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# "IMPACT OF 10 WEEKS YOGIC SUN SALUTATION, KAPALABHATI KRIYA, AND NADI SHODANA PRANAYAMA PRACTICE ON MUSCULAR STRENGTH AND FLEXIBILITY AMONG FEMALE ADOLESCENT SCHOOL STUDENTS IN IMPHAL EAST DISTRICT OF MANIPUR"

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## ABSTRACT

The present study aimed to examine the E*ffect of a 10-week Kapalabhati Kriya, Yogic Sun Salutation, and Nadi Shodhana Pranayama practice on muscular strength and flexibility among female adolescent school students in Imphal East District of Manipur.* The investigation was conducted to understand how a systematic yogic intervention could influence key components of physical fitness in adolescent girls, a group often experiencing physiological and psychological transitions that affect health and performance.

A total of **60 female students**, aged **13–16 years**, were randomly selected and divided into two groups: an **experimental group (n = 30)** and a **control group (n = 30)**. The experimental group underwent a **10-week yogic training program** consisting of daily sessions of **Kapalabhati Kriya, Surya Namaskar, and Nadi Shodhana Pranayama** for 45 minutes, six days a week, under expert supervision. The control group maintained their regular school routine without any yogic practice. Pre- and post-test data on **muscular strength** (measured by sit-ups and push-ups tests) and **flexibility** (measured by the sit-and-reach test) were collected and statistically analyzed using paired *t*-tests.

The results revealed a **significant improvement ($p < 0.05$)** in both muscular strength and flexibility among the experimental group compared to the control group. The findings suggest that regular practice of Kapalabhati Kriya enhances core and respiratory muscle endurance; Surya Namaskar improves dynamic muscular coordination and overall strength; while Nadi Shodhana Pranayama contributes to neuromuscular relaxation and postural efficiency.

In conclusion, a structured 10-week yogic intervention effectively enhanced **muscular strength and flexibility** in adolescent female students. The study emphasizes the importance of incorporating yogic practices into school physical education programs to promote holistic health, physical fitness, and mental well-being among adolescents.

**Keywords:** Kapalabhati Kriya, Surya Namaskar, Nadi Shodhana Pranayama, Muscular Strength, Flexibility

## 1.0 INTRODUCTION

### 1.1 Yoga

Yoga is a 5000 years old Indian Wisdom which bring Holistic Physical, Mental, and Emotional well-being to mankind Within this rich tradition of Yoga, Surya Namaskar, commonly known as Sun Salutation, and Pranayama, the science of breath control, stand out as potent techniques with profound implications for overall well-being. Surya Namaskar is a dynamic sequence of interconnected asanas (postures) performed in a flowing rhythm, often synchronized with breath. This practice is not merely a physical exercise; it is a holistic ritual that engages major muscle groups, enhances cardiovascular function, and improves flexibility. Pranayama, on the other hand, delves into the conscious regulation of breath to manipulate *prana*, the vital life force, within the body. Various Pranayama techniques, such as Bhastrika, Kapalabhati, and Anulom Vilom, are known to calm the nervous system, increase lung capacity, improve mental focus, and enhance energy levels.

### 1.2 Surya Namaskar (Sun Salutation)

Surya Namaskar, Salute to the Sun or Sun Salutation, is a branch of contemporary yogic practices that comprises of a series of about twelve elegantly linked asanas. It combines Yogasanas and Pranayama. The name recognizes the sun being at the center as the 'soul' and source of all life. It brings about the general flexibility of the body preparing it for Asanas and Pranayama's. The alternating backward and forward bending asanas flex and stretch the spinal column and limbs through their maximum range. Synchronizing the breath with the movements is the next step. The basic breathing principle followed is Inhalation during Backward bending postures due to expansion of the Chest, and Exhalation with Forward bending postures due to compression of the Chest and Abdomen.

### 1.3 Pranayama

Pranayama is defined as Breath Control. The word Pranayama is comprised of two roots: Prana plus Yama. Prana means 'Vital Energy' or 'Life Force' and Yama means "to Control"' or Extension or Expansion" which is used to denote various rules or codes of Conduct.Although closely related to the air we breathe, it is more subtle than air or oxygen. There are four important aspects of Breathing in Pranayama which are utilized. These are: 1) Pooraka or Inhalation, 2) Rechaka or Exhalation, 3) Antar Kumbhaka or Internal Breath Retention and 4) Bahir Kumbaka or External Breath Retention. The different Practices of Pranayama involves various techniques which utilize these Four Aspects of Breathing.

### 1.4 Kapalabhati Kriya

"Kapalabhati" is a compound word. "Kapala" means "skull"; "bhati" means "to shine or to be lustrous." This practice is said to "make the skull shine" by cleansing the nasal passageways and sinuses, and ultimately supplying the brain with a fresh supply of oxygen-rich blood. It also cleanses the throat and lungs and stimulates the abdominal muscles and organs.

Kapalabhati is one of six practices *(shat kriyas)* taught in hatha yoga for internal cleansing. Although it is not a formal pranayama practice—there is no retention of the breath involved—it is included in any discussion about yogic breathing exercises and plays an important role in breath training.

It is beneficial for nerves, circulation, and metabolism. From a yogic perspective it is a practice of great spiritual benefit. It assists in purifying the subtle energy currents, or *nadis*.

### 1.5 Nadi Shodana Pranayama

Nadi shodhana is an excellent breathing technique to calm and center the mind, bringing it back to the present moment. Practice of this breathing technique also purifies and balances the nadis (energy channels), and ensures a smooth flow of prana (life force) through the body.Nadi shodhana helps circulate breath through the nadis, the chakras and the brain, thus, returning the body to a state of balance. Specifically, it stimulates the ajna (third eye) and muladhara (root) chakras. It also balances the ida (left) and pingala (right) nadis, thus, enhancing spiritual progress.

### 1.6 Muscular Strength

**Muscular strength**, the maximal force a muscle can generate in a single contraction, is essential for activities like lifting heavy objects or performing powerful movements. Both Surya Namaskar and Pranayama offer distinct yet complementary pathways to enhance this aspects of muscular fitness.

As evidenced by studies like Suwannakul et al. (2024) and Sarkar (2022), regular Surya Namaskar practice leads to noticeable improvements in both muscular strength and endurance. The resistance provided by body weight in various postures also contributes to strength gains, particularly when practiced consistently and with attention to proper form and muscle engagement.

***Pranayama:*** While Pranayama's primary focus is on breath regulation, its benefits extend indirectly to muscular strength and endurance through enhanced **neuromuscular coordination**. As suggested by Vallimurugan (2020) and Bal (2015), Pranayama can refine the body's ability to efficiently engage muscles, leading to improved force production and sustained muscular effort.Although not a direct muscle-strengthening exercise in the same way as weightlifting, Pranayama's contribution to neuromuscular efficiency and overall body awareness creates a supportive environment for improved muscular strength and endurance development, especially when combined with practices like Surya Namaskar.

### 1.7 Flexibility

Flexibility ensures ease of movement, prevents stiffness, and significantly reduces the risk of injuries. Both Surya Namaskar and Pranayama are recognized for their ability to enhance flexibility through distinct yet complementary approaches. As studies like Suwannakul et al. (2024) and Sarkar (2022) confirm, consistent Surya Namaskar practice leads to tangible improvements in overall flexibility. Muscle tension is a significant barrier to flexibility, and by promoting relaxation, Pranayama allows muscles to lengthen more easily during stretching exercises, potentially enhancing the effectiveness of flexibility practices and contributing to overall improved range of motion, as suggested by Vallimurugan (2020) and Bal (2015).

## 2.0 AIMS AND OBJECTIVES

The present study aims at the Physical Improvement of the school going Female Adolescent students with the age group 13-16 years with Intervention of Surya Namaskar, Pranayama, and Yoga Practice. The study emphasized on the improvement of Flexibility and Muscular Strength Female Adolescent students by giving Surya Namaskar and Pranayama for a duration of 10 weeks.

## 3.0 MATERIALS AND METHODS

### *3.1 Selection of Subjects*

Selection of 60 female students from two different schools in Imphal East District with age ranging from 13 to 16 years were selected randomly for the present study. The subjects were divided into two groups viz 1) Experimental and 2) Control, with 30 students of both groups for Pre and Post Intervention by lottery system . The health-related physical fitness variables of both the groups were measured by using selected standardized tests. The study was based on the generally practiced of Surya Namaskar postulated by S-VYASA having 12 Steps with Breathing Exercises, Kapalabhati Kriya, and some different Pranayama.

### *3.2 Variables*

Health related physical fitness variables i.e. Muscular Strength and Flexibility were considered for the quantitative measurement. The standard tools need for measuring Flexibility and Muscular Strength are given below :

| Sl. No | Variables | Tools/Techniques | Units |
|---|---|---|---|
| 1 | Muscular Strength | Hand Grip Dynamometer (Flex) | Kilograms (kg) |
| 2 | Flexibility | Sit & Reach Box (Texon) | Centimetres (cm) |

*Table 1: Standard tool for measuring Flexibility and Muscle Strength*

### *3.3 Yoga Module for the present Study*

A Yoga Module comprising of some Loosening Stretching Exercises, and Breathing Techniques related with "Surya Namaskar and Pranayama" was prepared with the help of different practices at different Hatha Yoga Institutes . The Yoga Protocol includes

- Opening Session Prayer / Mantra Therapy (3 Minutes)
- Breathing Exercises (Hand in and Out, Hand Stretch, Ankle Stretch, Tiger Breathing) 5 Minutes)
- Kapalabhati Kriya/ Pranayama (60 stroke per minutes) (1-2 Minutes)
- Bhastrika Pranayama (60 Counts) (1 Minutes)
- Stretching Exercises (Jogging, Twisting, Side Bending, Forward and Backward Bending, Hip rotation) (5-6 Minutes )
- Surya Namaskar (12 rounds) (10-15 Minutes)
- Nadi Shudhi / Anuloma Viloma Pranayama (9 rounds)( 4-5 Minutes)
- Bharmari / Cooling Pranayama (3 rounds) ( 2 Minutes)
- Shavasana / Nadanusandhayana / AUM Meditation, (6 Minutes)
- Closing Session Prayer / Mantra Therapy, (3 Minutes)

The Experimental Group of 30 students were given the Yoga practice for 10 weeks in the morning for 45-50 minutes, 5 days per week. The Control group was not given any Physical exercise and Yoga practice except attending some games and sports

### *3.4 Experimental Design*

Random and Controlled design is adopted for this study. The subject was randomly selected and randomly divided into two groups by Lottery Method, one group serves as the experimental and other as a control group comprising of 30 Students per group.

### *3.5 Data Collection*

Muscular Strength and Flexibility of adolescent students of schools were measured by using Internationally/ Nationally accepted Standard Instruments (Hand Grip Dynamometer , Sit and Reach Box). In order to test the effect of Surya Namaskar and Pranayama training and practice, the data collected from both groups (Experimental group and Control group) before and after experimentation (Pre and Post Test) on health-related physical fitness variables were statistically analyzed by using Statistical Package. Collection of Data for this Research is done at two (2) different Schools. They are (1) Bal Vidya Mandir School, and (2) Irilbung High School, located in Imphal East District, Manipur State. Total number of 60 Students are respondent.

### 3.6 *Data Analysis*

1. Independent t-test, Paired Sample t-test, correlation coefficient, and ANCOVA (Analysis of Covariance) was employed to find out the significance of difference between control and experimental groups, in terms of physical fitness (Muscular Strength and Flexibility).
2. In all the cases, the level of confidence is fixed at 0.05 to the significance.

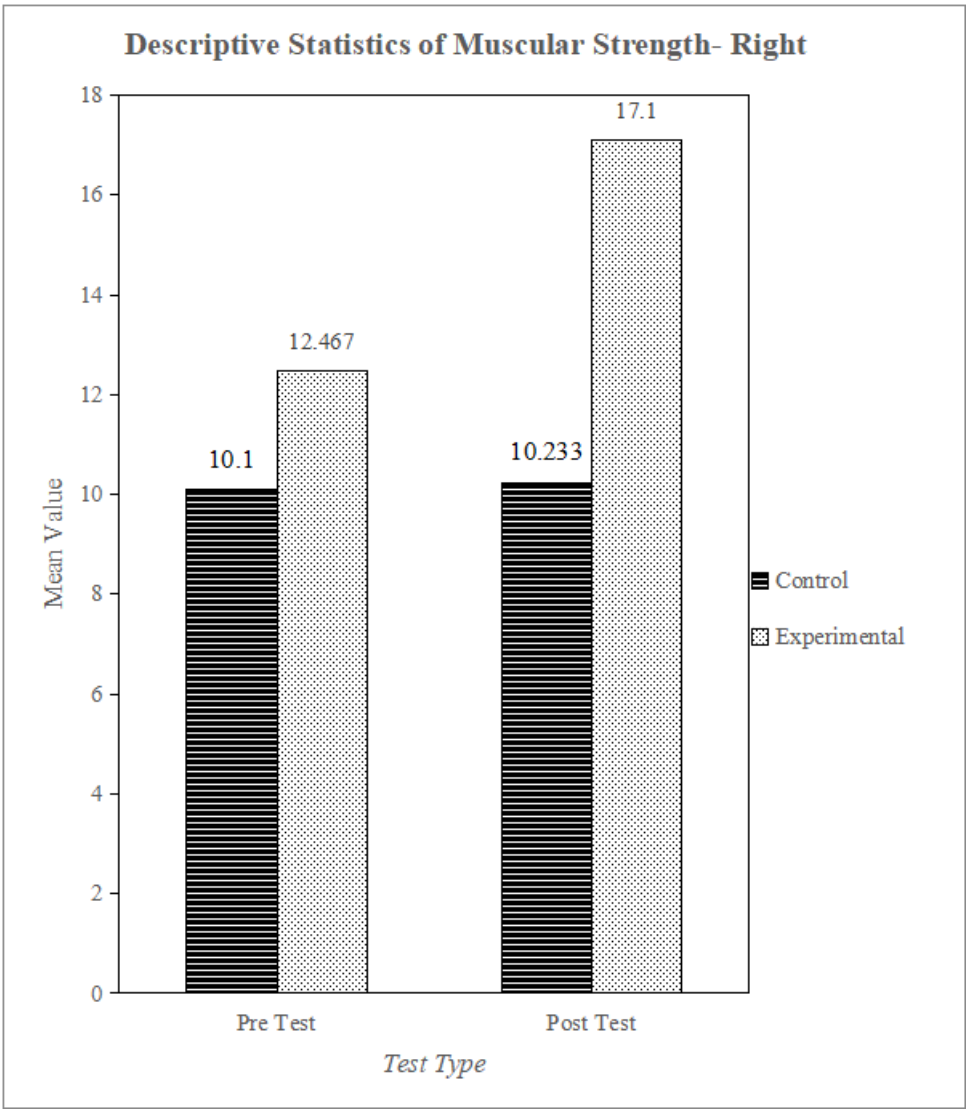
## 4.0 Results

### 4.1 Descriptive Statistics

#### 4.1.1 Muscular Strength– Right

| Group | Test Type | N | Mean | SD | SE | Coefficient of variation |
|---|---|---|---|---|---|---|
| Control | Pre Test | 30 | 10.1 | 6.116 | 1.117 | 0.606 |
| Control | Post Test | 30 | 10.233 | 5.575 | 1.018 | 0.545 |
| Experimental | Pre Test | 30 | 12.467 | 7.352 | 1.342 | 0.59 |
| Experimental | Post Test | 30 | 17.1 | 8.032 | 1.466 | 0.47 |

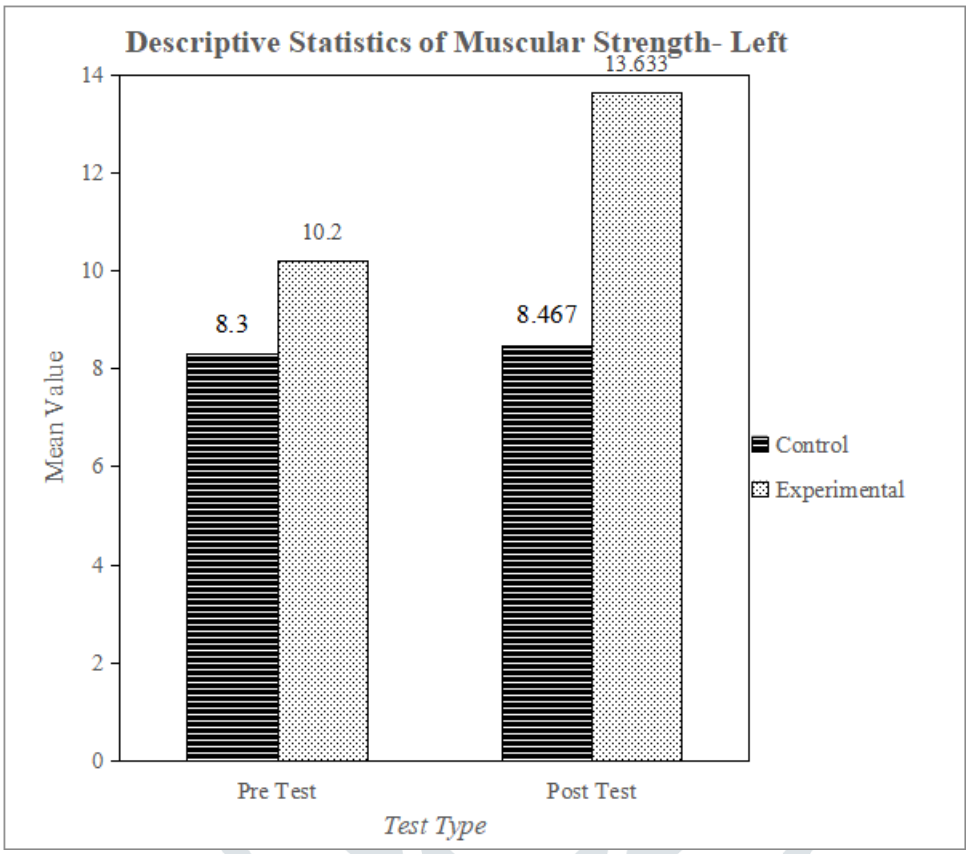
Table 2: Muscular Strength (Right) Descriptive Statistics



### 4.1.2 Muscular Strength – Left

| Group | Test Type | N | Mean | SD | SE | Coefficient of variation |
|---|---|---|---|---|---|---|
| Control | Pre Test | 30 | 8.3 | 4.292 | 0.784 | 0.517 |
| Control | Post Test | 30 | 8.467 | 3.989 | 0.728 | 0.471 |
| Experimental | Pre Test | 30 | 10.2 | 6.865 | 1.253 | 0.673 |
| Experimental | Post Test | 30 | 13.633 | 7.499 | 1.369 | 0.55 |

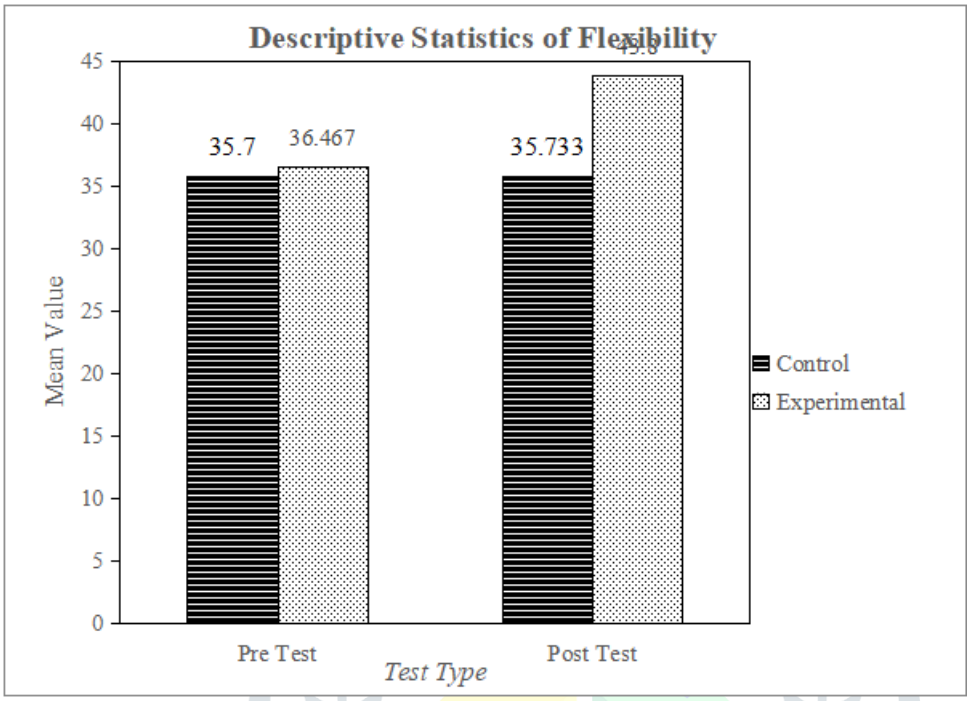
Table 3: Muscular Strength (Left) Descriptive Statistics



### 4.1.3 Flexibility

| Group | Test Type | N | Mean | SD | SE | Coefficient of variation |
|---|---|---|---|---|---|---|
| Control | Pre Test | 30 | 35.7 | 5.682 | 1.037 | 0.159 |
| Control | Post Test | 30 | 35.733 | 5.771 | 1.054 | 0.162 |
| Experimental | Pre Test | 30 | 36.467 | 5.894 | 1.076 | 0.162 |
| Experimental | Post Test | 30 | 43.8 | 6.167 | 1.126 | 0.141 |

Table 4: Flexibility Descriptive Statistics




## 4.2 Independent t-test

| Measure | Group | Mean (M) | SD | *t* | *df* | *p-value* | Interpretation |
|---|---|---|---|---|---|---|---|
| **Muscular Strength - Right** | Control | 0.1333 | 1.1958 | −11.363 | 58 | < .001 | Significant difference; Experimental group performed better. |
| | Experimental | 4.8000 | 1.5844 | | | | |
| **Muscular Strength - Left** | Control | 0.1667 | 1.1769 | −9.756 | 58 | < .001 | Highly significant; greater Muscular Strength in Experimental. |
| | Experimental | 3.4333 | 1.4065 | | | | |
| **Flexibility** | Control | 0.0333 | 1.4735 | −16.341 | 58 | < .001[a] | Strongly significant improvement in Experimental group. |
| | Experimental | 7.3333 | 1.9535 | | | | |

Table 5: Independent t-test of the three measures - Muscular Strength (Left and Right) and Flexibilit

### 4.3 Paired Sample t-test

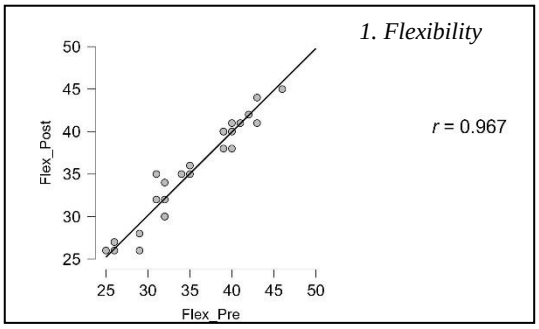
| Group | Measure | Pre (M ± SD) | Post (M ± SD) | *t* | *df* | *p-value* |
|---|---|---|---|---|---|---|
| **Control** | Muscular Strength - Right | 10.100 ± 6.116 | 10.233 ± 5.575 | 0.611 | 29 | 0.546 |
| | Muscular Strength - Left | 8.300 ± 4.292 | 8.467 ± 3.989 | 0.776 | 29 | 0.444 |
| | Flexibility | 35.700 ± 5.682 | 35.733 ± 5.771 | 0.124 | 29 | 0.902 |
| **Experimental** | Muscular Strength - Right | 12.467 ± 7.352 | 17.100 ± 8.032 | 14.024 | 29 | < .001 |
| | Muscular Strength - Left | 10.200 ± 6.865 | 13.633 ± 7.499 | 13.37 | 29 | < .001 |
| | Flexibility | 36.467 ± 5.894 | 43.800 ± 6.167 | 20.561 | 29 | < .001 |

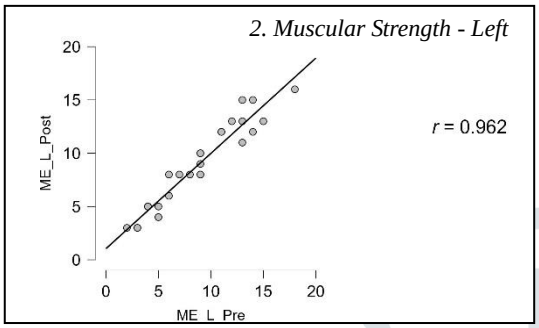
Table 6: Paired Sample t-test within the two group - Control and Experimental

### 4.4 Coefficient of Correlation

| Parameter | Group | Correlation (r) | p-value | Covariance | Interpretation |
|---|---|---|---|---|---|
| Muscular Strength-Right | Control | 0.983 | <0.001 | 33.528 | Very strong correlation, moderate change. |
| | Experimental | 0.976 | <0.001 | 57.641 | Very strong correlation, substantial improvement due to intervention. |
| Muscular Strength - Left | Control | 0.962 | <0.001 | 16.476 | Strong correlation, but less variation. |
| | Experimental | 0.985 | <0.001 | 50.697 | Very strong correlation, significantly greater improvement. |
| Flexibility | Control | 0.967 | <0.001 | 31.71 | Strong correlation, natural improvement. |
| | Experimental | 0.949 | <0.001 | 34.476 | Strong correlation, slightly higher variability—positive intervention effect. |

Table 7: Pearson Correlation between Pre-test and Post-test Scores for Muscular Strength (Left and Right) and Flexibility



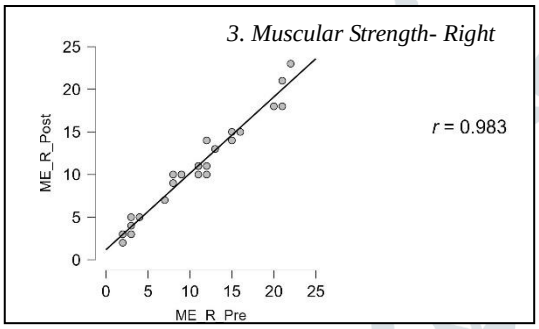
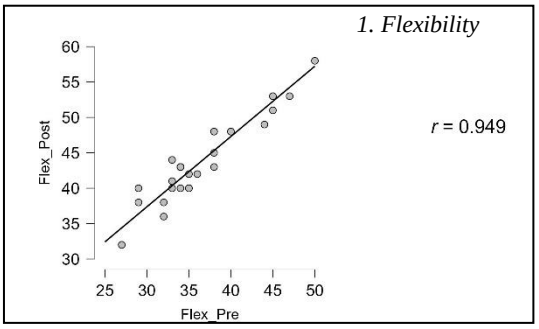
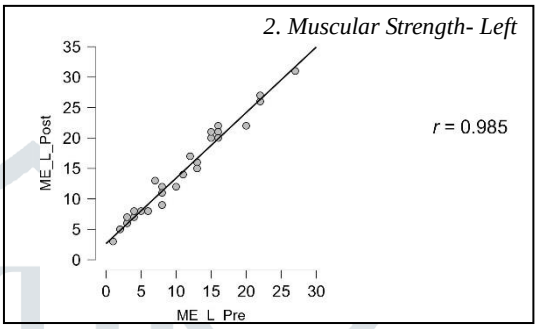




Figure 1: Control Group



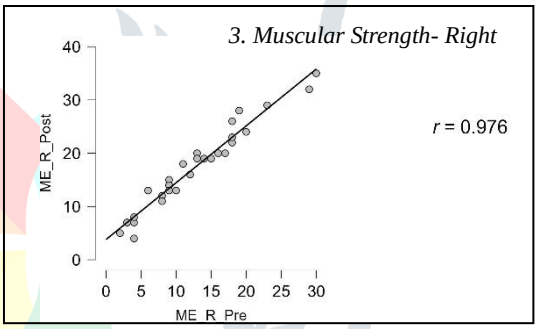




Figure 2: Experimental Group

## 4.5 ANCOVA (Analysis of Covariance)

| Measure | Source | Sum of Squares | *df* | Mean Square | *F* | *p-value* |
|---|---|---|---|---|---|---|
| **Muscular Strength - Right** | Group | 295.389 | 1 | 295.389 | 123.433 | < .001 |
| | Pre-Test (Cov.) | 2635.659 | 1 | 2635.659 | 1101.351 | < .001 |
| | Residuals | 136.408 | 57 | 2.393 | - | - |
| **Muscular Strength - Left** | Group | 151.199 | 1 | 151.199 | 89.424 | < .001 |
| | Pre-Test (Cov.) | 1996.057 | 1 | 1996.057 | 180.531 | < .001 |
| | Residuals | 96.376 | 57 | 1.691 | - | - |
| **Flexibility** | Group | 797.837 | 1 | 797.837 | 262.374 | < .001 |
| | Pre-Test (Cov.) | 1895.339 | 1 | 1895.339 | 623.294 | < .001 |
| | Residuals | 173.328 | 57 | 3.041 | - | - |
| **Note: Type III Sum of Squares** | | | | | | |

Table 8: ANCOVA for the three measures - Muscular Strength (Left and Right) and Flexibility

## 5.0 MECHANISMS AND INCLUSIVE STUDIES

Hypothalamus -Pituitary- Axis ( HPA) as such the Organs involved in the Surya Namaskar practice are stimulated and bring Holistic balance resulting increases in balancing, strength, and flexibility. The Surya Namaskar practice is an almost considered a Yogic Exercise at Annamaya Kosa level touching all the body parts. Besides, Pranayama - Breath Control is the practice at the Pranamaya Kosha level enhancing the Vital Energy of the Body Holistically.

## 6.0 DISCUSSION

*Surya Namaskar* involves dynamic stretching and body-weight resistance, improving muscular Strength. Breathing exercises improve oxygenation, mental focus, and overall physical capacity. The present study findings showed a significant improvement in Spine Flexibility and Muscular Strength of Fingers which increase Stamina of the Body after Surya Namaskar regular practice. The results align with previous studies showing yoga's positive impact on adolescent health.

The Co-efficient of Correlation studies of the Control group and Experimental group (Yoga group) in respect of Muscular Strength and Flexibility after 10 weeks (( more than 2 months) of Yoga Intervention shows that the Muscular Strength of Left (Lh) and Right Hand (Rh) are observed highly significant value (r=0.962 (Lh) 0.983(Rh) , r=0.985(Lh) 0. 976(Rh) in case Pre and Post comparison(F*igure 4.1,and 4.2)* . Further in respect of Flexibility, it is found correlated value (r=0.967, r=0.949) between Pre and Post Comparison (F*igure 1.1, and 4.2).*

There is a statistically significant difference between the control and experimental groups after Yoga Intervention controlling for Pre- Test **Muscle Strength (P is <0.001)** in Table 7 and Table 8. This implies that the intervention had a real effect, not just due to initial differences. The pre-test scores significantly influence the post-test scores, meaning it was correct and necessary to adjust for baseline ability.

There is a statistically significant difference in post-test **Flexibility** scores between the Control and Experimental groups **(P is <0.001)** in Table 7 and Table 8. This implies that the intervention had a significant effect on **flexibility** improvement. Pre-test flexibility scores strongly predicted post-test scores, as expected. Participants with higher initial flexibility tended to have higher post-test values.

The present finding is in conformity with the findings of **Halder et al., (**2014), **Gauri et al.,** (2011), **Safa A et al.,** (2017), **Shikalgar** (2017), and **Kristine M. Fondran** (1992) who observe that their improvement of Muscular Strength and also improvement in overall flexibility through regular practice of Yoga and Surya Namaskar.

**Shikalgar** (2017) indicates that the two weeks of Surya Namaskar training may be effective to observe improvising flexibility in female students. **Kristine M. Fondran** (1992) concluded that Surya Namaskar and Pranayama are effective to increase the flexibility of the hamstring and improve Muscular Strength. Thus, the study was justified in relation to the present study.

## 7.0 CONCLUSION

Regular practice of Sun Salutation(Surya Namaskar), Kapalahati Kriya, Nadi Shudhi Pranayama and Yogic Breathing significantly enhances Muscular Strength and Flexibility. Health related Physical Fitness of a person is extremely important to lead a Peaceful and Happy Life. The goal of Holistic Health can be attained by Practicing Surya Namaskar and Pranayama. In order to provide a Scientific bases to the claim of Surya Namaskar and Pranayama to be effective in improving Health related Physical Fitness of Adolescent School Students, the present study was conducted. Thus, after a training Period of 10 weeks (more than 2 months) significant difference was found in Flexibility, and Muscular Strength. These practices should be integrated into school physical education curricula to promote holistic health.

***Recommendations***

- *The same study can also be conducted at Community Level for efficiency assessment.*
- *Schools should adopt structured yoga programs.*
- *Further research can explore effects on other parameters like balance, coordination, and mental health.*
- *Similar type of study may be conducted by selecting large sample pool size and for long duration of Yoga Practice*
- *Studies may also conducted for different age categories.*

***Finance Assistants (Funding Sources)***

- *None*

## APPENDIX

**Table: Collected data of the two groups – Control and Experimental**

CONTROL GROUP ( Female Adolescence Students)

| Sl. No | Name with Age | School | MUSCULAR STRENGTH | | | | | | FLEXIBILITY | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **Pre** Test | | **Post** Test | | **Difference** | | Pre Test | Post Test | **Difference** |
| | | | **Right Hand** | Left Hand | **Right Hand** | Left Hand | **Right Hand** | Left Hand | | | |
| 1. | **CG-1,** 13 | BVM | **3** | 4 | **3** | 5 | **0** | **1** | 25 | 28 | **3** |
| 2. | **CG-2,**12 | BVM | **3** | 3 | **3** | 3 | **0** | **0** | 32 | 38 | **6** |
| 3. | **CG-3,** 12 | BVM | **2** | 2 | **3** | 3 | **1** | **1** | 29 | 30 | **1** |
| 4. | **CG-4,** 13 | BVM | **3** | 4 | **5** | 2 | **2** | **-2** | 32 | 35 | **3** |
| 5. | **CG-5,**16 | BVM | **13** | 9 | **13** | 11 | **0** | **2** | 40 | 41 | **1** |
| 6. | **CG-6,**18 | BVM | **22** | 13 | **27** | 18 | **5** | **5** | 41 | 43 | **2** |
| 7. | **CG-7,**14 | BVM | **21** | 9 | **20** | 15 | **-1** | **6** | 46 | 49 | **3** |
| 8. | **CG-8,**13 | BVM | **8** | 13 | **9** | 8 | **1** | **-5** | 40 | 44 | **4** |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 9. | **CG-9,**12 | BVM | **12** | 4 | **14** | 7 | **2** | **3** | 34 | 35 | **1** |
| 10. | **CG-10,**13 | BVM | **11** | 11 | **16** | 18 | **5** | **7** | 26 | 27 | **1** |
| 11. | **CG-11,**14 | BVM | **4** | 5 | **5** | 4 | **1** | **-1** | 32 | 35 | **3** |
| 12. | **CG-12,**14 | BVM | **7** | 15 | **7** | 16 | **0** | **1** | 40 | 44 | **4** |
| 13. | **CG-13,**15 | BVM | **12** | 9 | **13** | 8 | **1** | **-1** | 43 | 47 | **4** |
| 14. | **CG-14,**15 | BVM | **11** | 13 | **12** | 13 | **1** | **0** | 39 | 42 | **3** |
| 15. | **CG-15,**14 | BVM | **9** | 4 | **10** | 5 | **1** | **1** | 42 | 44 | **2** |
| 16. | **CG-16**,16 | IHS | **15** | 14 | **19** | 21 | **4** | **7** | 43 | 47 | **4** |
| 17. | **CG-17,**12 | IHS | **2** | 6 | **5** | 8 | **3** | **2** | 39 | 42 | **3** |
| 18. | **CG-18,**13 | IHS | **12** | 5 | **8** | 4 | **-4** | **-1** | 35 | 37 | **2** |
| 19. | **CG-19,**13 | IHS | **8** | 7 | **13** | 10 | **5** | **3** | 39 | 41 | **2** |
| 20. | **CG-20,**12 | IHS | **3** | 3 | **3** | 3 | **0** | **0** | 31 | 35 | **4** |
| 21. | **CG-21,**14 | IHS | **11** | 8 | **9** | 11 | **-2** | **3** | 39 | 42 | **3** |
| 22. | **CG-22,** 13 | IHS | **16** | 12 | **15** | 16 | **-1** | **4** | 32 | 35 | **3** |
| 23. | **CG-23,**12 | IHS | **15** | 14 | **19** | 18 | **4** | **4** | 29 | 30 | **1** |
| 24. | **CG-24,** 12 | IHS | **2** | 6 | **5** | 4 | **3** | **-2** | 32 | 38 | **6** |
| 25. | **CG-25,**16 | IHS | **9** | 4 | **10** | 5 | **1** | **1** | 40 | 41 | **1** |
| 26. | **CG-26,** 16 | IHS | **11** | 11 | **18** | 18 | **7** | **7** | 26 | 27 | **1** |
| 27. | **CG-27,** 14 | IHS | **13** | 9 | **13** | 11 | **0** | **2** | 40 | 44 | **4** |
| 28. | **CG-28,** 15 | IHS | **21** | 9 | **20** | 15 | **-1** | **6** | 35 | 37 | **2** |
| 29. | **CG-29,** 16 | IHS | **4** | 5 | **5** | 4 | **1** | **-1** | 31 | 35 | **4** |
| 30. | **CG-30,** 14 | IHS | **20** | 18 | **23** | 18 | **3** | **0** | 39 | 42 | **3** |
| | | | | | | | **42** | **53** | | | **84** |

EXPERIMENTAL GROUP ( Female Adolescence Students)

| Sl. No | Name with Age | School | MUSCULAR STRENGTH | | | | | | FLEXIBILITY | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **Pre** Test | | **Post** Test | | **Difference** | | Pre Test | Post Test | **Difference** |
| | | | **Right** Hand | Left Hand | **Right** Hand | Left Hand | **Right** Hand | **L**eft Hand | | | |
| 1. | **EX-1,**13 | BVM | **4** | 3 | **6** | 4 | **2** | **1** | 33 | 44 | **11** |
| 2. | **Ex-2,**15 | BVM | **13** | 16 | **20** | 22 | **7** | **6** | 29 | 41 | **12** |
| 3. | **EX-3,**16 | BVM | **8** | 6 | **12** | 8 | **4** | **2** | 33 | 41 | **8** |
| 4. | **EX-4,**12 | BVM | **3** | 2 | **5** | 3 | **2** | **1** | 33 | 40 | **7** |
| 5. | **EX-5,**15 | BVM | **9** | 8 | **14** | 8 | **5** | **0** | 34 | 43 | **9** |
| 6. | **EX-6,** 16 | BVM | **12** | 10 | **16** | 12 | **4** | **2** | 44 | 49 | **5** |
| 7. | **EX-7,** 12 | BVM | **3** | 3 | **5** | 6 | **2** | **3** | 27 | 32 | **5** |
| 8. | **EX-8,**14 | BVM | **17** | 22 | **20** | 26 | **3** | **4** | 35 | 40 | **5** |
| 9. | **EX-9**, 13 | BVM | **18** | 8 | **20** | 12 | **2** | **4** | 35 | 40 | **5** |
| 10. | **EX-10,** 13 | BVM | **8** | 11 | **11** | 14 | **3** | **3** | 38 | 43 | **5** |
| 11. | **EX-11,**12 | BVM | **4** | 1 | **7** | 3 | **3** | **2** | 32 | 38 | **6** |
| 12. | **EX-12,** 15 | BVM | **19** | 16 | **28** | 21 | **9** | **5** | 47 | 53 | **6** |
| 13. | **EX-13,** 13 | BVM | **15** | 6 | **19** | 8 | **4** | **2** | 34 | 43 | **9** |
| 14. | **EX-14,** 13 | BVM | **2** | 3 | **5** | 7 | **3** | **4** | 35 | 42 | **7** |
| 15. | **EX-15,** 14 | BVM | **10** | 8 | **13** | 11 | **3** | **3** | 45 | 50 | **5** |
| 16. | **EX-16,** 12 | IHS | **9** | 5 | **15** | 8 | **6** | **3** | 34 | 39 | **5** |
| 17. | **EX-17,**16 | IHS | **9** | 15 | **14** | 20 | **5** | **5** | 45 | 53 | **8** |
| 18. | **EX-18,**15 | IHS | **9** | 4 | **13** | 7 | **4** | **3** | 40 | 48 | **8** |
| 19. | **EX-19,**12 | IHS | **6** | 4 | **13** | 8 | **7** | **4** | 36 | 40 | **4** |
| 20. | **EX-20,**18 | IHS | **23** | 22 | **29** | 27 | **6** | **5** | 38 | 48 | **10** |
| 21. | **EX-21,** 14 | IHS | **18** | 27 | **26** | 31 | **8** | **4** | 50 | 58 | **8** |
| 22. | **EX-22,** 14 | IHS | **30** | 15 | **35** | 21 | **5** | **6** | 38 | 43 | **5** |
| 23. | **EX-23,**14 | IHS | **29** | 12 | **32** | 17 | **3** | **5** | 34 | 43 | **9** |
| 24. | **EX-24,** 14 | IHS | **14** | 8 | **19** | 8 | **5** | **0** | 40 | 48 | **8** |
| 25. | **EX-25,**15 | IHS | **20** | 13 | **20** | 16 | **0** | **3** | 38 | 48 | **10** |
| 26. | **EX-26,**12 | IHS | **11** | 7 | **18** | 13 | **7** | **6** | 29 | 41 | **12** |
| 27. | **EX-27,**13 | IHS | **16** | 13 | **18** | 15 | **7** | **6** | 34 | 43 | **9** |
| 28. | **EX-28,**12 | IHS | **4** | 2 | **6** | 3 | **2** | **1** | 27 | 32 | **5** |
| 29. | **EX-29,**14 | IHS | **18** | 16 | **23** | 20 | **5** | **4** | 45 | 53 | **8** |
| 30. | **EX-30,**13 | IHS | **13** | 20 | **19** | 22 | **6** | **2** | 32 | 38 | **6** |
| | | | | | | | **132** | **99** | | | **220** |