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Research Article

Effect of Sudarshan Kriya Yog on IgG Levels Against COVID19 & Cortisol Levels in Fully Vaccinated Subjects

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Abstract:
This study aimed to evaluate the impact of Sudarshan Kriya Yoga (SKY) on serum IgG and cortisol levels in fully vaccinated individuals against COVID-19. Conducted at Moti Lal Nehru Medical College and SRN Hospital, Prayagraj, Uttar Pradesh, 222 subjects participated in this quasi-experimental study with a non-equivalent control group design. The objective was to assess the effectiveness of SKY in enhancing IgG levels and reducing cortisol, potentially aiding in antibody development post-COVID-19 vaccination. Data were gathered through a demographic questionnaire and COVID-19 neutralizing antibody micro ELISA test.
Pre- and post-intervention data analysis revealed that, on average, IgG levels increased from 22.7 to 77.3, while Cortisol level decreased from 16. 9 to 12.8 significantly after 11 weeks of SKY practice following the second vaccination dose.
Descriptive and inferential statistical analyses indicated a sustained rise in IgG and a reduction in cortisol levels lasting approximately two months post-SKY in the experimental group, with further improvements observed with continued practice. These findings suggest that SKY may positively influence immune resilience by boosting IgG and reducing cortisol, potentially enhancing vaccine efficacy against COVID-19. This study emphasizes the role of regular SKY practice in supporting immune health by promoting antibody formation and lowering stress-related cortisol levels.

Keywords: Yoga, COVID-19, Immunity, Sudarshan Kriya Yog, IgG levels, & cortisol level Covid -19 vaccination.

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INTRODUCTION:

Yoga is an ancient mind–body practice increasingly recognized for its health benefits across various clinical and non-clinical conditions. This systematic review evaluates randomized controlled trials on yoga's effects on immune system functioning, supporting its potential clinical applications. Breathing techniques, such as Sudarshan Kriya Yoga (SKY), have gained attention for their ability to manage stress, enhance organ function, and promote relaxation. SKY comprises specific breathing patterns, including Ujjayi, Bhastrika, and Sudarshan Kriya, and has shown promise in addressing anxiety, depression, stress, and related medical conditions.

Yogic breathing, defined as deliberate manipulation of breath movement, positively influences immune function, autonomic nervous system imbalances, and stress-related disorders. Chronic psychosocial stress, linked to oxidative stress, accelerates aging and contributes to diseases like coronary disorders, cancer, and arthritis. Mind–body therapies (MBTs) like yoga, Tai Chi, and Qi Gong integrate moderate physical activity, breathing techniques, and meditation to reduce stress, potentially modulating the immune system. SKY, in particular, is associated with favorable effects on the mind–body connection, improving psychological well-being and physiological health.

The SKY technique consists of four main components: Ujjayi, Bhastrika, Om chanting, and Sudarshan Kriya. Ujjayi, or "Victorious Breath," involves slow, deliberate breathing with throat constriction, inducing physical calmness and mental alertness. Bhastrika, a rhythmic breathing practice, energizes the body and calms the mind, offering mild sympathetic stimulation similar to regular exercise. Om chanting promotes physiological alertness and synchronicity of biorhythms, while Sudarshan Kriya incorporates rhythmic, cyclical breathing at varying speeds. Scientific studies highlight the stress-relieving effects of SKY, including significant reductions in cortisol levels.

The benefits of SKY extend to balancing the autonomic nervous system, enhancing resilience to acute stressors, and alleviating stress-related disorders. This review explores the physiological mechanisms, mind–body connection, and clinical applications of SKY, providing insights into its role in improving immune system functioning and overall health.

MATERIALS AND METHODS:

This section details the research strategy, design, context, population, sampling criteria, sampling method, study variables, data collection tools, pilot study, procedure, and analysis methods.

Research Design:

The study employed a quasi-experimental non-equivalent control group design. Randomization is used to select experimental and control groups in this design (Sharma, 2011). Randomization occurs at the level of the intervention. After verifying that the intervention groups are in a state of equilibrium (equal in terms of prognostic, confounding, and clinical factors), each group's baseline measure of the outcome is obtained. The intervention is then administered to the intervention group, while the control intervention (if any) is administered to the control group. A second outcome measurement is obtained and compared to the initial outcome measurement to determine whether the treatment had a significant effect in comparison to the control. Both between-subjects (treatment vs. control) and within-subjects (baseline vs. post) effects are examined for a potential interaction. The study groups are randomly assigned to receive either the intervention or a placebo. In the current investigation, 222 participants were assigned to investigate the effect. Only the experimental group received intervention, while the control group received standard treatment center care. Therefore, this design was deemed suitable for evaluating the effect of Sudarshan Kriya Yoga on fully immunized subjects.

Study area:

The study will be conducted in the MotiLal Nehru Medical College vaccination center and SRN Hospital, including yoga centers of Prayagaraj U.P.

Population:

In this study 222 subjects fully vaccinated with covid-19 vaccine, age range 25 years to 65 years will be selected from Moti Lal Nehru Medical College Prayagraj vaccination center, including yoga centers of Prayagaraj U.P

Sampling:

The sample was recruited by using random sampling techniques and 222 subjects those who were fully vaccinated subjects were included in this study. Subjects were included from hospital as well as yoga centers suffering from COVID-19, 111 each for intervention and control group.

Sample size:

222 individual Sample size is calculated on the basis of this following formula:-

Sample Size formula $\mathbf{n= \frac{(Z_{1-\alpha 2} + Z_{1-\beta})^2 \times (\sigma^2_1+\sigma^2_2)}{(\mu_2-\mu_1)}}$

$N= \frac{(1.96+0.84)^2 \times (1.41^2+1.06^2)}{(120.2-119.73)=110.44}$

It means 111 sample in each group total sample will be 222

n = Desired sample size

$(Z_{1-\beta})$= 0.84 inverse normal value at 80% power

$(Z_{1-\alpha/2})$ = 1.96 inverse normal value at 5% level of significance

σ_1&σ_2 are standard deviation

μ_2&$\mu_1$are mean of parameter

Sample size of 222 patients will be enrolled in this study.

Ethical committee clearance:

The problem and objectives of the research were approved by the research committee. The appropriate authorization from the institution's authorities was requested and obtained. Consent was obtained after an explanation of the purpose of the study and the nature of the questionnaire was given. The study participants

were assured of their anonymity and the confidentiality of the data collected from them. Assured study participants that no physical or mental damage would be caused.

Techniques of Data Analysis and Interpretation:

All significant information was included in the frequency tables. Using IBM SPSS Statistics 22 and Microsoft Excel, descriptive and inferential statistical methods were utilized for data analysis. In the analysis of demographic variables, descriptive statistics were utilized. Statistical inference was used to determine the effect of Sudarshan Kriya Yoga.

Using descriptive statistics, the central tendency (mean) and dispersion (standard deviation) of the variables were calculated.

Student 't' test was used to analyse the effect of Sudarshan Kriya Yoga on IgG and cortisol levels between experimental and control group

Paired't' test was used to analyze the difference between pre and post test level of IgG and Cortisol levels in both groups.

Mann Whitney U test was used to compare means of intervention and control group

Results:

The Aim of the study was to determine the effect of Sudarshan Kriya Yoga on IgG and Cortisol levels among fully COVID vaccinated. A total number of 222 subjects were selected for the study. Among 222 samples, 111 were allocated in intervention and 111 in control group respectively. Purposive sampling method was adopted to recruit the study participants. The level of IgG and Cortisol among subjects was assessed before and after the intervention.

Analysis on the level of IgG and Cortisol among Subjects in experimental group:

After implementation of Sudarshan Kriya Yoga mean score of IgG was increased from 22.07 and 77.3 respectively with a mean difference of 55.23 and standard deviation of 6.07 and 15.4 respectively. The calculated 't' value 36.845 was significant at 0.001 level.The result shows that there exists a significant effect of Sudarshan Kriya Yoga on IgG among subjects in Experimental group. There is significant ($p<0.05$) association found between level of IgG dependents in experimental group during post test.

After implementation of Sudarshan Kriya Yoga mean score of Cortisol was decreased from16.09 and 12.8 respectively with a mean difference of 3.2 and standard deviation

of 3.3 and 1.8 respectively. The calculated 't' value 15.02 was significant at 0.001 level. The result shows that there exists a significant effect of Sudarshan Kriya Yoga on Cortisol among subjects in Experimental group. There is significant ($p<0.05$) association found between level of Cortisol dependents in experimental group during post test.

Analysis on level of IgG and Cortisol among Subjects in control group:

Paired't' test was used to assess the level of IgG among subjects at 1st and 11th week of Sudarshan Kriya Yoga in control group. It was identified that, the mean score of IgG before and after was 20.03 and 62.4 respectively. The mean score was increased after11 weeks of second dose COVID vaccine administration. The mean difference was 42.37. Standard deviation were 6.06 and 15.58 respectively and the calculated 't' value 28.01 which was higher than the table value. Hence difference was found in the level of IgG in control group. But the corresponding 't' value was lower than observed in Experimental group.

Paired 't' test was used to assess the level of Cortisol among subjects at 1st and 11th week of Sudarshan Kriya Yoga in control group. It was identified that, the mean score of Cortisol before and after was 16.09 and 17.75 respectively. The mean score was increased after 11 weeks of second dose of vaccine. The mean difference was 1.66. Standard deviation were 3.30 and 1.91 respectively and the calculated 't' value 9.41 which was higher than the table value. Hence difference was found in the level of Cortisol in control group. 't' value observed in control group was lower than in experimental group and hence Sudarshan Kriya Yoga helped significantly in decreasing Cortisol level than subjects who did not practice intervention.

In the present study, out of 111 subjects in experimental group, most of them 38 (34.2%) belongs to the age group of 56-65 years, 34 (30.6%) belongs to 46-55 years of age, 21 (18.9%) belongs to 36-45 years of age and 18 (16.2%) belongs to 25-35 years of age. In control group most of them 34 (30.6%) belong to age group of 25-35 years, 27 (24.3%) belongs to 46-55 years of age, 26(23.4%) belongs to 36-45 years and 24(21.6%) belongs to 56-65 years of age.

Table1: Gender Distribution Among Vaccinated Subjects

S.No.	**Gender**	**Experimental Group (n=111)**	**Control Group (n=111)**
		Frequency (%)	**Frequency (%)**
1.	Male	57 (51.3 **%**)	56 (50.4**%**)
2.	Female	54 (48.6 **%**)	55 (49.5 **%**)

The above table depicts that in the experimental group higher number of subjects was male, 57(51.3%) as well as in control group, 56 (50.4%). And female were 54(48.6%) in experimental group and 55 (49.5%).

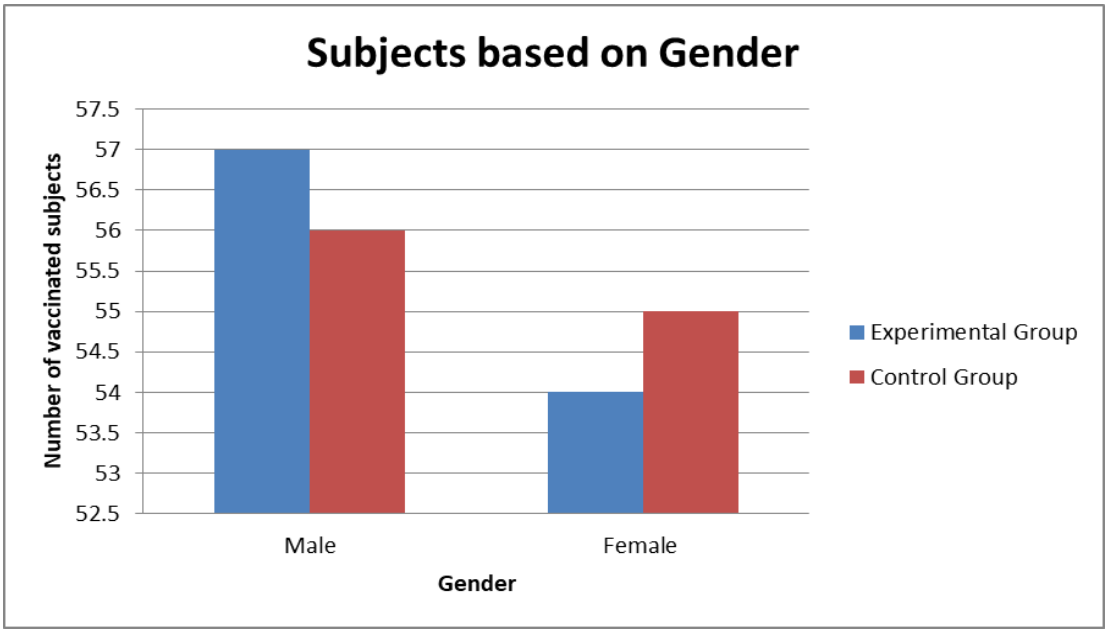

Table 2: BMI Distribution Among Vaccinated Subject

S.No.	BMI	Experimental Group (n=111)	Control group (n=111)
		Frequency (%)	Frequency (%)
1.	Underweight	1 (0.9 **%)**	1 (0.9 **%)**
2.	Normal	101 (90.9 **%)**	105 (94.6 **%)**
3.	Overweight	9 (8.1 **%)**	5 (4.5 **%)**

The majority of subjects in both groups were within the normal BMI range:
101(90.9%) in the experimental group and 105 (94.6%) in the control group.
Few participants were underweight or overweight.

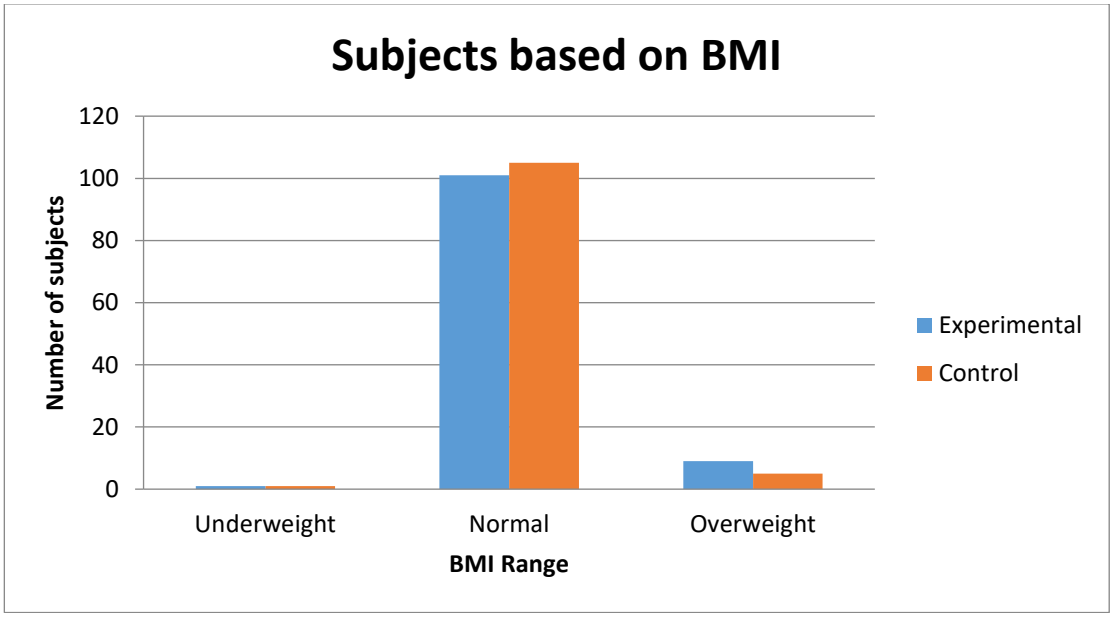

Table 3: IgG Levels at 1 Week Among Experimental and Control Groups

S. No.	Level of IgG	Experimental group (n=111)	Control Group (n=111)
		Frequency (%)	Frequency (%)
1.	Positive	16 (14.4 %)	0 (0 %)
2.	Negative	95 (85.5 %)	111 (100 %)

At 1 week, 16 (14.4%) subjects in the experimental group tested positive for SARS-CoV-2 neutralizing antibodies, while no antibodies were detected in the control group.

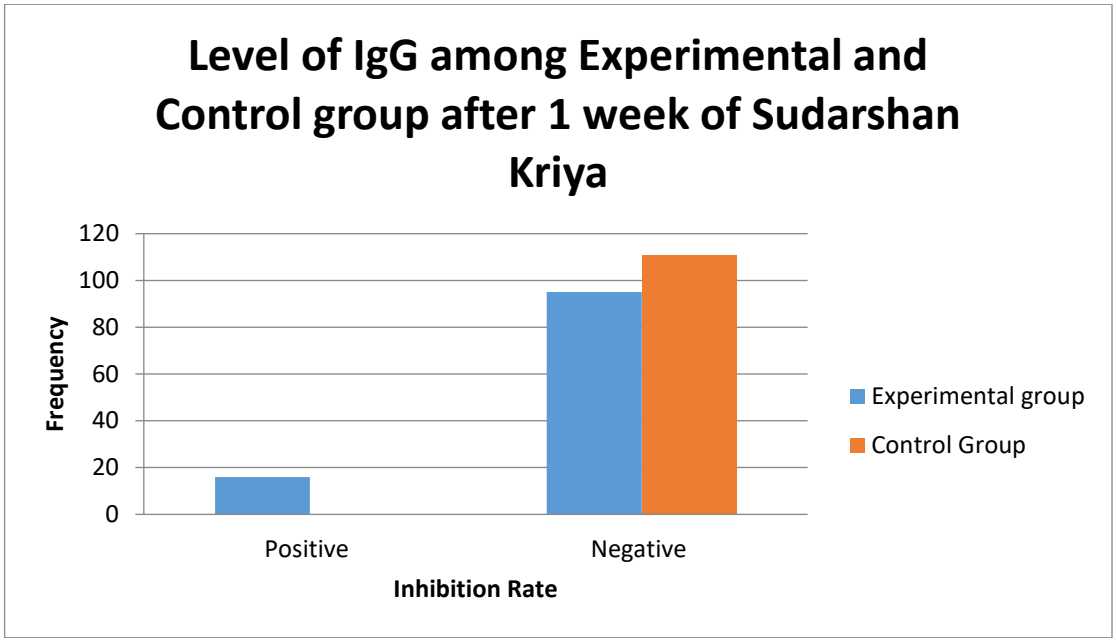

Table 4: IgG Scores at 1 Week Among Experimental and Control Groups

S.No.	IgG Reading	Experimental Group(n=111)	Control Group(n=111)
		Frequency (%)	Frequency (%)
1.	0-10	4 (3.6%)	8 (7.2 %)
2.	11-20	50 (45%)	43 (38.7%)
3.	21-30	51 (45.9%)	60 (54%)
4.	31-40	6 (5.4%)	0 (0%)

Table 5: IgG Levels at 3 Weeks among Experimental and Control Groups

S.No.	Level of IgG	Experimental group (n=111)		Control Group (n=111)	
		Frequency	Percentage	Frequency	Percentage
1.	Positive	104	93.6 %	101	90.9 %
2.	Negative	7	6.3 %	10	9 %

At 3 weeks, IgG levels improved in both groups, with 104 (93.6%) testing positive in the experimental group compared to 101 (90.9%) in the control group.

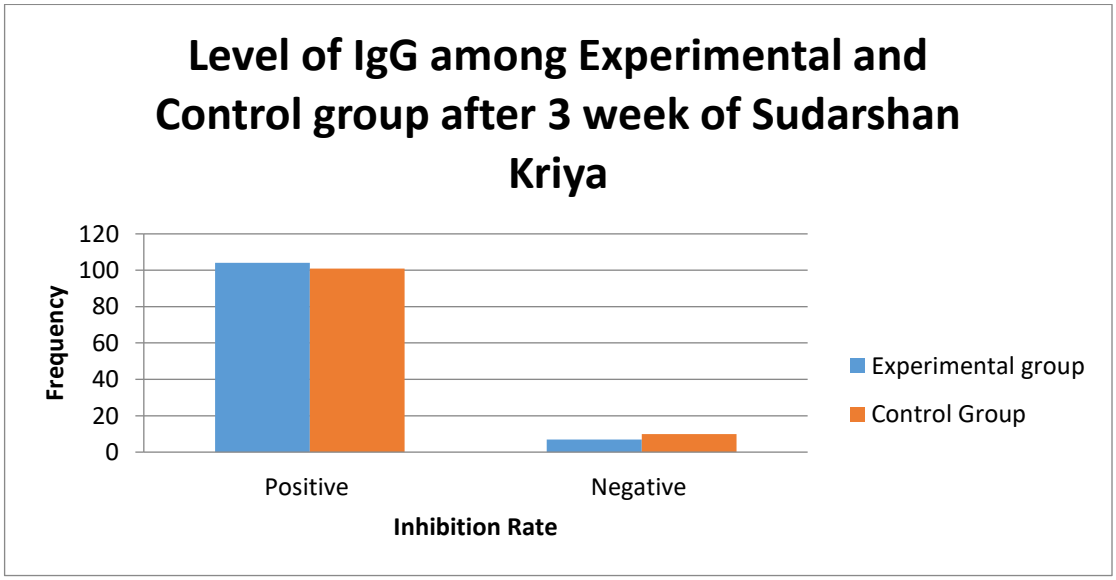

Table 6: IgG Levels at 11 Weeks Among Experimental and Control Groups

S.No.	Level of IgG	Experimental group (n=111)		Control Group (n=111)	
		Frequency	Percentage	Frequency	Percentage
1.	Positive	111	100 %	103	92.7%
2.	Negative	0	0%	8	7.2 %

After 11 weeks, 111 (100%) subjects in the experimental group had positive IgG levels, indicating universal antibody presence, compared to 103 (92.7%) in the control group.

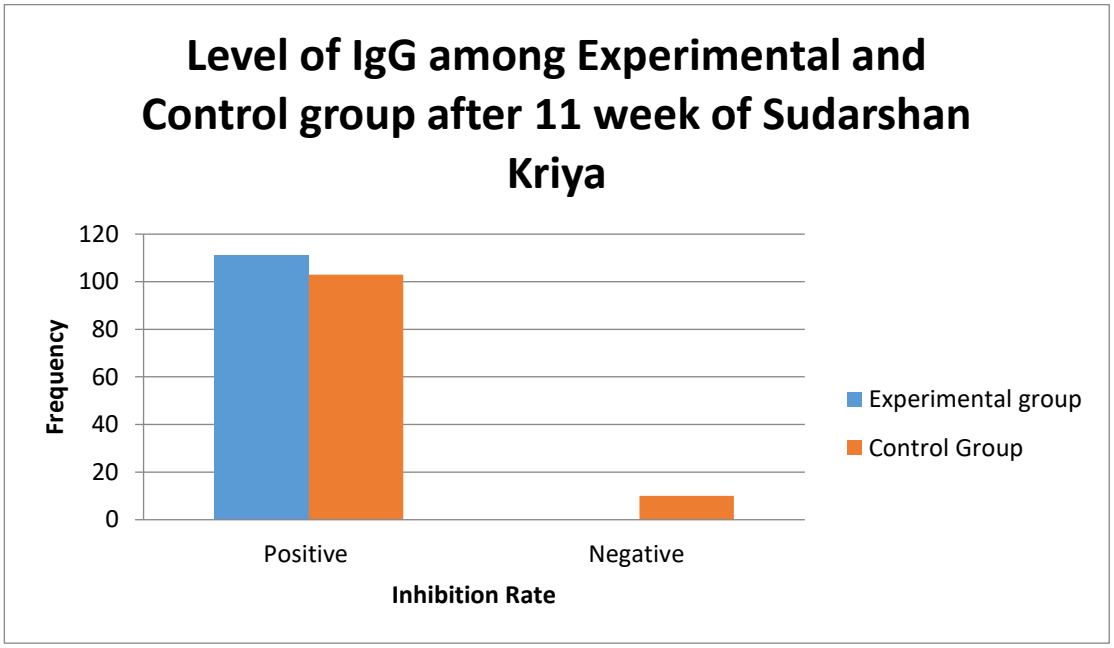

Table 7: IgG Scores at 11 Weeks Among Experimental and Control Groups

S.No.	IgG Reading	Experimental Group(n=111)	Control Group(n=111)
		Frequency (%)	Frequency (%)
1.	20-30	0 (0%)	8 (7.2%)
2.	31-40	5 (4.5 %)	5 (4.5%)
3.	41-50	5 (4.5 %)	5 (4.5%)
4.	51-60	1 (0.9 %)	24 (21.6%)
5.	61-70	29 (26.1%)	33 (29.7%)
6.	71-80	26 (23.4%)	31 (27.9%)
7.	81-90	22 (19.8%)	3 (2.7%)
8.	91-100	23 (20.7%)	0 (0%)

The experimental group showed higher IgG scores in the 81–100 range compared to the control group, where scores peaked between 61–70.

Table 8: Cortisol Levels in Experimental and Control Groups at Baseline (1 Week)

S. No.	Level of Cortisol	Experimental group (n=111)	Control Group (n=111)
		Frequency (%)	Frequency (%)
1.	Normal	111 (100 %)	111 (100%)
2.	Abnormal	0 (0%)	0 (0%)

At 1 week, all participants in both groups had normal cortisol levels within the range of 6–23 mcg/dL.

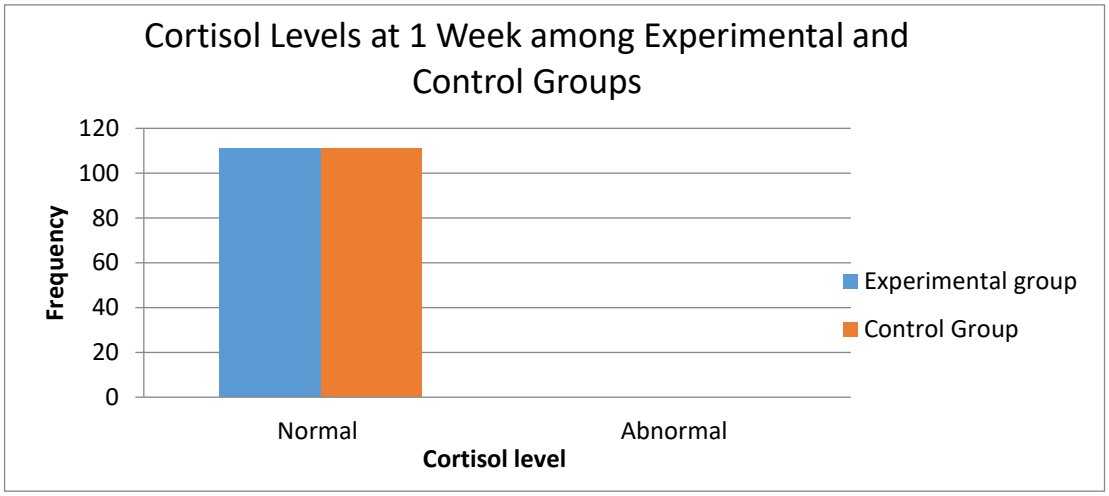

Table 9: Cortisol Levels in Experimental and Control Groups After 1 Week of Sudarshan Kriya Yoga

S. No.	Cortisol level	Experimental Group (n=111)	Control Group (n=111)
		Frequency (%)	Frequency (%)
1.	6-16	61 (54.9%)	62 (55.8%)
2.	17-23	50 (45 %)	49 (44.1%)

After 1 week of practicing Sudarshan Kriya Yoga, 61 (54.9%) participants in the experimental group and 62 (55.8%) in the control group had cortisol levels within the 6–16 mcg/dL range. The remaining participants (45% in the experimental group and 44.1% in the control group) had cortisol levels between 17–23 mcg/dL.

Table 10: Cortisol Levels in Experimental and Control Groups After 3 Weeks of Sudarshan Kriya Yoga

S.No.	Level of IgG	Experimental group (n=111)	Control Group (n=111)
		Frequency (%)	Frequency (%)
1.	Normal	111 (100 %)	96 (86.4%)
2.	Abnormal	0 (0%)	15 (13.5%)

After 3 weeks, all participants in the experimental group (111, 100%) maintained cortisol levels within the normal range (6–23 mcg/dL). However, in the control group, 96 participants (86.4%) had normal cortisol levels, while 15 participants (13.5%) exhibited abnormal cortisol levels.

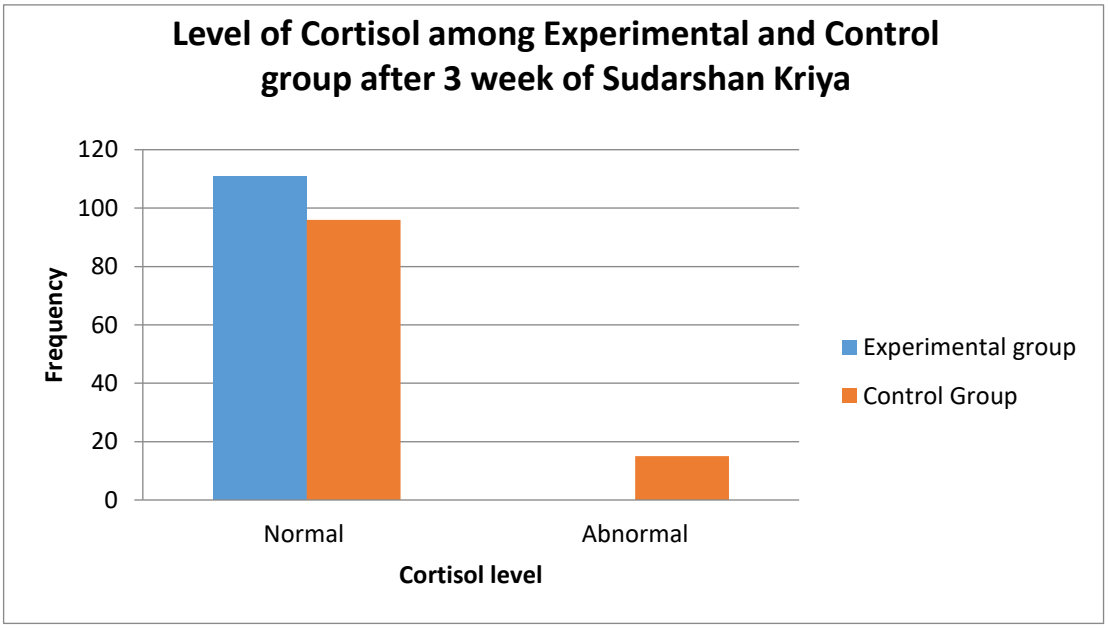

Table 11: Cortisol Levels in Experimental and Control Groups After 11 Weeks of Sudarshan Kriya Yoga

S.No.	Level of IgG	Experimental group (n=111)	Control Group (n=111)
		Frequency (%)	**Frequency** (%)
1.	Normal	111 (100 %)	111 (100%)
2.	Abnormal	0 (0%)	0 (0%)

At the 11-week mark, all participants in both the experimental and control groups (111, 100%) had cortisol levels within the normal range (6–23 mcg/dL). No abnormal cortisol levels were detected in either group.

Results and Discussion:

Demographic and Baseline Characteristics

In the experimental group, the majority of participants (38, 34.2%) were in the age group of 56–65 years, followed by 34 (30.6%) in the 46–55 years group, 21 (18.9%) in the 36–45 years group, and 18 (16.2%) in the 25–35 years group. In contrast, the control group had most participants (34, 30.6%) in the 25–35 years group, with 27 (24.3%), 26 (23.4%), and 24 (21.6%) in the 46–55, 36–45, and 56–65 years groups, respectively.

Gender distribution revealed a nearly equal ratio in both groups, with males slightly predominant. In the experimental group, 57 (51.3%) were male and 54 (48.6%) female, while in the control group, 56 (50.4%) were male and 55 (49.5%) female.

Anthropometric Measurements

Regarding height, the experimental group had the highest proportion of subjects (41, 36.9%) in the 160–170 cm range, while the control group predominantly fell in the 161–170 cm range (45, 40.5%). In terms of weight, most participants in the experimental group (33, 29.7%) weighed between 51–60 kg, whereas the control group was dominated by individuals in the 40–50 kg range (35, 31.5%). Body Mass Index (BMI) analysis revealed that the majority in both groups had normal BMI: 101 (90.9%) in the experimental group and 105 (94.6%) in the control group.

Serum IgG and Cortisol Levels at 1 Week

At the end of the first week, 16 (14.4%) participants in the experimental group tested positive for SARS-CoV-2 neutralizing antibodies, whereas all control group participants tested negative. Cortisol levels remained within the normal range (6–23 mcg/dL) for all participants in both groups, indicating no initial elevation in stress levels post-vaccination.

Serum IgG and Cortisol Levels at 3 Weeks

By the third week, the experimental group showed a significant rise in IgG levels, with 104 (93.6%) testing positive for SARS-CoV-2 neutralizing antibodies, compared to 101 (90.9%) in the control group. The mean IgG levels were significantly higher in the experimental group (51.81) compared to the control group (45.82), with a calculated t-value of 3.7 ($p < 0.05$).

Cortisol levels revealed contrasting trends. While 15 (13.5%) of the control group exhibited abnormal cortisol levels, all participants in the experimental group maintained cortisol levels within the normal range. The mean cortisol level was significantly lower in the experimental group (18.9) compared to the control group (20.2), with a t-value of 4.076 ($p < 0.05$), suggesting a stress-reducing effect of Sudarshan Kriya Yoga.

Serum IgG and Cortisol Levels at 11 Weeks

After 11 weeks, all participants in the experimental group (111, 100%) tested positive for SARS-CoV-2 neutralizing antibodies, compared to 103 (92.7%) in the control group. The mean IgG levels were markedly higher in the experimental group (77.3) than in the control group (62.4), with a t-value of 7.14 ($p < 0.001$), indicating a sustained and amplified immune response in the experimental group.

Cortisol levels remained normal for all participants in the experimental group, while the control group displayed elevated cortisol levels in 13.5% of participants. The mean cortisol level in the experimental group decreased to 12.8, while the control group exhibited an increase to 17.75, with a significant t-value of 9.41 ($p < 0.05$).

Effect of Sudarshan Kriya Yoga on IgG and Cortisol

Sudarshan Kriya Yoga significantly enhanced the immune response, as evidenced by the greater rise in IgG levels over time in the experimental group. The intervention also demonstrated a significant stress-reducing effect, as cortisol levels decreased consistently in the experimental group but increased in the control group post-vaccination.

Conclusion

The study demonstrates that Sudarshan Kriya Yoga (SKY) significantly enhances immune response and reduces stress levels in vaccinated individuals. Participants practicing SKY exhibited a substantial increase in IgG levels compared to the control group, indicating its efficacy in augmenting post-vaccination antibody production. Additionally, SKY significantly reduced cortisol levels, with a mean cortisol score of 12.8 in the experimental group compared to 17.7 in the control group, yielding a mean difference of 4.87 and a highly significant t-value of 19.2 ($p < 0.001$).

Future implications and limitations:

These findings underscore the potential of Sudarshan Kriya Yoga as an effective adjuvant therapy to boost immune function and regulate stress in fully vaccinated individuals. Incorporating such mind-body interventions in public health strategies could enhance vaccine efficacy and promote overall well-being. Further large-scale, multicenter trials are recommended to validate these results and explore their broader

applications in clinical practice. The findings suggest that Sudarshan Kriya Yoga is effective in augmenting post-vaccination immune responses and mitigating stress, as reflected by higher IgG levels and reduced cortisol levels in the experimental group. This highlights the potential of integrating mind-body interventions in post-vaccination care to enhance overall outcomes. Further studies are warranted to explore these effects across larger and more diverse populations**.**

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