

CORE STABILITY EXERCISE OUTWEIGHS SURYA NAMASKAR YOGA IN IMPROVING ABDOMINAL MUSCLE ENDURANCE AMONG STUDENTS OF YOGA AND HEALTH DEPARTMENT OF UHN I GUSTI BAGUS SUGRIWA DENPASAR

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ABSTRACT

A reduced level of physical activity can cause a decline in core muscle endurance, one of which is abdominal muscle endurance. Abdominal muscle endurance plays a crucial role to support daily physical activity. Abdominal muscle endurance can be enhanced through physical exercises such as surya namaskar yoga and core stability exercise. This study aims to examine the difference in the effect of surya namaskar yoga and core stability exercise in improving abdominal muscle endurance among students of the yoga and health department at UHN I Gusti Bagus Sugriwa Denpasar. This study is an experimental study using a randomized pre- and post-test control group design. The subjects of this study were 12 students, which were divided into 2 groups. Group 1 received surya namaskar yoga and Group 2 received core stability exercise. Abdominal muscle endurance was measured using the flexor endurance muscle test. Based on the results of the independent t-test, there was a difference in the average abdominal muscle endurance after treatment between groups, with p-value = 0.008 ($p < 0.05$), where the Mean of increase in abdominal muscle endurance in Group 1 was 20.16 ± 0.75 , while in Group 2, it was 32.00 ± 2.09 . Therefore, core stability exercise outweighs surya namaskar yoga in improving abdominal muscle endurance among students of yoga and health department of UHN I Gusti Bagus Sugriwa, Denpasar.

Keywords: *Surya Namaskar Yoga, Core Stability Exercise, Muscle Endurance*

Introduction

To prevent Covid-19 transmission, the government has strongly encouraged the public to comply with health protocols by washing hands, using face masks, and implementing physical and social distancing. The physical distancing policy was one of the efforts to break the chain of Covid-19 transmission that consequently restricted human activities in many sectors of life including education. Specifically, at the higher education level, students were no longer allowed to come to the University to attend face-to-face theoretical and practical lectures, and thus, the face-to-face lecture shifted to online learning via video conference. As a result, students who get used to performing sports activities on campus, either through practical lectures and Student Activity Units (UKM) missed practical lectures and sports training sessions due to online lectures from home (Ashadi et al., 2020).

Attending the online lecture causes an increase in the frequency of using smartphones or laptops for a long time among the students as they have to listen to the material given by lecturers through video conferencing applications from their smartphones or laptops. On average, the duration of video conference attendance among the students ranged from 3-4 hours per day, and also while implementing physical distancing at home, students spent time playing on smartphones while sitting and sleeping in the bed for 5 hours per day (Ashadi et al., 2020)

Without immediate intervention, such conditions can make students lack physical activity. Sitting while playing on smartphones for long periods triggers a sedentary lifestyle or a lack of physical exercise among the students. This notion is supported by a study conducted by Ashadi et al. (2020) that involve 573 students to compare sports activity patterns between

students at sports faculty and non-sports faculty before and during the Covid-19 pandemic. The study found a significant change in the pattern of sports activities which include exercise habits, frequency, and duration, as well as types of sports activities in sports faculty students and non-sports faculty students before and during the Covid-19 pandemic with $p\text{-value} = < 0.05$, where the frequency of exercise among the students at the sports faculty decreased from 3 - 5 times or more a week, to 1-3 times per week. The pattern of exercise duration also changes from > 40 minutes to < 15 minutes per session and the type of exercise were primarily individual exercise.

The decrease in physical exercise patterns and being more sedentary can lead to decreased abdominal muscle endurance among the students. This assertion has been supported by research conducted by (Jakiwa et al., 2020) which aims to examine the difference and the relationship between the amount of time spent doing physical activity and abdominal muscle endurance between cadets and civilian students. Time of performing physical activity was measured based on the total minutes and total days spent doing physical exercise, while abdominal muscle endurance was measured using a 1-minute sit-up test. The results of this study showed a positive relationship between physical activity and abdominal muscle endurance in both groups. Abdominal muscle endurance plays an important role in supporting quality activities to prevent rapid fatigue. The abdominal muscles are a part of the core muscles. A recent study shows that weak core muscles predispose to the risk of back pain (Mullerpatan et al., 2020).

Abdominal muscle endurance can be improved through several methods, one of which is doing physical exercise based on the dose of exercise. A good training concept is an exercise that adopts the FITT (Frequency, Intensity, Time, Type) package. Exercise frequency refers to the amount of exercise or how often the exercise is performed within a week. The ideal exercise frequency for endurance training is 2-5 times per week. Meanwhile, exercise intensity reflects how heavily the exercise can affect the increase in the exercise pulse while duration or time shows how long it takes per training session, and type of exercise demonstrates what kind of exercise is conducted, including aerobic or anaerobic exercise.

The two most popular, low-budget, and popular exercises among young people today is surya namaskar yoga training (Subrata, 2020) and core stability exercise. Literally, Surya namaskar is interpreted as a salutation to the sun god as a source of life energy. There are 12 movements in surya namaskar yoga (Muliartini, 2018). The previous studies aimed at examining the effect of Surya namaskar yoga on abdominal muscle endurance have been conducted at the Ashramik Chhatrabas Seva Bharati Mahavidyalaya male dormitory in Jhargram district, West Bengal, India (Bhowmik, 2018), that involved 20 students aged 19-23 years. Surya namaskar yoga was administered for 12 weeks, and abdominal muscle endurance was measured using a sit-up test. The results of the study showed that after 12 weeks of yoga asanas including surya namaskar yoga, students showed an increase in abdominal muscle endurance.

The core stability exercises are training to strengthen all core muscles that are responsible for strengthening and stabilizing the spine without exceeding the injury threshold. Therefore, core stability exercises can help activate the inner abdominal muscles, restore the function of weak muscles and increase the ability to support and control the spine and pelvis. The other previous studies aimed at examining the effect of core stability exercise on core muscle endurance have been conducted on volleyball players in Shiraz, Iran. The study involved 65 teenage volleyball players aged 14-19 years. Core stability exercise was administered for 6 weeks. The results of this study showed a significant difference after treatment of core muscle endurance with $p\text{-value} = 0.001$ ($p < 0.05$) which means that 6 weeks

of core stability exercises increased core muscle endurance, one of which was the abdominal muscles (Tafakoriollah et al., 2020).

Based on the analysis above, these two exercises can increase abdominal muscle endurance. However, there have been no studies that compare these methods in improving abdominal muscle endurance. Therefore, the authors were interested in examining the difference in the effect of surya namaskar yoga and core stability exercise on abdominal muscle endurance in students majoring in yoga and health at the Faculty of Brahma Widya of UHN I Gusti Bagus Sugriwa Denpasar.

Method

This study is an experimental study using the Randomized Pre-test and Post-test Control Group Design. The division of groups is done randomly or randomly. The research subjects were 12 students who were divided into two groups, namely Group 1 which was given surya namaskar yoga, while Group 2 was given core stability exercise. The subjects of the study were the student population majoring in yoga and health at the Faculty of Brahma Widya of UHN I Gusti Bagus Sugriwa, Denpasar which was selected using inclusion, exclusion criteria, and dropout criteria. The sampling technique used is simple random sampling, which is research subject selection using a simple random method. The inclusion criteria in this study were (1) aged between 18-25 years, (2) performing mild physical activity from assessment of physical activity, having a normal BMI of 18.5-22.9 kg/m², (3) research subjects in healthy condition from examination of vital signs conducted by the author, (4) willing to participate in the study from beginning to end by signing a letter of consent. Exclusion criteria in this study were (1) suffering from fractures, strains, sprains, and edema, and (2) having a history of respiratory and cardiac diseases. Meanwhile the criteria for termination or Drop Out included (1) Not fulfilling the frequency of the exercise program by consecutively not participating in training 3 times, (2) experiencing a decrease in general condition (decreased vital signs) that does not enable exercise, (3) withdrawing before the training program ends due to obstacles or other reasons.

Surya namaskar yoga training was practiced by doing 12 movements of the surya namaskar yoga poses. Each session of surya namaskar yoga lasted for 30 minutes composed of 5 minutes of pranayama, 20 minutes of asana, and 5 minutes of savasana. Meanwhile, core stability exercise consisted of poses of plank, side plank, abdominal curl, bicycle movement, supine bridge, superman, and lateral crunch. Each training session lasted for 30 minutes, divided by 5 minutes of warming up, 20 minutes of core training, and 5 minutes of cooling down. Both pieces of training were carried out 3 times a week for 6 weeks, with a day lag between the treatments. This study was conducted at the Yoga Lab, Faculty of Brahma Widya's building, UHN I Gusti Bagus Sugriwa Denpasar and was guided by professional instructors.

Results and Discussion

The results of the study were analyzed after the author provided an overview of the characteristics of the research subjects described in the study in both groups. The characteristics of research subjects, including gender, age, BMI (body mass index), physical activity, and food intake in both groups, can be seen in Table 1.

Table 1. Characteristics of research subjects

Variable	Group 1 of Surya Namaskar Yoga	Group 2 of Core Stability Exercise
Gender (%)		
Male	(3) 50%	(3) 50%
Female	(3) 50%	(3) 50%
Age (Year)		
(Mean \pm SD)	20,50 \pm 1,04	20,16 \pm 1,32
BMI (Kg/m ²)		
(Mean \pm SD)	19,86 \pm 1,11	20,93 \pm 1,41
Physical Activity (MET)		
(Mean \pm SD)	426,17 \pm 81,40	510,67 \pm 132,18
Daily Calorie Intake (Kcal)		
Male		
(Mean \pm SD)	2.501,80 \pm 28,25	2.603,73 \pm 93,50
Female		
(Mean \pm SD)	2.084,73 \pm 79,42	2.214,30 \pm 138,74

Based on the results of this study, in terms of gender, Group 1 of surya namaskar yoga and Group 2 core stability exercise have similar gender composition. From the descriptive analysis carried out, 3 participants (50%) were male and 3 participants (50%) were female in each group which showed that the gender composition in group 1 of surya namaskar yoga, and Group 2 of core stability exercise are equal.

Looking at the age of the research subjects, The average age of Group 1 of surya namaskar yoga was 20,50 years, while the average age of Group 2 of core stability exercise was 20,16 years. In this study, the age category of the research subjects ranged from 18-25 years. The age range was chosen because young people at that age are susceptible to changes in the anthropometry of the body of the individuals due to lifestyle changes, both in their physical activity and diet.

In terms of physical activity of research subjects, Group 1 of surya namaskar yoga had an average MET value of 426,17 MET - minutes per week, while Group 2 of core stability exercise had an average MET of 510,67 MET - minutes per week. The average MET in both groups was classified as light physical activity from the reported physical activity that was not sufficient to meet the moderate activity category with a total value of at least 600 MET minutes per week. This change in physical activity patterns is one of the indicators in determining abdominal muscle endurance in students majoring in yoga and health, Faculty of Brahma Widya UHN I Gusti Bagus Sugriwa Denpasar. This is due to changes in physical activity as a result of undergoing efforts to prevent the spread of Covid-19. Students who are usually active in sports activities on campus, both through practical lectures and the Student Activity Unit (UKM), lose practical lectures and sports training sessions with online lectures from home (Ashadi et al., 2020).

Undergoing the online learning process leads to a prolonged smartphone or laptop use due to attending online lectures. On average, students spend 3-4 hours per day attending video conferences, and also while implementing physical distancing at home, students spend more time playing on smartphones while sitting and sleeping in the bed for 5 hours per day (Ashadi et al., 2020). This can cause a decrease in abdominal muscle endurance among students at the yoga and health department, Faculty of Brahma Widya of UHN I Gusti Bagus Sugriwa Denpasar.

In terms of the daily calorie intake of the research subjects, the average daily calorie intake in the male subjects of Group 1 of surya namaskar yoga was 2.501,80 kcal while in the female it was 2.084,73 kcal. Meanwhile, in Group 2 of core stability exercise, the average daily calorie intake in male research subjects was 2.603,73 kcal, while in the female it was 2.214,30 kcal. Based on the Nutrition Adequacy Rate recommended for the Indonesian people by the Minister of Health of The Republic of Indonesia in 2019, the ideal daily calorie intake for men aged 19-25 years is 2.650,00 kcal, while for women in the same age of 19-25 years it is 2.250,00 kcal. Such excessive daily calories result in the accumulation of excessive energy in the body, which can later be converted as long-term energy storage in the form of fat. Thus, based on the results above, the daily calorie intake for each research subject in each group remains in the medium category.

Adequacy of daily calorie intake is also supported by data on Body Mass Index (BMI) in each group. Based on the descriptive data, the average BMI in Group 1 of surya namaskar yoga was 19,86 kg/m², while in Group 2 of core stability exercise, it was 20,93 kg/m². Based on the data, it can be concluded that all research subjects both in Group 1 of surya namaskar yoga or Group 2 of core stability exercise had normal BMI that met the inclusion criteria of research subjects. According to WHO, from the Asia Pacific perspective, a BMI of 18,5-22,9 kg/m² is categorized as normal, 23-24,9 kg/m² is categorized as overweight, and over 25 kg/m² is categorized as obese.

Table 2. The results of normality and homogeneity of abdominal muscle endurance

Abdominal muscle endurance	Normality test using <i>Shapiro Wilk Test</i>				Homogeneity test (Levene's Test) p-value
	Group 1 of Surya Namaskar Yoga		Group 2 of Core Stability Exercise		
	Mean ± SD**	p-value	Mean ± SD	p-value	
FET* Pre test	108,67 ± 9,73	0,855	114,33 ± 8,21	0,702	0,781
FET Post test	128,83 ± 10,04	0,934	146,33 ± 8,26	0,481	0,743

* *Flexor Muscle Endurance Test*

** Standard Deviation

Based on Table 1.2, it can be seen that the results of the normality test using the Shapiro Wilk Test revealed Mean pre-test of Flexor Muscle Endurance Test in Group 1 of surya namaskar yoga was 108,67 ± 9,73 with p-value = 0,855 ($p > 0,05$) while in Group 2 of core stability exercise, it was 114,33 ± 8,21 with the value of p-value = 0,702 ($p > 0,05$). The average post-test of Flexor Muscle Endurance Test in Group 1 of surya namaskar yoga was 128.83 ± 10,04 with a p-value = 0,934 ($p > 0,05$) while in Group 2 of core stability exercise, it was 146.33 ± 8,26 with p-value = 0,481 ($p > 0,05$). A homogeneity test was conducted using Levene's test. In the pre-test and post-test measurement with Flexor Muscle Endurance Test each get the p-value = 0,781 and p-value = 0,743 ($p > 0,05$).

Based on the results of the normality test and homogeneity test, the data of the average abdominal muscle endurance in each group were normally distributed and homogeneous. Therefore, parametric statistical can be used to test hypothesis testing.

Table 3. Results of Paired Sample t-test on mean of abdominal muscle endurance using the Flexor Muscle Endurance Test

Group	Before Training	After Training	Mean Difference ± SD	p-value
	Rerata ± SD*	Rerata ± SD		
Group 1	108,67 ± 9,73	128,83 ± 10,04	20,16 ± 0,75	0,000
Group 2	114,33 ± 8,21	146,33 ± 8,26	32,00 ± 2,09	0,000

* Standard Deviation

Table 3 presents the results of the research in Group 1 of surya namaskar yoga. The average value of abdominal muscle endurance before training measured using the Flexor Muscle Endurance Test was $108,67 \pm 9,73$, while the average value of abdominal muscle endurance after training was $128,83 \pm 10,04$. From the results of pre- and post-training comparisons, the difference was $20,16 \pm 0,75$. Subsequently, the hypothesis testing was conducted using the Paired Sample T-Test and revealed p-value = 0,000 ($p < 0,05$), which means that there was a significant difference in the average endurance of the abdominal muscles between before and after the surya namaskar yoga training. This result indicated that surya namaskar yoga training increases abdominal muscle endurance among students of yoga and health department at the Faculty of Brahma Widya of UHN I Gusti Bagus Sugriwa Denpasar. The results of this study were also supported by several previous studies, which showed an increase in abdominal muscle endurance following surya namaskar yoga training (Singh et al., 2010; Bhowmik, 2018; Bhole & Waydande, 2021). Abdominal muscle endurance improved because many muscles are activated during Surya namaskar yoga such as Lower trapezius, Latissimus dorsi, Erector spinae, Rectus abdominis, Gluteus maximus, Vastus lateralis, Gastrocnemius, or in general there is an increase in activation of the core muscles, and upper and lower extremities (Mullerpatan et al., 2020).

In Group 2 of core stability exercise, the average value of abdominal muscle endurance before training measured using the flexor muscle endurance test was $114,33 \pm 8,21$, while the average value of abdominal muscle endurance after training was $146,33 \pm 8,26$. From the pre- and post-training comparison, the difference was $32,00 \pm 2,09$. Furthermore, hypothesis testing was performed using the Paired Sample T-Test. The results showed p-value = 0,000 ($p < 0,05$), which means that there was a significant difference in the average abdominal muscle endurance between before and after core stability exercise training. This result implies that core stability exercise enhances abdominal muscle endurance in students of yoga and health department at the Faculty of Brahma Widya of UHN I Gusti Bagus Sugriwa Denpasar. The results of this study are also supported by some previous studies which demonstrated the effect of core stability exercise on abdominal muscle endurance (Aly, 2017; Tafakoriollah et al., 2020). The abdominal muscles consist of the abdominal rectus, internal and external oblique abdominals, and the transversal abdomen. Core stability exercises focus on the core muscles; thus, this exercise involves many muscle contractions in the core muscles, including the abdominal muscles. Each exercise pose provides a neuromuscular adaptation response can lead to increased muscle endurance.

Table 4. Results of mean comparison of abdominal muscle endurance between the groups

Abdominal muscle endurance	Measurement	Group	<i>n</i>	Mean \pm SD*	p-value
Flexor Muscle Endurance Test	Before treatment	Group 1	6	108,67 \pm 9,73	0,301
		Group 2	6	114,33 \pm 8,21	
Flexor Muscle Endurance Test	After treatment	Group 1	6	128,83 \pm 10,04	0,008
		Group 2	6	146,33 \pm 8,26	

*Standard Deviation

Based on the results of the independent t-test which aims to compare the mean of abdominal muscle endurance between groups, the mean of abdominal muscle endurance after treatment as measured by the Flexor Muscle Endurance Test in Group 1 of surya namaskar yoga was $128,83 \pm 10,04$, while in Group 2 of core stability exercise, it was $146,33 \pm 8,26$ and $p\text{-value} = 0,008$ ($p < 0,05$) which indicated a significant difference in the mean of abdominal muscle data after treatment between the groups. This shows that core stability exercise outweighs surya namaskar yoga in improving abdominal muscle endurance among the students of yoga and health department at the Faculty of Brahma Widya of UHN I Gusti Bagus Sugriwa Denpasar.

The results of this study indicate that core stability exercise outweighs surya namaskar yoga in improving abdominal muscle endurance among the students of yoga and health department at the Faculty of Brahma Widya of UHN I Gusti Bagus Sugriwa Denpasar. This result can be explained by the difference in the activity level of the target muscle in each group treatment. Group 1 of surya namaskar yoga has shown wider involvement of muscles in the training process, including Lower trapezius, Latissimus dorsi, Erector spinae, Rectus abdominis, Gluteus maximus, Vastus lateralis, Gastrocnemius. The highest activity occurs in the erector spinae muscles, while moderate activity occurs in the lower trapezius, latissimus dorsi, gluteus maximus, vastus lateralis, and rectus abdominis muscles, and the lowest activity occurs in the gastrocnemius muscle (Mullerpatan et al., 2020). In contrast, in Group 2 of core stability exercise, the exercise is specifically designed to target high activity in all core muscles including the abdominal muscles in the training, thereby creating different effects between core stability exercise and surya namaskar yoga on abdominal muscle endurance. In surya namaskar yoga training, the level of abdominal muscle activity is moderate, while in core stability exercise the level of abdominal muscle activity is high during the training.

Conclusion

Based on data analysis and discussion, it can be concluded that both treatments, surya namaskar yoga, and core stability exercise, increase abdominal muscle endurance. However, if these two treatments are compared, core stability exercise outweighs surya namaskar yoga in improving abdominal muscles endurance among students of yoga and health department at the Faculty of Brahma Widya of UHN I Gusti Bagus Sugriwa Denpasar.

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