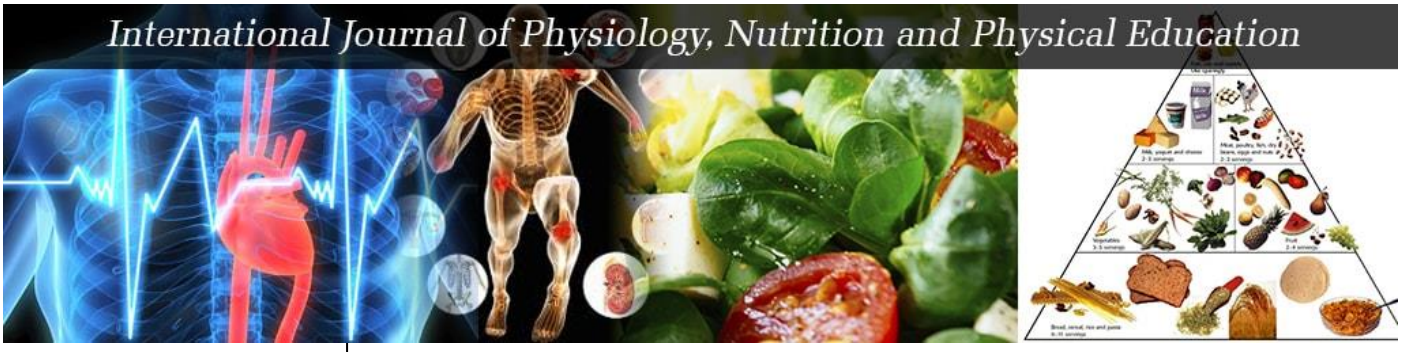

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Comparison of physically active and inactive males on breathing variables

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Abstract
120 males in the age group of 18 to 25 years who attended a regular check up programme over a 2 weeks camp were studied. The marathon runners, weight lifters and yoga group participants were those who had actively participated in related program at least 4 days a week and done at least 45 minutes of training or practice whereas the control group were sedentary males. Spirometric data for each participant were collected for that active period of time ensuring that there was not more than 3 days gap in the training of each experimental group participant. The study included the following sports: marathon (full) runners (n = 30), control (n = 30), weightlifting (n =30), yoga (n=30), control group (n=30). One way ANOVA statistical package SPSS 23 version was used to draw inferences. It was observed that the marathon runners and yoga group showed significant breathing parameters as compared to weightlifting and control group.

Keywords: Yoga, vital capacity, ANOVA, sportspersons

1. Introduction
Regular aerobic exercise performed for conditioning or for performance enhancement have beneficial effects on various systems of our body. The energy supply for performing an activity takes place with the unified working of circulatory and respiratory systems primarily. Unlike a number of studies on cardiovascular components and how they adapt to intensive physical activity, there is a dearth of studies on respiratory system in athletes (e.g. vital capacity, maximum flow rates etc.). The physical and physiological fitness of an individual can be gauged through lung function tests by evaluating his/her pulmonary function. Spirometry is a physiological test used in sports performance enhancement and evaluation that measures how an individual inhales or exhales volumes of air as a function of time (in seconds or in minutes), quality (magnitude or capacity) and quantity (in liters). Spirometry is the most commonly used pulmonary function test (PFT) measuring and evaluating respiratory system functions. Sports training age influences the lung volumes to a great extent but there are particularly less studies in the field that are comprehensive in nature. With the increasing practices of yoga, pranayama and other such exercises that claim to have a strong impact on lung capacity, it is pertinent to study the influence of such practices as an adjunct to sports training and solely without any other intervention amongst the sedentary persons. The purpose of this research was to study and compare pulmonary function in different types of sports and compare them with controls and amongst themselves in order to find out which sports/group improves which lung function variable in comparison to the other groups.

2. Procedure
120 males in the age group of 18 to 25 years who attended a regular check up programme over a 2 weeks camp were studied. The marathon runners, weight lifters and yoga group participants were those who had actively participated in related program at least 4 days a week and done at least 45 minutes of training or practice. Spirometric data for each participant were collected for that active period of time ensuring that there was not more than 3 days gap in the training of each experimental group participant. The study included the following sports: marathon (full) runners

(n = 30), control (n = 30), weightlifting (n =30), yoga (n=30), control group (n=30).

The admission criteria for the 30 sedentary controls were they were not connected with any particular sport or yoga program and did not have a regular exercise programme. All participants were non-smokers, and none had a history of recurrent respiratory illness, such as asthma or a chronic cough.

Design: Before being tested, examinees were asked to be empty stomach at lease for 4 hours prior to testing. No intake of stimulants such as alcohol or caffeine or any other drug was allowed in the 12 hours before testing. Information on participant's height, body mass was used to calculate BMI. Participants consent was taken beforehand. The testing took place in laboratory settings at the same time of day in the morning 8 AM to 10 am, using the same instruments and techniques. Measurements were carried out under standard environmental conditions; comfort temperature (between 18 and 22 ^{0}C), atmospheric pressure of 760 mmHg, and relative atmospheric humidity of 30-60%. Spirometry was performed using the (Turninac, Pneumotah)
Pony FX (Cosmed Pulmonary Function Equipment; Italy). Pulmonary function test followed the ATS/ERS guidelines. Spirometry was performed in a sitting position in arm chairs at the place of training before any warm-up, wearing light clothing and a nose clip. Pulmonary function tests were performed three times for each participant and the best average value was recorded. ANOVA statistics was used for the analysis of demographic variables and respiratory variables. Multiple comparisons of all the 4 groups on breathing variables were being done using post hoc Tukey HSD test.

3. Results and Discussion

Table 1: Mean and standard deviation scores of 4 groups (N=120)

Group		Age (in years)	Body Mass Index (kg/m^2)	Height (in meters)	Body mass (in kg)
control gp	Mean	21.63	21.51	1.76	66.57
	Std. Deviation	2.14	0.61	0.02	3.14
Yoga	Mean	21.63	21.73	1.76	67.33
	Std. Deviation	1.92	0.72	0.02	2.90
Marathon Runners	Mean	21.57	21.65	1.76	67.00
	Std. Deviation	1.92	0.70	0.02	2.78
Weightlifters	Mean	21.60	21.79	1.76	67.23
	Std. Deviation	1.92	0.70	0.02	2.57
Total	Mean	21.61	21.67	1.76	67.03
	Std. Deviation	1.95	0.68	0.02	2.83

The mean and standard deviation of age, height, body weight and Body Mass Index characteristics of different groups of athletes and of sedentary controls are presented in Table 1. Mean and standard deviation value of control group age was 21.63±2.14, Body mass index 21.51±0.61, height 1.76±0.02, body mass 66.57±3.14. Mean and standard deviation value of Yoga age was 21.63±1.92, Body mass index 21.73±0.72, height 1.76±0.02, body mass 67.33±2.90. Mean and standard deviation value of marathon runner's age was 21.57±1.92, Body mass index 21.65±0.70, height 1.76±0.02, body mass 67.00±2.78. Mean and standard deviation value of weightlifters age was 21.60±1.92, Body mass index 21.79±0.70, height 1.76±0.02, body mass 67.23±2.83. Mean Height of all the groups was found to be 1.76 meters. Slight differences can be seen in the body weight with control group being lighter as compared to other groups and Yoga group slightly heavier than other 3 groups.

Table 2: ANOVA showing level of differences in four basic demographic variables of all 4 groups

Group		Sum of Squares	df	Mean Square	F	Sig.
Age (in years)	Between Groups	0.09	3	0.03	0.00	0.99
	Within Groups	454.50	116	3.91		
	Total	454.59	119			
Body Mass Index (kg/m^2)	Between Groups	1.35	3	0.45	0.96	0.41
	Within Groups	54.3	116	0.46		
	Total	55.66	119			
Height (in meters)	Between Groups	0.00	3	0.00	0.16	0.92
	Within Groups	0.05	116	0.00		
	Total	0.05	119			
Body mass (in kg)	Between Groups	10.46	3	3.48	0.42	0.73
	Within Groups	945.40	116	8.15		
	Total	955.86	119			

The table-2 shows the output of the ANOVA analysis and whether there is a statistically significant difference between the group means. Statistically non-significant differences were observed in all the four groups on age, height and weight and body mass index ($p > 0.01$). We can see that the significance value for age differences is 0.99 (i.e., $p = .99$), which is above 0.05 and even above 0.01 and therefore there is a statistically non-significant difference between the mean age of the groups. The significance value for BMI differences is 0.413 (i.e., $p = 0.41$), which is above 0.05 and even above 0.01 and therefore there is a statistically non-significant difference between the mean BMI of the groups. The significance value for height differences is 0.922 (i.e., $p = .92$), which is above 0.05 and even above 0.01 and therefore there is a statistically non-significant difference between the mean height of the groups. The significance value for body mass differences is 0.733 (i.e., $p = .73$), which is above 0.05 and even above 0.01 and therefore there is a statistically non-significant difference between the mean body mass of the groups. It was ensured that all the assumptions have been met to have applied one way ANOVA.

Table 3: Descriptive statistics showing mean and standard deviations of breathing variables

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
FEV1 (Letres)	control gp	30	4.89	0.53	0.10	4.69	5.09	4.02	6.00
	Yoga	30	5.40	0.51	0.09	5.21	5.59	4.25	6.58
	Marathon runners	30	4.76	0.70	0.13	4.50	5.02	4.01	7.65
	weightlifters	30	4.66	0.41	0.08	4.51	4.81	4.00	5.38
	Total	120	4.93	0.61	0.06	4.82	5.04	4.00	7.65
FEV_VC (Letres)	control gp	30	90.05	4.61	0.84	88.33	91.77	75.90	98.10
	Yoga	30	82.63	2.39	0.44	81.74	83.52	79.50	91.00
	Marathon runners	30	82.25	2.81	0.51	81.20	83.30	77.60	91.00
	weightlifters	30	82.45	2.75	0.50	81.42	83.47	75.90	91.00
	Total	120	84.34	4.61	0.42	83.51	85.18	75.90	98.10
FVC (Letres)	control gp	30	4.99	0.49	0.09	4.81	5.18	4.00	5.97
	Yoga	30	5.81	0.46	0.08	5.64	5.98	4.99	6.77
	Marathon runners	30	5.63	0.45	0.08	5.46	5.80	4.98	6.77
	weightlifters	30	4.94	0.47	0.09	4.77	5.12	4.00	5.99
	Total	120	5.34	0.60	0.05	5.24	5.45	4.00	6.77
MVV (Letres/minute)	control gp	30	174.81	6.54	1.19	172.37	177.25	145.64	180.91
	Yoga	30	198.92	6.50	1.19	196.49	201.35	179.34	206.34
	Marathon runners	30	198.77	8.29	1.51	195.67	201.86	169.34	218.00
	weightlifters	30	174.80	11.51	2.10	170.50	179.09	156.31	210.34
	Total	120	186.82	14.68	1.34	184.17	189.48	145.64	218.00
PEF (Letres)	control gp	30	10.94	0.99	0.18	10.57	11.31	9.28	14.20
	Yoga	30	9.47	1.30	0.24	8.98	9.96	7.35	12.30
	Marathon runners	30	8.85	1.09	0.20	8.44	9.26	6.59	11.25
	weightlifters	30	9.03	1.30	0.24	8.54	9.51	6.59	12.30
	Total	120	9.57	1.43	0.13	9.31	9.83	6.59	14.20
VC (Letres)	control gp	30	5.55	0.16	0.03	5.49	5.61	5.20	5.94
	Yoga	30	6.29	0.38	0.07	6.15	6.43	5.24	6.82
	Marathon runners	30	6.00	0.43	0.08	5.84	6.16	5.24	6.85
	weightlifters	30	5.44	0.28	0.05	5.33	5.54	5.00	5.94
	Total	120	5.82	0.47	0.04	5.73	5.91	5.00	6.85

Forced vital capacity (FVC); forced expiratory volume in 1 s (FEV1); peak expiratory flow (PEF); vital capacity (VC); Tiffeneau-Pinelli index (FEV1/VC); maximum voluntary ventilation (MVV).

Table-3 shows the mean and standard deviations of FEV1, FEV/VC, FVC, PEF (expressed in liters), MVV (liters/min), VC of the different sports and of the control sedentary group. Mean value of FEV1 for Yoga was higher (5.39±0.50) than the other 3 groups. Mean value of FEV_VC for control group was higher (90.04±4.60) than the other 3 groups but alternately the standard deviation was also comparatively higher. FVC mean value was higher (5.80±0.46) for Yoga group and lowest for weightlifters and control group. MVV mean value was highest for Yoga (198.92±6.50) and fro marathon runners (198.76±8.28). PEF mean value was highest for the control group (10.94±0.98). Vital Capacity (VC) mean value was highest (6.28±0.37) for the Yoga group as compared to the other 3 groups.

Table 4: One way ANOVA for all the 6 breathing variables

		Sum of Squares	df	Mean Square	F	Sig.
FEV1	Between Groups	9.65	3	3.22	10.72	0.00
	Within Groups	34.78	116	0.30		
	Total	44.43	119			
FEV_VC	Between Groups	1302.87	3	434.29	40.97	0.00
	Within Groups	1229.75	116	10.60		
	Total	2532.62	119			
FVC	Between Groups	17.50	3	5.83	26.56	0.00
	Within Groups	25.48	116	0.22		
	Total	42.98	119			
MVV	Between Groups	17340.88	3	5780.29	80.79	0.00
	Within Groups	8299.05	116	71.54		
	Total	25639.94	119			
PEF	Between Groups	81.32	3	27.11	19.52	0.00
	Within Groups	161.05	116	1.39		
	Total	242.36	119			
VC	Between Groups	14.13	3	4.71	43.90	0.00
	Within Groups	12.45	116	0.11		
	Total	26.58	119			

Table-4 shows the between and within group differences for all the 6 breathing variables. All the groups showed highly significant differences in FEV1, FEV/VC, FVC, MVV, PEF and VC variables (p>.01)

Table 5: Multiple Comparisons of all the 4 groups on breathing variables using Tukey HSD

Dependent Variable			Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
FEV1	control gp	Yoga	-.50733*	0.14	0.00	-0.88	-0.14
		Marathon runners	0.13033	0.14	0.79	-0.24	0.50
		weightlifters	0.22933	0.14	0.37	-0.14	0.60
	Yoga	control gp	.50733*	0.14	0.00	0.14	0.88
		Marathon runners	.63767*	0.14	0.00	0.27	1.01
		weightlifters	.73667*	0.14	0.00	0.37	1.11
	Marathon runners	control gp	-0.13033	0.14	0.79	-0.50	0.24
		Yoga	-.63767*	0.14	0.00	-1.01	-0.27
		weightlifters	0.09900	0.14	0.90	-0.27	0.47
	weightlifters	control gp	-0.22933	0.14	0.37	-0.60	0.14
		Yoga	-.73667*	0.14	0.00	-1.11	-0.37
		Marathon runners	-0.09900	0.14	0.90	-0.47	0.27
FEV_VC	control gp	Yoga	7.41667*	0.84	0.00	5.23	9.61
		Marathon runners	7.79333*	0.84	0.00	5.60	9.98
		weightlifters	7.60000*	0.84	0.00	5.41	9.79
	Yoga	control gp	-7.41667*	0.84	0.00	-9.61	-5.23
		Marathon runners	0.37667	0.84	0.97	-1.81	2.57
		weightlifters	0.18333	0.84	1.00	-2.01	2.37
	Marathon runners	control gp	-7.79333*	0.84	0.00	-9.98	-5.60
		Yoga	-0.37667	0.84	0.97	-2.57	1.81
		weightlifters	-0.19333	0.84	1.00	-2.38	2.00
	weightlifters	control gp	-7.60000*	0.84	0.00	-9.79	-5.41
		Yoga	-0.18333	0.84	1.00	-2.37	2.01
		Marathon runners	0.19333	0.84	1.00	-2.00	2.38
FVC	control gp	Yoga	-.81533*	0.12	0.00	-1.13	-0.50
		Marathon runners	-.64000*	0.12	0.00	-0.96	-0.32
		weightlifters	0.05033	0.12	0.98	-0.27	0.37
	Yoga	control gp	.81533*	0.12	0.00	0.50	1.13
		Marathon runners	0.17533	0.12	0.47	-0.14	0.49
		weightlifters	.86567*	0.12	0.00	0.55	1.18
	Marathon runners	control gp	.64000*	0.12	0.00	0.32	0.96
		Yoga	-0.17533	0.12	0.47	-0.49	0.14
		weightlifters	.69033*	0.12	0.00	0.37	1.01
	weightlifters	control gp	-0.05033	0.12	0.98	-0.37	0.27
		Yoga	-.86567*	0.12	0.00	-1.18	-0.55
		Marathon runners	-.69033*	0.12	0.00	-1.01	-0.37
MVV	control gp	Yoga	-24.11233*	2.18	0.00	-29.81	-18.42
		Marathon runners	-23.95967*	2.18	0.00	-29.65	-18.27
		weightlifters	0.01200	2.18	1.00	-5.68	5.70
	Yoga	control gp	24.11233*	2.18	0.00	18.42	29.81
		Marathon runners	0.15267	2.18	1.00	-5.54	5.85
		weightlifters	24.12433*	2.18	0.00	18.43	29.82
	Marathon runners	control gp	23.95967*	2.18	0.00	18.27	29.65
		Yoga	-0.15267	2.18	1.00	-5.85	5.54
		weightlifters	23.97167*	2.18	0.00	18.28	29.66
	weightlifters	control gp	-0.01200	2.18	1.00	-5.70	5.68
		Yoga	-24.12433*	2.18	0.00	-29.82	-18.43
		Marathon runners	-23.97167*	2.18	0.00	-29.66	-18.28
PEF	control gp	Yoga	1.47367*	0.30	0.00	0.68	2.27
		Marathon runners	2.09567*	0.30	0.00	1.30	2.89
		weightlifters	1.91433*	0.30	0.00	1.12	2.71
	Yoga	control gp	-1.47367*	0.30	0.00	-2.27	-0.68
		Marathon runners	0.62200	0.30	0.18	-0.17	1.42
		weightlifters	0.44067	0.30	0.47	-0.35	1.23
	Marathon runners	control gp	-2.09567*	0.30	0.00	-2.89	-1.30
		Yoga	-0.62200	0.30	0.18	-1.42	0.17
		weightlifters	-0.18133	0.30	0.93	-0.97	0.61
	weightlifters	control gp	-1.91433*	0.30	0.00	-2.71	-1.12
		Yoga	-0.44067	0.30	0.47	-1.23	0.35
		Marathon runners	0.18133	0.30	0.93	-0.61	0.97
VC	control gp	Yoga	-.73300*	0.08	0.00	-0.95	-0.51
		Marathon runners	-.45100*	0.08	0.00	-0.67	-0.23
		weightlifters	0.11867	0.08	0.50	-0.10	0.34
	Yoga	control gp	.73300*	0.08	0.00	0.51	0.95
		Marathon runners	.28200*	0.08	0.01	0.06	0.50
		weightlifters	.85167*	0.08	0.00	0.63	1.07

	Marathon runners	control gp	.45100*	0.08	0.00	0.23	0.67
		Yoga	-.28200*	0.08	0.01	-0.50	-0.06
		weightlifters	.56967*	0.08	0.00	0.35	0.79
	weightlifters	control gp	-0.11867	0.08	0.50	-0.34	0.10
		Yoga	-.85167*	0.08	0.00	-1.07	-0.63
		Marathon runners	-.56967*	0.08	0.00	-0.79	-0.35

*. The mean difference is significant at the 0.05 level.

Table-5 shows multiple Comparisons of all the 4 groups on breathing variables using Tukey HSD**.** FEV1 was significantly higher in Yoga practitioners than in the control, marathon and weightlifters group ($p< 0.01$). FEV_VC in case of control group was significantly higher (p> 0.01) than other 3 groups while there was non significant differences amongst the Yoga, marathon and weightlifting groups ($p< 0.05$). Statistically significant differences were found between Yoga and control group and Yoga and weightlifters ($p< .05$). Non significant results were found between control group and weightlifters (p>0.5) with Yoga and marathon runners showing significant higher values on FVC than control and weightlifters. on MVV variable, there was a statistically significant difference between Yoga and control and Yoga and weightlifters ($p< 0.01$). YOGA MVV and marathon runners MVV values were significantly higher than that of marathon and control groups. When analyzing PEF value, the value was statistically higher in control group than the other three groups ($p< 0.1$). PEF value was not significantly different amongst the YOGA, marathon and weightlifting groups (p> .05). Vital capacity (VC) was significantly higher in Yoga group than the rest of the 3 groups ($p<.01$). Control group and weightlifters had the lowest VC values than YOGA yog and marathon runners group.

S. Mazic *et al.* compared the sedentary persons with sportspersons (n=493) asymptomatic Caucasian international level competitors (18-34 years of age) who attended a regular check-up programme over a four-year period and found that on Basketball, water polo and rowers had higher vital capacity, forced vital capacity and forced expiratory volume in one second than the normal sedentary control individuals. The maximum voluntary ventilation was also recorded in water polo and the rowing group. They concluded that these sports could be recommended for the improvement of the lung function if respiratory parameters were tested on a larger number of participants. Even more so, could water polo and rowing be suggested at an early age, to strengthen the lung function. It should perhaps be considered that these sports or their specific way of training might be involved in pulmonary rehabilitation programmes.

Sud Sushant Sud Khyati S. in their study on “effect of pranayama on pulmonary functions - an overview” found that Pranayama breathing may prevent serious cardio-respiratory complications by emphasizing optimal physical and mental conditioning. It was summarized in the said study that Pranayama improves respiratory breathing capacity by increasing chest wall expansion and forced expiratory lung volumes.

Shobha Rani Vedala *et al.* in their study on 152 active and sedentary subjects studied the differences in Pulmonary Function Test among the Athletic and Sedentary Population. The results showed pulmonary function profile of the athletic group were having higher mean of percentage value of FVC, FEV3, PEFR and FEV1/ FVC ratio as compared to sedentary group. On the basis of this they concluded that regular exercise has an important role in determining and improving lung functions.

4. References

1. Mazic S, Lazovic B, Djelic M *et al*. Respiratory parameters in elite athletes-does sport have an influence? Rev Port Pneumol. 2015; 21:192-7.
2. Sud Sushant Sud Khyati S. effect of pranayama on pulmonary functions - an overview, Review Article International Ayurvedic Medical Journal ISSN: 2320 5091, IAMJ, 2013, 1(2).
3. Shobha Rani Vedala *et al*. PFT among Athletic and Sedentary Groups, National Journal of Physiology, Pharmacy & Pharmacology. 2013; 3(2):118-123