

Impact of specific calisthenics conditioning program on physiological and health-related fitness parameters of sedentary adults

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ABSTRACT

Background: Physical inactivity is a global pandemic, with a significant proportion of adults classified as sedentary, and it leads to a chief threat issue for numerous lasting health problems. The present study examined the effect of a specific calisthenics conditioning program on the metabolism, skeletal weight, body age, body fat, and blood pressure of sedentary adults. **Methods:** The program was implemented for 10 weeks, with 15 participants in each training and control group. A bioelectrical impedance analysis scan was conducted to evaluate the participant's metabolism and health-related parameters, while blood pressure was assessed using a sphygmomanometer. The participants were exposed to a specific calisthenics conditioning program for 10 weeks, three days a week, with an emphasis on muscular strength, muscular endurance, and cardiorespiratory. **Results:** The specific calisthenic conditioning program has significantly improved diastolic blood pressure, resting metabolism, heart rate, and body fat. However, the training had insignificant effects on systolic blood pressure, skeletal muscle percentage, and body age. **Conclusion:** The study shows that using a calisthenic conditioning program has a promising and positive impact on sedentary adults' physiological and health-related fitness parameters.

Keywords: Health-related fitness, Calisthenics program, Conditioning, Cardiorespiratory endurance, Resting metabolism, Blood pressure, Body fat.

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INTRODUCTION

Physical inactivity is a global pandemic, with a significant proportion of adults classified as sedentary.¹ This lack of regular exercise is a chief threat issue for numerous lasting health problems, which comprises cardiovascular illness, type 2 diabetes, and certain cancers.² Increasing physical activity levels, particularly among sedentary adults, is a crucial public health objective to promote well-being and reduce the health burden.³

A specific conditioning program is a need of the hour; it is designed to cater to individual demands in terms of targeting specific physiological and health-related fitness components. These components typically comprise cardiovascular endurance, muscular strength, muscular endurance, flexibility, and body composition.³

Lack of exercise and unhealthy lifestyle choices contribute to a major global health issue, with around more than 56% of growing adults as classified as sedentary. Proper health and fitness choices are key to a better life. Lack of physical activity directly affects our body and is associated with a multitude of health risks; it causes diseases, including increased risk of cardiovascular illness, type 2 diabetes, certain cancers, and certain musculoskeletal disorders. The World Health Organization (WHO) recommends regular physical activity for adults to improve overall health and well-being.⁴

A conditioning program is a structured exercise routine to improve specific fitness components. The program targets key health areas like cardio, muscle strength and endurance, flexibility, and body composition.⁵ Regular participation in

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calisthenics programs effectively mitigates the negative health consequences of a sedentary lifestyle.

This study investigates the impact of a specifically designed calisthenic conditioning program on the health-related fitness of sedentary adults. Health-related fitness encompasses several key components essential for daily living and overall well-being, including major fitness components of health such as endurance, strength, flexibility, and body composition.

Calisthenics was discovered by the Greek civilization and was related to the ancient gymnastics invented in ancient Greece and linked to Greco-Roman gymnastics. This type of workout means strengthening and working with body weight. Usually, this includes a variety of movements without any equipment.⁶

Several studies highlight the influence of weight training and gym training with equipment, but whether the calisthenic

conditioning program can effectively improve health-related fitness markers in a sedentary population is an area of concern. Therefore, this research work can contribute valuable insights into designing and promoting effective calisthenic exercise interventions tailored to increase physical fitness and potentially reduce the risk of chronic diseases in this high-risk group. The potential implications of the research findings would help promote physical activity and improve public health among sedentary adults.^{4,7-10} The present study examined the effect of a specific calisthenics conditioning program on the metabolism, skeletal weight, body age, body fat, and blood pressure of sedentary adults.

MATERIALS AND METHODS

Subjects

The study was conducted from January to April 2024 on 30 adult individuals grouped into 'Training' and 'Control' groups with 15 participants each. Only sedentary male volunteers of 25-35 years who were not participating in any physical activity or conditioning program were incorporated in this research study (Table 1). The study was confined to a calisthenic training program, which includes bodyweight exercises with different training loads and levels of intensity. The participants were informed about the testing and experiment procedure before training, including the positive and possible harmful effects. The participants were briefed about the exercise and how to perform the routine with the help of a demonstration. Although the training was conducted under expert supervision, they were guided on testing and were informed about the risks, such as dehydration and overexertion, while performing the exercise. Written informed consent regarding participation was obtained before the commencement of the training session. The Institutional Ethics Committee, Amity School of Physical Education and Sports Science, Amity University cleared the study.

Procedures

The volunteers were properly instructed, and pre-training data collection was completed. Heart rate and blood pressure were noted by experienced and trained personnel. All the manual data collection was done using standard clinical techniques. Body fat, body age, resting metabolism, and skeletal muscle mass were recorded through a BIA scan. A specific calisthenic conditioning program was formulated and validated with the help of experts in the field. The program was administered thrice weekly (Tuesday, Thursday, and Saturday) for 10 weeks. The scientific exercise program was formulated with specific levels, sets, repetitions, and intensities, details of which are mentioned in Table 2.

Statistical Analysis

All the variables were analyzed with the help of mean, standard deviation, and dependent 't' Test. Comparison and effect on the training and control group on the pretest and

Table 1: Anthropometric parameters of the participants

	Control group	Training group
Age (Years)	28.8 ± 2.68	29.27 ± 3.47
Weight (kg)	73.30 ± 6.78	74.90 ± 6.68
Height (cm)	172.57 ± 2.69	172.26 ± 1.93
Body mass index	24.63 ± 2.34	25.23 ± 2.12
Dietary habits (veg vs non-veg)	2:1	2:1
Indoor exercises sessions	Nil	Thrice a week
Outdoor exercises sessions	Nil	Nil
Playing session outdoors	Weekly once	Weekly once

post-test data were analyzed with the help of the dependent 't' test. The significance level was defined at 0.05. Data was analyzed using Microsoft Excel 2003.

RESULTS

The present study compared the effects of the calisthenics conditioning program training on the sedentary adult male volunteers. The study comprised two groups, to which the volunteers were assigned randomly and employed for 10 weeks. The studied physiological parameters like resting heart rate (Beats/minute), systolic BP (mmHg), diastolic BP (mmHg), resting metabolism (kcal), body age, skeletal muscle (%), and body fat (%) showed that there was not much difference between the volunteers of the recruited study groups (Figure 1).

Although there were not much alterations in either of the studied parameters, the calisthenics conditioning program altered some of the tested health-related parameters significantly (Table 3). The intervention of applied specific

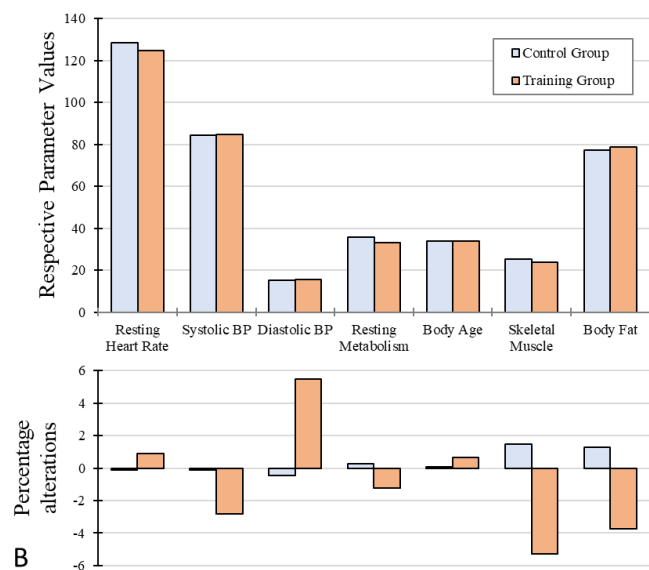


Figure 1: A. comparison of the groups for their parameter values before the specific calisthenics conditioning program starts. B. comparison of the groups in terms of percentage alterations of their pre-program parameter values after the calisthenics conditioning program

Table 2: Characteristics of calisthenics conditioning program with training load and exercise intensity

Exercises	Levels	Sets × Repetitions	Intensity
Squats/ Wall Squats	Level 1 (W1-W4)	2 × 20 reps / 2 × 30 s	Low
	Level 2 (W5-W8)	2 × 30 reps / 2 × 45 s	Moderate
	Level 3 (W9,W10)	3 × 30 reps / 2 × 60 s	High
Plank	Level 1 (W1-W4)	2 × 30 s	Low
	Level 2 (W5-W8)	2 × 60 s	Moderate
	Level 3 (W9,W10)	3 × 60 s	High
Side plank	Level 1 (W1-W4)	2 × 30 s	Low
	Level 2 (W5-W8)	2 × 60 s	Moderate
	Level 3 (W9,W10)	3 × 60 s	High
Lunges/ reverse lunges	Level 1 (W1-W4)	2 × 15	Low
	Level 2 (W5-W8)	2 × 25	Moderate
	Level 3 (W9,W10)	3 × 30	High
Pushups/ knee pushups	Level 1 (W1-W4)	2 × 15	Low
	Level 2 (W5-W8)	2 × 20	Moderate
	Level 3 (W9,W10)	3 × 25	High
Crunches/ leg raises	Level 1 (W1-W4)	2 × 20 / 2 × 15	Low
	Level 2 (W5-W8)	2 × 25 / 2 × 20	Moderate
	Level 3 (W9,W10)	3 × 25 / 2 × 25	High
Stair climb	Level 1 (W1-W4)	2 × 30	Low
	Level 2 (W5-W8)	2 × 35	Moderate
	Level 3 (W9,W10)	3 × 30	High
Jogging (Treadmill)/ Walking	Level 1 (W1-W4)	20 min	Low
	Level 2 (W5-W8)	15 min	Moderate
	Level 3 (W9,W10)	25 min	High
High knees/ alternate knee ups	Level 1 (W1-W4)	2 × 30	Low
	Level 2 (W5-W8)	2 × 40	Moderate
	Level 3 (W9,W10)	3 × 40	High
Jumping jacks	Level 1 (W1-W4)	2 × 30	Low
	Level 2 (W5-W8)	2 × 45	Moderate
	Level 3 (W9,W10)	3 × 40	High

Note: W1 to W10 represents = Respective training weeks. s = seconds. reps = repetitions

calisthenics conditioning program resulted in statistically significant changes in the training group's diastolic blood pressure ($p = 0.0179$), resting metabolism ($p = 0.0006$), body fat percentage ($p = 0.0003$) and resting heart rate ($p = 0.0061$). However, the systolic blood pressure ($p = 0.2760$), body age (0.1599), and skeletal muscle mass ($p = 0.1099$) of the training group showed no significant difference after training. On the other hand, none of the studied parameters were altered significantly in the case of the Control group.

DISCUSSION

Body composition refers to the proportion of fat mass to lean mass in a person, and it is a critical aspect of overall health, influencing physical fitness, disease risk, and quality of life. Our study revealed that the calisthenic conditioning program helps in the reduction of the fat mass percentage of the participants. The comparison of the pre-and post-test results clearly indicates the participants have reduced their body fat mass after participating in this specific conditioning program. These results are consistent with the several studies conducted on how physical activity, especially calisthenics, helps in mitigating obesity and fat percentage amongst various age groups of people.⁶⁻¹¹ It was concluded that regular physical activity reduces the fat mass in sedentary people. Additionally, body fat percentages are also associated with better and enhanced metabolism. Our study investigated the influence of physical activity on metabolism and highlighted some relevant and interesting findings. Though resting metabolism depends on several lifestyle factors, the activity level of an individual is decisive in maintaining the resting metabolism of an individual. The current study depicts that the training group has shown significant changes in the resting metabolism whereas there was no improvement in the control group. Therefore, it may be suggested that the Training group might have benefitted from the training program. World Health Organisation and many health reports^{3,12} indicated the positives of physical activity on metabolism and overall health. In terms of resting metabolism, our study verified that calisthenic activity could enhance the resting metabolism.

Blood pressure and heart rate indicate the level of cardiovascular fitness in an individual. Athletes possess a lower resting heart and control systolic and diastolic blood pressure as they engage in consistent physical activity. Results of the study showed that calisthenic activity helps improve sedentary adults' resting heart rate and diastolic blood pressure. These findings are consistent with many studies¹³⁻¹⁷ where the investigation was done on the effect of exercise type and intensity on cardiovascular components such as heart rate and blood pressure. However, there was no significant improvement in the systolic blood pressure of the participants, which means that the intensity and aerobic component of the training program were not sufficient to increase the systolic blood pressure of the participants.

Another relevant finding of the study was an improvement in resting heart rate amongst the participants, which was oblivious as when a sedentary individual participates in a regular exercise regime, the heart rate is destined to improve. The study depicts that the training group's resting heart rate improved significantly. Though calisthenic exercises are simple exercises done with the help of body weight, they can influence the cardiovascular and muscular systems in a significant manner. Many studies indicated similar results to the point that resting heart rate and cardiac health of sedentary adults have improved significantly after physical activity and calisthenic training protocols.^{5,17-20}

Table 2: Effect of calisthenics conditioning program on the physical and health-related parameters of the recruited volunteers

	Control group		Training group	
	Pretest	Post-test	Pretest	Post-test
Resting heart rate	77.26 ± 7.50	78.26 ± 6.71	78.93 ± 7.01	76.00 ± 7.66*
Systolic BP (mmHg)	128.33 ± 7.51	128.20 ± 7.09	124.86 ± 7.64	126.00 ± 3.44
Diastolic BP (mmHg)	84.40 ± 4.88	84.3 ± 4.48	84.70 ± 5.25	82.3 ± 2.19*
Resting metabolism (kcal×100)	15.34 ± 1.70	15.27 ± 1.35	15.70 ± 1.78	16.56 ± 1.44*
Body age	35.90 ± 5.44	36.00 ± 4.74	33.00 ± 5.75	32.60 ± 5.28
Skeletal muscle (%)	34.03 ± 2.68	34.06 ± 2.63	33.78 ± 3.55	34.00 ± 3.15
Body fat (%)	25.51 ± 4.23	25.88 ± 3.32	23.99 ± 4.49	22.72 ± 4.02*

* indicates a significant ($p < 0.05$) difference in comparison to the pretest value.

Body age and skeletal muscle are physiological parameters that primarily depend on diet and genetic factors. The current study disclosed only insignificant changes in body age and skeletal muscle in the case of both the training and control groups. As a person grows old, there are several structural and functional changes in the individual's skeletal muscle and body age. While lifestyle and diet influence the status and condition of skeletal muscle and body age, physical activity and exercise are found to be beneficial in maintaining and regenerating the skeletal muscle in a person's body.²¹ In our study, the participants did not show improvement in the body age and skeletal because these variables depend on many different factors, including diet, genetics, stress, and exercise duration and intensity. A study highlighted that skeletal muscle can be improved with the appropriate permutation of time and intensity of the exercise to achieve better skeletal muscle capillarization.²²

Coaches, exercise physiologists, and physical training instructors can utilize this program to formulate training programs for their clients and students. The study sheds light on the effect of calisthenics on various physiological parameters, specifically body mass, heart rate, and blood pressure. It was concluded that the designed program effectively reduced body fat percentage and improved the resting heart rate, diastolic blood pressure, and resting metabolism of the sedentary adult population. The limitation of the study was that the training program was restricted to one gender, and the duration of training was limited. However, a longitudinal study should be conducted to understand the impact of this specifically designed calisthenics training program on other parameters such as skeletal age and body age.

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PEER-REVIEWED CERTIFICATION

During the review of this manuscript, a double-blind peer-review policy has been followed. The author(s) of this manuscript received review comments from a minimum of two peer-reviewers. Author(s) submitted revised manuscript as per the comments of the assigned reviewers. On the basis of revision(s) done by the author(s) and compliance to the Reviewers' comments on the manuscript, Editor(s) has approved the revised manuscript for final publication.