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The Effect of Sit Up Exercises on Abdominal Circumference Reduction of UPRI Sports Coaching Education Students

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ABSTRACT

Background: Abdominal circumference is one of the key anthropometric indicators of central obesity and health risk in young adults, including university students. Sedentary habits among sports coaching students who lack structured exercise programs contribute to increased abdominal fat accumulation. Objectives: This study aims to analyze the effect of sit-up exercise on the reduction of abdominal circumference in students of the Sports Coaching Education Program at Universitas Pejuang Republik Indonesia (UPRI) Makassar. Methods: A pre-experimental design with one-group pretest-posttest approach was applied to 30 male students selected through purposive sampling. The sit-up training program was conducted for 8 weeks, 3 sessions per week, with progressive frequency from 3 sets of 15 repetitions increasing to 3 sets of 25 repetitions. Abdominal circumference was measured using a non-elastic anthropometric tape at the level of the navel. Data were analyzed using paired t-test with a significance level of $\alpha = 0.05$. Results: The mean abdominal circumference before the intervention was 86.74 ± 6.32 cm, which decreased to 83.12 ± 5.87 cm after the 8-week program, representing a reduction of 3.62 cm ($p = 0.000 < 0.05$). Conclusions: Sit-up exercise performed systematically and progressively for 8 weeks is effective in significantly reducing abdominal circumference in Sports Coaching Education students at UPRI Makassar.

Keywords: Sit-Up Exercise; Abdominal Circumference; Sports Coaching Education; UPRI; Central Obesity.

INTRODUCTION

Abdominal circumference is one of the most widely used anthropometric indicators to assess the distribution of middle (central) body fat. Increased abdominal circumference is closely related to the accumulation of visceral fat which is a major risk factor for various non-communicable diseases, such as type 2 diabetes mellitus, hypertension, coronary heart disease, and metabolic syndrome (Kurniaziz et al., 2022; Todingan et al., 2016). In adult men, the normal limit of abdominal circumference according to the Indonesian Obesity Study Association (HISOBI) is below 88.7 cm, while values above the threshold are categorized as central obesity that needs serious attention.

College students, including students of the Sports Coaching Education (PKO) study program, are not spared from the phenomenon of increasing abdominal circumference. The paradox that is often found is that sports science students who should have a good level of physical fitness, do not always apply an active lifestyle regularly outside of lecture hours (Firmansyah & Syahri, 2022). Factors such as a high-calorie diet, lack of structured physical activity, and a

sedentary lifestyle due to academic demands contributed significantly to the increase in abdominal fat in this group.

Universitas Pejuang Republik Indonesia (UPRI) Makassar as one of the private universities in South Sulawesi has a Sports Coaching Education study program that produces professional coaching personnel. Based on initial observations made by researchers on UPRI PKO students, it was found that a number of students had abdominal circumference that exceeded the normal limit, indicating a risk of central obesity that needs to be addressed through programmed and structured physical exercise interventions.

Sit-up exercises are one of the simplest forms of core strength training, do not require special equipment, and can be done anywhere. Physiologically, sit-ups involve contractions of the muscles of the rectus abdominis, obliquus externa and internus, and transversus abdominis (Dondokambey et al., 2020). Repeated and systematic activation of the core muscles through sit-up exercises is expected to improve local metabolism, improve abdominal muscle tone, and contribute to a decrease in fat accumulation in the abdominal region.

Several studies have examined the effect of sit-up exercises on physical condition. A study by Firmansyah and Syahri (2022) showed that sit-up exercises significantly increase the strength of the rectus abdominis muscle in martial artists. Research by Kurniaziz et al. (2022) proves that the combination of sit-ups with other core exercises is effective in lowering abdominal circumference in the group of mothers. Meanwhile, a literature review by Dondokambey et al. (2020) confirmed that sit-up exercises have an effect on increasing muscle mass through several physiological mechanisms.

However, a study that specifically examined the effect of sit-up exercises on abdominal circumference reduction in sports coaching education students in private universities, especially UPRI Makassar, has never been conducted. This research gap is an important foundation to be studied scientifically. Thus, this study aims to analyze the effect of sit-up exercises on the reduction of abdominal circumference of Sports Coaching Education students of the University of Pejuang of the Republic of Indonesia Makassar.

METHODS

Research Type and Design

This study is a pre-experimental research using a one-group pretest-posttest design. This design was chosen because the study involved one treatment group without a control group, with measurements of dependent variables carried out before and after the administration of the intervention (Arikunto, 2021). A quantitative approach is used to measure changes in abdominal circumference numerically and is statistically tested to see the significance of the changes.

Research Location and Time

This research was carried out in the sports field of the Sports Coaching Education Study Program, University of Pejuang of the Republic of Indonesia (UPRI), Jalan Raya Baruga Antang, Makassar City, South Sulawesi Province. The study lasted for 10 weeks, from January to March 2025, covering the preparation stage, pre-test data collection, the implementation of an 8-week training program, and post-test data collection.

Population and Sample

The research population is all male active students of the 2022 and 2023 UPRI Makassar Sports Coaching Education Study Program, totaling 87 people. The sample was taken using purposive sampling techniques based on inclusion criteria: (1) active male students, (2) aged 18–25 years, (3) have a circumference of ≥ 80 cm, (4) have no history of abdominal or spinal muscle injury in the last 6 months, (5) are not currently participating in other structured physical exercise programs, and (6) are willing to participate in the entire series of studies by signing an informed consent. Based on these criteria, a sample of 30 students was obtained.

Sit-Up Training Program

The sit-up training program was carried out for 8 weeks with a frequency of 3 sessions per week (a total of 24 sessions). The exercise program is designed progressively with an increase in volume and intensity every two weeks as listed in Table 1 below.

Table 1. 8-Week Sit-Up Training Program

Sunday	Sessions/Weeks	Set	Repetition	Rest (minutes)	Intensity
1–2	3	3	15	2	Low (≤40% max)
3–4	3	3	18	1.5	Moderate (41–60%)
5–6	3	3	22	1.5	Medium-High (61–75%)
7–8	3	3	25	1	High (76–85%)

Each training session begins with a 10-minute warm-up (light jogging and dynamic stretching), followed by a sit-up core workout, and ends with a 5-minute cool-down. The sit-up technique used is the standard technique: supine position, knees bent 90 degrees, hands at the sides of the head, and full trunk flexion movements until the elbows touch the knees. The research supervisor ensures the correct execution technique at each training session.

Data Collection Instruments and Techniques

Abdominal circumference measurements were carried out using a non-elastic anthropometric band with an accuracy of 0.1 cm. Measurements were taken at the navel-level point (umbilicus) in an upright standing position, at the end of normal expiration, according to WHO standards (2008). Each subject was measured twice and the average score was taken. Measurements are carried out by trained and certified enumerators, to ensure the consistency and reliability of the data.

Data Analysis Techniques

Data were analyzed using descriptive statistics (mean, standard deviation, minimum and maximum values) and inferential statistics. The prerequisite test for data normality was carried out with the Shapiro-Wilk Test considering the number of samples of 30 people ($n \leq 50$). If the data is distributed normally, the hypothesis test is carried out with the Paired Sample T-Test to compare the pre-test and post-test values. The significance level used is $\alpha = 0.05$. The entire analysis uses SPSS software version 26.0 for Windows.

RESEARCH RESULTS

Sample Characteristics Description

The general characteristics of the research sample are presented in Table 2 below.

Table 2. Statistical Description of Research Sample Characteristics (n=30)

Variabel	N	Min	Max	Mean ± SD
Age (years)	30	18	23	20.3 ± 1.4
Height (cm)	30	155	178	165.8 ± 5.2
Body Weight (kg)	30	52	89	68.4 ± 8.7
IMT (kg/m²)	30	19.8	31.2	24.9 ± 2.8
Pre Abdominal Circumference (cm)	30	74.5	101.0	86.74 ± 6.32

Based on Table 2, the average age of the sample was 20.3 ± 1.4 years with a height of 165.8 ± 5.2 cm and a body weight of 68.4 ± 8.7 kg. The average body mass index (BMI) of the sample was 24.9 ± 2.8 kg/m², which is in the overweight category according to the Asia-Pacific standard (BMI 23–24.9 kg/m²). The average pre-test abdominal circumference of 86.74 ± 6.32 cm showed that most of the samples had abdominal circumference that was in the high-risk category for men based on the HISOBI criteria.

Normality Test

The results of the data normality test using Shapiro-Wilk are presented in Table 3 below.

Table 3. Shapiro-Wilk Normality Test Results

Variabel	N	Say.	Alpha (α)	Remarks
Abdominal Circumference Pre-test	30	0.312	0.05	Normal
Abdominal Circumference Post-test	30	0.487	0.05	Normal

Table 3 shows that the significance value of pre-test abdominal circumference data is 0.312 and post-test is 0.487, both greater than α = 0.05. This means that the abdominal circumference data, both pre-test and post-test, are distributed normally, so that the hypothesis test can be continued using the Paired Sample T-Test.

Uji Hipotesis (Paired Sample T-Test)

The results of the Paired Sample T-Test to test the effect of sit-up exercise on abdominal circumference reduction are presented in Table 4 below.

Table 4. Results of the Paired Sample T-Test of Pre-Post Intervention Abdominal Circumference

Variabel	Pre-test (cm)	Post-test (cm)	Difference (cm)	Say.	Ket.
Abdominal Circumference	86.74 ± 6.32	83.12 ± 5.87	3.62 ± 1.14	0.000	Sig.

Based on Table 4, the average pre-test abdominal circumference was 86.74 ± 6.32 cm, while the average post-test abdominal circumference was 83.12 ± 5.87 cm. An average decrease in abdominal circumference of 3.62 ± 1.14 cm occurred after an 8-week sit-up exercise intervention. The results of the statistical test showed a significance value of p = 0.000 (p < 0.05), which means that there was a significant difference between abdominal circumference before and after the sit-up exercise program. Thus, the research hypothesis is accepted.

Frequency Distribution of Abdominal Circumference Category

The distribution of changes in abdominal circumference categories before and after the intervention is presented in Table 5.

Table 5. Frequency Distribution of Pre-Post Intervention Abdominal Circumference Category

Category	LP Range (cm)	Pre (n)	Pre (%)	Post (n)	Post (%)
Normal	< 85	14	46.7	20	66.7
High Risk	85 – 100	14	46.7	10	33.3
Obesitas Sentral	> 100	2	6.7	0	0
Total	-	30	100	30	100

Table 5 shows a shift in the distribution of positive abdominal circumference categories after 8 weeks of intervention. The proportion of students with normal abdominal circumference increased from 46.7% (n=14) to 66.7% (n=20). The high-risk group decreased from 46.7% (n=14) to 33.3% (n=10). The most significant was the absence of students in the central obesity category (>100 cm) at the post-test, compared to before the intervention which amounted to 2 people (6.7%). This change in distribution reinforces the statistical finding that sit-up exercise has a significant impact on abdominal circumference reduction.

DISCUSSION

The results of this study showed that the sit-up training program carried out for 8 weeks with a frequency of 3 sessions per week significantly reduced the abdominal circumference of UPRI Makassar Sports Coaching Education students, with an average decrease of 3.62 cm ($p = 0.000$). These findings are consistent with several previous studies that examined the effects of core exercise on body composition and abdominal circumference.

The physiological mechanism underlying abdominal circumference decrease through sit-up exercises can be explained through several pathways. First, repeated sit-up exercises activate the major muscles of the abdominal wall, especially the rectus abdominis, obliquus externa and internus, as well as transversus abdominis (Kisner & Colby, 2020). The contraction of these muscles repeatedly increases the local metabolic rate and total energy expenditure, which, if consistent in its course, will contribute to a reduction in subcutaneous fat deposits in the abdominal region. Research by Brobakken et al. (2023) supports this concept by showing that localized aerobic exercise in the abdominal area has the potential to provide more specific fat reduction effects on that area.

Second, the decrease in abdominal circumference obtained in this study is in line with the meta-analysis of Armstrong et al. (2022) who reported that regular physical exercise can reduce the average abdominal circumference by up to 3.2 cm in overweight adults. Although the study focused on aerobic exercise, similar effects can also occur through resistance exercises such as sit-ups, particularly when done at adequate volume and progressively. The study of Slentz et al. cited in Ross & Janssen (2009) confirms that total calorie expenditure is the main key to abdominal fat reduction, regardless of the exercise modality used.

The findings of this study are also in line with the research of Kurniaziz et al. (2022) which showed a decrease in abdominal circumference of 3.11 cm in the experimental group that received a combination of sit-up, knee touch crunch, and plank exercises. Although the study used a combination of exercises, the contribution of sit-ups as a key component remains relevant for comparison. The decrease achieved in this study (3.62 cm) was slightly larger, which was likely influenced by differences in sample characteristics, program duration, and participant compliance levels.

In addition to the fat reduction benefits, a structured sit-up exercise program also contributes to increased strength and endurance of the abdominal muscles. This is consistent with

the findings of Firmansyah & Syahri (2022) who reported an increase in rectus abdominis muscle strength by 41.66% after 8 weeks of sit-up training in college students. The strengthening of these core muscles also has a positive impact on posture stability, balance, and overall physical performance, which is very relevant for students of the Sports Coaching Education Study Program who need excellent physical capacity in their work as coaches in the future.

The shift in the distribution of abdominal circumference categories recorded in this study, particularly the loss of the central obesity category (>100 cm) at post-test, has significant clinical implications. A meta-analysis by Armstrong et al. (2022) showed that a decrease in abdominal circumference of 3.2 cm correlated with a 6% reduction in the risk of cardiovascular disease and a 4.5% reduction in the risk of death in men. Thus, the benefits of the sit-up exercise program in this study go beyond mere aesthetic aspects and have meaningful clinical relevance.

This research also strengthens the argument that a physical exercise program that is simple, affordable, and can be done without special facilities such as sit-ups, if designed systematically and progressively, can provide meaningful results. This is very important in the context of universities with limited resources such as UPRI Makassar. Harsono (2020) emphasized that the principles of progressivity and consistency in exercise are the keys to the success of physical condition coaching programs, regardless of the level of difficulty or sophistication of the training modality.

There are several limitations in this study that need to be acknowledged. First, the pre-experimental design of a one-group pretest-posttest without a control group limits the ability of stronger causality. Factors outside of the intervention, such as dietary changes and physical activity outside the program, were not strictly controlled. Second, the limited number of samples (n=30) limits the generalizability of the findings. Further research with a randomized controlled trial (RCT) design and a larger sample is needed to more conclusively confirm these findings.

CONCLUSIONS AND SUGGESTIONS

Conclusion

Based on the results of the research and discussion, it can be concluded that sit-up exercises that are carried out systematically and progressively for 8 weeks with a frequency of 3 sessions per week have proven to be statistically effective in reducing the abdominal circumference of students of the Sports Coaching Education Study Program, Pejuang University of the Republic of Indonesia Makassar. The average abdominal circumference reduction achieved was 3.62 cm (from 86.74 cm to 83.12 cm), with a significance value of $p = 0.000$ ($p < 0.05$). The distribution of the abdominal circumference category also experienced a positive shift, with an increase in the proportion of students in the normal category from 46.7% to 66.7%.

Suggestions

Based on these findings, it is recommended: (1) The PKO Study Program of UPRI Makassar needs to integrate a progressive sit-up training program as part of the physical education and student health curriculum; (2) Students with abdominal circumference exceeding the normal limit are advised to independently carry out sit-up exercises at least 3 times per week; (3) Follow-up research with a randomized controlled trial design, a more representative control group, and dietary monitoring, is strongly recommended to strengthen the validity of the causality of these findings; and (4) Measurements of additional variables such as body fat percentage, BMI, and aerobic capacity in subsequent studies will provide a more comprehensive picture of the benefits of sit-up exercise programs.

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