COMPETITOR:
JURNAL PENDIDIKAN KEPELATIHAN OLAHRAGA
e-ISSN: 2657-0734 & p-ISSN: 2085-5389 ‖ Volume 18, Number 1, 2026 ‖ P.1250-1261

Effect of Calisthenics Training During Ramadan On Body Physiological And Fitness Among Adolescents

Galih Cahya Sukma Samudera Budi[1A-E*], Bayu Agung Pramono[2B-D]
[1,2] Universitas Negeri Surabaya, Jawa Timur, Indonesia
galihcahya.22005@mhs.unesa.ac.id, bayupramono@unesa.ac.id

ABSTRACT
This study aims to identify the effects of calisthenics training during Ramadan on the blood pressure [BP], resting heart rate [RHR], blood glucose [B-Glu], body composition (Body Weight [BW], Body Mass Index [BMI], %Fat, %Water, Muscle Mass [MM], Bone Mass [BM], Basal Metabolic Rate [BMR], Visceral Fat [VF]) and physical fitness (Strength, Agility, Speed, Power, VO2Max). This quasi-experimental study involves 30 healthy adolescents as samples (Male = 22, Female = 8). The study involved two groups, namely treatment group (calisthenics training) = 15, control group (30-minutes of walk) = 15. The samples did training 4-times a week for 3 weeks. Furthermore, for treatment group, there are significant differences between the pre and post-test on Systolic BP, B-Glu, BW, %Fat, %Water, MM, Agility, Power, and VO2Max ($p < 0.05$). Nevertheless, thereare no significant differences between pre and post-test on Diastolic BP, RHR, BM, BMR, Strength, and Speed ($p > 0.05$). As for control group, there are also significant differences between pre and post-test on Systolic BP, RHR, BW, %Fat, %Water, and Agility (p 0.05).

ARTICLE HISTORY
Received: 2026/02/15
Accepted: 2026/02/23
Published: 2026/02/25

KEYWORDS
Ramadan;
Calisthenics Training;
Body Composition;
Fitness;
Adolescscents.

AUTHORS' CONTRIBUTION
A. Conception and design of the study;
B. Acquisition of data;
C. Analysis and interpretation of data;
D. Manuscript preparation;
E. Obtaining funding

Cites this Article : Budi, G.C.S.S.; Pramono, B.A. (2026). Effect of Calisthenics Training During Ramadan On Body Physiological And Fitness Among Adolescents. **Competitor: Jurnal Pendidikan Kepelatihan Olahraga**. 18 (1), p.1250-1261

INTRODUCTION

The lives of Muslims throughout the world are based on five main pillars, one of which is Ramadan Fasting (RF), where a Muslim refrains from lust, including eating and drinking from sunrise to sunset. Ramadan is the ninth month in the Islamic Calendar based on the lunar, and celebrated by Muslims for reflection, prayer, and fasting. The duration of Ramadan fasting depends on geographical location and season, it can be as long as 17 hours a day during summer in temperate climates (Meckel et al., 2008). Before fasting, a Muslim first performs sahur or "pre-dawn meal", namely eating in the early morning or before dawn. During Ramadan fasting, it's very easy to find someone experiencing acute dehydration due to dietary changes (Molla, 2003)(Shirreffs & Maughan, 2008). So, many of them reduce their level of daily physical activity. Previous research found that RF has a significant influence on changes in body composition (Husain et al., 1987)(Adlouni, 1997)(Khan & Khattak, 2002)(Fedail et al., 1982)(Larijani et al., 2003).

Discuss about "Sport and Ramadan", the most important discussion is improving health and fitness through physical exercise in all groups. This is very important to prevent cases of non-communicable diseases (NCD). Non-communicable diseases (NCD) kill 41 million people every year, equivalent to 74% of all deaths globally. The biggest cause of NCD death is cardiovascular disease with 17.9 million people every year, followed by cancer (9.3 million), respiratory disease (4.1 million), and diabetes (1.5 million) (World Health Organization Global Health Observatory, 2023). These four disease groups represent the biggest NCD challenge in the Southeast Asia region, which is the main cause of death due to NCD in the Southeast Asia region, claiming up to 55% of total lives each year (World Health Organization Regional Office for South-East Asia, 2013).

The globalization of unhealthy lifestyles contributes to these diseases. Behaviors that can be modified such as smoking, lack of exercise, poor diet, and excessive alcohol consumption, all contribute to the likelihood of developing non-communicable diseases (NCD). Lack of exercise is responsible for 830,000 fatalities each year (Institute for Health Metrics and Evaluation, 2020). Unhealthy diets and a lack of physical activity can cause elevated blood pressure, blood glucose, blood lipids, and obesity (World Health Organization, 2023). These are known as metabolic syndromes, and they can contribute to cardiovascular disease, the major cause of NCD mortality.

Increased blood pressure is the primary metabolic syndrome responsible for the highest number of deaths worldwide, accounting for 19% of all deaths (World Health Organization, 2023). High blood glucose levels and overweight or obesity follow closely behind. Excessive consumption of glucose, particularly from sweet foods and drinks, reduces physical activity levels in adolescents and could increase the risk of obesity (Reilly & Saltiel, 2015). Based on the World Health Organization survey, over 340 million kids and adolescents aged 5 to 19 were overweight or obese in 2016, representing over 18% of the world's population in this age group (World Health Organization, 2024). Obesity in adolescents has negative impacts on health, not only in the short term but also in the long term. Obesity in short term increases the possibility of several medical conditions, including hypertension, hyperlipidemia, and diabetes (Ogunbode et al., 2011). In the longer term, obesity in adolescents increases the risk of chronic diseases like cardiovascular disease and metabolic disorders (Ogunbode et al., 2011).

Implementing prevention strategies is essential to reducing the risk of non-communicable diseases and improving overall health. Exercise during Ramadan is an important topic, considering that lots of people are observing fasting and encountering changes in their daily routines. Recent empirical evidence on training during Ramadan includes studies of resistance training, HIIT/HIFT, and research in young athletes: some studies maintain that strength programs moved to after iftar or adjusted in volume can maintain or even increase strength, while for HIIT and endurance, results depend on timing and nutritional management; some HIIT protocols during Ramadan still improve fitness components when performed after iftar and with adequate hydration (Triki et al., 2024). Research specifically in adolescents/young athletes (studies in U14-U17) indicates that changes in sleep and nutrition patterns during Ramadan affect some aspects of

Galih Cahya Sukma Samudera Budi[1A-E*], Bayu Agung Pramono[2B-D]
galihcahya.22005@mhs.unesa.ac.id[1*]

fitness. Still, structured and supervised training can minimize performance declines, adapting to adolescents' needs if interventions are tailored (Guembri et al., 2024).

Calisthenics is a form of resistance training that utilizes body weight as the primary load to generate strength, endurance, and neuromuscular stability. Core movements such as push-ups, pull-ups, squats, and planks require simultaneous coordination of multiple muscle groups, making them functional and relevant for daily activities. According to Kotarsky et al., 2018 (Kotarsky et al., 2018), progressively structured calisthenics training can significantly increase upper body strength through neuromuscular adaptation and increased muscle performance.

Metabolically, Ramadan fasting forces the body to use energy reserves during the fasting phase. Decreased intrahepatic/muscular glycogen can trigger increased fat mobilization and ketone production as an alternative fuel source during prolonged fasting. These changes vary according to the daily fasting duration and eating patterns during breaking the fast/suhoor. At the hormonal level, modern studies report changes in the dynamics of energy- and appetite-related hormones (e.g., insulin, ghrelin, leptin) as well as cortisol fluctuations that often show phase shifts (altered diurnal patterns), so that metabolic responses during Ramadan are not always linear and are influenced by the time of measurement (Abdullah et al., 2020). Hydration and plasma volume can also be affected; many studies report reduced daytime hydration and hematological variations (e.g., transient increases in hematocrit/hemoglobin in some groups), especially when the weather is hot or fluid intake is inadequate at night (Khalfoun et al., 2024).

Calisthenics combined with a 30-minute walk (aerobic exercise) was chosen because it is an accessible, low-intensity form of exercise that requires minimal equipment and supervision, making it easily implemented by adolescents in a variety of settings, including during fasting periods such as Ramadan when high-intensity exercise may be less tolerated due to reduced energy intake and hydration challenges. This practical adaptability aligns with recent evidence showing that simple, sustainable physical activity interventions can still produce meaningful health benefits across diverse populations (Kim et al., 2025).

From a physiological perspective, the combination of aerobic and calisthenics training produces different effects on the primary dependent variables. Aerobic activity, such as walking, has been associated with weight loss and body fat reduction, whereas resistance training, including calisthenics, can increase lean muscle mass and strength (Li et al., 2025). In addition, a recent meta-analysis showed that combining multiple exercise modalities resulted in significant improvements in cardiometabolic markers, such as fasting glucose control, blood pressure, and cardiorespiratory fitness, when compared with single-modality training alone (AL-Mhanna et al., 2024).

In terms of fitness outcomes, aerobic exercise, such as walking and bodyweight training, has been consistently associated with improvements in health-related physical fitness parameters, including aerobic capacity (VO_2 max) and muscle strength. A meta-analysis highlighted that aerobic and combined exercise programs can modestly improve cardiorespiratory fitness and physical function, which are strongly correlated with a

Galih Cahya Sukma Samudera Budi[1A-E*], Bayu Agung Pramono[2B-D]
galihcahya.22005@mhs.unesa.ac.id[1*]

reduced risk of non-communicable diseases (Jayedi et al., 2024). Furthermore, interventions that include a strength training or calisthenics component contribute to improvements in musculoskeletal strength and functional fitness, which are important for performance and activities of daily living (Kim et al., 2025).

Relevant research shows that calisthenics is effective in improving fitness, and that Ramadan fasting can affect physiological performance. However, no research has specifically examined the effects of calisthenics training during Ramadan on adolescent fitness and physiology, particularly on variables such as VO_2max, resting heart rate, blood pressure, body composition, and physical fitness. Therefore, this study is needed to fill this scientific gap. This study aims to determine the effect of doing physical activity such as calisthenic and walking during Ramadan on body composition, blood pressure, pulse rate and blood glucose levels. On the other hand, it also aims to find out whether doing calisthenic training during Ramadan can improve a person's physical abilities.

METHODS

This study using quasi-experimental methods with non-equivalent (pretest-posttest) control group design conducted in Ramadan 2024 (March-April). The sampling method used in this study was the purposive sampling method involves 30 healthy adolescents who are student and aged between 18-20 years. The sample was divided into two groups which 15 adolescents (Male = 11, Female = 4) were categorized as the treatment group and the remaining 15 adolescents (Male = 11, Female = 4) were categorized as the control group.

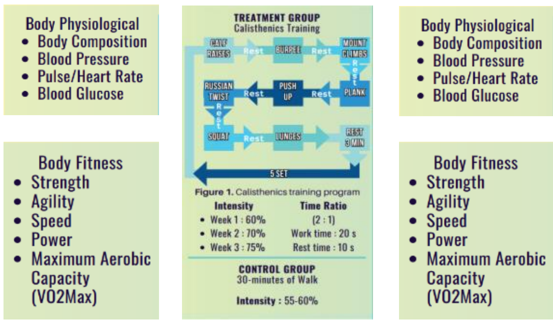

Figure 1.
Research Procedure

Body Composition

Body composition measurements in this study used BIA (Tanita BC-545N Inner-Scan Body Composition Monitor, Germany), with an accuracy of up to 0.1 kg. Prior to the measurement, subjects were asked to remove footwear and other accessories to ensure accuracy. After a few seconds, the device displayed body weight (BW), body mass index (BMI), water percentage (%water), fat percentage (%fat), muscle mass, bone mass, basal metabolic rate (BMR) and visceral fat (VF)

Omron HEM-7130-L for blood pressure and pulse rate

The Omron HEM-7130-L automated sphygmomanometer is a validated, upper-arm blood pressure monitoring device used to measure systolic and diastolic blood pressure as well as pulse rate. Its standardized cuff design and digital display make it suitable for use in research and clinical settings for cardiovascular assessment.

EasyTouch GCU ET-301 for blood glucose levels

The EasyTouch GCU ET-301 is a portable biochemical analyzer used to assess blood glucose levels through capillary blood sampling. The device employs electrochemical biosensor technology to provide rapid and reliable glucose measurements, making it suitable for use in clinical and research settings for metabolic assessment.

Leg Dynamometer

The leg dynamometer is a standardized instrument used to assess lower-limb muscular strength by measuring maximal isometric force generated by the leg muscles. This device provides objective and reproducible measurements and is widely utilized in exercise physiology and sports science research to evaluate muscular strength performance.

Agility T Test

The Agility T-Test is a standardized, field-based assessment used to evaluate agility, specifically the ability to change direction while maintaining balance and speed quickly. It provides a reliable and valid measure of neuromuscular coordination, speed, and dynamic control.

30-Meter Sprint Test

The 30-meter sprint test is a standardized performance assessment used to measure linear running speed and acceleration capacity. The test evaluates an individual's ability to generate rapid force and achieve maximal velocity over a short distance, and it is widely utilized in exercise physiology and sports performance research to assess speed-related physical fitness.

Counter Movement Jump

The Countermovement Jump (CMJ) test is a widely used assessment to evaluate lower-limb explosive power. It measures the ability of the neuromuscular system to utilize the stretch–shortening cycle during a rapid downward movement followed by a maximal vertical jump.

20 Meter Multi-stage Fitness Test (MFT)

To determine the subject's VO2max capacity, researchers used a multistage fitness test. In this test, subjects were asked to perform a series of progressive back-and-forth runs over 20 meters until they reached exhaustion and could no longer continue. The test began at an initial speed of 8.5 km/h, then increased by approximately 0.5 km/h each minute. This increase continued until the subjects felt they could no longer keep up. Throughout the test, researchers provided encouragement and motivation to ensure maximum effort.

Statistical Analysis

Data were collected and processed using SPSS version 25 application software. Data testing uses descriptive methods, paired samples t-test, and independent samples t-test with level of significance $p < 0.05$ in 2-tailed test

Galih Cahya Sukma Samudera Budi[1A-E*], Bayu Agung Pramono[2B-D]
galihcahya.22005@mhs.unesa.ac.id[1*]

RESULTS AND DISCUSSION

Result

Table 1.
Descriptives and Test of Normality (Saphiro-Wilk)

Variables		N	Treatment Group		Control Group	
			Mean±SD	Saphiro-Wilk Sig.	Mean±SD	Saphiro-Wilk Sig.
Strength (Kg)	Pretest	15	102.23±21.659	0.534*	87.43±28.704	0.414*
	Posttest	15	106.6±19.872	0.400*	82.07±23.521	0.790*
Agility (Sec)	Pretest	15	12.07±1.080	0.613*	11.53±1.540	0.224*
	Posttest	15	10.58±0.832	0.241*	10.61±0.767	0.373*
Speed (Sec)	Pretest	15	4.96±0.594	0.128*	5.01±0.637	0.543*
	Posttest	15	4.88±0.495	0.102*	5.15±0.764	0.291*
PAPw (Watts)	Pretest	15	5134.33±799.195	0.515*	5114.27±1096.99	0.233*
	Posttest	15	5645.9±683.112	0.797*	4876.61±1181.81	0.396*
Vo_2max (mL/Kg/Min)	Pretest	15	33.09±3.728	0.434*	35.72±6.327	0.261*
	Posttest	15	34.88±5.560	0.428*	36.45±6.787	0.249*
Blood Glucose (mg/dL)	Pretest	15	90.2±7.504	0.116*	86.67±10.445	0.302*
	Posttest	15	84.133±6.833	0.263*	83.133±10.842	0.193*
Systolic BP (mmHg)	Pretest	15	123.07±10.278	0.698*	119.27±12.354	0.160*
	Posttest	15	115.87±10.308	0.199*	113.27±13.414	0.485*
Diastolic BP (mmHg)	Pretest	15	75.53±6.534	0.644*	76±6.740	0.881*
	Posttest	15	72±7.474	0.784*	72.2±9.081	0.223*
Pulse Rate (BPM)	Pretest	15	78.53±19.383	0.277*	66.47±9.378	0.214*
	Posttest	15	69.53±9.898	0.278*	71.93±11.183	0.848*
Body Weight (Kg)	Pretest	15	63.3±8.999	0.627*	60.71±12511	0.064*
	Posttest	15	62.52±9.035	0.721*	59.04±12.340	0.072*
BMI (BB/TB^2)	Pretest	15	22.33±2.678	0.628*	22.05±2.778	0.016
	Posttest	15	21.94±2.704	0.779*	21.42±2.731	0.017
%Fat	Pretest	15	18.48±8.215	0.342*	22.1±7.444	0.933*
	Posttest	15	16.11±6.946	0.492*	19.61±7.753	0.524*
%Water	Pretest	15	54.98±5.969	0.737*	51.23±7.022	0.109*
	Posttest	15	57.98±6.37	0.801*	55±4.991	0.999*
Muscle Mass (Kg)	Pretest	15	48.64±6.574	0.657*	45.61±11.132	0.199*
	Posttest	15	49.42±6.503	0.911*	45.09±10.786	0.157*
Bone Mass (Kg)	Pretest	15	2.73±0.319	0.388*	2.52±0.523	0.626*
	Posttest	15	2.76±0.307	0.413*	2.53±0.543	0.357*
Basal Metabolic Rate	Pretest	15	1511.6±184.524	0.304*	1430±296.841	0.303*
	Posttest	15	1531.27±187.542	0.365*	1427.8±299.731	0.238*
Visceral Fat	Pretest	15	4.8±2.945	0.098*	4.07±2.878	0.033
	Posttest	15	4.07±2.731	0.057*	3.03±2.829	0.001

Table 1 shows the mean values of each variable before and after the intervention. There were changes in the mean values of each variable in this study. Data normality testing showed that the pre-test and post-test data for BMI and visceral fat variables were not normal (Sig. <0.5).

Table 2.
Paired t-Test

Variables	Treatment			Control		
	t	df	Sig. (2-Tailed)	t	df	Sig. (2-Tailed)
Strength (Kg)	-1.260	14	0.228	0.903	14	0.382
Agility (Sec)	4.625	14	0.000*	2.533	14	0.024*
Speed (Sec)	0.432	14	0.672	-0.742	14	0.470
PAPw (Watts)	-3.428	14	0.004*	1.453	14	0.168
Vo_2max (mL/Kg/Min)	-2.791	14	0.014*	-0.581	14	0.570
Blood Glucose (mg/dL)	2.854	14	0.013*	0.914	14	0.376
Systolyc BP (mmHg)	2.786	14	0.015*	2.643	14	0.019*
Diastolyc BP (mmHg)	1.922	14	0.075	1.731	14	0.105
Pulse Rate (BPM)	2.085	14	0.056	-2.176	14	0.047*
Body Weight (Kg)	2.485	14	0.026*	9.623	14	0.000*
Bmi (TB/BB^2)	1.352	14	0.198	6.197	14	0.000
%Fat	4.297	14	0.001*	7.406	14	0.000*
%Water	-6.915	14	0.000*	-2.407	14	0.030*
Muscle Mass (Kg)	-2.229	14	0.043*	0.717	14	0.485
Bone Mass (Kg)	-1.234	14	0.238	-0.367	14	0.719
Basal Metabolic Rate	-1.994	14	0.066	0.281	14	0.783
Visceral Fat	3.898	14	0.002	3.837	14	0.002

Table 2 shows a paired t-test between pretest and posttest scores. The results of the data analysis indicate that there were significant differents in the treatment group in the variables of agility, PAPw, VO2Max, blood glucose, systolic blood pressure, body weight, fat percentage, water percentage, and muscle mass. Furthermore, in the control group, there were significant changes in the variables of agility, systolic blood pressure, pulse rate, fat percentage, and water percentage. There were similarities in significant changes in the variables of agility, systolic blood pressure, body beats, fat percentage, and water percentage between the two groups. To determine the comparison between the two groups, the data after the intervention were compared using the Independent T-Test.

Table 3.
Independent t-Test

Variable	Levene's Test		t-Test Equality Of Means		
	F	Sig.	t	df	Sig. (2-Tailed)
Strength (Kg)	2.188	0.150	3.086	28	0.005*
Agility (Sec)	0.096	0.759	-0.098	28	0.923
Speed (Sec)	6.673	0.015	-1.123	24.01	0.271
Papw (Watts)	4.139	0.051	2.183	28	0.038*
Vo_2max (mL/Kg/Min)	0.557	0.462	-0.692	28	0.495
Blood Glucose (mg/Dl)	1.260	0.271	0.302	28	0.765
Systolyc BP (mmHg)	0.655	0.425	0.595	28	0.556
Diastolyc BP (mmHg)	0.818	0.373	-0.066	28	0.948
Pulse Rate (BPM)	0.121	0.730	-0.622	28	0.539
Body Weight (Kg)	0.731	0.400	0.885	28	0.384
BMI	0.307	0.584	0.531	28	0.600
%Fat	0.610	0.441	-1.305	28	0.203
%Water	1.329	0.259	1.425	28	0.165
Muscle Mass (Kg)	5.027	0.033	1.33	22.991	0.194
Bone Mass (Kg)	4.858	0.036	1.449	22.101	0.158
Basal Metabolic Rate	2.417	0.131	1.133	28	0.267
Visceral Fat	0.242	0.626	1.037	28	0.309

Table 3 shows a comparison of data between the two groups on the results after being given an exercise intervention during Ramadan. The data analysis results showed a significant difference between the post-exercise results between the two groups on the variables of strength and PAPw. This is due to the different types of exercise given to each group.

Galih Cahya Sukma Samudera Budi[1A-E*], Bayu Agung Pramono[2B-D]
galihcahya.22005@mhs.unesa.ac.id[1*]

Discussion

The results showed significant changes in body composition after the intervention. Both the treatment and control groups experienced increases in body water percentage and decreases in body weight and fat percentage. These findings align with the literature, which shows that combining intermittent fasting with physical activity can optimize changes in body composition, resulting in greater reductions in fat mass when physical activity is included in the fasting protocol compared to when exercise is absent. Systematic research has shown that time-restricted fasting interventions, combined with exercise, lead to decreases in lean body mass and fat mass, while preserving fat-free mass, in physically active individuals compared to nutritional controls alone (Hays et al., 2025).

The treatment group showed an average increase in muscle mass of 0.78 kg (1.6%) compared to before the intervention. This increase indicates that the stimulus of calisthenic exercise during fasting can maintain and even stimulate muscle mass increases despite energy restriction. Other studies have also reported that weight training or resistance training and bodyweight training can improve insulin sensitivity and increase fat-free body mass while decreasing body fat, contributing to improved body composition profiles (Silva et al., 2024).

Significant changes were also found in blood glucose levels, specifically an average decrease of 6,067 mg/dL in the treatment group. This decrease in blood glucose levels is thought to be related to increased insulin sensitivity induced by training adaptations, as well as the use of alternative energy substrates such as body fat through the gluconeogenesis pathway during fasting. Literature supports that physical exercise can increase muscle glucose uptake and insulin sensitivity through increased GLUT-4 expression and improved glucose metabolism, contributing to better blood glucose control (Hays et al., 2025).

The decrease in blood glucose levels and fat percentage in the treatment group can also be explained by the body's metabolic mechanisms during fasting. Fasting activates lipolysis and gluconeogenesis after glycogen stores are depleted, making fat the primary energy source. The accompanying increase in muscle mass can increase muscle's metabolic capacity to utilize glucose, contributing to overall blood glucose regulation. Physiological literature indicates that increasing the number of insulin-sensitive muscle cells increases glucose uptake, reduces insulin resistance, and improves glucose homeostasis (Hays et al., 2025)

In addition to changes in body composition and metabolism, significant changes also occurred in systolic blood pressure. The decrease in blood pressure in both the treatment and control groups suggests that the combination of regular exercise and fasting may improve cardiovascular function, although the specific mechanisms require further investigation in adolescents. Research evidence suggests that physical exercise generally has a positive impact on the cardiovascular profile through modulation of blood pressure, insulin sensitivity, and improved endothelial function, which contribute to improvements in systolic blood pressure (Perry et al., 2025).

Calisthenics training during Ramadan also positively impacts physical ability and fitness levels. Significant increases in agility, muscle strength, and maximal aerobic capacity

Galih Cahya Sukma Samudera Budi[1A-E*], Bayu Agung Pramono[2B-D]
galihcahya.22005@mhs.unesa.ac.id[1*]

(VO_2max) indicate that bodyweight training is effective in improving fitness components, even during fasting. Other literature supports that bodyweight training programs, or a combination of resistance and aerobic training, can improve physical performance, body composition, and aerobic capacity, even in nutritionally restricted settings.

Overall, the findings of this study confirm that the combination of calisthenics training and Ramadan fasting has a positive effect on physiological control and physical fitness in adolescents. These results are consistent with literature reporting that fasting strategies combined with physical activity can produce beneficial metabolic and physiological changes, including increased muscle mass, decreased adiposity, and improvements in other indicators of metabolic health (Hays et al., 2025)(Magnani Branco et al., 2020). If practiced regularly and sustainably, this approach has the potential to reduce the risk of future non-communicable diseases.

CONCLUSION

The results showed significant differences in body composition before and after the intervention. Both the treatment and control groups experienced an increase in water percentage, as well as a decrease in body weight and fat percentage. However, the decrease in the treatment group was accompanied by an increase in muscle mass, with an average of 0.78 kilograms (1.6%) compared to before the intervention. Furthermore, a significant difference in blood glucose levels was observed in the treatment group, with an average decrease of 6.067 mg/dL (6.73%) compared to before the calisthenics training. The decrease in blood glucose and fat percentage in the treatment group may be due to increased muscle mass and the action of the hormone insulin. The body's energy sources are not only blood glucose or glycogen reserves stored in the muscles and liver, but also the use of body fat reserves (gluconeogenesis). Gluconeogenesis occurs in the liver to maintain normal blood glucose levels. A significant difference was also observed in systolic blood pressure, with a decrease in both the treatment group (5.85%) and the control group (5.03%).

Calisthenics training during Ramadan also impacts physical ability and fitness. Significant differences were observed in agility (12.34% increase), strength (12.64% increase), and maximal aerobic capacity/VO2Max (5.41% increase). These findings confirm that the combination of calisthenics training and Ramadan fasting affects physiological control (body composition, blood pressure, and blood glucose) and improves physical fitness in adolescents. If practiced regularly, it is believed to reduce the risk of contracting dangerous non-communicable diseases (NCDs) in the future.

REFERENCES

Abdullah, K., AL-Habori, M., & Al-Eryani, E. (2020). Ramadan Intermittent Fasting Affects Adipokines and Leptin/Adiponectin Ratio in Type 2 Diabetes Mellitus and Their First-Degree Relatives. BioMed Research International, 2020(1), 1281792. https://doi.org/https://doi.org/10.1155/2020/1281792

Adlouni, A. (1997). Fasting during Ramadan Induces a Marked Increase in High-Density Lipoprotein Cholesterol and Decrease in Low-Density Lipoprotein Cholesterol. Annals of Nutrition and Metabolism, 4(1), 242–249.

AL-Mhanna, S. B., Batrakoulis, A., Ghazali, W. S. W., Mohamed, M., Aldayel, A., Alhussain, M. H., Afolabi, H. A., Wada, Y., Gülü, M., Elkholi, S., Abubakar, B. D., & Rojas-Valverde, D. (2024). Effects of combined aerobic and resistance training on glycemic control, blood pressure, inflammation, cardiorespiratory fitness and quality of life in patients with type 2 diabetes and overweight/obesity: a systematic review and meta-analysis. PeerJ, 12(6). https://doi.org/10.7717/peerj.17525

Fedail, S. S., Murphy, D., Salih, S. Y., Bolton, C. H., & Harvey, R. F. (1982). Changes in certain blood constituents during Ramadan. American Journal of Clinical Nutrition, 36(2), 350–353. https://doi.org/10.1093/ajcn/36.2.350

Guembri, M. A., Racil, G., Tounsi, M., Aouichaoui, C., Russo, L., Migliaccio, G. M., Trabelsi, Y., Souissi, N., & Padulo, J. (2024). Effects of Ramadan Fasting on Sleep and Physical Fitness among Young Female Handball Players. Children, 11(8). https://doi.org/10.3390/children11080954

Hays, H. M., Sefidmooye Azar, P., Kang, M., Tinsley, G. M., & Wijayatunga, N. N. (2025). Effects of time-restricted eating with exercise on body composition in adults: a systematic review and meta-analysis: Clinical Research. International Journal of Obesity, 49(5), 755–765. https://doi.org/10.1038/s41366-024-01704-2

Husain, R., Duncan, M. T., Cheah, S. H., & Ch'ng, S. L. (1987). Effects of fasting in Ramadan on Tropical Asiatic Moslems. British Journal of Nutrition, 58(1), 41–48. https://doi.org/10.1079/bjn19870067

Institute for Health Metrics and Evaluation, I. (2020). Global Burden of Disease Collaborative Network, Global Burden of Disease Study 2019 (GBD 2019) Results. https://vizhub.healthdata.org/gbd-results/

Jayedi, A., Soltani, S., Emadi, A., Zargar, M. S., & Najafi, A. (2024). Aerobic Exercise and Weight Loss in Adults: A Systematic Review and Dose-Response Meta-Analysis. JAMA Network Open, 7(12), e2452185. https://doi.org/10.1001/jamanetworkopen.2024.52185

Khalfoun, J., Zouhal, H., Triki, R., Jribi, W., Saeidi, A., Almaqhawi, A., Clark, C. C. T., Laher, I., & Ben Abderrahman, A. (2024). Ramadan Intermittent Fasting and Plasma Volume Variations in Individuals with Different Body Weights. Medicina, 60(7). https://doi.org/10.3390/medicina60071143

Khan, A., & Khattak, M. M. A. K. (2002). Islamic Fasting: An Effective Strategy for Prevention and Control of Obesity. Pakistan Journal of Nutrition, 1(4), 185–187. https://doi.org/10.3923/pjn.2002.185.187

Kim, J., Bressel, E., Kim, M., Kim, T., Koh, S., & Kim, D. (2025). The Effects of a Combined Exercise Intervention on Body Composition, GDF-15, Apelin-12, and IL-15 Among Older Korean Women According to Obesity Status. Journal of Clinical Medicine, 14(14). https://doi.org/10.3390/jcm14144981

Kotarsky, C. J., Christensen, B. K., Miller, J. S., & Hackney, K. J. (2018). Effect of Progressive Calisthenic Push-up Training on Muscle Strength and Thickness. The Journal of Strength & Conditioning Research, 32(3).

Larijani, B., Zahedi, F., Sanjari, M., Amini, M. R., Jalili, R. B., Adibi, H., & Vassigh, A. R. (2003). The Effect of Ramadan Fasting on Fasting Serum Glulcose in Healthy Adults. Medical Journal of Malaysia, 58(5), 678–680.

Li, Z., Gong, T., Ren, Z., Li, J., Zhang, Q., Zhang, J., Chen, X., & Zhou, Z. (2025). Impact of sequence in concurrent training on physical activity, body composition, and fitness in obese young males: A 12-week randomized controlled trial. Journal of Exercise Science and Fitness, 23(2), 112–121. https://doi.org/10.1016/j.jesf.2025.02.001

Magnani Branco, B. H., Carvalho, I. Z., Garcia de Oliveira, H., Fanhani, A. P., Machado Dos Santos, M. C., Pestillo de Oliveira, L., Macente Boni, S., & Nardo, N. J. (2020). Effects of 2 Types of Resistance Training Models on Obese Adolescents' Body Composition, Cardiometabolic Risk, and Physical Fitness. Journal of Strength and Conditioning Research, 34(9), 2672–2682. https://doi.org/10.1519/JSC.0000000000002877

Meckel, Y., Ismaeel, A., & Eliakim, A. (2008). The effect of the Ramadan fast on physical performance and dietary habits in adolescent soccer players. European Journal of Applied Physiology, 102(6), 651–657. https://doi.org/10.1007/s00421-007-0633-2

Molla, A. M. (2003). Effects on health of fluid restriction during fasting in Ramadan. European Journal of Clinical Nutrition, 57, S30–S38. https://doi.org/10.1038/sj.ejcn.1601899

Ogunbode, A. M., Ladipo, M. A., Ajayi, I. O., & Fatiregun, A. A. (2011). Obesity: An emerging disease. Nigerian Journal of Clinical Practice, 14(4), 390–394. https://doi.org/10.4103/1119-3077.91741

Perry, A., Bonner, J., Williams, S., Xiong, W., Garcia, A., Velasquez, C., Friedman, A., Lee, D. L., Hernandes, I. de L., Shen, J., Meyer, M., & Fernandez, L. (2025). Integrating Physical Activity into a Nutrition and Exercise Science Middle School Curriculum: The THINK Program. Nutrients , 17(9), 1–18. https://doi.org/10.3390/nu17091538

Reilly, S. M., & Saltiel, A. R. (2015). A Futile Approach to Fighting Obesity? Cell, 163(3), 539–540. https://doi.org/10.1016/j.cell.2015.10.006

Shirreffs, S. M., & Maughan, R. J. (2008). Water and salt balance in young male football players in training during the holy month of Ramadan. Journal of Sports Sciences, 26(SUPPL. 3), 37–41. https://doi.org/10.1080/02640410802428097

Silva, F. M., Duarte-Mendes, P., Teixeira, A. M., Soares, C. M., & Ferreira, J. P. (2024). The effects of combined exercise training on glucose metabolism and inflammatory markers in sedentary adults: a systematic review and meta-analysis. Scientific Reports, 14(1). https://doi.org/10.1038/s41598-024-51832-y

Triki, R., Ben Abderrahman, A., Salhi, I., Rhibi, F., Saeidi, A., Almaqhawi, A., Hackney, A. C., Laher, I., Granacher, U., & Zouhal, H. (2024). Effects of time-of-day resistance training on muscle strength, hormonal adaptations, and sleep quality during Ramadan fasting. Frontiers in Nutrition, 11, 1439738. https://doi.org/10.3389/fnut.2024.1439738

World Health Organization Global Health Observatory, W. (2023). Noncommunicable diseases: Mortality. https://www.who.int/data/gho/data/themes/topics/topic-details/GHO/ncd-mortality

Galih Cahya Sukma Samudera Budi[1A-E*], Bayu Agung Pramono[2B-D]
galihcahya.22005@mhs.unesa.ac.id[1*]

World Health Organization Regional Office for South-East Asia, W. (2013). Action Plan for The Prevention and Control of Noncommunicable Diseases in South-East Asia, 2013–2020. In World Health Organization. www.searo.who.int

World Health Organization, W. (2023). Noncommunicable diseases. Fact Sheet. https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases

World Health Organization, W. (2024). Obesity and overweight. Fact Sheet. https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight