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Effect of *Suryanamaskara* and Heating *Pranayama* on Grade 1 Obesity - A Randomized Controlled Trial

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ABSTRACT

Background: Obesity is a prevalent health condition in society with potentially fatal side effects that can result in serious disability. The objective of this study was to assess the Effect of *Suryanamaskara* and Heating *Pranayama* on Body Mass Index, Waist circumference, Skin fold thickness among obese individuals. **Materials and Methods:** A total of 60 subjects aged 18-30 years were screened and after filling inclusion criteria as well as diagnostic criteria (WHO criteria of obesity) 30 subjects were recruited to the study. *Suryanamaskara* and Heating *Pranayama* was given for the duration of 45 minutes each for 5 days. **Results:** Study results demonstrate that there is a significant decrease in Body Mass Index (BMI), Waist Circumference (WC), and Skin Fold Thickness (SKF) in the study group after 45 minutes of *Suryanamaskara* and heating *Pranayama* practice for 4 weeks, while there is no improvement in the control group. **Discussion:** The study reveals that practice of *Suryanamaskara* and heating *Pranayama* can help the people suffering from obesity. So, finally it can be concluded that the practice of *Suryanamaskara* and heating *Pranayama* can help to manage Grade 1 obesity.

Key words: *Suryanamaskara*, Heating *Pranayama*, BMI, WC, SKF, Obesity.

INTRODUCTION

Obesity is the condition of excessive accumulation of fat and fat depots resulting in more than 20% of excess of expected body weight.^[1] Obesity (BMI > 30 kg/m²) is recognized by the World Health Organization as a global issue that also has an impact on many developing nations.^[2] The World Health Organization

(WHO) predicts that >1.9 billion adults were overweight or obese worldwide in 2015. Obesity's adverse effects are correlated with both the distribution of stored fat and total body weight.^[3] There are more than 135 million obese people in India, and women are more likely than men.^[4]

Obesity comes in four different forms. In particular, generalized obesity where the uniform deposition of extra body fat throughout the body, android obesity causes extra fat to accumulate around the waist, gynoid obesity causes extra fat to accumulate around the hips and thighs, and superior or central obesity causes extra fat to accumulate around the face, neck, and upper part of the trunk while the limbs are thin.^[5]

Various etiological factors, including genetic, behavioral, environmental (sedentary lifestyle coupled with energy consumption), physiological, and cultural, contribute to obesity.^[6]

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Yoga is a science, an art, and philosophy. It affects a man's life on every level, including the physical, mental, and spiritual. It is a useful technique for giving one's life meaning, value, and virtue.^[7]

Yoga is a method for balancing and harmonizing the body, mind, and emotions on a more practical level.^[8]

In *Asana Pranayama Mudra Bandhas Swami Satyananda Saraswathi* explain about *Suryanamaskara* as- practice of *Suryanamaskara* gives a great number of benefits. It strengthens the back and helps balance the metabolism.^[6]

Kapalabhati is a *Pranayama* technique which invigorates the entire brain and awakens the dormant center which is responsible for the subtle perception.

Bhastrika Pranayama is the name of the *Pranayama* which imitates the action of *Bastra* or bellow and fans the internal fire heating the physical and subtle bodies.^[7]

Surya Anuloma Viloma Pranayama means heating and generating breathing structure when respiratory cycle of inhalation and exhalation is completed to the right nostril exclusively. Thus, increase in metabolic function by activating basal oxygen consumption and also increase in vasomotor sympathetic activity.^[8]

Obesity is a significant health issue and has been linked to a number of ailments. After practicing *Suryanamaskar*, obese females displayed a significant decrease in mean body weight, body fat, improvement in muscle mass, and increased upper limb muscle endurance. These factors suggest that *Suryanamaskar* is a useful method for controlling weight, maintaining physical fitness, and enhancing cardiorespiratory fitness.^[9]

In this study, *Pranayama*, which comprises abdominal muscle contractions with a powerful exhale and a spontaneous inhalation, may have contributed to the decrease in weight and BMI. Respiratory, abdominal, and gastrointestinal receptors are stimulated as a result. Afferents, brainstem centers, cortex, and effectors are all stimulated as well. This results in synchronous stimulation of the hypothalamus, pineal

gland, autonomic nervous system, and other related brain structures, which boosts synchronous discharge to all body regions, including endocrine and metabolic functions. This is what causes *Pranayama's* impact on fat metabolism. This increases basal metabolic rate, which leads to an increase in caloric intake, a decrease in fat synthesis, and a consequent decrease in body weight.^[10]

Obesity is linked to the development of the most common diseases in contemporary society, including cancer, osteoarthritis, pickwickian syndrome, hypertension, hyperlipoproteinemia, atherosclerosis, non-alcoholic fatty liver disease, hyperinsulinemia, and type 2 diabetes mellitus.^[12] Hence, the current study is undertaken to understand the outcome of *Suryanamaskara* and heating pranayama on grade1 obesity.^[11]

AIMS AND OBJECTIVES

AIM

To study the Effect of *Suryanamaskara* and Heating *Pranayama* on grade1 obesity.

OBJECTIVES

Assess the Effect of *Suryanamaskara* and Heating *Pranayama* on

- Body Mass Index,
- Waist circumference,
- Skin fold thickness among obese individuals

MATERIALS AND METHODS

This is a randomized controlled trial pre-post-study design. The subject were recruited from Alva's Naturopathy OPD, Moodbidri and Alva's Anandamaya Arogyadhama Nature cure and Yoga Hospital, Mijar, managed by Alva's education foundation, Moodbidri 574227, Dakshina Kannada Dist, Karnataka, India. After obtaining a legally signed written consent, participants of the male and female genders, age 18 to 30 years, who were diagnosed with Grade 1 obesity according to the World Health Organization Criteria and were

willing to participate, joined the study. Subject with Co morbidity associated with obesity, Subject taking other treatments and alcohol consumption were eliminated. 60 people were chosen for the study based on the inclusion and exclusion criteria. The Alvas College of Naturopathy and Yogic Sciences' ethical committee authorized the study.

Ethical Considerations

The study's purpose and the participants' rights as research subjects were explained to them. For individuals who couldn't comprehend English, an informed consent form was given in their native language, Kannada, and explained. Each subject received enough time to read the information sheet and have their entire enquiry. It was explained to them that they had the right to leave the study at any moment and that they had to be willing to take part voluntarily. By signing an informed consent form, each subject indicated their willingness to take part in the study. The institution's ethical committee has given the approval for the project with the ethical clearance registration certificate no ACNYS/IECHS/2021/70

CTRI Registration number - CTRI/2022/08/057258

Assessments

Body weight measurement:

The body weights of each participant were calculated using a calibrated digital scale. Participants' weights were recorded when the scale's digital number was fixed for 5 seconds and they were standing firmly on it without swaying to one side or the other.

Height measurement:

Subjects required to take off their shoes so that the height could be measured while they stood straight up with their heels together. Participants in this method maintained a straight stance while gazing forward. Centimeters were used to measure the data.

Waist circumference measurement:

A horizontal measurement was obtained at the greatest anterior extension of the abdomen at the level

of the umbilicus with the participant standing straight and relaxed. At the conclusion of a normal exhale, the measured values were recorded without pulling the tape tightly.

Skin folds thickness measurement:

A skin fold caliper is a tool that measures the thickness of a fold in your skin and the layer of fat that lies behind it. A mark is made 5 cm to the right, next to the umbilicus (belly button). The calipers are positioned immediately below the vertical pinch, which is made at the designated marking. Avoid inserting your fingers or the caliper inside the navel. While taking the readings, don't let go of your left hand's fingers. It is crucial to maintain a firm grip on the skin fold with your fingers so that the caliper is only measuring the thickness of the fold of skin. When you set the calipers on the skin fold, you'll notice that they "creep" a little. Once the "creep" slows down, the measurement should be taken. Prior to releasing any caliper pressure, take note of the scale's reading.^[12]

The skin fold thickness of following sites were measured

Abdominal site:

Situated at the middle of the navel, 2 cm out from the right lateral side of the omphalion, in an elevated vertical fold

Triceps site:

On the back of the right arm, midway along the acromion-olecranon line, in a raised vertical fold.

Sub-scapular site:

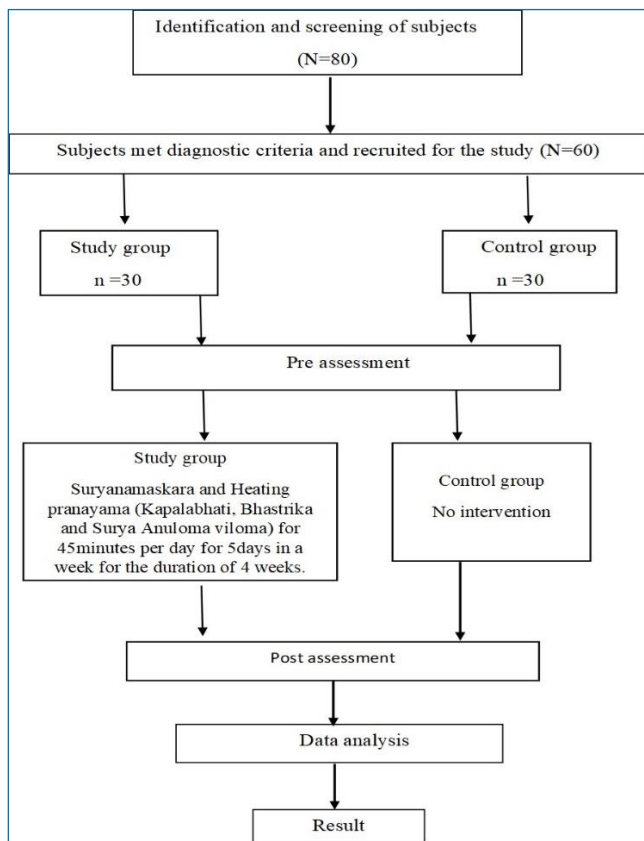
1 to 2 cm under the lower angle of the scapula, in a raised oblique fold (45-degree angle).^[13]

Body Mass Index:

Body mass index (BMI) is a simple measure based on height that is frequently used to categorize individuals as underweight, overweight, or obese. It is determined by dividing the weight in kilograms by the square of the height in meters (kg/m²).

Body mass index = Weight (kg)/ Height (m²).^[14]

Figure 1: Illustration of study plan



Intervention

Suryanamaskara: each subject will be instructed to follow.

Position 1: *Pranamasana* (Prayer pose)

Close your eyes. Keep the feet firmly place together and keep body straight. Slowly bend the elbows, making the *Namaskara Mudra* with the palms facing each other in front of the chest, paying respect to the sun, the origin of all life. Body-wide relaxed.

Position 2: *Hasta Utthanasana* (Raised arms pose)

Keep your hands apart as you raise both of your arms shoulder-width above your head. Slowly bend backward the upper body, arms, and head.

Position 3: *Padahastanasana* (Hand to Foot pose)

Bend forward from the hips to touch the floor with the palms of your hands both sides of the foot. Bring the forehead as near to the legs as is comfortable. Don't strain. Keep your knees straight.

Position 4: *Ashwa Sanchalanasana* (Equestrian pose)

Place the hands next to the feet on the ground. Reaching down with the toes, extend the right leg as far back as it is comfortable. While maintaining the left foot's position on the ground, simultaneously bend the left knee. Arm should remain straight. The body should be supported in its final position by the left foot, right knee, right foot toes, and both hands. The back should be arched, the head leaned back, and the eyes should be focused upward toward the middle of the eyebrows.

Position 5: *Parvatasana* (Mountain pose)

Take the left foot back next to the right foot while maintaining the hand and right foot in place. Raised the buttock and lowered the head between the arms at the same time, forming a triangle with the back and legs on opposite sides. In the final position, the arms and legs are strengthened, and the heels point down towards the floor. Head and shoulder should be brought near the knees.

Position 6: *Astanga Namaskara* (Salute with eight parts or points)

Keep the hands and feet steady. The feet will rise up onto the toes as you bend your knee, chin, and chest toward the floor. In the finished position, the toes, knee, chest, hands, and chin touched the floor. First, if this is not possible, bend your knees the chin comes next, followed by the chest. The abdomen hips, and buttocks should all be raised.

Position 7: *Bhujangasana* (Cobra pose)

Hold your hands and feet firmly in place. The cobra position is achieved by sloping the chest forward, lifting the head, shoulders, and elbows before arching the spine. Thus, the hip and buttocks are brought to the ground. Turn the head back and look up at the middle of the eyebrows. The trunk is supported by the arms as the thigh and hips stay on the ground. The arms will remain a little bent unless the spine is highly flexible.

Position 8: *Parvatasana* (Mountain pose)

In position 7, the hands and feet remain steady. Assume *Parvatsana* from *Bhujangasana*. Use the

strength of the arms to lift the buttocks and lower the heels to the ground while keeping the arms and legs straight.

Position 9: Ashwa Sanchasana (Equestrian pose)

Keep your right foot in place and your palms flat on the ground. Bring the left foot forward in front of the hands while bending the left leg. Push the pelvis forward while simultaneously bringing the right knee to the floor. Leaning back, arching the spine, and focusing on the middle of the eyebrows.

Position 10: Padahasthasana (Hand to foot pose)

Bring the right foot forward near to the left foot. Set both legs in a straight position. Bring your knees as near to your forehead as you can without straining.

Position 11: Hasta Uttanasana (Raised arm pose)

Maintain a straight line with your arm and spine. Stretching the arm above the head while raising the torso. Maintain shoulder-width separation between your arms. Head, arms, and upper body should all slightly bend backward.

Position 12: Pranamasana (Prayer pose)

Place the hands in front of your chest.

Heating Pranayama:

Kapalabhati Pranayama:

The subject will be told to adopt a relaxed meditation asana. With the hands resting on the knees in either the chin *Mudra* or the *Jnana Mudra*, the head and spine should be straight. Eyes closed, relax your entire body. Exhale through both nostrils while concentrating your abdominal muscles with vigor by allowing the abdominal muscles to relax, the subsequent inhalation and exhalation should be passive. Inhalation need to be a natural, effortless reflex. Take ten quick breaths in a row, and then take a slow, deep breath. Let the breath return to its regular rhythm.

Bhastrika Pranayama

Sit comfortably for meditation, placing your hands in the *Jnana* or chin *Mudras* on your knees. Close your eyes, keep your spine straight, and relax your entire body. Inhale deeply, then exhale quickly through your

nose. After that, inhale with the same vigor. Forceful intake and forceful expiration cause the abdominal muscles to tense firmly. Avoid straining.^[8]

Surya Anuloma Viloma Pranayama

The subject will be asked to sit in any comfortable meditation position, such as *Padmasana* or *Sukhasana*, with their eyes closed and their spine straight, their hands cupped in the *Mudras* of the chin and *Nasikagra*, respectively. The left nostril should be covered with the ring finger, and breathing should only be done through the right nostril (both inhaling and exhaling). Repeat these steps while relaxing your entire body.^[15]

Table 1: Method of Suryanamaskara and heating Pranayama

<i>Suryanamaskara</i>	15 rounds (1 round/2minutes) 30 minutes
Rest	2 minutes
<i>Kapalabhati</i>	3 rounds (120 strokes/round) 3minutes
Rest	1minute
<i>Bhastrika</i>	3 rounds (100strokes/round) 3minutes
Rest	1 minute
<i>Surya Anuloma Viloma</i>	(20-25 rounds) 3 minutes
Relaxation	2 minute

Data analysis

The data was visually inspected for manual typographic errors. The shapiro-wilk's test for Normality showed that the data was normally distributed. Paired samples t-test was used to assess within group differences. ANCOVA was performed to assess between group changes controlled for their respective baseline values. Levene's test for equality of variances were performed

RESULTS

Within group changes in the experimental group showed a significant reduction in weight ($p \leq 0.05$), body

mass index ($p \leq 0.05$), waist circumference ($p \leq 0.05$), abdominal circumference ($p \leq 0.05$), Triceps circumference ($p \leq 0.05$) and subscapular circumference ($p \leq 0.05$). In the control group it was observed that there was a slightly increase in weight and waist circumference.

Between group changes performed using analysis of covariance for variables of interest adjusted for their respective baseline values indicated a significant difference in weight ($F(1, 57) = 203.4, p \leq 0.05, \eta^2 = 0.78$), BMI ($F(1, 57) = 186.7, p \leq 0.05, \eta^2 = 0.766$), waist circumference ($F(1, 57) = 36.11, p \leq 0.05, \eta^2 = 0.388$), abdominal circumference ($F(1, 57) = 85.8, p \leq 0.05, \eta^2 = 0.601$), Triceps circumference ($F(1, 57) = 24.75, p \leq 0.05, \eta^2 = 0.303$) and subscapular circumference ($F(1, 57) = 54.48, p \leq 0.05, \eta^2 = 0.489$) Table 2.

Table 2: Table representing BMI and Anthropometric variables in Mean \pm SD before and after the intervention.

	Experimental Group		Control Group	
	Pre (Mean \pm SD)	Post (Mean \pm SD)	Pre (Mean \pm SD)	Post (Mean \pm SD)
Weight	79.93 \pm 7.88	77.43 \pm 7.75 ^a	82.6 \pm 5.54	83.17 \pm 5.47 ^a
BMI	32.93 \pm 1.09	31.92 \pm 1.19 ^a	33.26 \pm 0.98	33.50 \pm 0.96
WC	110.03 \pm 5.79	108.2 \pm 5.6 ^a	116.87 \pm 9.25	117.8 \pm 8.86 ^a
Abdominal Circ	36.07 \pm 3.54	33.80 \pm 3.58 ^a	36.6 \pm 1.91	36.8 \pm 1.79
Tricep Circ	33.73 \pm 2.91	32.07 \pm 2.9 ^a	33.73 \pm 2.45	34.47 \pm 2.86
Subscapular Circ	34.60 \pm 4.46	32.60 \pm 4.46 ^a	33.40 \pm 2.3	33.73 \pm 2.15

Table mentioning the results of within and between group comparisons through paired samples t-test and analysis of covariance and the average (Mean \pm SD) values of the assessments.

^a within group comparisons using paired t-test, level of significance $p \leq 0.05$.

^b Between group comparisons using Analysis of covariance adjusted for baseline values, level of significance $p \leq 0.05$.

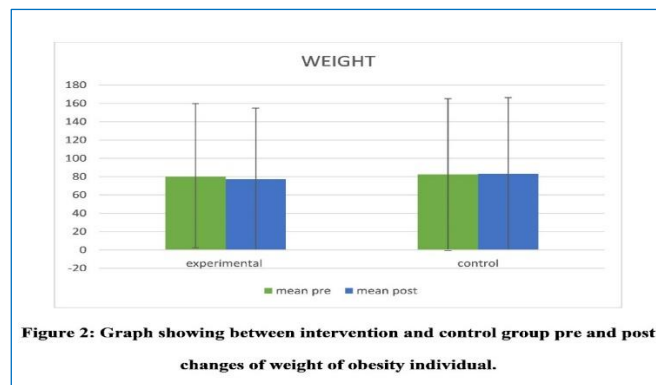


Figure 2: Graph showing between intervention and control group pre and post changes of weight of obesity individual.

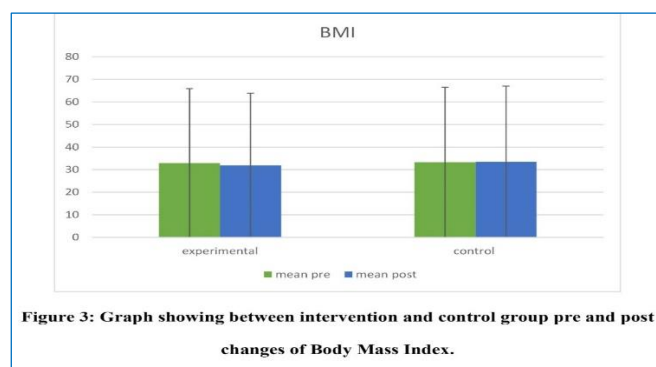


Figure 3: Graph showing between intervention and control group pre and post changes of Body Mass Index.

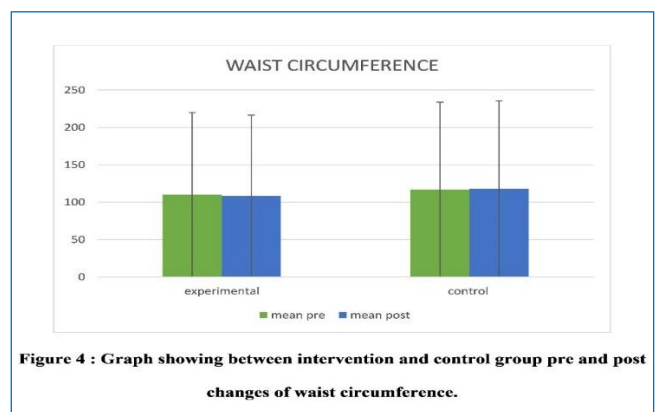


Figure 4: Graph showing between intervention and control group pre and post changes of waist circumference.

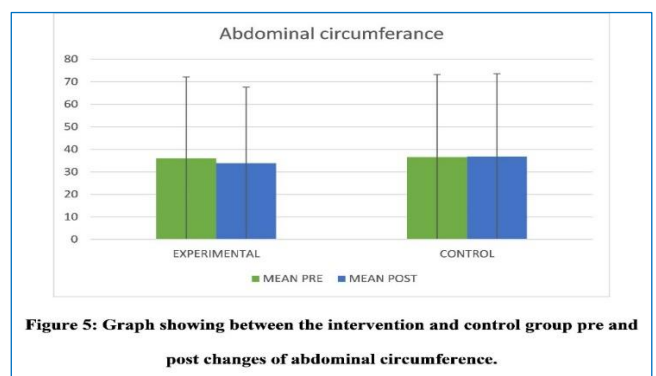


Figure 5: Graph showing between the intervention and control group pre and post changes of abdominal circumference.

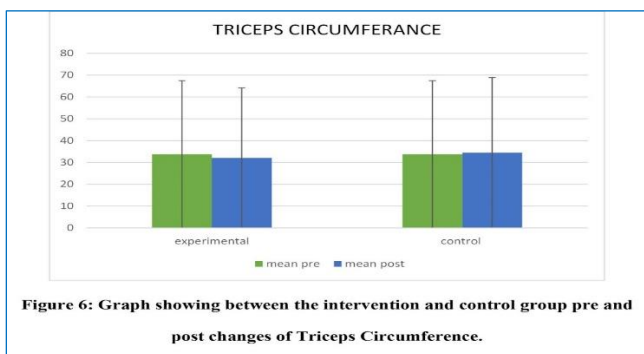


Figure 6: Graph showing between the intervention and control group pre and post changes of Triceps Circumference.

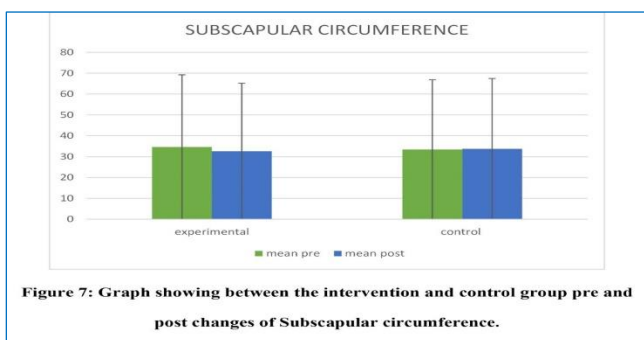


Figure 7: Graph showing between the intervention and control group pre and post changes of Subscapular circumference.

DISCUSSION

The present study demonstrates that after 4 weeks of intervention, there was a significant decrease in body mass index, waist circumference, and skin fold thickness in the study group that practiced *Suryanamaskara* and heating *Pranayama*. The control group's above-mentioned parameters remained unchanged throughout the study. When comparing the post-training final findings of all the data between the study group and control group, it was determined that the difference in BMI and waist circumference and skin fold thickness was statistically significant in study group.

Obesity is the most prevalent dietary issue which is characterized by an energy imbalance between calories consumed and calories expended. Obesity can be avoided by adopting a healthy diet and engaging in frequent, moderate physical activity.^[16]

Obesity is condition characterize by the low-grade inflammation.

Adipocytokines from adipose tissue, particularly leptin and adiponectin, are linked to inflammation caused by obesity. This condition of inflammation can make the body more susceptible to a chronic state of

inflammation that causes metabolic dysfunctions, such as increased insulin resistance and endothelial dysfunction that causes cardiovascular illnesses.^[17]

Body mass index (BMI) is an essential measure of the amount of muscle in the body. Obese people have BMI values above the normal range. Basal metabolic rate (BMR) is the minimal amount of energy required to maintain cellular metabolism when the body is in the resting state.

The *Suryanamaskar* is recommended as a great exercise for college students to achieve optimum physical health. It was observed that there was a considerable reduction in body fat and BMI, as well as an increase in muscle strength and endurance.^[18]

Yoga-based lifestyle changes are effective for weight loss,^[19] in addition to preventing weight gain, it also helps those who are overweight.^[20] Adiponectin levels and IL-6, IL-18, and CRP levels in obese and postmenopausal women respectively showed a decrease in inflammation in addition to this lifestyle change.^[21]

Another study with obese postmenopausal women found that yoga improved adiponectin levels, serum lipids, and risk factors for metabolic syndrome.^[22] In obese and normal weight people, a short-term yoga-based lifestyle intervention has been demonstrated to reduce IL-6 and TNF- α .^[23]

It has been demonstrated that a *Yoga*-based intervention given to obese adults significantly lowers weight, BMI, and SBP. Additionally, IL-6 significantly decreased, and adiponectin increased.^[24]

The YBLI group had significantly lower levels of leptin, the leptin-to-adiponectin ratio, IL-6, 8-OHdG, and TBARS, while significantly higher levels of adiponectin and SOD were found. This suggests that people with Met S undergo less oxidative stress. In people with Met S, a 12-week YBLI had a positive impact on oxidative stress.^[25]

The *Pranayama* techniques used in this study, which involve abdominal muscle contractions along with strong exhalations and spontaneous inhalations, may be the cause of the study's weight and BMI reduction.

It is a type of workout that works the abdomen, lungs, and autonomic systems. As a result, receptors in the gastrointestinal, abdominal, and respiratory systems are triggered. Additionally, afferents, brainstem centers, the cortex, and effectors are stimulated. This results in synchronous stimulation of the autonomic nervous system, hypothalamus, pineal gland, and other related brain structures, which enhances synchronous discharge to all regions of the body, including endocrine and metabolic functions. Because of this, *Pranayama* has an impact on how your body burns fat. Because of the increased basal metabolic rate caused by this, more calories are consumed, fat is not deposited, and weight is subsequently reduced. This may be the possible reason why the BMI decreased in this study.^[26]

According to the result of the current study *Suryanamaskara* and heating *Pranayama* shows a significant improvement on BMI, WC and SKF on Grade 1 Obesity Individuals. In accordance with previous research, the current study showed that performing *Suryanamaskara* and heating *Pranayama* helps in reducing weight by improving adiponectin levels with lowering leptin levels, and reducing inflammatory cytokines including IL-6 and TNF-. TNF- α . Hence *Suryanamaskara* and heating *Pranayama* suggested for therapeutic benefits for Obesity

CONCLUSION

Suryanamaskara, a sequence of twelve yoga asanas that are synchronized with mindful breathing, and heating pranayama, a breathing technique that involves inhaling and exhaling rapidly through the nose while generating heat in the body, have been reported to have significant benefits for individuals seeking to reduce their body weight, body mass index (BMI), skin fold thickness, and waist circumference. Thus, it can be inferred that the utilization of *Suryanamaskara* and heating pranayama presents a particularly effective therapeutic approach in the realm of yoga for individuals struggling with obesity and seeking to alleviate its detrimental impacts on health and wellness.

Limitations and Future directions of study

The limitation of the study is short duration of the study plan. Further research could be conducted with longer duration to assess the effect of *Suryanamaskara* and heating *Pranayama* on obesity. Such studies require a larger sample size, advanced techniques, and a longer intervention period than previous studies.

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