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Comparative Effect of Different Variation of Suryabhedan Pranayama on Blood Hemoglobin among School Children

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Abstract

The aim of this study was to find out the comparative effect of different variation of Suryabhedan Paranayama on Blood Haemoglobin. For this study 60 male school students from Govt. Higher Secondary School Tikamgarh, M.P, were selected randomly as the subjects for the study. The age of subjects was 13 to 18 years. The students were randomly assigned into four groups each consist of 15 students. Further, the experimental treatment was also assigned randomly to three experimental groups for 8 weeks and one group served as a control group. Pre-test, Post-test randomized group design was employed in the study. To find out the difference between different pair mean, the ANCOVA was used. The level of significance was set at 0.05.

Keywords: *Physiology, Suryabhedan Paranayama, Blood Haemoglobin, Oxygen, Carbon dioxide, Puraka, Kumbhaka and Rechaka etc.*

Introduction

This year, the International Yoga Day is being celebrated on 21st June, with great aplomb throughout the globe. This fact itself speaks volumes about the popularity of Yoga in the modern day world. This event has united the world on a common platform. People have realized up to the therapeutic benefits of this life science and now are making it a part of their life.

According to Maharishi Panini, the word Yoga is derived from two roots viz. Yujir and yuja. Yujir referring to yoking (yujir yoga), and Yuja referring to mental concentration (yuj Samadhan) and to sense control (Astdhyayi)[1].Hiranyagarbha of the earliest Vedic and Upanishads lore is spoken of as the first being of reveal yoga (Mahabharata)[2].

More than a discipline to stay fit and healthy. Yogic techniques are known to improve one's overall performance and work capacity (Bhattacharya and Krishna, 1960). Yoga appears to provide a comparable improvement in health status (Caroline et al., 2007)[3].

The blood serves as a principal transport medium of the body carrying oxygen, nutrients, and chemical massages to the tissues and waste products and synthesized metabolites away. The circulatory system provides access to all cells of the body for materials ingested or prepared elsewhere in the organism. Thus blood plays many important roles in coordinating the individual's cells in to a whole complex organism. This accomplish by presence in the fluid of dispersed or dissolved nutrients,

[1] Astdhyayi, 3.3.121
[2] Mahabharata, 12.35.69
[3] Caroline, S., Jane, B.M. & Kerena, E. (2007). A randomized comparative trial of yoga and relaxation to reduce stress and anxiety. *Complementary Ther. Med. 15* (2), 77-83.

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metabolites, electrolytes, hormones ,substances to counteract infection and haemorrhage and by equilibria between the cell and the blood stream so that homeostasis with respect to temperature, oxidation , reduction potential and ionic concentration is maintained throughout the organism (Sajwan & Uppal 1999). Old Indian life science is still relevant in serving the modern day world.

Holmgren(1963) found own his study that intermittent long term training resulted in an increased in physical working capacity in a steady state, total haemoglobin and blood volume. The major function of red blood cells is to transport haemoglobin, which in turns carries oxygen from the lungs to the tissue. In some lower animals haemoglobin circulates as free protein in the plasma, not enclosed in red blood cells, however, when it is free in the plasma of the human being, approximately 3 percent of it leaks through the capillary membrane in to the tissue spaces or through the glomerular membrane of kidney in to bowman's capsule each time blood through the capillaries. Therefore, for haemoglobin to remain in the blood stream, it must exist in red blood cells there are approximately 4.5-5 million RBC's per micro-liter of blood.

The practice of Pranayama is emphasized almost all the traditional scripture. According to Yogic terminology a systematic process by which one gains control over Prana is referred as Pranayama. Pranayama constitutes fourth step of eight fold of Yoga described in the Patanjaliyogasutra[4] and occupies second place in Hathapradipika[5] and fifth place in Gherandasamhita[6]. According to Patanjaliyogasutra, Pranayama is a cessation of the movement of inhalation and exhalation (PYS)[7]. Pranayama can produce different physiological responses in healthy individuals (Upadhyay et al., 2008)[8]. Pranayama consists of modifications of the breathing process which we bring about deliberately and consciously in a sitting posture which is steady and comfortable.[9]. The science of Pranayama is based on the retention of prana called 'Kumbhaka'.

2. Aim and Objective

The aim and objective of the study was to see the effect of different variation of Suryabhedan Pranayama training on Blood Haemoglobin among school children.

3. Hypotheses

1. There will be significant difference among the mean of different variations of Surybhedana Pranayama training on Blood Haemoglobin count.
2. Suryabhedan Pranayam with 1:4:2 ratio training will produce significant improvement on Blood Haemoglobin count better than the ratio 1:2:2 and 1:1:1 of Suryabhedan Pranayama training.

4. Methods

4.1. Selection of Subjects: The study was designed to find out the comparative effect of different variation of suryabhedan paranayama on selected blood component. For this study 60 male school students from Govt. Higher Secondary School Bamhori kalan, Palera, Tikamgarh, and M.P were selected randomly as the subjects for the study. The age of subjects was 13 to 18 years. The students were randomly assigned into four groups each consist of 15 students.

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[4] Patanjaliyogasutra (PYS)
[5] Digambarji & Shastri, R.N. (1998). Op, Cit.
[6] Digambarji & Gharote, M.L. (1997). *Gherandsamhita*. Pune: Kaivalyadhama, S.M.Y.M. Samiti, 2nd Edition. Lonavala.
[7] Patanjaliyogasutra, PYS II/49
[8] Upadhyay, D.K., Malhotra, V., Sarkar, D., & Prajapati, R. (2008). Effect of alternate nostril breathing exercise on cardiorespiratory functions. *Nepal Medical College Journal, 10* (1), 25-27.
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4.2. Experimental Design: The study was formulated as per Pre and Post-Randomized group design, in which 60 students were randomly divided into four equal groups, each comprising of 15 subjects. The experimental group – 1 (n=15) 1:1:1 group underwent for suryabhedan pranayama training, the experimental group -2 (n=15) 1:2:2 group underwent for suryabhedan pranayama training, experimental group – 3 (n=15) 1:4:2 group underwent for suryabhedan pranayama training, and group – 4 served as control group (n=15) who did not undergo any specific training.

Pre test and Post test Randomized group design:

G1	R	O1	T	O2
G2	R	O1	T	O2
G3	R	O1	T	O2
G4	R	O1		O2

4.3. Training and Practice of Suryabhedan Pranayam: The training program was administered in the play field of Govt. Higher Secondary School, Bamhorikalan, Palera, Tikkamgarh (M.P), by the researcher himself.

Training session was lasted for 40 minutes per day for each experimental group. The training programme was scheduled in the early morning from 7.00 am to 7.40 am for experimental group (G1), 7.50 am to 8.30 am for experimental group (G2), 8.40 am to 9.20 am experimental group (G3).The control group was not exposed to any specific training.

The details of the training program are as follows:

- Total training program duration was eight weeks.
- Five days a week training session.
- Training session was 30-40 minutes/day for each group.

The details of the training program are given below in table no. 1

TABLE 1
Training schedule for all the Experimental groups
(Eight weeks, Five days a week, 30-40 min/day)

Activities	**Total time duration for all the Groups = 30-40 min**
Prayer	3 min
Nadi Shuddhi	5 min
Suryabhedana Pranayama	20-30 min
Shanti Path	2 min

Group D did not participated in any training program as it served as a controlled group.

The training session was started with prayer, which takes three minutes. After that subject were asked to perform Nadi-Shuddhi (Pranayama) for five minutes. After that subject was asked to perform Surybhedan Pranayama (with their assigned ratio) for 30 minutes. And session was ended with two minutes shanti path. Same sequence was followed to the other experimental group with their assigned training programme.

In suryabhedan pranayam, the meaning of "Surya" is Sun and the meaning of the word "Bhedana" is piercing, enter or breaking through something. In term of yoga Right nadi (right nostril) is called surya

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nadi or Pingala, and Left nadi (left nostril) is named as Chandra nadi or Ida nadi. The right nadi is the entrance way of Pingala Nadi, speaking to the sun vitality, the hot vitality or the manly vitality in our body. That the resion behind imparting the training in winter sisiion, each subject was allowed for inhalation (Puraka), retention (kumbhaka) and exhalation (Rechaka) according to their training ratio.

4.4. Procedure For Blood Sample Collection: Venous blood was collected in the early morning after the subject were abstained from food and drinking except water for 10 hours to estimate the selected blood components.5 ml of blood was drawn from the subjects by syringe drawn procedure and the blood was immediately transferred into sterilized small bottles, kept under the freeze box, and transported to the laboratory for testing of blood sample. Blood sample were taken at the beginning (pre test) and finally at the end of the experiment period of 8 weeks (post test).

Statistical Procedure: To find out the significance difference between groups, the ANCOVA was used. The level of significance was set at 0.05.

5. Results

TABLE 2
Descriptives Statistics for all four groups

		N	Mean	Std. Deviation	Minimum	Maximum
BEFORE TRAINING	G1 (1:1:1)	15	12.92667	.996040	10.400	14.600
	G2 (1:2:2)	15	12.53000	1.384326	9.300	14.550
	G3 (1:4:2)	15	12.40000	1.378405	8.400	13.900
	G4 (CONTROLL GROUP)	15	12.35333	1.128125	10.500	15.400
	Total	60	12.55250	1.222578	8.400	15.400
AFTER TRAINING	G1 (1:1:1)	15	13.87133	.432301	13.110	14.980
	G2 (1:2:2)	15	13.74733	.314494	13.100	14.250
	G3 (1:4:2)	15	15.11000	.773268	13.980	16.870
	G4 (CONTROLL GROUP)	15	12.27400	.861177	11.100	13.780
	Total	60	13.75067	1.188922	11.100	16.870

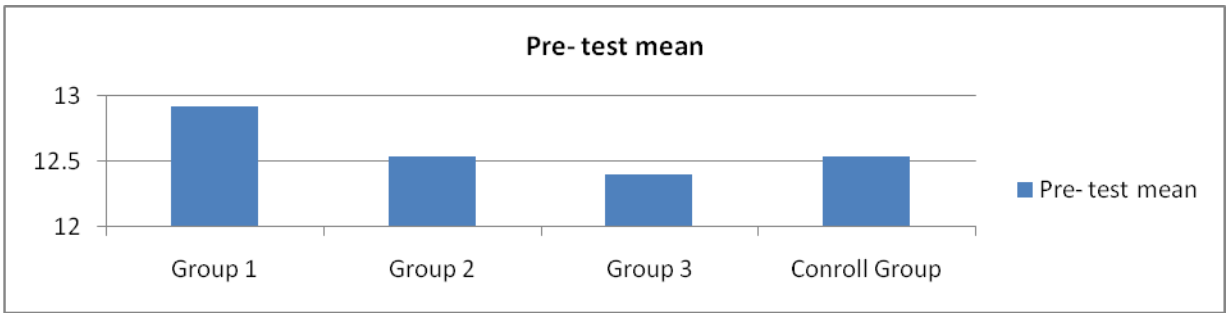

Figure-1.Pre-test mean for all four groups.

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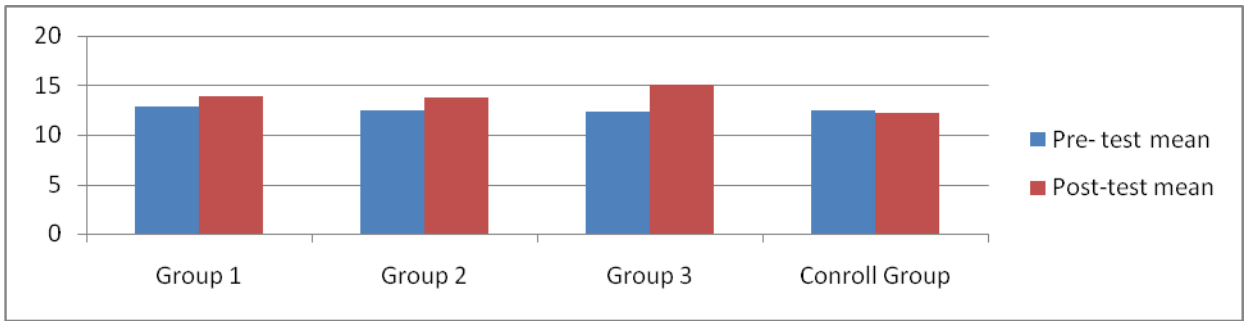

Figure-2.Pre-test and Post-test mean for all four groups.

Assumptions for ANCOVA: For measuring One- way Ancova we have to measure several assumptions, which give strengthening to our research statistics.

Assumption I (assumption of the linear relationship)

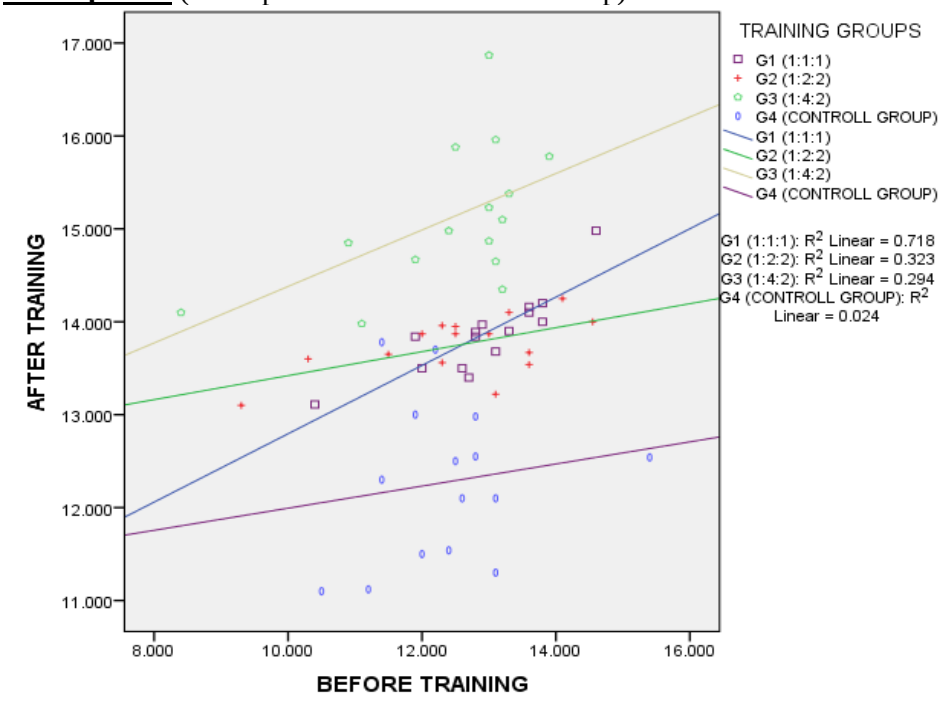

Figure-3. Assumption of the linear relationship for all four groups

In the above graph four lines are appeared on the graph, each line represent one groups. From the graph it is indicating that all four lines are following general linear passion. So we can say that we have not violated the assumption of the linear relationship. The above graph, this clearly signifies that the all four groups i.e. 1:1:1, 1:2:2 & 1:4:2 and control group is following linear relationship.

Assumption II (assumption of homogeneity of regressions)

TABLE 3

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Tests of Between-Subjects Effects to check the statistical significance interaction between treatment and covariate (pretest)

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
PRETEST	4.167	1	4.167	12.228	.001
GROUP * PRETEST	.894	3	.298	.875	.460

***Significant at 0.05 level**

From this table it was evident that the obtained P-value (.460) is greater than .05, thus indicating that there was an insignificant difference among the all four groups. So this indicates that we have not violated the assumption of homogeneity of regressions. This supports that earlier conclusion we had from the looking at the scattered plots that appears, these groups are very similar as far as their slops, and as far as trends of the data we have.

Assumption III (assumption of homogeneity of variance)

TABLE 4
Levene's Test of Equality of Error Variances[a]

F	df1	df2	Sig.
6.935	3	56	.000

***Significant at 0.05 level**

From this table it was evident that P-value (.000) is less than .05, it is significant at .05 level, this means variance is not equal amongst the groups, we have violates the assumption of homogeneity of variance. But to test the significance amongst the group we proceed to one-way Ancova, because we have already full fill two assumptions. If sample sizes are equal (or very nearly so), then the ANCOVA isn't sensitive to the assumption.

Note:-Assumption of homogeneity of variance was violated, and that tends to affect the accuracy of the hypothesis decision.

TABLE 5

F -Test of Between Subject Effects for Blood Haemoglobin count in terms of outcome variable (Blood Haemoglobin)

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Observed Power[b]
Corrected Model	64.784[a]	4	16.196	47.854	.000	.777	1.000

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Intercept	64.589	1	64.589	190.839	.000	.776	1.000
PRETEST	4.140	1	4.140	12.234	.001	.182	.930
GROUP	59.899	3	19.966	58.994	.000	.763	1.000
Error	18.615	55	.338				
Total	11428.249	60					
Corrected Total	83.399	59					

R Squared = .777 (Adjusted R Squared = .761)

Computed using alpha = .05

It was observed from the table that, there was a significant difference in mean Blood haemoglobin [F (3, 55) =58.99, P=0.00] between the Groups (G1, G2, G3 and G4). the obtained P-value (.000) is less than .05, thus indicating that there was a significant difference among all the four groups in terms of outcome variable (Blood haemoglobin), and the value of Eta square (.763) also indicating that the 76.3% variability were shown by the groups in Blood haemoglobin count. Power level for the analysis was 1.00 which is very high.

From table it was also found that Pre-test (Covariate) obtained P-value (.001) is less than .05. Thus indicate that Pre-test (Covariate) had a significant effect on the outcome variable (Blood haemoglobin count). So variable should that included as a covariate because it was have negative effect on the ability to see the effect of the treatment. And the value of Eta square (.182) also indicating that the 1.82% variability were shown by the groups in post test (Blood haemoglobin count).

As the F value (58.99) was found significant, Bonferroni Post-Hoc test was applied to see the pair wise comparison of groups for Blood haemoglobin count.

TABLE 6

Pairwise Comparisons of all four groups

(I) TRAINING GROUPS	(J) TRAINING GROUPS	Mean Difference (I-J)	Std. Error	Sig.
G1 (1:1:1)	G2 (1:2:2)	.037	.214	1.000
	G3 (1:4:2)	-1.355*	.215	.000
	G4 (CONTROLL GROUP)	1.471*	.215	.000
G2 (1:2:2)	G1 (1:1:1)	-.037	.214	1.000
	G3 (1:4:2)	-1.391*	.213	.000
	G4 (CONTROLL GROUP)	1.434*	.213	.000
G3 (1:4:2)	G1 (1:1:1)	1.355*	.215	.000
	G2 (1:2:2)	1.391*	.213	.000
	G4 (CONTROLL GROUP)	2.826*	.212	.000

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G4 (CONTROLL GROUP)	G1 (1:1:1)	-1.471*	.215	.000
	G2 (1:2:2)	-1.434*	.213	.000
	G3 (1:4:2)	-2.826*	.212	.000

Based on estimated marginal means
The mean difference is significant at the .05 level.
Adjustment for multiple comparisons: Bonferroni.

Table revolved that, there is a significant difference between G1 and G3 (0.000), G1 and G4 (0.000), G2 and G3 (0.000), G2 and G4 (0.000), and G3 and G4 (0.000) because their obtained P-value is less than .05. From the above findings, this clearly signifies that the Suryabhedana pranayama with all the three variation's. 1:1:1, 1:2:2 & 1:4:2 are having significant effect on Blood haemoglobin count. The rate of increase in Blood haemoglobin count was different in the G3 (1:4:2) but similar in the G1 (1:1:1) and G2 (1:2:2) after the post test it can be concluded from the above findings that the Suryabhedana pranayama with the ratio 1:4:2 is better for improving Blood haemoglobin cunt followed by other two ratio 1:2:2 & 1:1:1.

TABLE 7
Estimated Marginal Means

Dependent Variable: AFTER TRAINING (Blood Hemoglobin)

TRAINING GROUPS	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
G1 (1:1:1)	13.789[a]	.152	13.484	14.094
G2 (1:2:2)	13.752[a]	.150	13.451	14.053
G3 (1:4:2)	15.144[a]	.151	14.842	15.445
G4 (CONTROLL GROUP)	12.318[a]	.151	12.016	12.620

Covariates appearing in the model are evaluated at the following values: BEFORE TRAINING = 12.55250.

The estimated marginal means section of the output gives the adjusted mean (controlling for the covariate 'pre-test') or each group. This simply means that effect of 'covariate' (pre-test) has been statistically removed. From four adjusted mean it is clear that G1, G2, and G3 increases the Blood Haemoglobin count after adjusting covariate (pre-test).In which G3 (1:4:2) increases the most Blood Haemoglobin count after adjusting covariate (pre-test).

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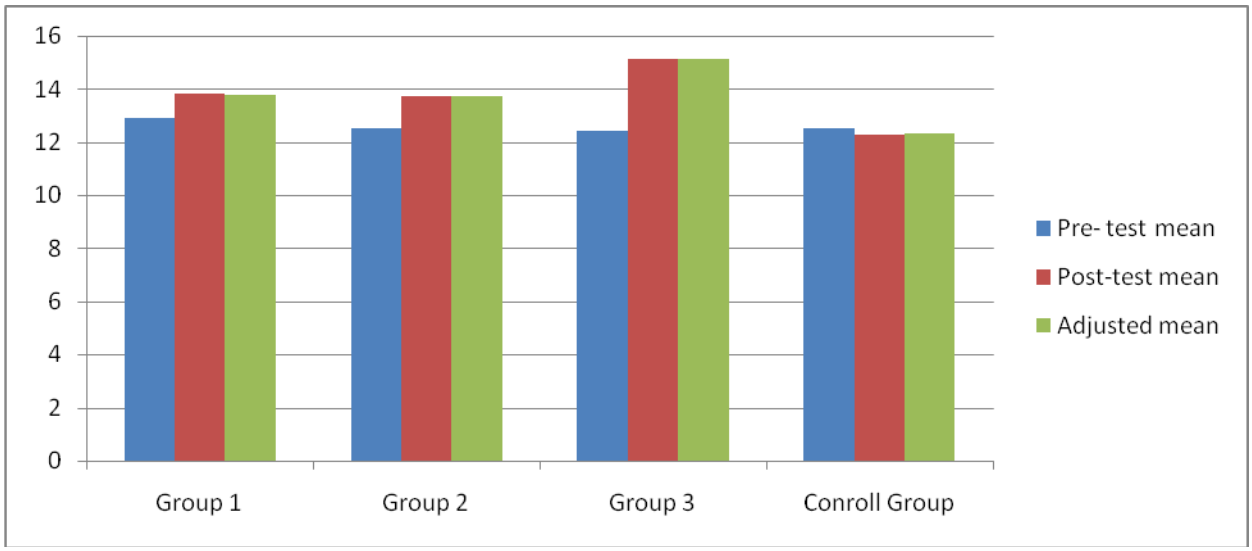

Figure 4: Pre-test mean, Post-test mean and adjusted mean of all four groups on Blood Haemoglobin.

6. Discussion

The result of the study indicates that Blood haemoglobin count increases significantly over the 8 weeks training period for all three experimental groups. However the differences among the three experimental groups were significant. The Suryubhedan training programme with ratio 1:4:2 significantly increases Blood haemoglobin count over 8 weeks training than the two experimental programmes (1:1:1 and 1:2:2). The experimental group with ratio 1:1:1 and 1:2:2 also increases the Blood haemoglobin count. The control group did not produce any significant improvement on Blood haemoglobin count with regard to subject age.

Some of the previous findings related to the effect of Yoga practices have been found with involvement of Pranayama. Bhogal,R.S et al., (1999) have observed that Meditation increase non significantly in blood Hb of subjects1. Khare, K.C. et al., (1989) have found remarkable improve in Hb level, total WBC count and PCV as a consequence of Yoga practice. Deshpande, R. R. & Bhole, M.V. (1982) has concluded insignificant increase in Hb due to effect of Kapalbhati. Govindarajulu,N. & Shivanadanam,G. et al., (2004) have met significant mean gain in RBC count as a consequence of Yoga practices.

7. Discussion on Hypothesis

1. There will be significant difference among the mean of different variations of Surybhedana Pranayama training on Blood Haemoglobin count, which is accepted.
2. Suryabhedan Pranayam with 1:4:2 ratio training will produce significant improvement on Blood Haemoglobin count better than the ratio 1:2:2 and 1:1:1 of Suryabhedan Pranayama training, which is accepted.

8. Conclusion

The present study demonstrated a increases in Blood haemoglobin count for G1, G2, and G3 respectively. However the Suryubhedan training programme with ratio 1:4:2 produced greater

improvement than the other two experimental programme (1:1:1 and 1:2:2). The control group did not produce any significant improvement on Blood haemoglobin count with regard to subject age.

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