

EFFECT OF COMBINED ACTION OF YOGASANAS AND PRANAYAMA EXERCISES REDUCES LIPID PROFILES AND ENHANCES ANTIOXIDANT STATUS IN YOUNG HEALTHY INDIVIDUALS

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ABSTRACT

The present study was designed to find out the effect of yogasanas and pranayama exercises lowers the lipid levels and increases the antioxidant status. Sixty men students of age 25-28years were selected randomly as subjects from B.P.E.d in the Department of Physical Education and Sports Science, Annamalai University. Selected subjects were divided into four groups with fifteen numbers of each. Group1 served as Control; Group 2 as Asana; Group 3 as Pranayama and Group 4 as Asana and Pranayama. Experimental study was carried out for three months duration. Selected yogasnas and pranayama exercises were given to the experimental groups for (4days/week) for 12 weeks. Blood samples were collected before and after the complete course of treatment. Biochemical analysis was done on selected lipid and antioxidant variables by the concerned Biochemist, Department of Biochemistry, Annamalai University. Resulted Data were statistically analyzed using ANOVA and DMRT and they were significant at $p \leq 0.05$ levels. Thus our study concluded that combined exercises of yogasanas and pranayama practices reduces the lipid levels and retains the antioxidant status. It is also revealed that combined exercises produced better effect than alternate exercise groups.

Keywords: TBARS (thiobarbituric acid reactive substances), Hydroperoxides, Cholesterol, Freefattyacids, Triglycerides, Phospholipids, and Antioxidants

INTRODUCTION

Yoga is one of the many different techniques for achieving relaxation. Yoga has its origin in ancient India and in its original form consisted of a system of spiritual, moral and physical practices (Pilkington et al., 2005).

The most central and common aspects of yoga practice today are different bodily postures (asanas)

and breathing exercises (pranayamas) (Parshad, 2004; Pilkington et al., 2005) that aim to focus the mind, achieve relaxation and increase wellness.

Various health benefits of yoga have been described in previous studies. A review of anti-depressive effects of different forms of yoga (Parshad, 2004; Pilkington et al., 2005) indicated potential beneficial

effects of yoga on depressive disorders. Other studies reported beneficial effects of yoga on anxiety, stress reduction and general well-being (Lavey et al., 2005; Ray et al., 2001). However, the results need to be interpreted carefully since many of the published studies about yoga are small and no systematic and comprehensive reviews of scientific research on yoga have been published. It may also be difficult to compare studies done on different forms of yoga since benefits of yoga practice might differ by the style of the practice (Cowen and Adams, 2005).

Oxidative stress induces free radical generation. While oxidation of nutrients is essential for life, one of the adverse side-effects of oxidation is generation of reactive oxygen species (ROS). The oxidative stress imposed by ROS contributes to the process of aging as well as a variety of chronic degenerative diseases (Halliwell 1994; Gutteridge 1993; Halliwell et al., 1992). The impact of the oxidative stress is minimized by a large number of endogenous as well as dietary antioxidants.

The level of oxidative stress depends on the balance between production of ROS and their quenching by antioxidant mechanisms. Psychosocial stress increases oxidative stress (Sivonova, 2004), possibly by increasing

the production of ROS. Correspondingly, a few recent studies have shown that relaxation techniques reduce oxidative stress (Schneider et al., 1998; Bhattacharya et al., 2002; Jatuporn et al., 2003).

Since only a few studies of this type are available, more studies are needed to establish the place of various relaxation techniques in mitigating the biochemical, effects of psychosocial stress. Our study is an attempt in that direction. One of the indicators of oxidative stress is the degree of lipid peroxidation. Lipid peroxidation is thought to be a major factor in pathogenesis of many human diseases (Halliwell and Chirico 1993). Lipid peroxidation may be assessed from the blood concentration of lipid peroxidation products as measured by thiobarbituric acid reactive substances (TBARS), of which malondialdehyde (MDA) is a principal constituent. We have measured the concentration of TBARS in the blood of patients undergoing a comprehensive yoga based lifestyle modification program at the beginning and end of the program

Sudarshan Kriya and related practices (SK&P) is a form of yoga practice that emphasizes breathing exercises. In addition to asanas, three different forms of pranayamas are practiced in succession (Jana-kiramaiah et al., 2000). Previous studies suggested

that SK&P may be useful for relieving depression, improving the antioxidant defenses of the body, giving rise to beneficial EEG patterns, and possible improvements in blood chemistry (Janakiramaiah et al., 2000; Nagavenkatesha murthy et al., 1998; Sharma et al., 2003). For example, Janakiramaiah et al. found that the degree of depression significantly decreased (68–73%) in subjects with clinical depression after they practised SK daily for three weeks and this decrease was as effective as conventional pharmacological treatment (Janakiramaiah et al., 2000).

The study was to develop a protocol that can investigate whether asanas and pranayama could be considered in connection with increased wellness. Even though what constitutes wellness can be debated, there are a number of studies demonstrating that the variables included in this study are among the most relevant to feeling of wellness by different approaches (Sharma et al., 2003; Cowen, 1994; Adams et al., 1997). To that end, outcome measures that were evaluated included depression, anxiety, mood, optimism, energy levels, and experience of altered states of consciousness. The present study was aimed to find out whether combined action of yogasanas and pranayama exercises reduces lipid profiles and enhances antioxidant status in young healthy individuals.

METHODOLOGY

Selection of subjects: Sixty male students studying BPED in the Department of Physical Education and sports science, Annamalai University, Tamil Nadu were selected randomly as subjects and their age ranged between 25–28 years. All the subjects involved in the experiment were healthy volunteers.

Experimental Design: Selected subjects were grouped into four of each fifteen members namely,

Group I - served as Control with fifteen of each,

Group II - as Asana,

Group III - as Pranayama and

Group IV - as Asana and Pranayama.

Experimental Duration: The yogic practices were given to all the treatment groups except the control for 3 months (4 days / week).

Food and Diet: Normal diet were taken and there is no restriction on diet

Selection of variables:

Biochemical variable includes Lipid peroxidative indices such as TBARS and hydroperoxides, HDL, LDL, VLDL, Cholesterol, triglycerides, Free fatty acids and phospholipids. Antioxidants includes both enzymic and non-enzymic antioxidants such as SOD, Catalase and GPX; non enzymic antioxidants includes GSH, Vitamin C, Vitamin E.

Selection of yogasnas and pranayama exercise

Yogic practices include specific asana such as:

Suryanamaskar, Tadasana, Trikonasana, Paschimottanasana and Bhujangasana to increase HDL and decrease cholesterol, triglycerides, freefattyacids and phospholipids, VLDL and LDL.

Sudarshan Kriya asana, Ujjayi-Pranayam, Bhastrika, Kapal-bhati, Bhramari, and Shavasna were practiced to increase the antioxidant levels.

Sudarshan Kriya (SK) is a breathing technique introduced by Sri Sri Ravi Shankarji and involves breathing in three different rhythms.

UjjayiPranayam- (long and deep breaths with constriction at the base of throat) and Bhastrika (fast and forceful breaths through nose along with arm movements).

Biochemical estimations

Biochemical Estimations were done by the concerned Biochemist in the Department of Biochemistry, Annamalai University. They followed the appropriate methods and the results were produced by them.

Lipid peroxidative indices such as TBARS were estimated by the method of Ohkawa et al., (1979) and hydroperoxides by Jiang et al., (1992). HDL, LDL, VLDL (Ross and Harker,1976), Estimation of Choles-

terol using Allain et al., 1974, triglycerides estimated by the method (Foster and Dunn, 1973), Freefattyacids by (Falholt,1973) and phospholipids(Zilversmit and Davis,1950).

Antioxidant includes enzymic antioxidants such as SOD estimated by the method of Kakkar et al., (1942), catalase (Sinha, 1972) and GPX (Rotruck et al., 1973). Non enzymic antioxidants include GSH by (Ellman, 1959) method, Vitamin C (Roe and Kuther, 1942), Vitamin E (Baker et al., 1980) was analyzed.

Measuring Instrument

Colorimeter was used for taking readings for the above estimations.

Statistical analysis

Biochemical variables were assessed before and after 3 months of yoga practices. The data were analyzed using ANOVA and the group means were compared by Duncan's Multiple Range Test (DMRT). Differences was considered to be significant when $p \leq 0.01$.

RESULTS

Table-1
Changes in the levels of TBARS and hydroperoxides in control and exercise groups

Groups	TBARS(mM)	Hydroperoxides ($\times 10^{-5}$ mM)
Control	2.01 $\pm$ 0.13 ^a	8.22 $\pm$ 0.2 ^a
Asanas	1.53 $\pm$ 0.2 ^b	7.1 $\pm$ 0.4 ^b
Pranayama	1.68 $\pm$ 0.25 ^c	6.11 $\pm$ 0.13 ^c
Asanas and Pranayama	1.46 $\pm$ 0.13 ^d	5.36 $\pm$ 0.2 ^d

Data represents mean $\pm$ SD from 15 subjects in each group.

Values not sharing a common superscript letter (a,b,c, d) differ significantly at $p \leq 0.01$ (Duncan's multiple range test)

Group comparison: Group one with all, Group 2 and 3 with 4.

Descriptive

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Min.	Max.
						Lower Bound	Upper Bound		
TBARS	1.00	15	2.0167	.13886	.03585	1.9398	2.0936	1.53	2.11
	2.00	15	1.5387	.20135	.05199	1.4272	1.6502	1.33	2.20
	3.00	15	1.6867	.25681	.06631	1.5444	1.8289	1.53	2.60
	4.00	15	1.4613	.13298	.03434	1.3877	1.5350	1.33	1.70
	Total	60	1.6758	.28299	.03653	1.6027	1.7489	1.33	2.60
Hydroperoxides	1.00	15	8.2233	.20866	.05388	8.1078	8.3389	7.68	8.62
	2.00	15	7.1060	.40781	.10530	6.8802	7.3318	6.45	8.30
	3.00	15	6.1173	.13025	.03363	6.0452	6.1895	5.99	6.50
	4.00	15	5.3687	.28377	.07327	5.2115	5.5258	5.03	5.89
	Total	60	6.7038	1.11433	.14386	6.4160	6.9917	5.03	8.62

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
TBARS	Between Groups	2.717	3	.906	25.249	.000
	Within Groups	2.008	56	.036		
	Total	4.725	59			
Hydroperoxides	Between Groups	68.959	3	22.986	299.165	.000
	Within Groups	4.303	56	.077		
	Total	73.262	59			

Table.2
Changes in the levels of cholesterol, triglycerides, freefattyacids and Phospholipids in control and exercise groups

Groups	Cholesterol mg/dl	Triglycerides mg/dl	Free fattyacids mg/dl	Phospholipids mg/dl
Control	179.10±26.05 ^a	119.38±0.3 ^a	5.76±0.9 ^a	184.33±0.21 ^a
Asanas	175.6±10.9 ^b	116.3±0.13 ^b	4.41±0.26 ^b	177.44±0.2 ^b
Pranayama	170.32±9.9 ^c	110.22±0.7 ^c	3.79±0.22 ^c	174.86±0.4 ^c
Asanas and Pranayama	165.7±1.75 ^d	102.3±4.19 ^d	3.16±0.21 ^d	170.38±0.1 ^d

Data represents mean± SD from 15 subjects in each group.

Values not sharing a common superscript letter (a,b,c,d) differ significantly at p≤0.01 (Duncan's multiple range test)

Group comparison: Group one with all, Group 2 and 3 with 4.

Descriptive

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Min.	Max.
						Lower Bound	Upper Bound		
Cholesterol	1.00	15	179.1067	26.05819	6.72820	164.6761	193.5372	165.90	272.30
	2.00	15	175.6000	10.93891	2.82441	169.5422	181.6578	166.90	213.15
	3.00	15	170.3280	9.90281	2.55689	164.8440	175.8120	162.30	204.50
	4.00	15	165.7000	1.75368	.45280	164.7288	166.6712	164.69	171.90
Total		60	172.6837	15.49129	1.99992	168.6818	176.6855	162.30	272.30
Triglycerides	1.00	15	119.3887	.31713	.08188	119.2130	119.5643	118.92	119.95
	2.00	15	116.3040	.12783	.03301	116.2332	116.3748	116.10	116.70
	3.00	15	110.2240	.72477	.18714	109.8226	110.6254	107.63	110.60
	4.00	15	102.3053	4.19090	1.08209	99.9845	104.6262	87.18	103.70
Total		60	112.0555	6.89947	.89072	110.2732	113.8378	87.18	119.95
Freefattyacids	1.00	15	5.7613	.93705	.24195	5.2424	6.2803	4.20	6.60
	2.00	15	4.4167	.26912	.06949	4.2676	4.5657	4.10	4.90
	3.00	15	3.7953	.22360	.05773	3.6715	3.9192	3.50	4.20
	4.00	15	3.1687	.21013	.05426	3.0523	3.2850	3.02	3.90
Total		60	4.2855	1.08821	.14049	4.0044	4.5666	3.02	6.60
Phospholipids	1.00	15	184.3333	.21266	.05491	184.2156	184.4511	184.00	184.67
	2.00	15	177.4453	.20000	.05164	177.3346	177.5561	177.20	177.90
	3.00	15	174.8667	.42538	.10983	174.6311	175.1022	174.00	175.40
	4.00	15	170.3880	.12491	.03225	170.3188	170.4572	170.23	170.60
Total		60	176.7583	5.09923	.65831	175.4411	178.0756	170.23	184.67

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
Cholesterol	Between Groups	1561.210	3	520.403	2.313	.086
	Within Groups	12597.619	56	224.957		
	Total	14158.829	59			
Triglycerides	Between Groups	2553.678	3	851.226	187.022	.000
	Within Groups	254.882	56	4.551		
	Total	2808.561	59			
Free fatty acid	Between Groups	55.243	3	18.414	70.509	.000
	Within Groups	14.625	56	.261		
	Total	69.868	59			
Phospholipids	Between Groups	1530.182	3	510.061	7240.626	.000
	Within Groups	3.945	56	.070		
	Total	1534.127	59			

Post Hoc Tests Homogeneous Subsets CHOLESTEROL

Duncan

GROUP	N	Subset for alpha = .01
		1
4.00	15	165.7000
3.00	15	170.3280
2.00	15	175.6000
1.00	15	179.1067
Sig.		.027

Means for groups in homogeneous subsets are displayed.

a Uses Harmonic Mean Sample Size = 15.000.

TRIGLYCERIDES

Duncan

GROUP	N	Subset for alpha = .01			
		1	2	3	4
4.00	15	102.3053			
3.00	15		110.2240		
2.00	15			116.3040	
1.00	15				119.3887
Sig.		1.000	1.000	1.000	1.000

Means for groups in homogeneous subsets are displayed.

a Uses Harmonic Mean Sample Size = 15.000.

FREEFATTYACID

Duncan

GROUP	N	Subset for alpha = .01			
		1	2	3	4
4.00	15	3.1687			
3.00	15		3.7953		
2.00	15			4.4167	
1.00	15				5.7613
Sig.		1.000	1.000	1.000	1.000

Means for groups in homogeneous subsets are displayed.

a Uses Harmonic Mean Sample Size = 15.000.

PHOSPHOLIPIDS

Duncan

GROUP	N	Subset for alpha = .01			
		1	2	3	4
4.00	15	170.3880			
3.00	15		174.8667		
2.00	15			177.4453	
1.00	15				184.3333
Sig.		1.000	1.000	1.000	1.000

Means for groups in homogeneous subsets are displayed.

a Uses Harmonic Mean Sample Size = 15.000.

Table-3

Changes in the levels of HDL, LDL and VLDL in Control and exercise groups

Groups	HDL mg/dl	LDL mg/dl	VLDL mg/dl
Control	55.7 ±0.3 ^a	110.41 ± 0.10 ^a	32.49 ±0.2 ^a
Asana	57.4 ± 2.7 ^b	107.45 ± 0.18 ^b	28.36 ±0.16 ^b
Pranayama	59.9 ± 1.6 ^c	103.37 ±0.23 ^c	25.24 ± 0.1 ^c
Asanas and Pranayama	66.25± 0.19 ^d	100.4±.18 ^d	23.27±.15 ^d

Data represents mean± SD from 15 subjects in each group.

Values not sharing a common superscript letter (a,b,c,d) differ significantly at p≤0.01 (Duncan's multiple range test)

Group comparison: Group one with all, Group 2 and 3 with 4.

Descriptive

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Min.	Max.
						Lower Bound	Upper Bound		
HDL	1.00	15	55.7067	.35421	.09146	55.5105	55.9028	55.10	56.04
	2.00	15	57.4087	2.79359	.72130	55.8616	58.9557	50.60	65.30
	3.00	15	59.9073	1.63423	.42196	59.0023	60.8123	59.25	65.78
	4.00	15	66.2507	.19514	.05038	66.1426	66.3587	66.00	66.75
	Total	60	59.8183	4.33817	.56006	58.6977	60.9390	50.60	66.75
LDL	1.00	15	110.4140	.10329	.02667	110.3568	110.4712	110.20	110.60
	2.00	15	107.4587	.18330	.04733	107.3572	107.5602	107.12	107.80
	3.00	15	103.3753	.23862	.06161	103.2432	103.5075	103.00	103.70
	4.00	15	100.4060	.18130	.04681	100.3056	100.5064	100.18	100.80
	Total	60	105.4135	3.85792	.49806	104.4169	106.4101	100.18	110.60
VLDL	1.00	15	32.4933	.20275	.05235	32.3811	32.6056	32.15	32.80
	2.00	15	28.3693	.16131	.04165	28.2800	28.4587	28.16	28.65
	3.00	15	25.2427	.10375	.02679	25.1852	25.3001	25.12	25.45
	4.00	15	23.2753	.15629	.04035	23.1888	23.3619	23.12	23.55
	Total	60	27.3452	3.51626	.45395	26.4368	28.2535	23.12	32.80

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
HDL	Between Groups	961.427	3	320.476	120.498	.000
	Within Groups	148.937	56	2.660		
	Total	1110.364	59			
LDL	Between Groups	876.253	3	292.084	8713.984	.000
	Within Groups	1.877	56	.034		
	Total	878.130	59			
VLDL	Between Groups	728.049	3	242.683	9487.126	.000
	Within Groups	1.432	56	.026		
	Total	729.481	59			

**Post Hoc Tests
Homogeneous Subsets
HDL**

Duncan

GROUP	N	Subset for alpha = .01			
		1	2	3	4
1.00	15	55.7067			
2.00	15		57.4087		
3.00	15			59.9073	
4.00	15				66.2507
Sig.		1.000	1.000	1.000	1.000

Means for groups in homogeneous subsets are displayed.

a Uses Harmonic Mean Sample Size = 15.000.

LDL

Duncan

GROUP	N	Subset for alpha = .01			
		1	2	3	4
4.00	15	100.4060			
3.00	15		103.3753		
2.00	15			107.4587	
1.00	15				110.4140
Sig.		1.000	1.000	1.000	1.000

Means for groups in homogeneous subsets are displayed.

a Uses Harmonic Mean Sample Size = 15.000.

VLDL

Duncan

GROUP	N	Subset for alpha = .01			
		1	2	3	4
4.00	15	23.2753			
3.00	15		25.2427		
2.00	15			28.3693	
1.00	15				32.4933
Sig.		1.000	1.000	1.000	1.000

Means for groups in homogeneous subsets are displayed.

a Uses Harmonic Mean Sample Size = 15.000.

Table-4
Changes in the level of enzymic antioxidant status in control and exercise group

Groups	SOD (U ^A /mg Hb)	CATALASE (U ^A /mg Hb)	GPX (U ^A /mg Hb)
Control	0.93±0.4 ^a	8.7±0.7 ^a	55.11±0.4 ^a
Asana	1.36±0.1 ^b	9.8±0.1 ^b	60.33±0.1 ^b
Pranayama	1.7±0.2 ^c	11.8±1.2 ^c	62.11±0.4 ^c
Asanas and Pranayama	2.4±0.1 ^d	14.42±0.3 ^d	64.54±1.6 ^d

Data represents mean± SD from 15 subjects in each group.

Values not sharing a common superscript letter (a,b,c,d) differ significantly at $p \leq 0.01$ (Duncan's multiple range test)

Group comparison: Group one with all, Group 2 and 3 with 4.

A- Enzymes required for 50% inhibition of NBT reduction / min / mg Hb

Descriptive

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Min.	Max.
						Lower Bound	Upper Bound		
SOD	1.00	15	.9393	.46108	.11905	.6840	1.1947	.59	2.55
	2.00	15	1.3600	.14142	.03651	1.2817	1.4383	1.26	1.85
	3.00	15	1.7080	.24826	.06410	1.5705	1.8455	1.09	2.30
	4.00	15	2.4000	.13464	.03476	2.3254	2.4746	2.20	2.59
Total		60	1.6018	.60449	.07804	1.4457	1.7580	.59	2.59
CATALASE	1.00	15	8.7033	.75273	.19435	8.2865	9.1202	8.10	11.30
	2.00	15	9.8013	.19026	.04912	9.6960	9.9067	9.50	10.12
	3.00	15	11.8080	1.25303	.32353	11.1141	12.5019	10.70	13.80
	4.00	15	14.4207	.34599	.08933	14.2291	14.6123	13.82	14.77
Total		60	11.1833	2.31450	.29880	10.5854	11.7812	8.10	14.77
GPX	1.00	15	55.1180	.44967	.11610	54.8690	55.3670	54.35	55.80
	2.00	15	60.3360	.10894	.02813	60.2757	60.3963	60.20	60.60
	3.00	15	62.1167	.44432	.11472	61.8706	62.3627	61.23	62.80
	4.00	15	64.5467	1.69158	.43676	63.6099	65.4834	62.20	66.20
Total		60	60.5293	3.60202	.46502	59.5988	61.4598	54.35	66.20

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
SOD	Between Groups	17.186	3	5.729	73.361	.000
	Within Groups	4.373	56	.078		
	Total	21.559	59			
CAT	Between Groups	283.963	3	94.654	165.149	.000
	Within Groups	32.096	56	.573		
	Total	316.059	59			
GPX	Between Groups	719.678	3	239.893	293.183	.000
	Within Groups	45.821	56	.818		
	Total	765.499	59			

Post Hoc Tests Homogeneous Subsets SOD

Duncan

GROUP	N	Subset for alpha = .01			
		1	2	3	4
1.00	15	.9393			
2.00	15		1.3600		
3.00	15			1.7080	
4.00	15				2.4000
Sig.		1.000	1.000	1.000	1.000

Means for groups in homogeneous subsets are displayed.

a Uses Harmonic Mean Sample Size = 15.000.

CAT

Duncan

GROUP	N	Subset for alpha = .01			
		1	2	3	4
1.00	15	8.7033			
2.00	15		9.8013		
3.00	15			11.8080	
4.00	15				14.4207
Sig.		1.000	1.000	1.000	1.000

Means for groups in homogeneous subsets are displayed.

a Uses Harmonic Mean Sample Size = 15.000.

GPX**Duncan**

GROUP	N	Subset for alpha = .01			
		1	2	3	4
1.00	15	55.1180			
2.00	15		60.3360		
3.00	15			62.1167	
4.00	15				64.5467
Sig.		1.000	1.000	1.000	1.000

Means for groups in homogeneous subsets are displayed.

a Uses Harmonic Mean Sample Size = 15.000.

Table-5

Changes in the levels of nonenzymic antioxidant status in control and exercise groups

Groups	GSH mg/dl	Vit-E mg/dl	Vit-C mg/dl
Control	58.34±0.19 ^a	1.53±0.21 ^a	1.88±0.1 ^a
Asana	64.19±0.23 ^b	1.98±0.13 ^b	2.37±0.15 ^b
Pranayama	65.73±0.47 ^c	2.37±0.11 ^c	3.07±0.33 ^c
Asanas and Pranayama	70.33±0.12 ^d	2.98±0.15 ^d	4.3±0.26 ^d

Data represents mean± SD from 15 subjects in each group.

Values not sharing a common superscript letter (a,b,c, d) differ significantly at p≤0.01 (Duncan's multiple range test)

Group comparison: Group one with all, Group 2 and 3 with 4.

A-μmoles of H₂O₂ utilized / min / mg Hb

Descriptive

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Min.	Max.
						Lower Bound	Upper Bound		
GSH	1.00	15	58.3467	.19104	.04933	58.2409	58.4525	58.10	58.90
	2.00	15	64.1947	.23772	.06138	64.0630	64.3263	63.80	64.67
	3.00	15	65.7300	.47580	.12285	65.4665	65.9935	65.11	66.40
	4.00	15	70.3360	.12437	.03211	70.2671	70.4049	70.12	70.55
	Total	60	64.6518	4.33009	.55901	63.5333	65.7704	58.10	70.55
VITE	1.00	15	1.5300	.21679	.05598	1.4099	1.6501	1.41	2.30
	2.00	15	1.9873	.13541	.03496	1.9123	2.0623	1.80	2.20
	3.00	15	2.3733	.11030	.02848	2.3122	2.4344	2.21	2.55
	4.00	15	2.9813	.15982	.04126	2.8928	3.0698	2.80	3.30
	Total	60	2.2180	.55910	.07218	2.0736	2.3624	1.41	3.30
VITC	1.00	15	1.8807	.10747	.02775	1.8212	1.9402	1.76	2.20
	2.00	15	2.3733	.15079	.03893	2.2898	2.4568	2.22	2.85
	3.00	15	3.0760	.33970	.08771	2.8879	3.2641	2.50	3.36
	4.00	15	4.3887	.26060	.06729	4.2444	4.5330	4.00	4.90
	Total	60	2.9297	.97812	.12627	2.6770	3.1823	1.76	4.90

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
GSH	Between Groups	1101.545	3	367.182	4386.066	.000
	Within Groups	4.688	56	.084		
	Total	1106.233	59			
VITE	Between Groups	17.000	3	5.667	219.978	.000
	Within Groups	1.443	56	.026		
	Total	18.443	59			
VITC	Between Groups	53.400	3	17.800	327.210	.000
	Within Groups	3.046	56	.054		
	Total	56.446	59			

Post Hoc Tests Homogeneous Subsets GSH

Duncan

GROUP	N	Subset for alpha = .01			
		1	2	3	4
1.00	15	58.3467			
2.00	15		64.1947		
3.00	15			65.7300	
4.00	15				70.3360
Sig.		1.000	1.000	1.000	1.000

Means for groups in homogeneous subsets are displayed.
a Uses Harmonic Mean Sample Size = 15.000.

VITE

Duncan

GROUP	N	Subset for alpha = .01			
		1	2	3	4
1.00	15	1.5300			
2.00	15		1.9873		
3.00	15			2.3733	
4.00	15				2.9813
Sig.		1.000	1.000	1.000	1.000

Means for groups in homogeneous subsets are displayed.
a Uses Harmonic Mean Sample Size = 15.000.

VITC

Duncan

GROUP	N	Subset for alpha = .01			
		1	2	3	4
1.00	15	1.8807			
2.00	15		2.3733		
3.00	15			3.0760	
4.00	15				4.3887
Sig.		1.000	1.000	1.000	1.000

Means for groups in homogeneous subsets are displayed.
a Uses Harmonic Mean Sample Size = 15.000.

The levels of TBARS and hydroperoxides were found to be increased in control groups of healthy individuals. Practice of yogasnas and pranayama reduces the levels of TBARS and hydroperoxides but the combined work of yogasna and pranayama were found to be more significant than other groups. (Table.1)

Table 2 shows the levels of cholesterol, triglycerides, free fatty acids and phospholipids in control and exercise groups. The levels of lipid profiles increased in control groups of healthy individuals. Yogasna and pranayama practices decrease the levels of lipid profile. Significant reduction was seen in combined action of yogasna and pranayama exercise group than other groups.

Table 3 shows the levels of lipoprotein levels in control and exercise groups. Significant increase in HDL and decrease in LDL and VLDL were found in yogasna and pranayama groups. Practice of yogasna and pranayama reduces the LDL and VLDL level and increases the HDL levels than non practice control group. We found better improvement in combined action of both yogasnas and pranayama.

SOD, CAT and GPX were significantly decreased in control group of healthy individuals. The activities of enzymic antioxidants were

significantly elevated in yogasna, pranayama and yogasna and pranayama group. Regular practice of exercise enhances the antioxidant status and it was also found that better improvement in combined group of yogasna and pranayama group than other. (Table .4)

Non-enzymic antioxidants levels were decreased in control group of healthy individuals. The levels of GSH, vit-C and vit-E were retained in yogasna, pranayama and yogasna and pranayama groups by doing their exercise regularly. Much better improvement in repairing the antioxidant status was noticed in performing the combined exercise of yogasana and pranayama. (Table.5)

DISCUSSIONS

Resulted studies revealed that Asanas and Pranayama group produced better effect in modifying the lipid levels and thereby enhances the antioxidant status. A review showed that yoga had beneficial effect on Body Weight, Blood Pressure, Blood Glucose level and Cholesterol level (Yang, 2007).

The practice of yoga was associated with significant decrease in cholesterol among subjects with cardiovascular diseases, atherosclerosis, angina, hypertension and Type 2 Diabetes at different duration of yoga (Yang, 2007; Mahajan et

al., 1999; Agarwal et al., 2003; Satyajit, 2004; Bijlani et al., 2005; Damodaran et al., 2002; Gorden et al., 2008). Results of our study found that 12 week practice of asana and pranayama significantly decreases cholesterol, triglycerides, free fatty acids, phospholipids, LDL, VLDL and increases HDL and enzymic and non-enzymic antioxidant status. Better effect was observed in combined form of asana and pranayama exercises.

Studies on the ancient practice of Yoga have demonstrated an improvement in respiratory function. Yoga consists of a number of different practices, the most common of which are the pranayama, the coordination of controlled ventilation and the asanas or stretching exercises. Pranayama requires breath holding which may result in increased parasympathetic control of respiratory control centers (Mauch and Dr. Day 2008). Long duration training of SKY (Sudharsana Kriya yogasana) improves many body functions.

Studies showed that the ancient Indian yoga system emphasizes on controlled breathing (pranayama), body postures (asanas), relaxation of mind (Meditation) (Madan and Pal, 2002; Agte and Tarwadi, 2004). Better ability to overcome stress can be cited as possible mechanism for improvement in lipid profile (Vyas et al., 2008).

SKY is a unique breathing process not practiced as a single technique but is integrated with asanas, pranayama, meditation and attitude training. This type of yoga is said to heal and purify within, is a natural and non invasive stress relieving technique (Agte and Tarwadi, 2004). SKY or "Proper Vision by Purifying Action" is an advanced form of cyclical breathing at variant rate, slow, medium and fast (Sharma et al., 2008). It is preceded by Ujjayi pranayama (long & deep breath with constriction at the base of throat) and Bhastrika (fast and forceful breaths through nose along with arm movements) (Sharma et al., 2008). Our results shows decrease in total cholesterol, LDL-C along with significantly increase in HDL-C after 12weeks of SKY training.

TBARS and hydro peroxides are the lipid peroxidative indices prone to produce free radicals leading to disease condition in even healthy individuals. (Girotti, 1985). Lipid peroxidation and generation of free radicals are associated with pathogenesis of many diseases. In our study increase in lipid peroxidation is found due to oxidative stress. Oxidative stress/ free radicals may contribute to the patho physiology of many chronic diseases. (Himani Sharma et al., 2003).

Practice of Sudarshan Kriya Yoga (SKY) along with asana and pranayama performed consciously and with awareness (Madan and

Pal, 2002) play vital role in reducing total cholesterol, LDL-cholesterol and significantly increasing HDL cholesterol.

Yoga emphasizes on controlled breathing (pranayama), body posture (asana), relaxation of mind (meditation) keeps a person energetic & healthy for maintaining health and fitness and for treating diseases (Madan and Pal, 2002; Agte and Tarwadi, 2004). SKY has a sound scientific basis and is an ideal tool for improving the health. A study reviewed that practice of yoga has beneficial effect on biochemical and physiological functions (Madan and Pal, 2002).

Recent research also showed that regular practice of yoga reduces the oxidative stress and improves the antioxidant levels (Bhattacharya et al., 2002).

An antioxidant is a substance that scavenges free radicals generated due to oxidative stress. It has been suggested that exercise training is known to be effective in type 2 diabetes mellitus by increasing insulin sensitivity (Ibanez J, Izquierdo et al., 2005), and regular exercise can strengthen antioxidant defenses and may reduce oxidative stress (Kim et al., 1996). Exercises including yoga postures have been shown to play a role in preventing type 2-diabetes (Sahay and Dahay, 2002). The yoga postures are slow rhythmic move-

ments which emphasize the stimulation of the organs and glands by easy bending and extensions which do not over-stimulate muscles but concentrate on glandular stimulation (Nayak and Shankar, 2004). A major benefit of non-exhaustive exercise such as yoga is to induce a mild oxidative stress that stimulates the expression of certain antioxidant enzymes. This is mediated by the activation of redox-sensitive signaling pathways (Reid, 2001). For example, gene expression of SOD is enhanced after an acute bout of exercise preceded by an elevation of NF-kappaB and AP-1 binding. An increase in de novo protein synthesis of an antioxidant enzyme such as SOD or catalase usually requires repeated bouts of exercise (Jil, 2002). This could explain the increase in the activity of SOD in the Hatha yoga and conventional PT exercise groups at the end of six months. (Lorenzo A Gordon et al., 2008).

“Pranayama” (the practice of voluntary breath control, consisting of conscious inhalation, retention and exhalation) is often practiced in conjunction with “dhyana” (meditation), and “asanas” (physical posture) (Yardi, 2001). Versions of pranayama vary from single nostril breathing to belly breathing. Pranayama consists of three phases: “puraka” (inhalation); “kumbhaka” (retention) and “rechaka” (exhalation) that can be either fast or slow

(Chodzinski, 2000). Although all pranayama has three phases, different forms of pranayama evoke dissimilar and sometimes opposite responses in the subject depending on variables such as which nostril is used or the speed of the respiration. Pranayama has been researched mostly for its beneficial applications in treatment of cardiovascular diseases such as hypertension (Chodzinski, 2000; Singh et al. 2004; Harinath et al. 2004), pulmonary disease such as asthma (Cooper S et al., 2003; Singh et al., 2000; Vedanthan et al., 1998), autonomic nervous system imbalances (Pal et al., 2004), and psychologic or stress related disorders (Harinath K et al. 2004; Brown and Gerbarg 2005).

Pranayama is known to improve pulmonary function (Malhotra et al. 2002) and cardiovascular profile (Chodzinski, 2000; Singh et al. 2004; Harinath et al. 2004). In studies that examined pranayama as a form of exercise, nostril breathing was shown to increase hand grip strength of both hands (Raghuraj P et al. 1997). Pranayama, by reducing risk factors associated with cardiovascular disease (Bijlani et al. 2005), has shown that it is not only therapeutic but also preventative. Reduction in oxidative stress levels with increased super-oxide dismutase and decreased number of free radicals may explain in part the beneficial long term impact pranayama has on the cardiopulmonary system (Bhattacharya et al., 2002).

Cellular intracellular enzymes such as SOD and catalase along with non-enzymatic antioxidants (gluta-thione) act as primary line of defense to cope with the deleterious effects of reactive oxygen species (Bradley and Nathan, 1984). Superoxide dismutase detoxifies superoxide radicals and converts them to hydrogen peroxide which is further converted to water by catalase and glutathione peroxidase.

Reduced scavenging of free radicals by SOD, decreased glutathione and decreased activity of catalase are associated with diabetes and vascular pathology (Baynes and Thorpe, 1996). Reduced capacities of antioxidant enzymes lead to increased oxidative stress in diabetes (Arai et al., 1987) in the study evaluation of antioxidant status demonstrated significant increase in SOD activity and non-significant increase in catalase activity with a concomitant significant reduction in MDA in the Hatha yoga and conventional PT groups after six months. The improved antioxidant status due to these exercise regimens may point to adaptive response to oxidative stress reflecting free radical production and increased enzyme biosynthesis (Lui et al., 1993). Furthermore, in oxidative stress when excessive superoxide formation may be accompanied by increased nitric oxide levels, elevated SOD

activity may play a protective role in preventing cells from peroxy-nitrite formation (Li et al., 2000).

A variety of natural antioxidants exist to scavenge oxygen free radicals and prevent oxidative damage to biological membranes. One group of these antioxidants is enzymatic (intracellular), which includes superoxide dismutase

(SOD), glutathione peroxidase and catalase (Halliwell B, Gutteridge 1999). In addition to enzymatic antioxidants, are the major natural antioxidants, most of them derived from natural sources by dietary intake and include vitamin A, vitamin C, vitamin E and carotenoids (Liu et al., 2006). Abnormally high levels of peroxidation and the simultaneous decline of antioxidant defense mechanisms can lead to damage of cellular organelles and oxidative stress (Mahboob et al., 2005). To encounter act our study has been carried out for 12 weeks of regular practice of yogasanas and was found to be effective in reducing the oxidative stress and retains the antioxidant status in healthy individuals.

CONCLUSION

Thus our study concluded that combined action of yogasanas and pranayama produces beneficial effect in reducing lipid levels by enhancing the antioxidant status. It is also revealed that yogasanas and

pranayama by their combined exercises helps us to keep our body and mind healthy and free from disease.

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