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Association of anthropometric indices and prevalence of hypercholesterolemia

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Abstract
Hypercholesterolemia (literally: high blood pressure) is the presence of high level of cholesterol in the blood. It is a modifiable risk factor for heart diseases. It is not a disease but a metabolic derangement secondary to many disease particularly CHD. The aim of the project was to identify the anthropometric factors responsible for hypercholesterolemia by collecting data in a questionnaire form. The study was done on 100 patients and 50 normal subjects. Selection criteria for experimental group were LDL≥130mg/dl; HDL≤40 mg/dl; and Total Cholesterol (TC) ≥200mg/dl and free from any serious complications and control group had normal range of LDL, HDL and TC. Subjects were divided in two groups – control and test. It was found that hypercholesterolemic patients have higher levels of BMI; waist circumference, BSF, TSF and body fat than the control group. Higher body fat; Waist hip ratio; TSF; BSF and increased body fat could be a precipitating factor towards hypercholesterolemia in these patients but further studies will be required to validate the hypothesis.

Keywords: Hypercholesterolemia, Cholesterol, Waist hip ratio, Hypothesis.

1. Introduction

Hypercholesterolemia (literally: high blood cholesterol) is the presence of high levels of cholesterol in the blood. It is not a disease but a metabolic derangement that can be secondary to many diseases and can contribute to many forms of disease, most notably cardiovascular disease. An observational study showed that total cholesterol (≥ 200 mg/dl) was associated with increased long-term cardiovascular mortality in Indian CHD patient [2]. The projected increase in CHD will be economically disastrous and creating adequate facilities for millions of new heart disease and stroke patients would be beyond the abilities of most developing countries. Thus, there is increasing emphasis on research to develop an understanding of the causes of chronic diseases as well as action of modulating factors as a basis for prevention, which is definite means of disease control. There have been intensive efforts to develop new and potent procedures to reduce risk factors for CHD. Blood cholesterol level has a lot to do with chances of getting heart disease. High blood cholesterol is one of the major risk factors for heart disease. A risk factor is a condition that increases chance of getting a disease. In fact, the higher your blood cholesterol level, the greater your risk for developing heart disease or having a heart attack. Cholesterol is a waxy fat like substance that is found in the cells of the body. (U.S. Department of Health and Human Services – NIH). The body needs some cholesterol to work the right way. The body makes all the cholesterol it needs besides it is also found in some of the foods one eats. The body uses cholesterol to make hormones, Vit. D, and substances that help digest foods. To travel in the bloodstream, cholesterol is carried in small packages called lipoproteins. Two kinds of lipoproteins carry cholesterol throughout the body

- LDL – (bad cholesterol) – the main source of cholesterol build up and blockage in arteries.
- HDL – (good cholesterol) – helps keep cholesterol from building up in the arteries

When there is too much cholesterol in the blood, it builds up in the walls of the arteries. Over time this build up causes "hardening of the arteries" so that arteries become narrowed and blood flow to the slowed down or blocked. The blood carries oxygen to the heart and if enough blood and oxygen cannot reach the heart, one may suffer chest pain. If the blood supply to a portion of the heart is completely cut off by a blockage, the result is a coronary heart disease. The WHO has predicted that by the year 2030, cardiovascular disease will remain the leading cause of death, affecting approximately 23.6 million people around the World. The WHO also estimated that by 2015, half of all deaths in India are likely to be caused by CHD [1].

Materials and Methodology

The present study was an endeavor to assess the anthropometric status of the 100 patients selected against 100 control subjects. Selection criteria for experimental group were LDL≥130mg/dl; HDL≤40 mg/dl; and Total Cholesterol (TC) ≥200mg/dl and free from any serious complications and control group had normal range of LDL, HDL and TC. There was no specific distinction regarding the gender entering the study. The samples included patients belonging to North India specifically Punjab.

Development and pre-testing of interview schedule/ questionnaire: An open ended preliminary interview schedule was drafted to elicit information pertaining to onset of CHD, complications, etc. of the subjects so as to investigate their base line information.

The preliminary interview schedule was pre tested on five at risk CHD subjects so as to test the validity and suitability of the interview schedule. Thereafter, necessary modifications were incorporated. The modified questionnaire was used in the present study. These five subjects were not included in the study.

Collection of data: Data was collected personally by interviewing the subjects and filled accordingly in the interview schedule.

Anthropometric measurements

Various anthropometric parameters viz. height, weight, waist and hip circumference, mid upper arm circumference and triceps skinfold thickness were recorded using standard method given by Jellife (1966). The techniques applied were practiced and standardized on ten preliminary hypercholesterolemic subjects. BMI and waist hip Ratio was calculated before and after supplementation.

Height

A vertical wooden rod attached to the platform was used to measure the height of the subjects. The subjects were made to stand barefoot on the platform with feet parallel, heels, buttocks, shoulders and back touching the scale. The head was held comfortably erect, head piece was lowered, crushing the hair making contact with top of the head and height was recorded in centimeters (cm) up to 0.5 cm accuracy [4].

Weight

A liver balance was used for weighing the subjects. The subjects were weighed empty stomach; without shoes and making them stand straight. The weight was recorded in Kilograms (Kg), up to 0.2 kg accuracy [4].

Body Mass Index (BMI)

BMI was calculated by using the following formula:

$$\frac{\text{Weight in kilograms}}{(\text{Height in meters})^2}$$

BMI was categorized according to the classification given by James *et al.* (2003) [5].Where>25 is an indicator of obesity.

BMI Class	Presumptive diagnosis	
<16.0	CED-Grade III	Severe undernutrition
16.0-17.0	CED-Grade III	Moderate undernutrition
17.0-18.5	CED-Grade III	Mild undernutrition
18.5-20.0	Low weight-normal	
20.0-25.0	Normal	
25.0-30.0	Obese grade I	
>30	Obese grade II	

Waist to Hip Ratio

A narrow flexible, non-stretch fiber glass tube was used to record the measurement. Tape was placed gently and firmly around the waist line, below the chest and above the stomach. Measurements were recorded. Then the tape was placed around the hip and measurements were recorded. Waist to hip ratio was then calculated.

Mid upper arm circumference

A narrow flexible, non-stretch fiber glass tape was used to take the measurements. Tape was placed gently and firmly around the left upper arm, midway between acromial and olecraneon according to the compression of soft tissues and measurements were taken.

Triceps skin fold thickness

The measurements of the skin fold thickness was made with Harpenders caliper (Triceps Skin Fold Thickness is an estimate of the subjects fat stores which measures a double layer of skin and subcutaneous fat). Measurements were taken on the relaxed left arm, at the midpoint between acromial process of scapula (shoulder, blade) and the olecranon process of Ulna (tip of the elbow). Skin fold at the midpoint was firmly grasped between the index finger and the thumb of the left hand slightly lifted up, to make the underlying muscle fall back on the bone. The caliper was placed on the fold, one inch of the finger at the depth equal to skin fold, released off the caliper and the measurements were taken at 0.2 mm accuracy.

Results and Discussions

Anthropometric Information of the Subjects

Anthropometric Parameters of The Subjects before and after Probiotic Yogurt Supplementation Anthropometric profile of the subjects is presented in Table: 1.

Height The mean daily height of the pateints were 173.25±6.51cm against the 174.44±6.70cm of the control The average height of Punjabis in the age group of 40-60 years was reported as 168.9 cm (Kaur and Bains 2004) and the subjects of the present study were taller.

Weight In the present investigation the weight of the patients was 76.10±6.43, whereas the control group weighted 70.34±9.14. Thus concluding that weight of the hypercholestrolmeic group was more than the normal range. Schuize and Hu (2007) reported that excess adiposity is the most important risk factor for diabetes and CVD. Maintaining a healthy body weight and avoiding weight gain during adulthood is the cornerstone of diabetes and CVD prevention.

Stein (2008) reported that stomach fat promotes heart disease by boosting blood pressure and constricting blood flow.

In a fourteen year study, Pesic (2009) indicated that middle aged women with a BMI index of ≥ 23, but ≤ 25 had an approximate 50% increase in the risk of both fatal and non-fatal CHD which thus indicated a clear, direct connection between obesity and heart disease.

In area of Nova Scotia, the rate of overweight and obesity is higher as 63% of adults in this province had a self-reported BMI in the overweight or obese range in 2009 leading to almost 2400 deaths, 1200 of which were attributed to IHD (ATP III 2010).

Body Mass Index (BMI) The mean BMI in the control group was 22.69±1.86 as compared to 23.19±1.58 kg/m^2 of the experimental group.

Biceps and Triceps Skin Fold Thickness The present data revealed that the control group had BSF 13.8±1.007 as compared to 15.54±1.08 mm. Bisht (2008) also reported significant ($p \leq 0.05$) decrease in Skin fold thickness among diabetic subjects after the supplementation period. Similar results were found by Srivastava (2009). Thus resulting the increased incidence of CVD in experimental group.

Waist Hip Ratio (WHR) The data collected in the present study revealed that the mean WHR of the experimental group .95±.024 and .88±.054 of control.

Body fat % of the experimental group was much higher i.e. 35.36±6.78 as compared to 30.5±8.630. In a fourteen year study, Pesic (2009) indicated that middle aged women with a BMI index of ≥ 23, but ≤ 25 had an approximate 50% increase in the risk of both fatal and non-fatal CHD which thus indicated a clear, direct connection between obesity and heart disease.

Conclusion

Thus it was found that by measuring the anthropometric indices it was possible to assess the risk of development of CVD to a large extent. Body mass index (BMI) and CHD are positively related, as BMI goes up, the risk of CHD also increase. An Estimate 3, 00,000 adults die each year of factors related to obesity. Dyslipidemia is directly related to BMI. In women, higher BMI's are associated with triglyceride levels that are 35 to 48 mgldl higher than average and HDL cholesterol levels that are 5 to 9 mg/dl lower than average (Denke et al., 1994). Weight loss has been correlated with lower fibrinogen (Ditschuneit 1995) and C – reactive protein levels, both of which are indicative of atherosclerosis. Weight distribution (upper - body or abdominal versus low – body distribution) is also predictive of CHD risk and affects glucose tolerance and serum lipid levels. A waist circumference of less than 35 inches for women and 40 inches for men is recommended (NIH, 2010). The metabolic consequences of abdominal obesity include increased risk of Type 2 diabetes, atherogenic dyslipidemia and hypertension, are all well-established risk factors for CHD.

Table 1: Anthropometric Measurements of the Groups

Groups	Wt (kg)	Ht(cm)	BMI(kg/m2)	WC(cm)	HC(cm)	W/H Ratio	BSF(mm)	TSF(mm)	Body Fat (%)
Control	70.34±9014	174.44±6.70	22.96±1.86	78.86±4.07	89.29±7.82	.88±.054	13.86±1.007	15.50±.65	30.58.630
Test	70.10±6.45	173.25±6.51	23.19±1.58	90.69±7.28	95.21±7.48	.95±.024	15.54±1.08	18.42±2.05	35.366.78
t- value	-.186	-1.045	1.713	10.67	4.49	10.71	9.12	9.77	3.767
P - value	.853	.298	.089	.01**	.01**	.01**	.01**	.01**	.01**

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