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Anthropometric and General Health Measures in Elderly Exercisers and Yoga Practitioners: A Comparative Study.

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ABSTRACT

Obesity is a growing problem, resulting in significant morbidity and mortality from weight-related diseases and reduced quality of life. The association between elevated BMI and subsequent disability provides evidence that obesity in older populations is associated with a substantial increase in risk for poor health outcomes. A total 102 elderly male subject above 60 yrs of age selected for study. Thee groups were prepared with 34 subject in each group. Group 1 subjects who are practicing yoga more than 3yrs. Group 2 subject doing daily light exercise for last 3yrs. Group 3 control group who are not practicing yoga or exercise. Height, Weight, BMI, mid arm circumference, mid calf circumference, waist hip ratio and BMR recorded. Socio demographic and general health questionnaire recorded and data analyzed. Result of present study shows that the yoga group have lower thresholds of BMI and BMR. Anthropometric norms are with in normal limits for their respective age. Yoga group reported better health, lower somatic symptoms, anxiety and depressive state. Yoga rather than physical exercise is recommended for preventive and promotive health in elderly.

INTRODUCTION

Obesity is a growing problem, resulting in significant morbidity and mortality from weight-related diseases and reduced quality of life[1].The association between elevated BMI and subsequent disability provides evidence that obesity in older populations is associated with a substantial increase in risk for poor health outcomes [2].Obese individuals are more likely to develop arthritis, lung disease, diabetes, metabolic syndrome, hypertension, coronary artery disease, congestive heart failure, urinary incontinence, cataracts, and cancer, and are more likely to suffer an earlier death [3].

The world's older population has been growing for centuries. What is new is the accelerating pace of aging. India ranks second (59.6 millions) in rank order of the world's 25 largest older populations, next to China (106.1 millions) [4]. A rising trend in prevalence of obesity from 1999 to 2005 with marked rural-urban differences was observed in the Indian National Family Household Survey [5]. Obesity is increasing in all age groups. The prevalence of obesity was 18.4% in US pre-school children (4 year old); 8.5 % [6] and 3.4% among south Indian children for overweight and obese respectively [7].

The elderly people exhibit an increase in total body fat with greater intra-abdominal (visceral) fat stores [8]. Being active helps in the control of weight and has beneficial effects on body composition by reducing the percentage of body fat, thereby reducing the risk of obesity-induced diseases [9]. Despite the well-documented benefits of exercise in enhancing quality of life and maintaining long-term independence, the percentage of inactive adults is still high. This is particularly disturbing when we look at the escalating figures for prevalence of obesity in the elderly [10].

Anthropometric measurements are essential and reliable tools for evaluation of malnutrition, muscular mass loss, fat mass gain and adipose tissue redistribution in geriatrics [11]. These are simple and acceptable measures comparable to more sophisticated methods such as hydro densitometry, dilution techniques, whole body

counting by using K-40 and electronic bio impedance), the use of which is restricted by complexity and cost in population studies [12] .

Life style change programs that have included yoga have shown beneficial effects in obesity related metabolic disorders such as diabetes, hyperlipidemia, and heart disease [13] osteoarthritis [14] in different age groups. Yoga practitioners usually combine techniques such as asana, pranayama, as well as meditation in their daily yoga practice. A study done on long term effect of yoga (6 months) on BMR shows that there is a significantly reduced BMR, probably linked to reduced arousal, with the long term practice of yoga using a combination of stimulatory and inhibitory yogic practices[15]. Breathing through a particular nostril, while performing the Surya Anuloma Viloma (right nostril breathing), has been shown to increase oxygen consumption by 28% [16]. An increase of 19% in oxygen consumption has been observed during the practice of one type of pranayama called the Ujjayi Pranayama [17]. Other specific asanas can also increase the metabolic rate transiently [18,19].

While the acute effect of each of these techniques has been documented, the combined effect of these practices on BMR, Health and other anthropometric parameters is unknown. The present study evaluated the effect of long term regular integrated yoga practices in healthy elderly population (age>60 years).

METHODOLOGY

One hundred and two healthy elderly male subjects above the age of 60 years participated in this study. The yoga group consisted of 34 integrated yoga practitioners who were practicing yoga regularly for ≥ 3 years. The exercise group included of 34 participants who were doing physical exercises like exercise/free hand exercises on a regular basis for ≥ 3 years. The control group comprised of 34 normal healthy elderly who did not practice yoga or any other active physical exercises.

Yoga practitioners were selected from the yoga center .The physical exercise participants were selected from parks, where people came for regular exercise and/or free hand exercises. Subjects for control group were selected from senior citizen clubs; Healthy male volunteers above 60 years were selected. Subjects with health problems like asthma, hypertension, heart disease, diabetes, major psychiatric illnesses etc were excluded.

The subjects were told that the tests were for their self-assessment to understand the benefit they derived from the course. Informed consent was signed by all subjects. Those who gave their consent to participate in the study were recruited. All tests are essentially noninvasive in nature.

Study Groups

This was a three armed cross sectional matched control study.

Yoga

The subjects in the yoga group were regular practitioners of integrated yoga which consisted of yoga asanas (25 minutes), relaxation techniques (7 minutes), pranayama (20 minutes), meditation (10 min) and daily interactive talks (5 minutes) on the concepts of yogic lifestyle including diet and stress management through yama, niyama, pratyahara, bhakti yoga, jnana yoga and karma yoga. All these subjects were attending the classes regularly for ≥ 3 years for their positive health. The classes were conducted by a senior yoga teacher over several years.

Physical exercises

The subjects in this group were regular practitioners who were habituated to go to early morning walk/exercise for several years. We selected only those who satisfied the selection criteria and were regular (one hour/day; > 20 days /month) for ≥ 3 years as per their statements. Some of them were doing both exercise and physical exercises (not yoga) whereas some were doing only exercise for the entire hour.

Control

The control group comprised healthy elderly who did not practice yoga or any other active physical exercises.

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ASSESSMENT

Socio-demographic questionnaire

A socio-demographic check list was developed for this study to document the following: Name, address, level of education, gender, Duration of practice, age, presence of major diseases, medications are enquired and are excluded from the study.

Weight

The weight was recorded using a standard electronic weighing scale. The participants were asked to remove as much outerwear as possible. Further they were asked to remove the shoes and step up onto the weighing scale and stand still over the center of the scale with body weight evenly distributed between both feet.

Height

The height was measured using standard scale- Stadiometer.

Body Mass Index (BMI)

BMI was measured using an equation
BMI= weight (kgs)/height (m^2)

Mid Calf Circumference (MCC)

MCC was measured using a flexible centimeter tape at mid-point between the anterior superior iliac spine and the tip of the bony point on the lateral aspect of the ankle.

Mid Arm Circumference (MAC)

MAC was measured at mid-point between the tip of Acromion and the lower end of Humerus at the elbow using a flexible centimeter tape.

Waist circumference (WC)

Measured about 2 cms above the umbilicus.

Hip Circumference (HC)

WAIST HIP RATIO (WHR)

Waist circumference / hip circumference.

Basal Metabolic Rate (BMR)

BMR was calculated using Harris Benedict formula [20].

BMR (Men) = 66+ (13.7× weight) + (5×height)-(6.8×age)

We subtracted 5% from the value obtained from this formula as recommended for Indians [21].

Harris Benedict Formula

To determine your total daily calorie needs, multiply your BMR by the appropriate activity factor, as follows:

- If you are sedentary (little or no exercise) : Calorie-Calculation = BMR x 1.2
- If you are lightly active (light exercise/sports 1-3 days/week) : Calorie-Calculation = BMR x 1.375
- If you are moderately active (moderate exercise/sports 3-5 days/week) : Calorie-Calculation = BMR x 1.55
- If you are very active (hard exercise/sports 6-7 days a week) : Calorie-Calculation = BMR x 1.725
- If you are extra active (very hard exercise/sports & physical job or 2x training) : Calorie-Calculation = BMR x 1.9

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24 hour diet recall

A detailed history of the recall of all the solids and liquids consumed on a normal day was recorded and the total calories consumed /day was calculated from a ready reference calorie chart. [22].

General Health Questionnaire (GHQ)

The GHQ designed by Goldberg in order to identify psychiatric morbidity in general practice, is a self-administered questionnaire. It has 28 items with four subscales to measure somatic symptoms (SS), anxiety and insomnia (AI), social dysfunction (SF) and severe depression (SP). It provides information about the recent mental status, thus identifying the presence of possible psychiatric disturbance. This questionnaire has acceptable psychometric properties and has good internal consistency and reliability with Cronbach's alpha of 0.85 and validity of 0.76(39).

Data Analysis

Statistical package SPSS version 10 was used for analysis of data. A test of normality showed that the data on all variables for all three groups were normally distributed (Shapiro-Wilk's test). As there were three groups the data were analyzed using ANOVA.

RESULTS

The subjects enrolled in this study were from male population between the age ranges 60- 80 years. The mean age of the study population was 71.6± 8.3 years. The distribution of study population across different categories of age range, education, occupation and religion are given under table 1.

Table 1: Sociodemographic characteristics of the study population

Variables		Yoga N (%)	Exercise N (%)	Control N (%)
Total		34	34	34
Age *	60- 64 years	3	2	3
	65-70 years	14	16	15
	71-75, years	11	12	11
	>75 years	6	4	5
Education	Only High school	3	1	6
	Only Graduates	18	19	15
	Post graduates	13	14	13
Occupation	Employed	2	1	2
	Retired	32	33	32
Religion	Hindus	34	32	34
	Muslims	0	0	0
	Christians	0	2	0

*All subjects in this study were males and there were no females.

Anthropometry

Overall on ANOVA there was a significant difference between the three groups in weight ($p<0.001$), BMI ($p<0.001$), waist circumference ($p<0.001$), hip circumference ($p=0.001$). Post hoc bonferroni tests showed significantly lower body weight in yoga compared to exercise ($p=0.004$) and control group ($p=0.004$) but not between control and exercise group. Post hoc bonferroni tests showed significantly lower body BMI in yoga compared to exercise ($p<0.001$) and control group ($p<0.001$) but not between control and exercise group. Post hoc bonferroni tests showed significantly lower waist circumference in yoga compared to exercise ($p=0.02$) and control group ($p<0.001$) but not between control and exercise group. Post hoc bonferroni tests showed significantly lower hip circumference in yoga compared to control group ($p<0.001$) alone but not between control and exercise and yoga and exercise group. There were no significant changes between groups for mid calf circumference, BMR and waist hip ratio (See Table 2).

General Health Questionnaire

Overall on ANOVA there was a significant difference between the three groups in 3 subscales of GHQ [somatic symptoms ($p<0.001$), anxiety insomnia ($p<0.001$), social dysfunction ($p<0.001$)] and total health of GHQ ($p<0.001$) with yoga group having lower mean scores compared to exercise and control group. Post hoc Bonferroni tests showed Yoga group had significantly lower scores on somatic symptoms ($p<0.001$ and $p<0.001$), anxiety insomnia ($p<0.001$ and $p<0.001$), and social dysfunction ($p<0.001$ and $p<0.001$), compared to exercise and

control group. There was no significant difference between exercise and control arm on these sub domains of GHQ. Yoga group also showed significantly lower scores on total health compared to exercise (p<0.001) and control groups (p<0.001) on post hoc bonferroni test. Exercise group also reported lower significantly lower scores on total health compared to control group (p=0.03) (Table 3).

Table 2: Comparison of anthropometric variables between yoga, exercise and control groups using ANOVA and Post Hoc Bonferroni Correction.

Variable	Group	Mean ± SD	95% CI LB, UB	Sig, p-values ANOVA, p value	Post-hoc tests	
Weight	Y	64.27 ± 10.48	60.6, 67.9	<.001	Y-E	0.004
	E	71.65 ± 7.17	69.1, 74.9		Y-C	0.004
	C	71.58 ± 9.53	68.2, 74.9		E-C	1.000
BMI	Y	22.84 ± 2.92	21.8, 23.8	<0.001	Y-E	<0.001
	E	27.10 ± 2.34	26.2, 27.9		Y-C	<0.001
	C	27.40 ± 2.88	26.3, 28.4		E-C	1.000
MAC	Y	27.58 ± 2.77	26.6, 28.5	0.159	Y-E	ns
	E	28.78 ± 4.24	27.2, 30.2		Y-C	ns
	C	29.20 ± 3.59	27.9, 30.4		E-C	ns
MCC	Y	33.53 ± 3.16	31.4, 33.6	0.782	Y-E	ns
	E	32.44 ± 4.16	31, 34		Y-C	ns
	C	33.03 ± 3.78	31.7, 34.3		E-C	ns
WC	Y	89.70 ± 8.24	86.8, 92.5	<0.001	Y-E	0.024
	E	94.23 ± 5.26	92.4, 96		Y-C	<0.001
	C	97.35 ± 6.87	94.9, 99.7		E-C	0.197
HC	Y	100.76 ± 7.54	98.1, 103.4	0.001	Y-E	0.113
	E	104.77 ± 7.66	102.1, 107.4		Y-C	<0.001
	C	108.41 ± 8.33	105.5, 111.3		E-C	ns
WHR	Y	0.88 ± 0.052	0.86, 0.89	0.331	Y-E	ns
	E	0.89 ± 0.048	0.87, 0.91		Y-C	ns
	C	0.89 ± 0.046	0.87, 0.91		E-C	ns

Abbreviations : MAC-mid arm circumference, MCC- mid calf circumference, Y –yoga, E-exercise, C-control.CI-Confidence Interval,, LB –lower bound, UB- upper bound.

Table 3: Comparison of scores on General Health Questionnaire in yoga, exercise and control groups using ANOVA and post hoc bonferroni correction.

Variable	Domains	Groups	Mean ±SD	CI LB, UB	P	Groups	Post -hoc
GHQ	Somatic symptoms	Y	0.52 ± 1.07	0.14, 0.92	<0.001*	Y-E	<0.001
		E	1.48 ± 1.22	1.05, 1.92		Y-C	<0.001
		C	2.11 ± 2.18	1.36, 2.88		E-C	0.492
	Anxiety insomnia	Y	0.76 ± 1.51	0.23, 1.29	<0.001*	Y-E	<0.001
		E	1.93 ± 1.14	1.53, 2.35		Y-C	<0.001
		C	2.61 ± 1.85	1.36, 2.88		E-C	0.079
	Social dysfunction	Y	0.5 ± 1.08	0.12, 0.88	<0.001*	Y-E	<0.001
		E	2.06 ± 1.53	1.51, 2.61		Y-C	<0.001
		C	2.38 ± 1.34	1.91, 2.85		E-C	0.280
	Severe depression	Y	0.11 ± 0.32	3.54E-03, 0.23	0.068*	-	-
		E	0.09 ± 0.29	-1.26E-02, 0.19		-	-
		C	0.64 ± 1.47	0.13, 1.16		-	-
GHQ total health		Y	1.91 ± 3.08	0.83, 2.99	<0.001*	Y-E	<0.001
		E	5.57 ± 3.12	4.47, 6.68		Y-C	<0.001
		C	7.76 ± 4.89	6.06, 9.47		E-C	0.037

Abbreviations: GHQ – General Health Questionnaire –yoga, E-exercise, C-control. CI-Confidence Interval,, LB –lower bound, UB-upper bound.

Metabolic changes

Basal metabolic rate, total energy expenditure and total calories required were derived and calculated from basic anthropometric measures using formulae as described under methods section. Overall on ANOVA yoga group had lower BMR compared to exercise and control group though this was not significant. Overall on ANOVA Total energy required was more in exercise group compared to yoga and controls (p<0.001). Post hoc bonferroni tests showed total energy required was significantly more in exercise group (p<0.001) and yoga group (p=0.007) compared to controls. Total energy required was more in exercise group compared to yoga group though the results were not significant. Total calories consumed were more in exercise group compared to yoga or controls but the differences were not significant (See Table 4).

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Table 4: Comparison of BMR, total energy required and total calories consumed across Yoga, exercise and control groups using ANOVA and post hoc Bonferroni correction.

Variable	Group	Mean ± SD	95% CI LB, UB	ANOVA P values	Difference between Groups	Post Hoc Bonferroni, p values
BMR	Y	1296.47 ± 267.67	1203, 1389.8	0.082	Y-E	ns
	E	1396.65 ± 127.39	1350.2, 1442		Y-C	ns
	C	1380.70 ± 166.13	1322.7, 1438.6		E-C	ns
Total energy required	Y	1970.02 ± 240.19	1886.2, 2053.8	<0.001	Y-E	0.079
	E	2096.33 ± 190.78	2029.5, 2162.8		Y-C	0.007
	C	1795.76 ± 249.86	1708.5, 1882.9		E-C	<0.001
Total calories consumed	Y	1927.029 ± 568.47	1729.0, 2125.7	0.198	Y-E	ns
	E	1800.713 ± 365.69	1673.1, 1928.3		Y-C	ns
	C	2002.71 ± 434.53	1851.1, 2154.3		E-C	ns

Abbreviations: BMR- Basal Metabolic Rate, Y–yoga, E-exercise, C-control. CI-Confidence Interval,, LB –lower bound, UB- upper bound.

DISCUSSION

Results from this cross sectional study showed those practicing yoga in daily life to be in better health compared to those taking recourse to exercise and no directed physical activity. Results suggest yoga group to have lower thresholds of BMI, waist circumference, body weight and hip circumference within the norms for their respective age. Yoga group also reported better health, lower somatic symptoms, anxiety and depressive states, better social function compared to exercise and control groups. Both yoga and exercise groups required more energy compared to control groups as they indulged in physical activities. Our results are consistent with observations from controlled trials using yoga intervention in various health care concerns where stress was believed to play a role [24,25]. Furthermore, our observations also add credence to earlier findings of anxiolytic and antidepressant effects, reduction in somatic symptoms and better health in geriatric population [26] and healthy volunteers [27] with yoga intervention. The observations also reinforce beneficial effects of exercise intervention in elderly population.

However, a major finding from this study is better psychological effects with yoga such as better mood states, reduction in somatic symptoms and better health compared to exercise intervention suggesting that yoga could help promote positive health behaviors and adherence to healthy lifestyle [28] compared to exercise or no physical activity group [29]. Participants in yoga group could experience a feeling of self-control and spiritual experiences through a conscious awareness of their environment that represent a powerful cognitive behavioral coping strategy for transforming the ways in which we respond to life events [30]. This is also known to reduce health care costs and visits for management of chronic illnesses [31].

Secondly, we observed that BMR in yoga group was lower than exercise or control group though the energy expenditure was more. BMR markedly decreases with advancing age in sedentary populations [32] at a rate of ~1–2% per decade after the age of 20. This is associated with decline in EE which probably contributes to an impaired ability to regulate energy balance with age. In contrast, we observed low BMR and higher energy expenditure in our yoga and exercise groups which may indicate metabolic efficiency. This is similar to earlier observations that have shown lower resting metabolic rate in advanced yoga practitioners' vs non practitioners matched for their age and sex using a metabolic analyzer. This change could be attributed to decrease in fat mass [33] that could be elucidated through a lower body weight, waist circumference and BMI seen in yoga group.

The main determinant of BMR is Fat Free Mass [6], while fat mass is significant only in obese subjects [9]. Hence, with normal ageing as the lean body mass deceases .the fat mass goes up and BMR drops. Energy expenditure also decreases with ageing as the fat free mass reduces (lean body mass) due to reduced physical activity. This was observed in our control group which showed higher fat %, lower lean body mass and EE. In contrast the exercise and yoga groups had lower fat, higher fat free mass and higher EE. It is known that obesity related health problems such as CVD, PCOS, Diabetes, cholelithiasis are traceable to excess visceral fat which is measured by WC [34] and WHR [35]. Lower WC and WHR and BMI offer support for reductions in visceral fat in yoga practitioners. This could have also contributed to overall improvement in health seen in yoga practitioners.

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CONCLUSION

The results from this study are preliminary and a pointer towards a trend. However larger cross sectional studies using random and cluster sampling strategies are needed to validate these observations in the elderly population. The trends seen in these observational studies need to be confirmed using randomized controlled trials comparing yoga and. physical exercise in the elderly to enable recommendations for preventive and promotive health.

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