Original article

Study of Anthropometric Parameters to Predict Coronary Artery Disease Risk Factors in Adult Male Population of Bangladesh

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Abstract

Objectives : In Bangladesh both incidence and prevalence of coronary heart disease has been increasing gradually. Coronary artery disease has a number of well determined risk factors of different anthropometric parameters like weight, height, body mass index, hip circumference, waist to height ratio, triceps skin fold, subscapular skin fold. Objective of the study was to determine various anthropometric parameters which can predict coronary artery disease risk factors in adult male population of Bangladesh.

Methods : A cross sectional analytical type of study conducted in 100 male patients of whom 50 were included as case suffering from coronary artery disease and 50 were control without coronary heart disease between 35-64 years of age.

Results : Significant difference in risk factors like body mass index, waist to height ratio, subscapular skin fold was observed between case and control group.

Conclusion : Body mass index, waist-height ratio, subscapular skinfold can predict risk factor for coronary arterial disease.

Key wards : Coronary artery disease, coronary heart disease, anthropometric parameters.

Introduction

Coronary artery disease also known as coronary heart disease is the most common type of heart disease. Coronary artery disease is the most serious and immediate health problem of many countries in the worldwide. Disease of the coronary arteries is almost always due to atherosclerosis. Atherosclerosis is a disease of the large and medium sized arteries. The disease is characterized by gradual build up of fatty plaques within reduction of the vessel lumen impairing blood flow to the distal tissues of the heart. In the heart, atherosclerosis the arterial wall, which eventually results in significant cause stable and unstable angina, myocardial infarction, arrhythmias and sudden death. It is a common and life threatening disease in both developed and developing country. Coronary heart disease mortality in developing countries is expected to be much greater than among the developed countries[1].

In contrast to the developed countries, countries of the South East Asia region are experiencing an increasing trend in the prevalence of coronary artery disease[2]. It is the most common cause of death in the UK. It results over 117000 deaths a year in the UK. The UK incidence of coronary artery disease remains amongst the highest in the world[3]. Coronary heart disease caused about one of every five deaths in the United States in 2005. It is the largest single killer of American people[4]. Bangladesh is one of the developing countries whose both incidence and prevalence of coronary heart disease has been increasing gradually and unless national policy of prevention of risk factors are undertaken, it is feared that in next 10-15 years time the number of coronary artery disease patients will increase dramatically. This will

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obviously put a serious stress on the health services resources[5]. The prevalence of coronary heart disease in Bangladesh was estimated at 3.3/1000 in 1976 and 17.2/1000 in 1986 indicating five folds increase in the disease in ten years[6]. The death rate of coronary artery disease among Bangladeshi male is 483 deaths /lac where as the mortality rate among female is 330 deaths/lac in 2006. In contrast to male, mortality levels due to cardiovascular disease among females remain considerably lower throughout the period 1986-2006 in Bangladesh[7]. According to the latest WHO data published in April 2011 coronary heart disease death in Bangladesh reached 163,769 or 17.11% of total deaths. The death rate of coronary artery disease is 203.69/lac of population and the ranking is twenty fifth in the world. Among the top 20 causes of death in Bangladesh, coronary artery disease is the leading cause. Coronary artery disease has a number of well determined risk factors. People with a combination of risk factors are at greatest risk. Age is the most powerful risk factor for atherosclerosis. Atherosclerotic vascular disease often runs in families due to a combination of shared genetic, environmental and lifestyle factors. A positive family history is present when clinical problems in first- degree relative occur at relatively young age, such as <50 years for men. Obesity particularly if central or truncal is an independent risk factor, although it is often associated with other adverse factors such as hypertension, diabetes mellitus. A close relationship has been found between coronary artery disease risk factors and different anthropometric parameters like weight, height, body mass index, waist circumference, hip circumference, waist to hip ratio, waist to height ratio, triceps skinfold, biceps skinfold, subcsapular skinfold, supraspinale skinfold, abdominal volume index, and conicity index. Waist circumference is the best screening measure for coronary artery disease[8]. On the other hand skin folds as a reliable alternative for measurement of body fat mass[9]. Gupta R et al [10]evaluated coronary artery disease risk factors, anthropometrically in 600 subjects of Punjabi Bhatia community. Virendra C.P[11] observed that age, and body mass index were very strongly associated with hypertension. Waist to height ratio is a better predictor of coronary artery disease[12, 13]. In a general population study in Taiwan found that the four anthropometric indices such as body mass index, waist circumference, waist to hip ratio, and waist to height ratio are closely related to coronary artery disease risk factors[14]. Guerrero-Romeo F., Rodriquez-Moran M.[15], in their study stated that abdominal volume index is a reliable risk factor for coronary artery disease. In southern Andhra Pradesh, India, a study of randomly selected population suggested that body mass index and waist circumference are better indicators of coronary artery disease risk factors[16]. Hsieh et al[17] in a study found that, the waist to hip ratio and waist to height ratio increased with age. A study in five Canadian provinces with general population, found that waist circumference, a measure of abdominal obesity, was highly correlated with coronary artery disease risk factors[18]. With the above perspective this study was carried out to find out whether anthropometric parameters like height, weight, body mass index, hip circumference, waist to height ratio, triceps skinfold and subscapular skinfold can predict coronary artery disease risk factors in adult male Bangladeshis.

Materials and methods

This cross-sectional analytical type of study was done in the department of anatomy, Dhaka Medical College from January to December 2014. Purposive sampling technique was followed. 100 adult male patient ages ranging from 35-64 years of which fifty persons were suffering from coronary artery disease were selected as case and fifty persons were without coronary artery disease and considered as control. Patients suffering from coronary artery disease confirmed by cardiologist/cardiac surgeon, patients who had received coronary stents, patients who had undergone coronary artery bypass surgery included in the study. Patient had history heart disease other than coronary artery disease like congenital heart disease, valvular heart disease, heart failure, any chronic disease like chronic kidney disease, pulmonary tuberculosis, endocrine diseases such as acromegaly, thyroid disorders, cushing syndrome (these diseases) were excluded by history taking and clinical examinations. In case group (Group A) data were collected from post coronary care unit of Dhaka Medical College Hospital and post coronary care unit and cardiac surgery wards of NICVD. In control group (Group B)) data were collected from different surgery wards of Dhaka

Medical College Hospital who were admitted for elective operations like cholecystectomy, hernia repair, vagotomy and bypass etc and had fitness for anaesthesia and they had normal chest skiagram, normal ECG findings, normal blood sugar level and normal blood pressure Each group of participants was further divided into three subgroups according to body mass index (BMI) into normal weight group(BMI 18-22.99) (Group A, Group A1), overweight group(BMI 23-27.99)(Group B, Group B1)and obese group (BMI ≥28) (Group C, Group C1).

With Approval by ethical committee of Dhaka Medical College Hospital and NICVD, Dhaka, an informed written consent was signed from each of the participants. Anthropometric parameter such as skinfolds thickness measured by skinfold caliper, taken on both right and left sides, body weight measured by weighing scale and height measured by stadiometer, circumferences measured by standardized flexible ribbon tape and recorded. Data were analyzed with the help of SPSS version 20.0.

Results are expressed as Mean±SD. Figures in parentheses indicate range.

Comparison between values of same groups of case and control was done by Unpaired Student's't' test. Comparison between different groups of case and control was done by One way ANOVA (PostHoc)

n=Number of subjects, ns = Not significant,

*=Significant at P<0.05, **=Significant at P<0.01,***= Significant at P<0.001

Results

Body mass index of normal weight group of case and control ranged from 21.00-22.60 kg/m^2 and 18.60-22.10 kg/m^2 and the mean (±SD) 22.05 ± 0.56kg/m^2 and 20.78±1.02 kg/m^2 respectively. In overweight group, ranged from 23.30-27.98 kg/m^2 and 23.20-26.80 kg/m^2 for case and control and the mean (±S D) was 25.95±1.11 kg/m^2 and 24.58± 1.15 kg/m^2 respectively. In obese group, ranged from 29.10-34.60kg/m^2 and 28.40-35.40kg/m^2 mean (±SD) 32.79±1.65kg/m^2 and 30.92±1.89kg/m^2 respectively. Significant difference in body mass index was observed between normal weight (p<0.01), overweight (p<0.01) and obese (p<0.001) group (table-1).

Table-1: Body Mass Index (BMI) of case and control group

Group Case (n=50)	BMI (Kg/m^2) Mean±SD
A (n=16)	22.05±0.56 (21.00-22.60)
B (n=18)	25.95±1.11 (23.30-27.98)
C (n=16)	32.79±1.65 (29.10-34.60)
Control (n=50)	
A1 (n=17)	20.78±1.02 (18.60-22.10)
B1 (n=17)	24.58±1.15 (23.20-26.80)
C1 (n=16)	30.92±1.89 (28.40-35.40)
	P value
A vs A1	0.006**
B vs B1	0.002**
C vs C1	0.0001***
A vs B	0.001***
B vs C	0.001***
A vs C	0.001***
A1 vs B1	0.001***
B1 vs C1	0.001***
A1 vs C1	0.001***

Hip circumference of normal weight group of case and control ranged from 86-102 cm and 90-101 cm and the mean (±SD) was 93.9±4.4cm and 95.2±3.2 cm respectively. In overweight group, it ranged from 86-103 cm and 89-104 cm and the mean (±SD) was 94.4± 5.4 cm and 95.3±4.5 cm. respectively. On the other hand Obese group, ranged from 88-106 cm and 90-107 cm with a mean (±SD) 96.0±5.7 cm and 96.1±3.9 cm respectively. No significant difference in hip circumference was observed between normal weight, overweight and obese (p>0.05) group of case and control (table-2).

Table-2 : Hip circumference (cm) of case and control group

Group Case (n=50)	Hip circumference(cm) Mean±SD
A (n=16)	95.2±3.2 (90-101)
B (n=18)	95.3±4.5 (89-104)
C (n=16)	96.1±3.9 (90-107)
Control (n=50)	
A1 (n=17)	93.9±4.4 (86-102)
B1 (n=17)	94.4±5.4 (86-103)
C1 (n=16)	96.0±5.7 (88-106)
	P-value
A vs A1	0.373^{ns}
B vs B1	0.555^{ns}
C vs C1	0.939^{ns}
A vs B	0.769^{ns}
B vs C	0.308^{ns}
A vs C	0.191^{ns}
A1 vs B1	0.955^{ns}
B1 vs C1	0.594^{ns}
A1 vs C1	0.567^{ns}

Waist to height ratio of normal weight group of case and control ranged from 0.47-0.51 and 0.45-0.49 and the mean (±SD) was 0.48±0.01 and 0.47±0.01 respectively. In overweight group, the ratio ranged from 0.52-0.56 and 0.50-0.55 and the mean (±SD) was 0.54±0.01 and 0.52±0.01 respectively. On the other hand in obese group, the ratio ranged from 0.59-0.67 and 0.57-0.62, with a mean (±SD) of 0.62±0.02 and 0.59±0.02 respectively. Significant difference in waist to height ratio was observed between normal weight ($p<0.01$), overweight ($p<0.001$) and obese ($p<0.001$) group of case and control (table-3).

Table-3: Waist to height ratio (WHtR) of case and control group

Groups Case (n=50)	Waist to height ratio Mean±SD
A (n=16)	0.48±0.01 (0.47-0.51)
B (n=18)	0.54±0.01 (0.52-0.56)
C (n=16)	0.62±0.02 (0.59-0.67)
Control (n=50)	
A1 (n=17)	0.47±0.01 (0.45-0.49)
B1 (n=17)	0.52±0.01 (0.50-0.55)
C1 (n=16)	0.59±0.02(0.57-0.62)
	P-value
A vs A1	0.001**
B vs B1	0.0001***
C vs C1	0.0001***
A vs B	0.0001***
B vs C	0.0001***
A vs C	0.0001***
A1 vs B1	0.0001***
B1 vs C1	0.0001***
A1 vs C1	0.0001***

Triceps skinfold of normal weight group of case and control ranged from 8-11mm and 8-11mm and the mean (±SD) was 9.63±1.02mm and 9.53±1.01mm respectively. In overweight group, it ranged from 11-15mm and 9-15mm and the mean (±SD) was 12.22±1.22mm and 11.53±1.28mm respectively. Obese group, ranged from 14-26mm and 13-30mm and the mean (±SD) was 18.19±3.56mm and 17.25±4.48mm respectively. No significant difference in triceps skinfold was observed between normal weight, overweight and obese ($p>0.05$) group of case and control(table-4).

Table-4 : Triceps skinfold of control case and control group

Group Case (n=50)	Triceps skinfold(mm) Mean±SD
A (n=16)	9.63±1.02 (8-11)
B (n=18)	12.22±1.22 (11-15)
C (n=16)	18.19±3.56 (14-26)
Control (n=50)	
A1 (n=17)	9.53±1.01 (8-11)
B1 (n=17)	11.53±1.28 (9-15)
C1(n=16)	17.25±4.48 (13-30)
	Pvalue
A vs A1	0.789^{ns}
B vs B1	0.410^{ns}
C vs C1	0.393^{ns}
A vs B	0.020*
B vs C	0.0001***
A vs C	0.0001***
A1 vs B1	0.003**
B1 vs C1	0.0001***
A1 vs C1	0.0001***

Subscapular skinfold of normal weight group of case and control ranged from 10-14mm and 11-14mm, the mean (±SD) was 14.38±1.58mm and 12.53±0.80mm respectively. In overweight group, it ranged from 15-21mm and 13-23mm and the mean (±SD)was 17.67±1.75mm and 16.47±2.55mm respectively. On the other hand in obese group, it ranged from 23-39 mm and 24-42 mm and the mean (±SD) was 34.88±3.54mm and 29.69±5.51mm respectively. Significant difference in subscapular skinfold was observed between of normal weight ($p<0.001$), overweight ($p<0.05$) and obese ($p<0.01$) group of case and control (table-5).

Table-5 : Subscapular skinfold of case and control group

Group Case (n=50)	Subscapular skinfold mm) Mean±SD
A (n=16)	14.38±1.58 (10-14)
B (n=18)	17.67±1.75 (15-21)
C (n=16)	34.88±3.54 (23-39)
Control (n=50)	
A1 (n=17)	12.53±0.80(11-14)
B1 (n=17)	16.47±2.55(13-23)
C1 (n=16)	29.69±5.51(24-42)

	Pvalue
A vs A1	0.0001***
B vs B1	0.042*
C vs C1	0.004**
A vs B	0.0001***
B vs C	0.0001***
A vs C	0.0001***
A1 vs B1	0.002**
B1 vs C1	0.0001***
A1 vs C1	0.0001***

Discussion

The anthropometric parameters (body mass index, hip circumference, waist-height ratio, triceps skinfolds, sub-scapular skinfold) is an easy and remarkable predictor of coronary artery disease risk factors. In the adult male population of our country increasing burden of coronary artery disease has an enormous impact on population health, the health care system and the economy. The need for a better understanding of how to slow down the process of coronary artery disease generation and progression and how to improve preventive and therapeutic strategies is obvious in societies with a steadily rising life expectancy. In the present study, Heath-Carter method is used for a comprehensive evaluation of various parameters.

In the present study, highly significant difference was present between body mass index of case and control (P<0.05). Hip circumference of case was not significantly higher than control (P>0.05). Waist-height ratio of case and control were significantly different (P<0.05).

Similar result found in study of Shankarappa C.[19], in Vydehi Institute Of Medical Sciences and Research Centre, Bangalore India, Uma M.I.[20], in The Maharaja Sayajirao University of Baroda, Gujarat, India, RohitS.[21], and Islam M.T[5].

No significant difference was found between triceps skinfold of case and control, (P>0.05). Study done by Shankarappa C.[19], showed that triceps skinfold of the case was significantly higher than control. Significant difference was observed between subscapular skinfold of case and control (P<0.05). Virendra, C.P[11] found in his study that subscapular skinfold of the case was significantly higher than control.

Conclusion

There is significant difference in body mass index, waist-height ratio, subscapular skinfold between cases and control (p<0.05) and can predict coronary artery disease risk factors in adult male population of Bangladesh. Hip circumference, and triceps skinfold between cases and controls were not significant (p>0.05). So body mass index, waist-height ratio, subscapular skinfold can predict risk factor for coronary arterial disease.

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