Correlation of Fitness, Fatness, Blood Cholesterol and Blood Sugar

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ABSTRACT

Unhealthy eating habits and decreased physical exercise lower physical fitness, increasing the risk factors of coronary heart disease and diabetes mellitus etc.

The present study planned to assess the level of physical fitness and its correlation with fatness, blood sugar (fasting & post meal) and blood cholesterol. The study was conducted on 50 overweight + obese individual & 50 healthy male subjects (control) in the age group of 20-40 years. Fatness assessed by measuring skin fold thickness on triceps, mid bicep region, lower tips of scapula, midway between elbow and shoulder, over iliac crest by Herpender Calliper. Fitness assessed by Harvard step test, which is simple, inexpensive and easy to perform. Blood sugar and blood cholesterol were estimated by enzymatic method.

Fitness index calculated, and found low in overweight + obese individuals. Skin fold thickness, body fat, blood cholesterol and blood sugar found statistically highly significant in overweight + obese individual (p< 0.001).The fitness index then negatively correlated with percentage of body fat (R-0.409),blood cholesterol (R-0.488),fasting blood sugar (R-0.522) and post meal blood sugar (R- 0.420). The fitness was high in control. Fatness, sr. cholesterol & blood sugar were high in over weight + obese, suggesting that the physical fitness should be increased by regular exercise, which will burn our excess body fat and blood sugar, and keep the cardiovascular diseases and diabetes away.

INTRODUCTION

Today's life style has produced large number of over fed, over weight sedentary people which cause accumulation of body fat, leading to weakness of cardiovascular system and diminished physical energies. Lack of exercise and decreased daily activities are responsible for decrease physical fitness & increase in cholesterol blood sugar. Regular exercise and daily activities increases physical fitness which results in optimal functioning of all the various physiological systems of the body particularly, heart, blood vessels, lungs and muscles.

The physical fitness is defined as "the ability to carry out daily task with vigor and alertness, without undue fatigue and with ample energy to enjoy leisure time pursuit and to meet unforeseen emergencies.[1]Physical fitness involves four basic health related components namely muscular strength, muscular endurance, flexibility & cardio- respiratory endurance.

Obesity is rare in primitive society and most prevalent in prosperous communities. It is the result of decreased physical fitness. It is associated with hypercholesterolemia and increased blood sugar level.

Obesity is defined as an excess deposition of fat in adipose tissue. If the person is having body weight 20% in excess than desirable weight in relation to height & age is considered obese.

The other criteria of obesity are body mass index, (which is the ratio of body wt in kg with height square in meter), skin fold thickness, measuring waist hip ratio.

Obesity is the result of incorrect energy balance, of taking in more energy in food than is expended in the activities of daily life.

There are various laboratory tests to assess the physical fitness like running on a treadmill, pedaling on a stationary bicycle (bicycle ergo meter), stepping upon a 20" bench (Harvard step Test) etc.

Harvard test is a simple test for assessing aerobic power or oxygen consumption indirectly. It is inexpensive, simple and easy to perform.

Performance is measured in terms of maximum duration of effort by maximum output of work. Fitness measured by magnitude of changes in heart rate during exercise & the rapidity with which the rate returns to normal when exercise is over.

Many studies have reported that obesity is associated with decreased physical fitness & increase in blood pressure, blood cholesterol & fasting blood sugar level. [9]

Therefore, to determine the level of physical fitness & its correlation with fatness, blood cholesterol & blood sugar this study carried out in a section of urban population in **Nagpur**

central India. These abnormalities are the main risk factors for coronary heart disease and one of the major causes of mortality & morbidity. Hence this study was carried out to find out with the following aims :-

1) To assess fitness index of overweight & healthy individual & healthy control individual by Harvard step test
2) To find out percentage of body fat by skin fold thickness
3) To measure total blood cholesterol & blood sugar(fasting & post meal) in overweight + obese individual & healthy control individual.
4) To determine correlation between fatness, blood cholesterol, & blood sugar level

MATERIAL AND METHOD

This study was conducted on 50 overweight + obese individual & 50 healthy male subjects (controls) in the age group of 20-45 years. Five groups were made according to age with10 Subjects in each group.

Gr.I: 20 – 25 yrs, Gr.II: 26 – 30 yrs, Gr.III: 31-35yrs, Gr.IV: 36-40yrs, Gr.V: 41-45yrs.

These subjects were professionals, students, health club members. The test was carried out in the morning between 9am to 11am in the dept. of Physiology I.G.G.M.C. Nagpur.

The detailed history and clinical examination of each subject is recorded in the Performa.

Height in centimeter (cm), weight in kilogram (kg) & body surface area in square meter (m²) from Duboid body surface chart.

The subject's fatness assessed by measurement of skin fold thickness by Herpender Caliper. The sites were over triceps, midway between elbow & shoulder, lower tips of scapula, mid bicep region, over iliac crest. For each site, two readings were taken

Then fasting blood sugar & serum cholesterol was done by enzymatic method. Light break fast was given and Harvard step test was performed. Post meal blood sugar was done after 1 ½ hrs of meal.

The Harvard step test is a simple test in which basal pulse recorded for 1 min. & then the subject was asked to perform exercise of ascending and descending platforms of 20"

High, 30 times per min. or as long as he can do. For the age group above 35yrs, step of 18" high is used. Recovery pulse recorded at 1 min, 2min & 3min.and then

Harvard Index calculated by the formula.

$$H.I = \frac{Exercise\ in\ seconds}{2 \times sum\ of\ recovery\ pulse} \times 100$$

Harvard Index is interpreted as:-
90 & above _ Excellent

80 – 89   ___ Good

55 –79   ___ Average

Less than 55___ poor

The subjects were divided into 5 groups in each over weight (ow) +obese & control group. The person having 10% excess weight in relation to height as per ht-wt chart were considered over weight and those having 20% excess weight were considered obese[6]

OBSERVATIONS
The percentage of body fat, fitness index, blood sugar (mg %) fasting & post meal,

Sr. cholesterol (mg %) of 100 individuals were estimated.Comparision made between

Overweight & obese healthy group and control group of 50 each. (Table-1)

Table 1- Subject characteristics (n=100)		
Parameters	overweight & Obese (n=50)	control (n=50)
Mean age (yrs)	33.16 ± 76.65	32.82 ± 7.46
Mean Height (cm)	163.64 ± 4.69	163.90 ± 4.42
Mean weight (kg)	79.62 ± 7.09	57.32 ± 8.34
Mean body surface area (m²)	1.87 ± 0.16	1.62 ± 0.11
Mean skin fold thickness (mm)	82.40 ± 11.53	36.40 ± 11.37
Mean % of body fat	26.25 ± 3.44	15.84 ± 4.47

These table shows that the study carried out in age matched & height matched groups. However, they differed in weight, body surface area, skin fold thickness & percentage of body fat. In view of above data, study done and we got the following findings.

Table 2		
Parameters	Ow + Obese	Control
Fitness Index (Mean)	58.72 +13.05	75.24 + 12.80
Sr. Cholesterol (Mean)	211.62 + 37.082	174.22 +20.421
Blood sugar fasting (Mean)	84.24 +9.596	77.76 + 8.036
Blood sugar post Meal (Mean)	104.80+ 10.824	95.40 + 9.245

The following table- 3 shows the relationship of fitness with percentage body fat; blood Cholesterol and blood sugar (fasting & post meal) in over weight + obese subjects.

Table – 3

Parameters	No. of Subjects	Correlation coefficient (R)	P Value	Significance
% of body fat	50	-0.409	<0.001	H.S
Sr. Cholesterol	50	-0.488	<0.001	H.S
Blood Sugar (F)	50	-0.522	<0.001	H.S
Blood Sugar (PM)	50	-0.420	<0.001	H.S

The study shows that fitness negatively correlated with percentage of body fat, Sr.Cholesterol & blood sugar (F & PM). This means that increase in body fat, blood sugar & Sr. Cholesterol leads to significant decrease in fitness.

The following table - 4 shows the correlation of Harvard Index & age in control & overweight + obese subjects and found to be negative and highly significant.

Table - 4			
Parameters	Over Weight +Obese	Control	Total
No. of Subjects	50	50	50
Correlation Coefficient (R)	-0.559	-0.469	- 0.443
P Value	<0.001	<0.001	<0.001
Significance	H.S	H.S	H.S

Note: - H.S = Highly Significant

With increase in age, the fitness index decreases significantly (p < 0.001).

DISCUSSION
Sedentary life has injurious effect on health of an individual and it specifically increases the risk of cardiovascular diseases, while physical fitness reduces body fat & has protective effect on various metabolic functions of body. The positive effects of physical fitness as literature suggests are reduction in total cholesterol level, triglyceride level, increasing HDL level, decreasing body weight, improving glucose tolerance, lowering blood pressure and increasing mental well being[5].

In our study the age & ht of ow + obese group and control group are matching. The other parameters such as weight, skin fold thickness and percentage of body fat when analysed, statistically significant difference found in ow + obese subject and control subjects.

FITNESS INDEX IN OW + OBESE AND CONTROL SUBJECTS:-
Fitness index in this study in all age group is highly significantly lower in ow + obese subject as compared to control subjects.

Kumgai (1993) observed lower level of physical activity & aerobic physical fitness are associated with obesity [4]

Moller Lars F (1991) observed significant association between fitness & BMI [5].

Physically active & normal wt. persons have higher fitness index & lower risk status, which may reflect a protective mechanism, mediated by more favorable lipoprotein distribution, improved glucose metabolism, & stress reduction.

In this study, significantly raised cholesterol level was found in ow. + Obese subjects as compared to control.

Serum LDL cholesterol level have been linked to early arterial lesion in aorta and coronary arteries. Further, more, total cholesterol measurement in young adulthood is a powerful predictor of CHD in middle age .Thus one can reduce the cholesterol by reducing weight & slow down the progress of arteriosclerosis.

Endogenous cholesterol production increased in obese individuals, and this may be responsible for increased level of sr.

cholesterol in obese individuals. Liver is the primary source of endogenous cholesterol production.

Recent studies have studies have suggested that adult onset obesity is primarily due to fat cell enlargement where as life long obesity is primarily due to increased adipose tissue

cells. Hence, obesity of adult onset is more likely to exhibit hypertriglyeridemia.

It has been proved by various studies that the dietary intake of total fat and saturated fat are associated with increase in triglyceride level and total cholesterol level. [7]

BLOOD SUGAR (F & PM) IN OW + OBESE AND CONTROL:-
Jallut D Golay (1990) demonstrated natural history of evolution from obesity to diabetes. The fasting & post meal blood sugar was significantly high in ow +obese subject as compared to control subjects. Our findings were correlated with the finding Jallut D Golay (1990).

There is evidence that diabetes have increased rate of hepatic glucose production. The substantial weight loss in obese individuals is associated with the return of oral glucose tolerance towards normal.

FITNESS & FATNESS:-
We observed that fitness & percentage of body is inversely related to each other and there significant negative correlation between percentage of body fat & fitness. Increase fitness decreases body fat [8].

FITNESS & CHOLESTEROL:
Physical fitness has favorable effect on plasma lipids & lipoproteins by reducing plasma conc. of cholesterol, LDL & triglyceride and by increasing HDL cholesterol. We found a statistically significant inverse relationship between fitness & blood cholesterol

Physical fitness leads to decrease in % of fat & also preferential deposition of fat from central to peripheral sites which probably modifies the cholesterol level.

FITNESS & BLOOD SUGAR:-
Physical fitness improves glucose metabolism & has beneficial effect on subject having diabetes mellitus. We observed a highly significant correlation between fitness & blood sugar indicating blood sugar is inversely related to fitness.

Exercise training has been observed to improve insulin sensitivity and responsiveness through acute & chronic adaptation in peripheral tissues, particularly skeletal muscles. Consistent with other studies we observed that higher fitness level is associated with decrease blood sugar level.

HARVARD INDEX & AGE:-
We found statically highly significant relationship between Harvard index & age in ow + obese when compared with control subjects.

Our finding correlates well with Moller L F [5] who observed decrease physical fitness with increase in age.

Several studies have illustrated that there is gradual decline in physical fitness with increasing age .It is difficult to determine exactly how much of the decline in fitness is due to biological aging process or due to inactive sedentary living.

Devries mentioned five biological variables (heart rate, stroke volume, lung ventilation, lung diffusion capacity for oxygen & utilization of oxygen by tissue) whose reduced function with advancing age may contribute to a decline in physical fitness.

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