mean	Std. Deviation
Age (yrs)	15	21.13	1.69
Body height (m)	15	1.56	0.04
Bodyweight (kg)	15	53.47	5.53
Body mass index (kg/m^2)	15	22.04	1.57
Systolic blood pressure (mmHg)	15	115.80	2.93
Diastolic blood pressure (mmHg)	15	75.87	2.90
Heart rate rest (bpm)	15	76.27	2.91
Oxygen saturation (%)	15	97.33	1.11

Based on the results of the descriptive analysis of the characteristics of the respondents, the research shows that the respondents' average age (21.13±1.69 yrs), bodyweight (53.47±5.53 kg), body height (1.56±0.04 m), body mass index (22.04±1.57 kg/m^2), systolic blood pressure (115.80±2.93 mmHg), diastolic blood pressure (75.87±2.90 mmHg), heart rate rest (76.27±2.91 bpm), oxygen saturation (97.33±1.11 %). The results of the analysis of the average maximum oxygen volume (VO_2max), agility, and muscle power between pretest vs. posttest are presented in Figure 1.

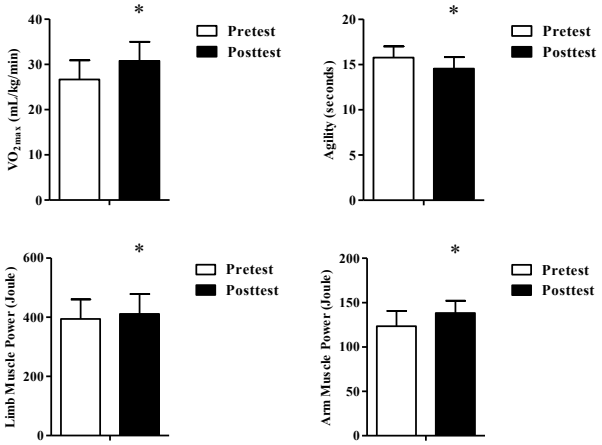

Fig. 1. The results of the analysis of the average VO_2max, agility, and muscle power between pretest vs. posttest. Description: Maximum oxygen volume (VO_2max). Data presented with Mean ± standard deviation (SD). *Significant vs. Pretest ($p \leq 0.001$). The p-value is obtained using the Paired Sample t-Test.

Based on Figure 1, it can be seen that there is a change in the average maximum oxygen volume (VO_2max), agility, and muscle power between pretest vs post-test. The results of the Paired Sample t-Test show that there is a significant difference in the mean VO_2max between the pretest vs. posttest (26.64 ± 4.25 vs. 30.76 ± 4.20 mL/kg/min; $p \leq 0.001$), mean agility between pretest vs. posttest (15.76 ± 1.24 vs. 14.55±1.27 seconds; $p \leq 0.001$), the mean limb muscle power between pretest vs. posttest (394.21 ± 66.36 vs. 411.09 ± 67.45 joule; $p \leq 0.001$), and the mean arm muscle power between pretest vs. posttest (123.45 ± 17.12 vs. 138.21 ± 13.92 joule; $p \leq 0.001$).

Discussion

This study aims to determine the effectiveness of zumba exercise on maximum oxygen volume (VO_2max), agility, and muscle power in students at Universitas Nusantara PGRI Kediri. The main finding in our study was that there was a significant increase in zumba exercise on VO_2max, agility, and muscle power between pretest and posttest. These findings provide the support that zumba exercise has many health benefits, including increasing VO_2max, agility, and muscle power. These results are in line with the results of research conducted by Donath et al. (2014) concluded that zumba exercise improves well-being, aerobic fitness level, and neuromuscular function in female students. Vendramin et al. (2016) found evidence that zumba exercise was effective in increasing aerobic capacity. VO_2max is the main parameter of aerobic capacity (Poole & Jones 2017). Poor cardiorespiratory fitness has been linked to chronic disease and premature death (Ricci et al., 2020). Exercise and physical activity, such as dancing, have a significant effect on improving mental health, although evidence suggests that many psychological, physiological, and biochemical processes may be involved (Domene et al., 2016; Teychenne et al., 2008; Crone et al., 2006; Salmon, 2001). Zumba exercise has been shown to reduce the risk of chronic disease by increasing VO_2max through many adaptations of the body by physical activity such as increasing cardiac size, cardiac output, stroke volume, or the number of mitochondria and mitochondrial function (Chavarrias et al., 2020; Bacon et al., 2013; Wilson et al., 2016). Since the whole body is trained at moderate to vigorous intensity and includes jumps, moves, core exercises, and choreography with exaggerated arm movements, among other things, increases in muscle strength can be possible from low starting levels (Barranco-Ruiz & Villa-González, 2020).

The World Health Organization (WHO) recognizes physical inactivity as a global public health burden, representing the fourth leading risk factor for global death, above high blood pressure, smoking, and high blood glycemia (Barranco-Ruiz & Villa-González, 2020; Benjamin et al., 2017). In addition to the health hazards associated with the metabolic changes and increased belly fat that usually accompany menopause, many women experience weight gain as a function of aging (Rossmeissl et al., 2016; Al-Safi et al., 2015; Lovejoy, 2009). Weight gain accompanied by a tendency to increase central fat distribution is common in middle-aged women. These changes are a result of aging, decreased estrogen levels after menopause, and other unique effects on postmenopausal women that interfere with adopting a healthy lifestyle (Kapoor et al., 2017).

Zumba exercise is the second most popular physical activity after walking for women of all ages (25 to 75 years and over) (Fan et al., 2013). Regular physical activity is considered one of the most important factors for lifestyle, maintaining good health, and increasing life expectancy, especially in the elderly (Douka et al., 2019). Public health professionals around the world should emphasize the need to increase activity levels during leisure time, as well as the need to incorporate physical activity into activities of daily living (Lee et al., 1997). Norouzi et al. (2020) described that aerobic exercise and zumba exercise could be recommended in addition to standard care to improve working memory and reduce the severity of depressive symptoms among female patients with

fibromyalgia. On the other hand, exercise therapy has become more widely used because of its benefits for the cardiovascular system, emotional state, and systemic function (Xie et al., 2020). Lack of physical activity has a hugely adverse effect on health all over the world. Reducing or eliminating these unhealthy behaviors can substantially improve health (Lee et al., 2012). Zumba exercise is considered an activity that offers different sensory engagements and connects movement to music with self-expression and applies different aspects of personality (Kaufmann, 2011; Studer-Lüthi & Züger, et al., 2012). Sports and daily activities can not be separated from skeletal muscle activity, the most important attribute of skeletal muscle is the ability to generate power, the product of strength and speed of movement (Kraemer & Newton, 2000). So that zumba exercises can be used as an effective sports activity to improve various components of health for the body.

Conclusion

In general, it can be concluded that the Zumba exercise which is carried out for 30 minutes/training session, with an intensity of 80% HRmax, which is carried out 3x/week for 8 weeks significantly increases the maximum oxygen volume (VO_2max), agility, and muscle power in the students of Universitas Nusantara PGRI Kediri, East Java, Indonesia. Based on the results of the study, it can be suggested that Zumba exercise can be an alternative non-pharmacological approach to improving an active lifestyle as an effort to improve health quality.

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Conflict of interest

No conflic of interest.

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ЕФЕКТИВНІСТЬ ВПЛИВУ ВПРАВ ЗУМБИ НА МАКСИМАЛЬНЕ СПОЖИВАННЯ КИСНЮ, СПРИТНІСТЬ І М'ЯЗОВУ СИЛУ У СТУДЕНТОК

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Авторський вклад: A – дизайн дослідження; B – збір даних; C – статаналіз; D – підготовка рукопису; E – збір коштів

Реферат. Стаття: 7 с., 1 табл., 1 рис., 45 джерел.

Метою дослідження було довести ефективність впливу вправ зумби на максимальне споживання кисню VO2max, спритність і м'язову силу у студенток Кедірійський університет Нусантара Асоціації вчителів Індонезії, Східна Ява, Індонезія.

Матеріали та методи. Це дослідження є передекспериментальною схемою дослідження з планом попереднього та підсумкового тестування на одній групі. Загалом у дослідженні добровільно брали участь 15 студенток зі студентської секції танцювальної аеробіки в Кедірійський університет Нусантара Асоціації вчителів Індонезії, Східна Ява, Індонезія, віком 19-24 роки, індекс маси тіла (ІМТ) 19,0-24,0 кг/м^2, артеріальний тиск нормальний, показник ЧСС у стані спокою нормальний, нормальне насичення киснем (SpO_2). Вправи зумби проводили по 30 хвилин/заняття з інтенсивністю 80% максимальної ЧСС (HRmax) із частотою 3 рази/тиждень протягом 8 тижнів. Для вимірювання максимального споживання кисню (VO_2max) використовували багатоетапний фітнес-тест човникового бігу на 20 метрів. Для вимірювання сили м'язів ніг використовували тест «Вертикальний стрибок», тоді як силу м'язів рук оцінювали за допомогою тесту «Кидок медболу». Для аналізу даних використовували t-критерій Стьюдента для парних вибірок за рівня значущості 5%.

Результати. Одержані результати: середній показник VO_2max у попередньому тестуванні порівняно з підсумковим (26,64±4,25 проти 30,76±4,20 мл/кг/хв; $p \leq 0,001$), середній показник спритності у попередньому тестуванні порівняно з підсумковим (15,76±1,24 проти 14,55±1,27 секунди; $p \leq 0,001$), середній показник сили м'язів кінцівок у попередньому тестуванні порівняно з підсумковим (394,21±66,36 проти 411,09±67,45 джоуля; $p \leq 0,001$) і середній показник сили м'язів рук у попередньому тестуванні порівняно з підсумковим (123,45±17,12 проти 138,21±13,92 джоуля; $p \leq 0,001$).

Висновки. За результатами дослідження було зроблено висновок, що вправи зумби, які проводили по 30 хвилин/заняття з інтенсивністю 80% максимальної ЧСС (HRmax) і частотою 3 рази/тиждень протягом 8 тижнів, підвищили показники VO_2max, спритності та сили м'язів у студенток Кедірійський університет Нусантара Асоціації вчителів Індонезії, Східна Ява, Індонезія.

Ключові слова: VO_2max, м'язова сила, спритність, вправи зумби.

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