

## WEIGHT TRAINING AND ITS EFFECTS ON SELECTED HEALTH RELATED PHYSICAL FITNESS VARIABLES OF SCHOOL CHILDREN

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### ABSTRACT

The study was conducted to analyse the effects of weight training on selected health related physical fitness variables of school children. Ten weeks, 4 days per week training programme was designed for experimentation. Total 30 male subjects of 14 to 16 years' age group were selected for experimentation. Selected subjects were divided in two groups i.e. experimental group (n=15) which was given selected weight training protocol for the duration of 10 weeks and control group (n=15) was not provided any training protocol. Health related components including Body Composition i.e. Body Fat %, BMI (Body Mass Index), SMM (Skeletal Muscle Mass), FFM (Fat Free Mass) and TBW (Total Body Water), Flexibility, Muscular Strength and Muscular Endurance i.e. (i) Dynamic Muscular Strength & Muscular Endurance of Arms and Shoulders (ii) Muscular Strength & Endurance of Trunk and Cardiovascular Endurance were selected as dependent variables. The pre and post test data were collected for Body Composition variables using Body Composition Analyser (IB 770), for flexibility using sit and reach test (in cm), Dynamic Muscular Strength and Endurance (Arms and Shoulder) was assessed using Pull Ups (in numbers) and of Trunk using Bent Knee Sit Ups (Number/min). Cardiovascular Endurance was assessed using 12 min run/walk. To check the significant difference between scores of pre and post training, paired t test was used. To analyse the significant difference (if any) between pre weight training & pre control and post weight training and post control independent t test was used. Descriptive statistics including Mean, t-ratio and SD. were computed. Based on the results, it was concluded that weight training has positive impact on the selected health related physical fitness variables i.e. Body Fat %, SMM, FFM, Flexibility, Muscular Strength and Muscular Endurance i.e. (i) Dynamic Muscular Strength & Muscular Endurance (Arms and Shoulders) (ii) Muscular Strength & Endurance of Trunk and Cardiovascular Endurance. No significant changes were observed in BMI and TBW.

**KEYWORDS:** Weight Training, Health Related Fitness Components, Flexibility, Muscular Strength, Muscular Endurance, Cardio-vascular Endurance.

### INTRODUCTION

Health related physical fitness includes the activities which improves overall physical health. It involves flexibility, muscular strength, body composition and cardiovascular endurance. Health related physical fitness increases power, stamina, metabolism, immunity, physical as well as mental health.<sup>1</sup> Weight Training is gaining popularity day by day. It is key method of developing fitness including physical fitness and health related fitness. It strengthens internal organs and muscles. It is a specific type of training where certain muscle or group of muscles are triggered. Due to lifting weights super compensation phase is experienced by trainees. It also helps in dealing muscular injuries during training and sports also. Regular weight training is found to be beneficial in burning calories, improving brain functioning and increase flexibility & mobility of the body.<sup>2</sup> Rhea et al (2014)<sup>3</sup>, conducted a study on Sixteen recreationally trained men of age = 21 ( $\pm$  2.0). 12 weeks' weight training, 3 days per week was given to the selected subjects. All subjects were randomly divided into two groups and both were given weight training with different load parameters i.e. one set and three sets of weight training respectively. The results indicate that for recreationally trained individuals, who were given DUP training including 3 training sets were found better than individuals using 1 set of weight training for maximal strength gains.

Weight training is systematic training process performed with the help of weights. It helps in increasing muscle contraction and resistance. Specialized equipment used in Weight training targets particular muscle group. Like strength training sets, repetitions, pace, weights and exercise types are used in weight training to gain strength and endurance. Specific attention is paid while designing a weight training programme with proper sets, ratio of reps, weights and workout schedule. lean muscle mass is increased with lifting heavy weights with fewer reps. Imran H. et al., (2013)<sup>4</sup> studied the effect of weight-training on physical fitness

variables of 100 School boys of 14-16 years of age. The experimental group was provided weight training for 16 weeks. The results evident that weight-training is effective tool for development of muscular strength, speed and abdominal strength endurance.

Modern and specific equipment like different modern machines adds different type of resistance which helps in overall strength development. As machines adds more torque or resistance which gives better results. Furthermore, different machines may be heavier or lighter despite using the same weight stack, which depends on configuration of pulleys. Haff, G.G & Kilore L.J. et al (2005)<sup>5</sup> pointed out that Dumb bells, barbells and pulley are used in weight training and body's own weight is also used i.e. in push-ups and chin ups etc. During training with weights one should have control over jerking and bouncing. During weight training gravity pull the bar downward when the movements are done fastly. The bar is pushed in opposite direction while bouncing off the chest, at the bottom of the movement. The bar is carried upward by momentum which helps to lift the weight but one should be careful about the possibilities of injuries. To avoid the injuries, during eccentric phase, while lifting the weight one should count 1 to 2. and during concentric phase one should count 2 to 3 while dropping the weight. After completion of the exercise one should not swing, jerk or bounce. Ojo, O. R., (2019).<sup>6</sup>Conducted a study on 179 Nigerian students (90 males and 89 females), considering two methods i.e. Free Weight Training (FWT) and Variable Resistance Training (VRT). The training was given for 12 weeks. Various tools of weight lifting were used like free weights, dumbbells, flex box, mediation balls and hand weights. Co-variance and informal communication methods were selected for the data analysis. The study concluded that there was an improvement in FWT.

One should keep in mind the concept of overload. Overload is the key, which helps the muscle to develop more strength. When anyone lifts the weight muscles are under tension for longer duration which helps in muscle growth. While lifting weights, 10 to 20 repetitions are used with correct form and maintaining correct speed. In starting, one can use 15 to 20 repetitions to provide sufficient time to muscles and tendons to adjust and the same time to nervous system to learn movement pattern. After a few months, 10-15 repetitions can be used in training schedule. Weight can be increased gradually with the increase in adaptability. Radnor, et al. (2017)<sup>7</sup>Conducted a 6 weeks, twice a week; Resistance Training programme. Eight school boys were randomly divided into four groups i.e. plyometric, resistance, combined training and control groups. Traditional strength training and combined training groups, were found to have more positive effects on acceleration speed and squat jump height.

### Sample

30 healthy male subjects of 14-16 years of age were chosen randomly from Sir Chottu Ram Modern Senior Secondary School, Ratangarh Majra, Sonipat, Haryana. The subjects were divided into two groups. The Experimental Group/ Weight Training Group comprises total 15 boys and Control Group also have total 15 boys. Pre and post test data of Experimental and control group were collected for all the selected health related components. After pre-test the experimental group i.e. weight training group underwent a selected training programme and control group was instructed to perform daily routine tasks.

### Training Design

Experimental Group/ weight training group was provided 10 Weeks, 4 days per week (Wednesday, Saturday and Sunday as rest days) training programme in the morning session from 6.30 am onwards (for 50-55 minutes). Load was progressively increased. The Experimental/ Weight training group was instructed to do 15 minutes of warm up. In first phase of three weeks of training the experimental group underwent selected weight training programme. On Monday, they were given upper body training and were instructed to perform 3 sets with eight reps in each set including incline bench press, flat dumb bell fly, Lat pull wide, dumb bell shoulder press, smith machine shrug, barbell curl and triceps push down. On Tuesday, they were given lower body training including leg press, leg extension, seated curl, leg press calves raises, laying leg raises and crunch. On Thursday, they were given upper body training programme including incline dumb bell press, incline dumb bell fly, Lat pull narrow, barbell shoulder press, dumb bell shrug, incline dumb bell curl, triceps dip. On Friday, they were given lower body training programme including Squat, seated calf raise, Dumb bell lunge, Romanian dead lift, standing calf raise, cable crunch and reverse crunches. They were instructed to perform 3 sets with 8 reps in each set.

10 WEEKS 4-DAYS SINGLESPLIT PROGRESSIVE RESISTANCE TRAINING PRINCIPLE								
EXERCISE	PHASE-1 WEEK 1,2,3 Rep completion time=4secs Sets X Reps	PHASE-2 WEEK 4,5,6 Rep completion time=4secs Sets X Reps	INTENSI TY (% OF 1RM) FOR PHASE-1 & PHASE-2	PHASE-3 WEEK 7,8 Rep completion time=4secs Sets X Reps	INTENS ITY (% OF 1RM)	PHASE-4 WEEK 9,10 Rep completion time=4secs Sets X Reps	INTENS ITY (% OF 1RM)	Rest (SEC) FOR ALL PHAS ES
<b>Day-1 (MON) UPPERBODY</b>					60%		65%	
Warm Up					1RM		1RM	
15 mins (treadmill, crosstrainer etc)	3x8	3x10	50% 1RM	3x10	60%	3x10	65%	120
Incline Bench Press	3x8	3x10	50% 1RM	3x10	1RM	3x10	1RM	120
Flat Dumb Fly	3x8	3x10	50% 1RM	3x10	60%	3x10	65%	120
Lat Pull Wide	3x8	3x10	50% 1RM	3x10	1RM	3x10	1RM	120
Dumb Sho Press	3x8	3x10	50% 1RM	3x10	60%	3x10	65%	120
Smith Machine	2x8	2x10	50% 1RM	2x12	1RM	2x12	1RM	90
Shrug	2x8	2x10	50% 1RM	2x12	60%	2x12	65%	90
Barbell Curl					1RM		1RM	
Triceps Push Down					60%		65%	
Cool down 10 Mins					1RM		1RM	
<b>Day-2 (TUE) LOWER BODY-</b>					60%		65%	
Leg Press	3x8	3x10		3x10	1RM	3x10	1RM	120
Leg Extension	3x8	3x10	50% 1RM	3x10	60%	3x10	65%	120
Seated Curl	3x8	3x10	50% 1RM	3x10	1RM	3x10	1RM	120
Leg Press Calves	3x8	3x10	50% 1RM	3x10	60%	3x10	65%	90
Raises	3x8	3x10	50% 1RM	3x10	1RM	3x10	1RM	90
Seated Calf Raises	2x10	2x12	50% 1RM	2x12	60%	2x12	65%	90
Lying Leg Raises	2x10	2x12	50% 1RM	2x12	1RM	2x12	1RM	90
Crunch					60%		65%	
Cool down 10 Mins					1RM		1RM	
<b>Day-3(THU) UPPERBODY</b>					60%		65%	
Warm Up 15 mins					1RM		1RM	
(treadmill,crosstrain er etc	3x8	3x10	50% 1RM	3x10	60%	3x10	65%	120
Incline Dumb Press	3x8	3x10	50% 1RM	3x10	1RM	3x10	1RM	120
Incline Dumb Fly	3x8	3x10	50% 1RM	3x10	60%	3x10	65%	120
Lat Pull Narrow	3x8	3x10	50% 1RM	3x10	1RM	3x10	1RM	120
Barbell Sho Press	2x8	2x12	50% 1RM	2x12	60%	2x12	65%	90
Dumb Shrug	2x8	2x12	50% 1RM	2x12	1RM	2x12	1RM	90
Incline Dumb Curl					60%		65%	
Triceps Dip					1RM		1RM	
Cool down 10 Mins								
<b>Day-4 (FRI) LOWERBODY</b>					60%		65%	
WarmUp15 mins					1RM		1RM	
(treadmill, crosstrainer etc	3x8	3x10	50% 1RM	3x10	60%	3x10	65%	120
Squat	3x8	3x10	50% 1RM	3x10	1RM	3x10	1RM	120
Dumb Lunge	3x8	3x10	50% 1RM	3x10	60%	3x10	65%	90
Romanian Dead Lift	3x8	3x10	50% 1RM	3x10	1RM	3x10	1RM	90
Seated Calf Raise	2x10	2x12	50% 1RM	2x12	60%	2x12	65%	90
Standing Calf Raise	2x10	2x12	50% 1RM	2x12	1RM	2x12	1RM	90
Cable Crunch					60%		65%	
Reverse Crunch					1RM		1RM	
Cool down 10 Mins								

Body Composition I.e. Body fat percent (Fat %), BMI, SMM, FFM and TBW, Flexibility, Muscular Strength and Muscular Endurance I.e. Dynamic Muscular Strength and Muscular Endurance (arm and Shoulders) & of trunk and Cardiorespiratory Endurance were chosen as criterion variables. All the Subjects were evaluated before providing the training and after the training programme i.e. Body Composition

Variables namely Body fat% in %, BMI in Weight (kg.) / height (m)<sup>2</sup>, SMM in Kg/(m)<sup>2</sup>, FFM in Kg/(m)<sup>2</sup> and TBW in Litres were measured with Body Composition Analyser (IB 770), Flexibility was measured with Sit and reach test in centimetres, Muscular Strength and Muscular Endurance i.e. Dynamic Muscular Strength and Muscular Endurance of arms & Shoulders was measured using Pull Ups (Numbers) and Muscular Endurance and strength of trunk was measured using Bent Knee Sit Ups (Hold/sec) and Cardio-Respiratory endurance was measured with 12 minute run/walk in Meters.

After data collection paired t test was computed to verify the significant changes between pre and post test scores of both groups. Independent t test was computed to check the significant changes between pre and post test scores of both groups.

## Results and analysis

**Table 1. Analysis of difference between Pre and post training scores of Weight training group**

Sr. No	Variables	Test Items	Scores	N	Mean	S.D	t - value	Sig.
1 (a)	Body Composition	Body Fat%	Pre	15	15.63	2.75	11.18	.000
			Post	15	14.36	2.47		
(b)		BMI	Pre	15	19.13	2.11	1.45	.172
			Post	15	19.02	1.96		
(c)		SMM	Pre	15	20.65	3.19	-17.83	.000
			Post	15	22.27	3.14		
(d)		FFM	Pre	15	46.09	6.30	-10.37	.000
			Post	15	47.40	6.11		
(e)		TBW	Pre	15	25.33	3.18	-1.68	.116
			Post	15	25.35	3.19		
2.	Flexibility	Sit and Reach	Pre	15	5.90	2.12	-12.85	.000
			Post	15	7.60	2.32		
3 (a)	Dynamic Muscular strength and endurance (arms and shoulders)	Pull Ups	Pre	15	4.21	1.58	-7.87	.000
			Post	15	6.13	0.99		
(b)	Muscular endurance and strength (Trunk)	Bent KSU	Pre	15	23.13	2.50	-14.53	.000
			Post	15	26.93	2.76		
4	Cardiovascular endurance	12 M R/W	Pre	15	2096.67	167.40	-7.67	.000
			Post	15	2276.67	174.10		

\*level of significance= 0.05, Table value =2.160

The results in the table are evident that mean scores of pre and post-test for Body fat % are 15.63 and 14.36 and S.D are 2.75 and 2.47 respectively. Pre and post-test BMI mean scores are 19.13 and 19.02 and S.D are 2.11 and 1.96 respectively. Pre and post-test mean scores of SMM are 20.65 and 22.27 and S.D are 3.19 and 3.14 respectively. FFM Pre and post-test mean scores are 46.09 and 47.40 and S.D are 6.30 and 6.11 respectively. Pre and post-test mean scores of TBW are 25.33 and 25.35 and S.D are 3.18 and 3.19 respectively. Sit and reach Pre and post-test mean scores are 5.90 and 7.60 and S.D are 2.12 and 2.32 respectively. Mean scores of Pre and post-test for Pull Ups are 4.21 and 6.13 and S.D are 1.58 and 0.99 respectively. BKSU Pre and post-test mean scores are 23.13 and 26.93 and S.D are 2.50 and 2.76 respectively. Mean scores of Pre and post-test for 12 Min R/W are 2096.67 and 2276.67 and S.D are 167.40 and 174.10 respectively. All the pre and post test scores are significant at 0.05 level as p=.000 except BMI and TBW.

Significant difference was noticed between pre and post training scores of weight training group which indicate significant improvement in selected health related components (p=.000) after 10 weeks' weight training programme. Body Fat %  $t = 11.18$ , indicates significant decrease in body fat %, SMM  $t = -17.83$  indicates significant increase in skeletal muscle mass, FMM  $t = -10.37$  indicates significant increase in Fat free mass, Sit and Reach  $t = -12.85$  indicates significant increase in Sit and Reach performance, Pull ups  $t = -7.87$  indicates significant increase in Pull ups performance, BKSU  $t = -14.53$  indicates significant increase in Bent Knee Sit Ups performance, 12 Min R/ W  $t = -7.67$  indicates significant increase in 12 Min Run/ Walk performance. BMI  $t = 1.45$  (p= .172) and TBW  $t = -1.68$  (p= .116) indicates no significant changes.

The hypothesis stated that there will be no significance difference in both pre and post training scores of selected health related components after 10 weeks Weight training programme. The null hypothesis is rejected in case of Body Fat %, SMM, FMM, Sit and Reach, pull ups, BKSU and 12 Min R/ W as significant differences were noticed between pre and post training scores after 10 weeks of Weight training programme. The nullhypothesis is accepted in case of BMI and TBW as no significant changes were found between pre and post training scores after 10 weeks of Weight training programme.

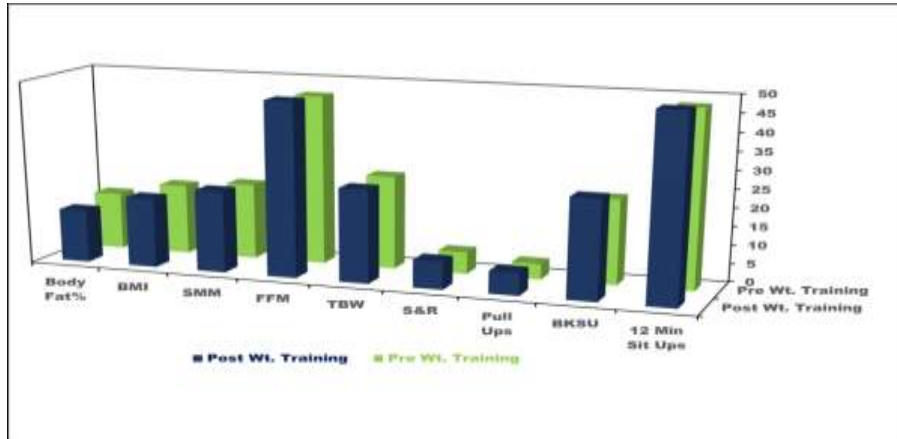


Fig. 1: Comparison of scores of Pre and Post-test of Experimental Group

Table 2. Analysis of difference between Pre and post training scores of Control group

Sr. No	Variables	Test Items	Scores	N	Mean	S.D	t - value	Sig.
1 (a)	Body Composition	Body Fat%	Pre	15	15.64	3.15	0.25	.809
			Post	15	15.64	3.16		
(b)		BMI	Pre	15	19.12	2.72	1.00	.999
			Post	15	19.11	2.72		
(c)		SMM	Pre	15	20.68	3.34	-0.62	.545
			Post	15	20.68	3.33		
(d)		FFM	Pre	15	46.05	5.90	-1.00	.334
			Post	15	46.05	5.89		
(e)		TBW	Pre	15	25.37	4.07	-1.74	.104
			Post	15	25.38	4.07		
2.	Flexibility	Sit and Reach	Pre	15	5.97	2.75	0.18	.860
			Post	15	5.93	2.55		
3 (a)	Dynamic Muscular strength and endurance (arms and shoulders)	Pull Ups	Pre	15	4.2	0.94	-0.37	.719
			Post	15	4.27	0.70		
(b)	Muscular endurance and strength (Trunk)	BKSU	Pre	15	23.27	2.05	-0.82	.424
			Post	15	23.47	1.84		
4	Cardiovascular endurance	12 M R/W	Pre	15	2096.67	196.82	-0.15	.881
			Post	15	2098	184.32		

\*level of significance= 0.05, Table value =2.160

The results of the table are evident that mean scores of pre and post-test for Body fat % are 15.64 and 15.64 and S.D. are 3. 15 and 3. 16 respectively. BMI pre and post-test mean scores are 19.12 and 19. 11 and S. D are 2.72 and 2.72 respectively. Pre and post-test mean scores of SMM are 20.68 and 20.68 and S.D are 3.34 and 3.33 respectively. FFM pre and post-test mean scores are 46.05 and 46.05 and S.D are 5.90 and 5.89 respectively. Pre and post-test mean scores of TBW are 25.37 and 25.38 and S.D are 4.07 and 4.07 respectively. Sit and reach pre and post-test mean scores are 5.97 and 5.93 and S.D are 2.75 and 2.55 respectively. Pull Ups mean scores for Pre and post-test are 4.20 and 4.27 and S.D are 0.94 and 0.70 respectively. BKSU pre and post-test mean scores are 23.27 and 23.47 and S.D are 2.05 and 1.84 respectively. 12 Min R/W mean scores for Pre and post-test are 2096.67 and 2098 and S.D are 196.82 and 184.32 respectively. All the pre and post test scores were not found significant at 0.05 level.

No significant changes were noticed between pre-test and post test scores of control group which indicate no significant improvement in selected health related components after 10 weeks. Body Fat %  $t = 0.25$  ( $p = .809$ ), indicates no significant decrease in body fat %, BMI  $t = 1.00$  ( $p = .999$ ), indicates no significant decrease in body mass index. SMM  $t = -0.62$  ( $p = .545$ ) indicates no significant increase in skeletal muscle mass, FMM  $t = -1.00$  ( $p = .334$ ), indicates no significant increase in Fat free mass, TBW  $t = -1.74$  ( $p = .104$ ) indicates no significant change in total body water. Sit and Reach  $t = 0.18$  ( $p = .860$ ) indicates no significant increase in Sit and Reach performance, pull ups  $t = -0.37$  ( $p = .719$ ) indicates no significant increase in Pull ups performance, BKSU  $t = -0.82$  ( $p = .424$ ) indicates no significant increase in Bent Knee Sit Ups performance, 12 Min R/ W  $t = -0.15$  ( $p = .881$ ) indicates no significant increase in 12 Min Run/ Walk performance.

The hypothesis stated that no significance difference will be found between pre and post test scores of control group on selected health related components after 10 weeks. The null hypothesis is accepted for all selected health related components i.e. Body Fat %, BMI, SMM, FMM, TBW, Sit and Reach, pull ups, BKSU and 12 Min R/ W as no significant changes were observed between pre and post training scores after 10 weeks.

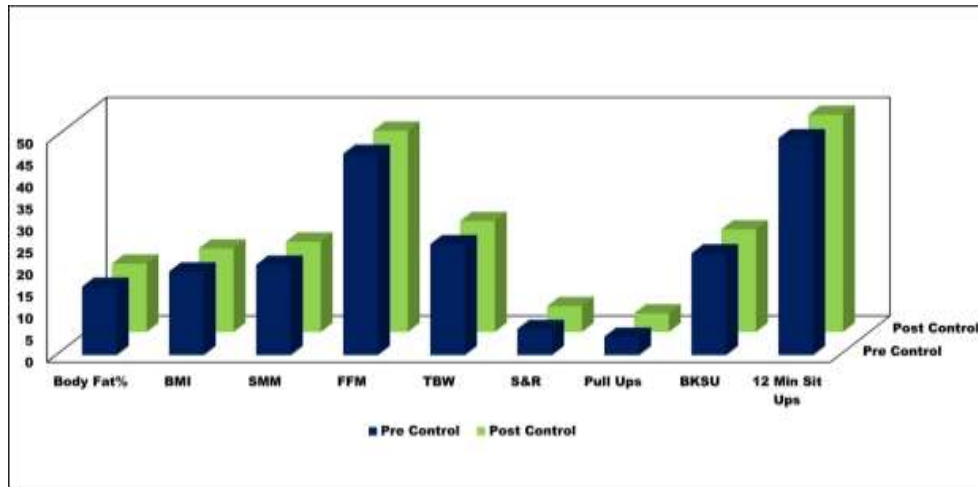


Fig. 2: Comparison of scores of Pre and Post-test of Control Group

Table. 3 Comparison between Pre-test scores of Weight Training and Control Group

SR. No	Variables	Test Items	Scores	N	Mean	S.D	S.E.M	t - value	Sig.
1 (a)	Body Composition	Body Fat%	W.T.G	15	15.63	2.75	0.710	-0.009	.973
			C.G	15	15.64	3.15	0.814		
(b)		BMI	W.T.G	15	19.13	2.11	0.546	0.007	.994
			C.G	15	19.12	2.72	0.703		
(c)		SMM	W.T.G	15	20.65	3.19	0.825	-0.020	.984
			C.G	15	20.68	3.34	0.861		
(d)		FFM	W.T.G	15	46.09	6.30	1.628	0.019	.985
			C.G	15	46.05	5.90	1.523		
(e)		TBW	W.T.G	15	25.33	3.18	0.822	-0.031	.975
			C.G	15	25.37	4.07	1.049		
2.	Flexibility	Sit and Reach	W.T.G	15	5.90	2.12	0.548	-0.074	.941
			C.G	15	5.97	2.75	0.711		
3 (a)	Dynamic Muscular strength and endurance (arms and shoulders)	Pull Ups	W.T.G	15	4.21	0.42	0.422	-0.142	.888
			C.G	15	4.20	0.24	0.244		
(b)	Muscular endurance and strength (Trunk)	BKSU	W.T.G	15	23.13	2.50	0.646	-0.159	.874
			C.G	15	23.27	2.05	0.529		
4	Cardiovascular endurance	12 M. R/W	W.T.G	15	2096.67	167.40	43.223	.000	1.00
			C.G	15	2096.67	196.82	50.818		

\*level of significance= 0.05, Table value=2.048

Findings of the study evident that pre-test mean scores of Weight training group and Control Group for Body Fat% are (15.63±2.75) and (15.64±3.15), for BMI are (19.13±2.11) and (19.12±2.72), for SMM are (20.65±3.19) and (20.68±3.34), for FFM are (46.09±6.30) and (46.05±5.90), for TBW are (25.33±3.18) and (25.37±4.07), for Sit and reach are (5.90±2.12) and (5.97±2.75), for pull up are (4.21±0.42) and (4.20±0.24), for BKSU are (23.13±2.50) and (23.27±2.05), for 12 min R/W are (2096.67±167.40) and (2096.67±196.82) respectively.

The results were not found significant at 0.05 level as t value of Body Fat % = -0.009 (p=.973), t value of BMI is 0.007 (p=.994), t value of SMM is -0.020 (p=.984), t value of FFM is 0.019 (p=.985), t value of TBW is -0.031 (p=.975), t value of Sit and reach is -0.074 (p=.941), t value of Pull ups is -0.142 (p=.888), t value of BKSU is -0.159 (p=.874), t value of 12 min R/W is 0 (p= 1.00). The table Value (0.05 level) is 2.048, which is higher than t values of all selected health related components.

No significance difference exists in pre-test scores of weight training and control group. So, null hypothesis is accepted for all selected health related components i.e. Body Fat %, BMI, SMM, FMM, TBW, Sit and Reach, pull ups, BKSU and 12 M. R/ W

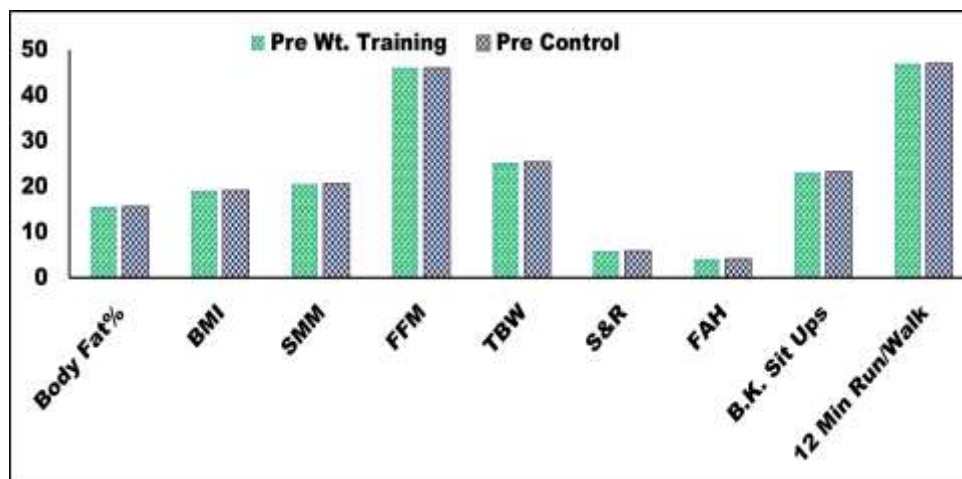


Fig. 3: Comparison of Pre-test scores of Weight Training versus Control Group

Table. 4 Comparison between Post-test scores of Weight Training and Control Group

Sr. No	Variables	Test Items	N	Mean	S.D	S.E.M	t - value	Sig.
1 (a)	Body Composition	Body Fat%	15	14.36	2.47	0.637	-1.232	.228
			15	15.64	3.16	0.815		
(b)		BMI	15	19.02	1.96	0.507	-0.115	.908
			15	19.11	2.72	0.703		
(c)		SMM	15	22.27	3.14	0.810	1.352	.187
			15	20.68	3.33	0.861		
(d)		FFM	15	47.40	6.11	1.576	0.613	.544
			15	46.05	5.89	1.521		
(e)		TBW	15	25.35	3.19	0.822	-0.019	.984
			15	25.38	4.07	1.050		
2.	Flexibility	Sit and Reach	15	7.60	2.32	0.600	1.87	.071
			15	5.93	2.55	0.658		
3 (a)	Dynamic Muscular strength and endurance (arms and shoulders)	Pull Ups	15	6.13	0.99	0.275	5.95	.000
			15	4.27	0.70	0.169		
(b)	Muscular endurance and strength (Trunk)	BKSU	15	26.93	2.76	0.714	4.04	.000
			15	23.47	1.84	0.477		
4	Cardiovascular endurance	12 min R/W	15	2276.67	174.10	44.951	2.73	.010
			15	2098	184.32	47.592		

\*level of significance= 0.05, Table value = 2.04

Findings of the study clearly indicate that mean scores for post-test of Weight training group and Control Group for Body Fat% are  $(14.36 \pm 2.47)$  and  $(15.64 \pm 3.16)$ , for BMI  $(19.02 \pm 1.96)$  and  $(19.11 \pm 2.72)$ , for SMM  $(22.27 \pm 3.14)$  and  $(20.68 \pm 3.33)$ , for FFM  $(47.40 \pm 6.11)$  and  $(46.05 \pm 5.89)$ , for TBW  $(25.35 \pm 3.19)$  and  $(25.38 \pm 4.07)$ , for Sit and reach  $(7.60 \pm 2.32)$  and  $(5.93 \pm 2.55)$  respectively. t value of Body Fat % is  $-1.232$  ( $p=.228$ ), t value of BMI is  $-0.115$  ( $p=.908$ ), t value of SMM is  $1.352$  ( $p=.187$ ), t value of FFM is  $0.613$  ( $p=.544$ ), t value of TBW is  $-0.019$  ( $p=.984$ ), t value of Sit and reach is  $1.87$  ( $p=.071$ ) respectively. The results indicate that significant change does not exist between post test scores of Weight training group and Control Group for selected health related components i.e. Body Fat %, BMI, SMM, FMM, TBW, Sit and Reach t 0.05 level of significance, so, the null hypothesis is acceptable in this case.

The results evident that post-test mean scores for pull up are  $(6.13 \pm 0.99)$  and  $(4.27 \pm 0.70)$ , for BKSU  $(26.93 \pm 2.76)$  and  $(23.47 \pm 1.84)$ , for 12 Min R/W  $(2276.67 \pm 174.10)$  and  $(2098 \pm 184.32)$  respectively. t value of Pull ups is  $5.95$  ( $p=.000$ ), t value of BKSU is  $4.04$  ( $p=.000$ ), t value of 12 min R/W is  $2.73$  ( $p=0.010$ ). The results are significant at 0.05 level in case of pull ups ( $p=.000$ ), BKSU ( $p=.000$ ) and 12 Min R/W ( $p=.010$ ), which shows significant increase in scores of post training for Weight training group in comparison to Control Group. Null hypothesis is rejected in case of pull ups, Bent knee sit ups and 12 min Run/Walk.

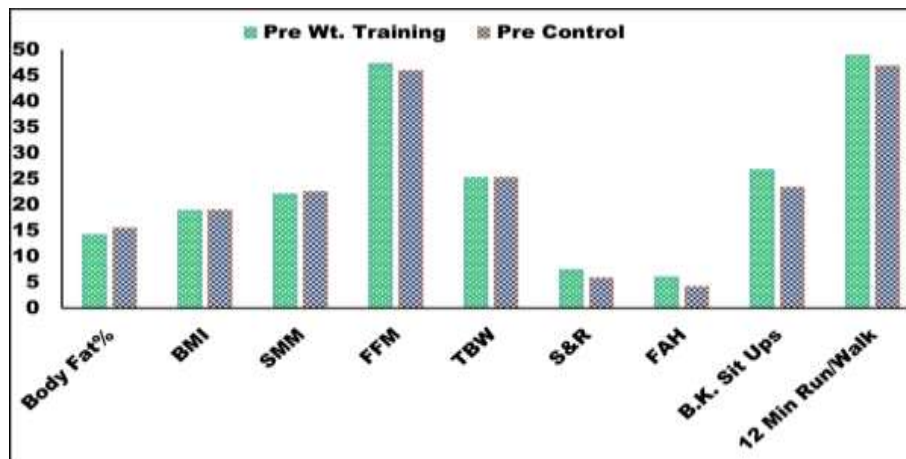


Fig. 4: Comparison of Post-test scores of Weight Training versus Control Group

### Results of the study

1. Significant changes exist between pre and post training scores of weight training group for selected health related components i.e. Body Fat %, SMM, FMM, Sit and Reach, pull ups, Bent Knee Sit Ups and 12 Min Run/ Walk.
2. Significant differences were not observed between pre and post training scores of weight training group for selected health related components i.e. BMI and TBW.
3. Significant difference did not exist between test scores of pre and post training of control group for selected health related components i.e. Body Fat %, BMI, SMM, FMM, TBW, Sit and Reach, pull ups, Bent Knee Sit Ups and 12 Min Run/ Walk.
4. Significant difference did not exist between scores of pre-test of weight training group and control group for selected health related components i.e. Body Fat %, BMI, SMM, FMM, TBW, Sit and Reach, pull ups, Bent Knee Sit Ups and 12 Min Run/ Walk.
5. Significant difference did not exist between scores of post-test for weight training group and control group for selected health related components i.e. Body Fat %, BMI, SMM, FMM, TBW, Sit and Reach.
6. Significant differences were noticed between post training scores of weight training group and control group for selected health related components i.e. pull ups, Bent Knee Sit Ups and 12 Min Run/ Walk.

### Conclusion

Results of the study indicates that weight training is effective in decreasing Body Fat%, Increasing Skeletal Muscle Mass (SMM), Fat Free Mass (FFM), Flexibility, Muscular Strength and endurance (arms and shoulders) and Muscular endurance & Strength (trunk) and 12 Min Run/ Walk.



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