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Impact of Short-Term Training of Kapalbhati Pranayama on Components of Health-Related Fitness

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Abstract

The present study was conducted with the objective to determine the Effects of 4-weeks Training of Kapalbhati Pranayama on Components of Health-Related Fitness. For the purpose of present study Twenty eight, university level girls between the age group of 21-26 years were selected. The subjects were purposively assigned into two groups: Group-A: Experimental (n_1=14); Group-B: Control (n_2=14). The subjects from Group-A: Experimental were subjected to a 4-weeks Kapalbhati Pranayama. Student t test for paired samples was utilized to compare the means of the pre-test and the post-test. Based on the analysis of the results obtained, we conclude that the significant differences were found in Components of Health-Related Fitness (i.e., Cardiorespiratory Endurance, Flexibility, % Body Fat, Fat Weight and Lean Body Weight) of University Level Girls. Insignificant between-group differences were noted in Muscular Strength and Muscular Endurance of University Level Girls.

Keywords: Kapalbhati Pranayama, Components of Health-Related Fitness

Introduction

Yoga is a mind-body intervention with historical roots in ancient Indian way of life. The very most primitive indication of the existence of some form of Yoga practices in India comes from the Harappan culture which can be dated at least as far back as 3000 B.C. Yoga is observed around the world as a footpath to well-being and divine perception. Yoga has been practiced for generations as a form of therapy for body, mind and spirit. Different forms of pranayama activate different branches of the autonomic nervous system effecting oxygen consumption, metabolism and skin resistance. Pranayamic breathing, characterized by brief breath retention, caused significant increases in oxygen consumption and metabolic rate while pranayamic breathing, characterized by long breath retention, caused lowering of oxygen consumption and metabolic rate (Telles, S., & Desiraju, 1991). This demonstrates that slow breathing enhances parasympathetic activation. In another study using breathing exercises mimicking pranayama, slow breathing over a period of three months was shown to improve autonomic function while fast breathing did not have an effect on the autonomic nervous system (Pal et al. 2004). Kapalbhati Pranayama is a miraculous yoga breathing exercise, invented by Indian yogis thousands years ego, for complete body fitness. It affects even those diseases which are impossible to be cured by medicines like cancer, diabetes, asthma. Numerous patients have gained healthy and happy life by adopting it, in their daily life (Chavhan, 2013). Pranayama may also affect the immune system. Inhibition of the sympathetic nervous system has been shown to enhance function of the immune system in several forms of meditation including mindfulness meditation and Transcendental meditation (Collins & Dunn, 2005; Takahashi, 2005). This practice is called 'Pranayama'. It is an art of controlling the breath. It involves taking in breath, retaining it then exhaling it (Sri Paramhansa, 2004; Swami Ramdev, 2004). Some studies have shown the various effects of Pranayama on young volunteers. The beneficial effects of six weeks practice of different pranayamas are well reported and have sound scientific basis (Joshi et al, 1992). In yoga tradition, it is taught that different pranayams have different effects. Raghuraj, 1998 have studied the acute effect of fast and slow pranayams on heart rate variability while Telles and Desiraju, 1992 have demonstrated the heart rate changes during the performance of different pranayams. Pranayama has immense therapeutic potential in a wide range of psychosomatic disorders, but there is currently lack of an adequate meta-analysis in relation to kapalbhati pranayama to assess its efficacy with respect to Components of Health-Related Fitness and as a result the present study was conducted to find out therapeutic effects of kapalbhati pranayama on Components of Health-Related Fitness.

Materials and Methods

Twenty eight, university level girls between the age group of 21-26 years were selected. The subjects were purposively assigned into two groups: Group-A: Experimental (n_1=14)**;** Group-B: Control (n_2=14).

Table 1. Distribution and Demographics of Subjects

Sample Size (N=28)			
Variables	**Total (N=28)**	**Experimental group (n_1=14)**	**Control group (n_2=14)**
Age	21.947±1.972	21.736±2.130	22.157±1.833
Body Height	5.352±0.137	5.357±1.261	5.347±1.504
Body Mass	56.263±2.446	53.368±2.191	55.157±2.733

Methodology

This study is designed as a retrospective cross-sectional study. The subjects from Group-A: Experimental were subjected to a 4-weeks training of Kapalbhati Pranayama. This lasted 4 weeks and consisted of daily sessions. The Cooper 12 minute run test was used to measure cardiorespiratory endurance. Muscular strength was measured by sit up test. Push up test was used to measure muscular endurance, Flexibility was measured by sit and reach test and Hydrostatic weighing technique was used for the measurement of fat and lean body tissue in a clinical setting.

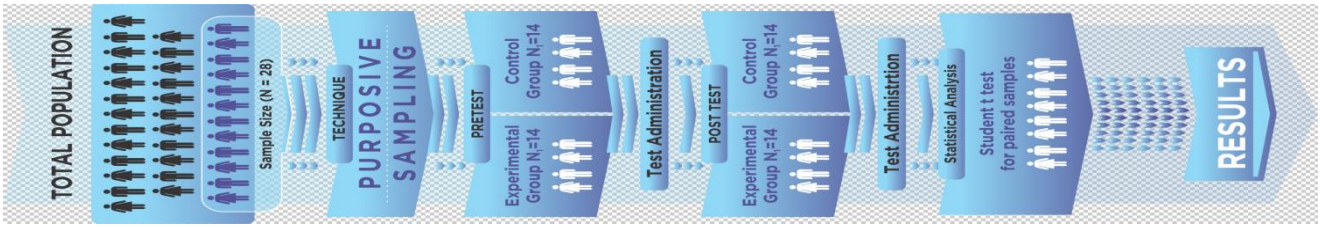


Fig. 1. Study Design

Table 2. Experimental Treatment

4-Weeks Kapalbhati Pranayama Training Programme			
Weeks	**Schedule**	**Time**	**Duration**
1st Week	Preliminary Yogic Exercises	5 Minute	20 Minute
	Practice of Kapalbhati Pranayama (9 Rounds X 1 Set)	10 Minute	
	Relaxation Posture	5 Minute	
2nd Week	Preliminary Yogic Exercises	5 Minute	25 Minute
	Practice of Kapalbhati Pranayama (9 Rounds X 2 Set)	15 Minute	
	Relaxation Posture	5 Minute	
3rd Week	Preliminary Yogic Exercises	5 Minute	30 Minute
	Practice of Kapalbhati Pranayama (9 Rounds X 3 Set)	20 Minute	
	Relaxation Posture	5 Minute	
4rd Week	Preliminary Yogic Exercises	5 Minute	35 Minute
	Practice of Kapalbhati Pranayama (9 Rounds X 4 Set)	25 Minute	
	Relaxation Posture	5 Minute	

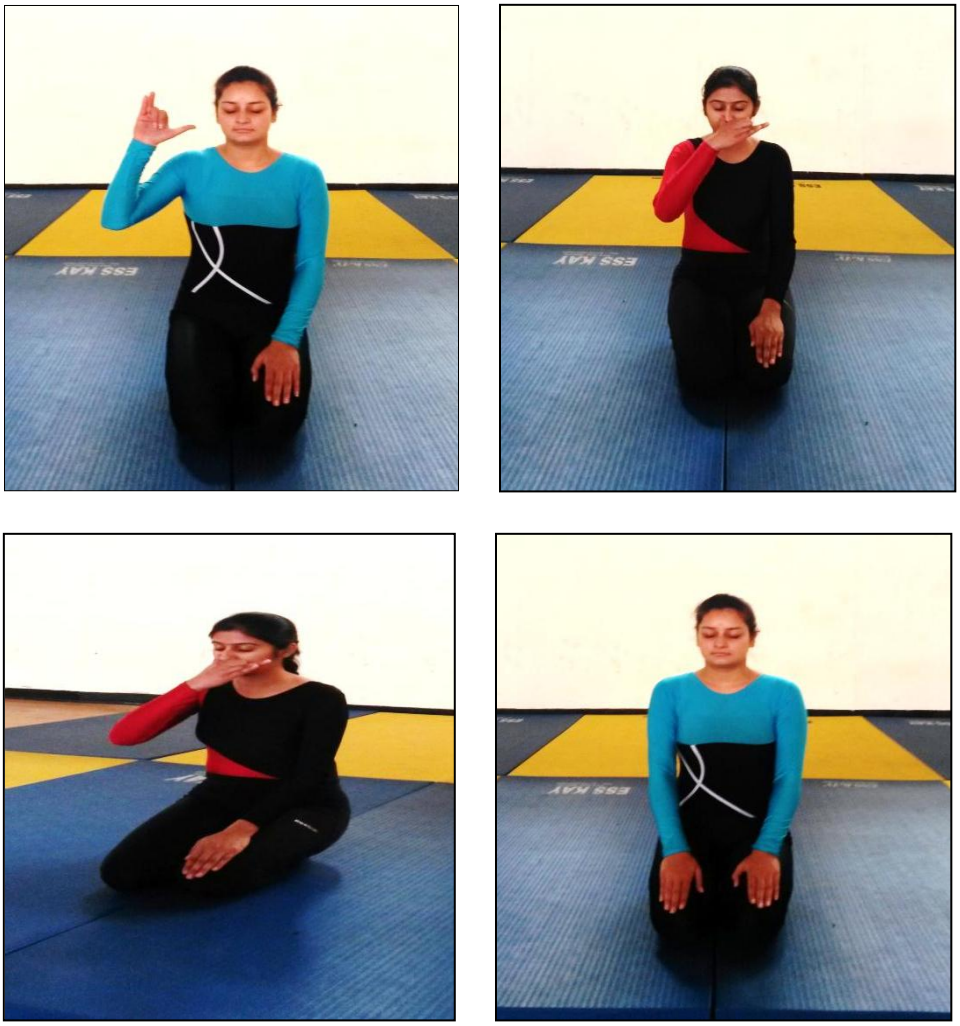


Fig. 2. Subjects Performing Kapalbhati Pranayama

Statistical Analyses

Data is expressed as the mean ± SD. Student t test for paired samples was utilized to compare the means of the pre-test and the post-test.

Results

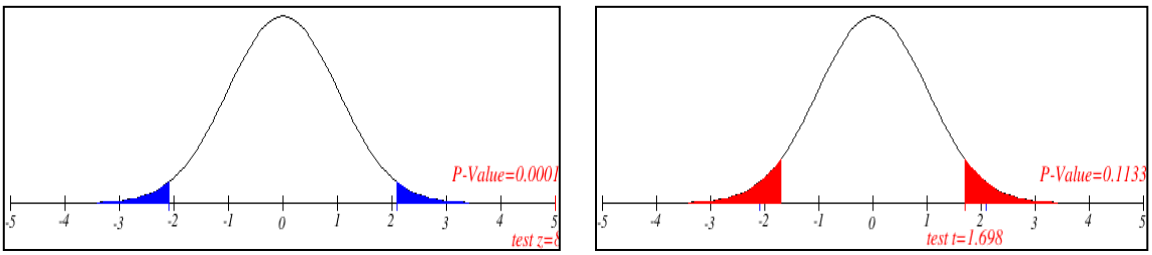
Table 3. Mean values (±SD) and Paired Sample t-test of Components of Health-Related Fitness (i.e., Cardiorespiratory Endurance, Muscular Strength, Muscular Endurance, Flexibility, % Body Fat, Fat Weight and Lean Body Weight) in Experimental and Control group (n=14 each) before (Pre) and after (Post) 4-weeks Kapalbhati Pranayama Training Programme (Experimental group only)

Parameters	Group	Pre-Test	Post-Test	t-value	p-value
Cardiorespiratory Endurance	Experimental	1984.64±414.55	1992.36±414.80	8.7072*	0.0001
	Control	1971.79±389.83	1973.64±391.18	1.6980	0.1133
Muscular Strength	Experimental	36.14±8.57	36.57±8.40	1.8829	0.0823
	Control	36.50±6.19	38.86±12.95	0.7683	0.4561
Muscular Endurance	Experimental	30.86±4.77	31.07±4.68	1.00	0.3356
	Control	27.57±3.82	27.79±3.40	0.8224	0.4257
Flexibility	Experimental	27.29±4.97	28.50±4.82	5.6667*	0.0001
	Control	22.64±4.01	22.71±3.36	0.1733	0.8651
% Body Fat	Experimental	29.34±7.38	29.38±7.37	4.7697*	0.0004
	Control	25.83±7.36	25.83±7.36	0.4932	0.6301
Fat Weight	Experimental	17.20±1.69	17.23±1.69	3.1948*	0.0070
	Control	16.67±1.677	16.67±1.672	1.2352	0.2386
Lean Body Weight	Experimental	62.21±4.013	62.22±4.015	3.6280*	0.0031
	Control	48.44±6.052	48.44±6.05	1.00	0.3356

Cardiorespiratory Endurance

The results of Components of Health-Related Fitness in group (Experimental) and group (Control) are shown in Table-3. The Mean and Standard Deviation (±SD) values of Cardiorespiratory Endurance of pre-test and post-test of experimental group were 1984.64±414.55 & 1992.36±414.80 respectively. However, the Mean and Standard Deviation (±SD) values of Cardiorespiratory Endurance of pre-test and post-test of control group were 1971.79±389.83 & 1973.64±391.18. The t-value in case of experimental group was 8.7072* and for control group it was 1.6980.

Significant between-group differences were noted in Cardiorespiratory Endurance in the experimental group before (Pre) and after (Post) subjected to 4-weeks Kapalbhati Pranayama Training Programme since, the calculated value of (t=8.7072*) is greater than tabulated value of $t_{.05}$ (13) = 2.14 for the selected degree of freedom and level of significance. However, no significant changes over that 4-weeks period were noted in the control group.



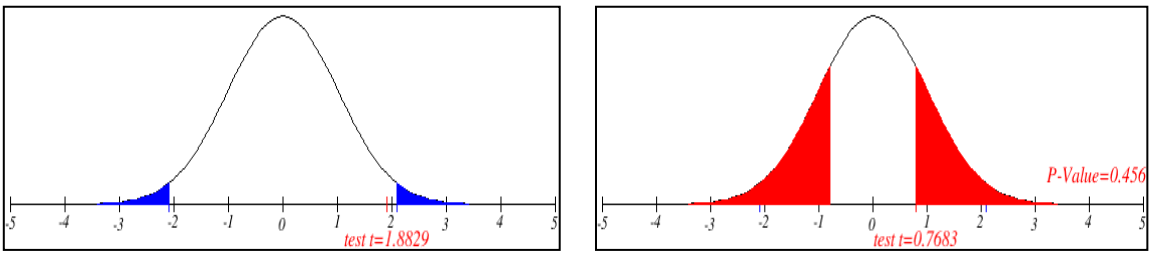
(a) **(b)**

Fig. 3. t-value and p-value for the Experimental (a) and Control (b) Groups Scores of Cardiorespiratory Endurance

Muscular Strength

The results of Components of Health-Related Fitness in group (Experimental) and group (Control) are shown in Table-3. The Mean and Standard Deviation (±SD) values of Muscular Strength of pre-test and post-test of experimental group were 36.14±8.57 & 36.57±8.40 respectively. However, the Mean and Standard Deviation (±SD) values of Muscular Strength of pre-test and post-test of control group were 36.50±6.19 & 38.86±12.95. The t-value in case of experimental group was 1.8829 and for control group it was 0.7683.

Insignificant between-group differences were noted in Muscular Strength in the experimental group before (Pre) and after (Post) subjected to 4-weeks Chandra-Nadi Pranayama Training Programme since, the calculated value of (t=1.8829) is greater than tabulated value of $t_{.05}$ (13) = 2.14 for the selected degree of freedom and level of significance. However, no significant changes over that 4-weeks period were noted in the control group.



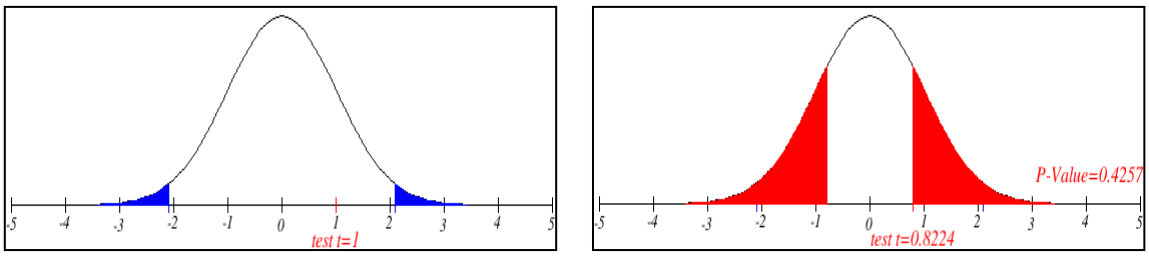
(c) **(d)**

Fig. 4. t-value and p-value for the Experimental (c) and Control (d) Groups Scores of Muscular Strength

Muscular Endurance

The results of Components of Health-Related Fitness in group (Experimental) and group (Control) are shown in Table-3. The Mean and Standard Deviation (±SD) values of Muscular Endurance of pre-test and post-test of experimental group were 30.86±4.77 & 31.07±4.68 respectively. However, the Mean and Standard Deviation (±SD) values of Muscular Endurance of pre-test and post-test of control group were 27.57±3.82 & 27.79±3.40. The t-value in case of experimental group was 1.00 and for control group it was 0.8224.

Insignificant between-group differences were noted in Muscular Endurance in the experimental group before (Pre) and after (Post) subjected to 4-weeks Kapalbhati Pranayama Training Programme since, the calculated value of (t=1.00) is greater than tabulated value of $t_{.05}$ (13) = 2.14 for the selected degree of freedom and level of significance. However, no significant changes over that 4-weeks period were noted in the control group.



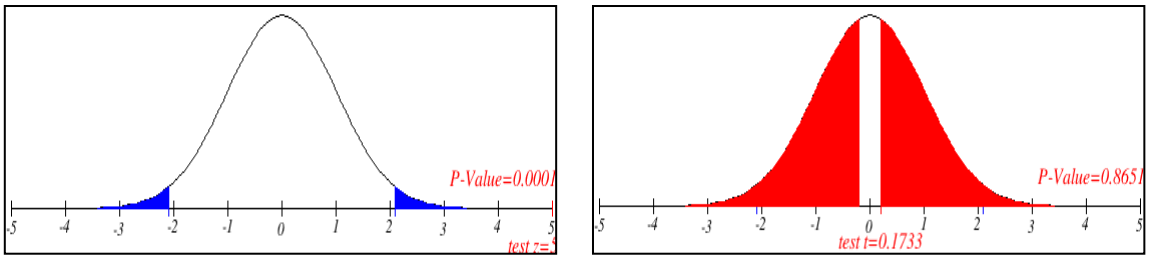
(e) **(f)**

Fig. 5. t-value and p-value for the Experimental (e) and Control (f) Groups Scores of Muscular Endurance

Flexibility

The results of Components of Health-Related Fitness in group (Experimental) and group (Control) are shown in Table-3. The Mean and Standard Deviation (±SD) values of Flexibility of pre-test and post-test of experimental group were 27.29±4.97 & 28.50±4.82 respectively. However, the Mean and Standard Deviation (±SD) values of Flexibility of pre-test and post-test of control group were 22.64±4.01 & 22.71±3.36. The t-value in case of experimental group was 5.6667* and for control group it was 0.1733.

Significant between-group differences were noted in Flexibility in the experimental group before (Pre) and after (Post) subjected to 4-weeks Kapalbhati Pranayama Training Programme since, the calculated value of (t=5.6667*) is greater than tabulated value of $t_{.05}$ (13) = 2.14 for the selected degree of freedom and level of significance. However, no significant changes over that 4- weeks period were noted in the control group.



(g) **(h)**

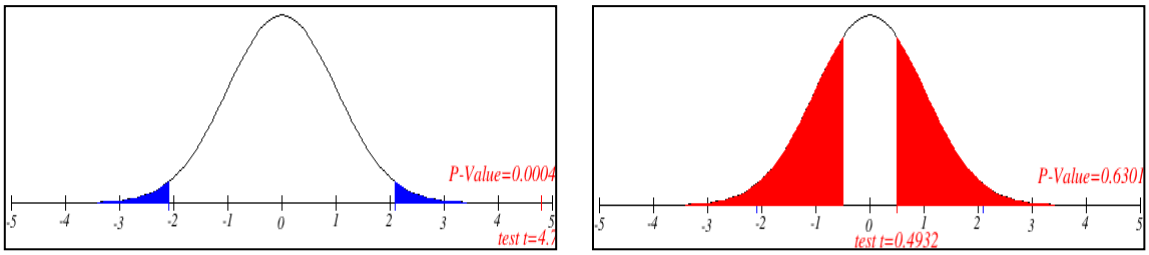
Fig. 6. t-value and p-value for the Experimental (g) and Control (h) Groups Scores of Flexibility

% Body Fat

The results of Components of Health-Related Fitness in group (Experimental) and group (Control) are shown in Table-3. The Mean and Standard Deviation (±SD) values of % Body

Fat of pre-test and post-test of experimental group were 29.34±7.388 & 29.38±7.37 respectively. However, the Mean and Standard Deviation (±SD) values of % Body Fat of pre-test and post-test of control group were 25.83±7.36 & 25.83±7.36. The t-value in case of experimental group was 4.7697*and for control group it was 0.4932.

Significant between-group differences were noted in % Body Fat in the experimental group before (Pre) and after (Post) subjected to 4-weeks Kapalbhati Pranayama Training Programme since, the calculated value of (t=4.7697*) is greater than tabulated value of $t_{.05}$ (13) = 2.14 for the selected degree of freedom and level of significance. However, no significant changes over that 4-weeks period were noted in the control group.



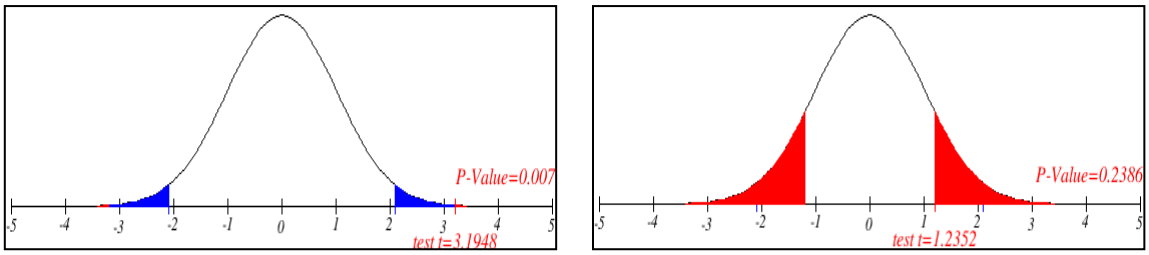
(i) **(j)**

Fig. 7. t-value and p-value for the Experimental (i) and Control (j) Groups Scores of % Body Fat

Fat Weight

The results of Components of Health-Related Fitness in group (Experimental) and group (Control) are shown in Table-3. The Mean and Standard Deviation (±SD) values of Fat Weight of pre-test and post-test of experimental group were 17.20±1.69 & 17.23±1.69 respectively. However, the Mean and Standard Deviation (±SD) values of Fat Weight of pre-test and post-test of control group were 16.67±1.677 & 16.67±1.672. The t-value in case of experimental group was 3.1948*and for control group it was 1.2352.

Significant between-group differences were noted in Fat Weight in the experimental group before (Pre) and after (Post) subjected to 4-weeks Kapalbhati Pranayama Training Programme since, the calculated value of (t=3.1948*) is greater than tabulated value of $t_{.05}$ (13) = 2.14 for the selected degree of freedom and level of significance. However, no significant changes over that 4-weeks period were noted in the control group.



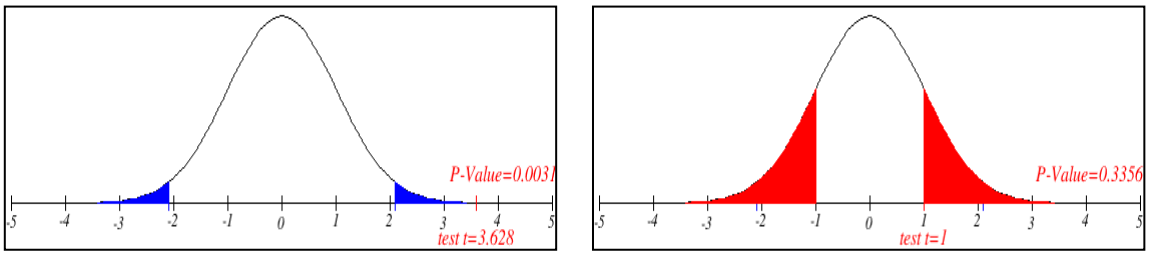
(k) **(l)**

Fig. 8. t-value and p-value for the Experimental (k) and Control (l) Groups Scores of Fat Weight

Lean Body Weight

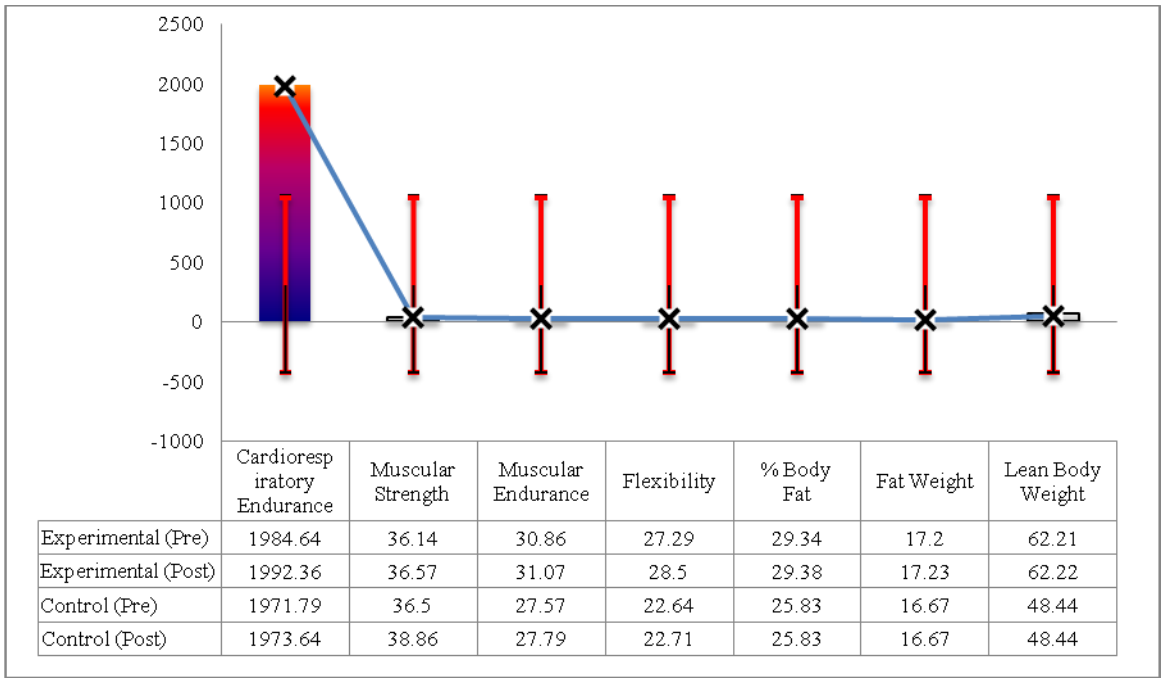
The results of Components of Health-Related Fitness in group (Experimental) and group (Control) are shown in Table-3. The Mean and Standard Deviation (±SD) values of Lean Body Weight of pre-test and post-test of experimental group were 62.21±4.013 & 62.22±4.015 respectively. However, the Mean and Standard Deviation (±SD) values of Lean Body Weight of pre-test and post-test of control group were 48.44±6.052 & 48.44±6.05. The t-value in case of experimental group was 3.6280*and for control group it was 1.00.

Significant between-group differences were noted in Lean Body Weight in the experimental group before (Pre) and after (Post) subjected to 4-weeks Kapalbhati Pranayama Training Programme since, the calculated value of (t=3.6280*) is greater than tabulated value of $t_{.05}$ (13) = 2.14 for the selected degree of freedom and level of significance. However, no significant changes over that 4-weeks period were noted in the control group.



(m) **(n)**

Fig. 9. t-value and p-value for the Experimental (m) and Control (n) Groups Scores of Lean Body Weight



	Cardiorespiratory Endurance	Muscular Strength	Muscular Endurance	Flexibility	% Body Fat	Fat Weight	Lean Body Weight
Experimental (Pre)	1984.64	36.14	30.86	27.29	29.34	17.2	62.21
Experimental (Post)	1992.36	36.57	31.07	28.5	29.38	17.23	62.22
Control (Pre)	1971.79	36.5	27.57	22.64	25.83	16.67	48.44
Control (Post)	1973.64	38.86	27.79	22.71	25.83	16.67	48.44

Fig. 10. Mean values of Components of Health-Related Fitness (i.e., Cardiorespiratory Endurance, Muscular Strength, Muscular Endurance, Flexibility, % Body Fat, Fat Weight

and Lean Body Weight) in Experimental and Control group (n=14 each) before (Pre) and after (Post) 4-weeks Kapalbhati Pranayama Training Programme (Experimental group only)

Conclusion

Based on the analysis of the results obtained, we conclude that the significant differences were found in Components of Health-Related Fitness (i.e., Cardiorespiratory Endurance, Flexibility, % Body Fat, Fat Weight and Lean Body Weight) of University Level Girls. Insignificant between-group differences were noted in Muscular Strength and Muscular Endurance of University Level Girls.

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