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Article

Determination of Some Variables Affecting Risk Factors of Coronary Heart Diseases in University Students

Ali OZKAN[1,2], Mutlu TURKMEN[1,3], Taner BOZKUS[1], Murat KUL[1], Recep SOSLU[4], Fatih YASARTURK[1], Recep AYDIN[1], Umit OZ[1]

[1]Bartin University, School of Physical Education and Sports, Bartin, Turkey; ali_ozkan1@hotmail.com; mutluturkmen@bartin.edu.tr; tanerbozkus@yahoo.com; muratkul61@gmail.com; fatihyasarturk@gmail.com; g.recep.aydin@gmail.com; ozumut06@hotmail.com
[2]Bartin University, Physical Education Research and Application Center, Bartin, Turkey, ali_ozkan1@hotmail.com
[3]Turkish Bocce Bowling and Darts Federation, Ankara, Turkey, mutluturkmen@bartin.edu.tr
[4]Karamanoğlu Mehmetbey University, School of Physical Education and Sports, Karaman, Turkey, recepsosli@gmail.com

Abstract: The purpose of the present study was to determine the relationship between healthy lifestyle behaviors, physical fitness and coronary risk factors in university students. 320 male and female (n_m:171; n_f:149) students from a university participated in this study voluntarily. For the determination of body composition and Body Mass Indexes (BMI), subjects' height, body weight, and skinfold thickness were taken and body fat percentage (%Fat) was determined. Healthy lifestyle behaviors were determined using the healthy lifestyle behaviors questionnaire. Indicators of physical fitness included flexibility (sit-up) (F), muscle strength and endurance (isometric knee (KS), back strength (BS) and a total of shuttle (TS), sprint performance, BMI, and body fat percentage (%fat). Coronary heart disease risk factors included mean arterial blood pressure (systolic (SBP) and diastolic (DBP)), fasting blood levels of triglycerides (TG), total cholesterol (TC), hematocrit (HT), and hemoglobin (HM). Results indicated subjects have normal body mass index, body fat percentage, SBP, DBP, TG, TCF, BS, KS. The results of the Pearson Product Moment Correlation Analysis, indicated that SBP, DBP, TG, TCF, BS, KS for male and female was significantly correlated with flexibility (sit-up) (F), muscle strength and endurance (isometric knee (KS), back strength (BS) and total of shuttle (TS)), sprint performance. ($p<0.01$; $p<0.05$), In conclusion, the findings of the present study indicated that physical fitness and healthy lifestyle behaviors play a determinant role in coronary heart disease risk factors for male and female students from a university.

Keywords: coronary heart disease risk factors, healthy lifestyle behaviors, physical fitness

1. Introduction

Coronary heart disease (CHD) continues to be a leading cause of morbidity and mortality among adults in Europe and North America [1]. For example, CHD is responsible for 29.500 deaths in Australia annually. Ninety-there percent of women and 80% of men who die as a result of CHD are over the age of 65 [2]. Similar statistics are reported in Canada [3] and the United States, United Kingdom [4] and Turkey [5]. Risk factors have included blood pressure, cigarette smoking, cholesterol (TC), LDL-C, HDL-C, and diabetes. 2-4 Factors such as obesity, left ventricular hypertrophy, family history of premature CHD and physically inactive [3] have also been considered in defining CHD risk [1] and increased physical activity leads to greater cardiorespiratory fitness, decreased blood pressure and body weight and increased HDL-C, all of which lead to a more favorable CHD risk profile [6]. The study of adaptive functional changes of the human body induced by physical effort to optimise the physical wellness and to combate the metabolic, circulation and respiratory diseases are in the trends of interdisciplinary scientific research from medicine and physical activity[7,8,9].

A recent meta-analysis showed a significant protective effect of physical activity and physical health-related fitness on CHD [10,11]. Physical inactivity is associated with an increased risk of a wide variety of diseases like cardiovascular diseases, hypertension, type 2 diabetes, obesity, and depression. It has been stated the above-mentioned diseases which are associated with physical inactivity seldom manifest themselves before adulthood, however, promotion of physical activity may be important as physical inactivity may also predispose to a future sedentary lifestyle and hence have an increased risk for these diseases. Several reviews have indicated that the associations among physical activity fitness and CHD risk factors in youth have not been conclusively delineated [3, 11, 12, 13]. A number of more recent studies have examined these associations but results remain equivocal. For example, in the cardiovascular risk in young finns study (9 to 24 years age), active males had lower TG and higher HDL-C level than inactive males, while active females had lower TG levels than inactive females controlling for pubertal status [12]. For instance, Heggebo et al [14] reported that the results in terms of the anthropometrical measures, diastolic and systolic blood pressure were the major factors explaining the cardiorespiratory fitness. Hence, the purpose of the present study was to determine the relationship between healthy lifestyle behaviors, physical fitness and coronary risk factors in university students

2. Materials and Methods

2.1. Subjects

320 male and female (n_m:171; n_f:149) students attending to Bartin University in Turkey participated in this study voluntarily. Their mean age, height, body weight and body fat were 20.89 (2.01) yrs, 168.04 (14.7) cm, 67.2 (16.25) kg, and 20.66 (7.01) respectively. All subjects gave their informed consent for inclusion before they participated in the study. The study was conducted in accordance with the Declaration of Helsinki and this study was approved by Bartin University Institutional Review Board, Ethics Committee and supported by Bartin University Scientific Research Projects Commission (Project No: 2016-SOS-A-006).

2.2. Anthropometric Measurements

Body height (cm), body mass (kg), and percentage of body fat (PBF) measurements were taken for each subject. The body height of the university students were measured by a stadiometer with an accuracy of ±1 cm (SECA, Germany), and while electronic scales (Tanita BC 418, Japan) accurate to within 0.1 kg were used to measure body mass and percentage of body fat [12]. Skinfold thickness was measured with a Holtain skinfold caliper (Holtain, UK) which applied a pressure of 10 g/mm2 with an accuracy of ±2 mm. Gulick anthropometric tape (Holtain, UK) with an accuracy of ±1 mm was used to measure the circumference of extremities. Diametric measurements were determined by Harpenden calipers (Holtain, UK) with an accuracy of ±1 mm.

2.3. Health-promoting life-style profile scale

The participants were asked to provide information about the demographic factors, such as age, gender, and education. Health-promoting Life-style Profile Scale was used for collecting data on their health behaviors. The scale was developed by Walker et al. [16]. It is composed of 48 items and 6 subscales and consists of questions about health-promoting behaviors. The subscales were on self-actualization (SA), health responsibility (HR), exercise (E), nutrition (N), interpersonal support (IS), and stress management (SM). The total score reflects the healthy life-style behavior. Four more items were added to the scale, and now the scale is composed of 52 items [16]. Each respondent was asked to rate each item on Likerts' 1 to 4 response scale where 1 corresponds to never, 2 sometimes, 3 often, 4 regularly. Alpha coefficient reliability of the scale was 0.92, and alpha coefficient reliability of the subscales varied from 0.70 to 0.90. The reliability of the scale for Turkish population was tested by Esin [17] and Akça [18]. Alpha coefficient reliability of the scale was 0.91 in Esin's study and 0.90 in Akça's study.

2.4. Flexibility measurement

Flexibility was evaluated by the sit and reach test which is the most common flexibility test used in health-related fitness test batteries. The subjects sat with their feet approximately hip-width against the testing box. They kept their knees extended and placed the right hand over the left, and slowly reached forward as far as they could by sliding their hands along the measuring board. Reaches short of the toes were recorded as negative forward reach scores, and reaches beyond the toes were recorded as positive forward reach scores in centimeter to the nearest 0.5 cm using the scale on the box [19].

2.5. Strength measurement

Isometric Dynamometer was used for the determination of knee, back, grip strength. Muscular strength was assessed using a Takei strength dynamometer (Takei Scientific Instruments, Tokyo, Japan).

2.6. Coronary Heart Disease Risk Factors

2.6.1. Blood Pressure

Systolic and diastolic blood pressures were measured with a sphygmomanometer (Erka perfect Aneroid, Germany) following the recommendations of the American Heart Association.

2.6.2. Lipids and Lipoproteins

All venous and capillary blood lipid concentrations were determined in the morning after an overnight fasting period of at least eight hours. In each subject, venous and capillary blood samples were collected at the same time. Supplementary capillary sampling was performed on two consecutive days following the first collection. Capillary TC and TG concentrations were determined with the Accutrend® Plus using two drops of blood (15-40 µL) collected from different fingers, by using a lancing device (Accu-check® Softclix® Pro, Roche Diagnostics GmbH, Mannheim, Germany). The Accutrend® Plus test is a capillary serum test. It is based on the retention of blood cells by filtration via a glass fibre fleece when a drop of blood is applied to the test strip. The enzymatic reaction that takes place in the underlying zone of the strip requires an adequate oxygen supply and results in the formation of a colored oxidation product. The reflectance of the strip (measured at 660 nm) is converted to concentration through a simple algorithm. The intra assay precision of Accutrend® Plus, as determined by the manufacturer, was 3.7% and 3.4% for TC and TG respectively. The inter-assay precision for Accutrend® Plus determined with control solution by the manufacturer was lower than 5.0% for TC and 2.4% for TG [20].

2.6.3. Hematocrit and Hemoglobin

The Mission® Plus Hemoglobin (Hb) and Hematocrit Testing System (ACON Laboratories, Inc., US) are for the quantitative determination of hemoglobin and hematocrit in non-anticoagulated capillary whole blood or anticoagulated venous whole blood in EDTA (K2, K3, Na2) or sodium heparin. The testing system is designed for point-of-care use in primary care settings. Estimation of hematocrit is only for hemoglobin values from 12.3 to 17.5 g/dL (123 to 175 g/L). The Mission® Plus hemoglobin and hematocrit Control Solution is intended to validate hemoglobin and hematocrit testing using the Mission® Plus Hemoglobin (Hb) Testing System. Mission® Plus hemoglobin and hematocrit Testing System is for professional in vitro diagnostic use only. This device has not been evaluated for pediatric subjects.

2.7. Statistical Analyses

Means and standard deviations are given as descriptive statistics and the relationship among the relationship between healthy lifestyle behaviors, physical fitness, and coronary risk factors were evaluated by Pearson Product Moment Correlation analysis. All analyses were executed in SPSS for Windows version 21.0 and the statistical significance was set at $p < .05$.

3. Results

Body composition, physical fitness characteristics, the healthy lifestyle behaviors and coronary risk factors of university students are displayed in Table 1, 2 and 3 respectively.

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Table 1: Body Composition Values of University Students

	Age (year)	Height (cm)	Body Weight (kg)	Fat (%)	BMI (kg/m^2)
Male (n:171)	20.37 ± 1.53	162.18 ± 5.56	58.15 ± 8.99	24.31 ± 6.15	22.08 ± 3.18
Female (n:149)	21.53 ± 3.00	175.16 ± 18.66	78.29 ± 16.30	16.35 ± 5.35	24.86 ± 5.56
Male and Female (n: 320)	20.89 ± 2.37	168.04 ± 14.76	67.22 ± 16.25	20.66 ± 7.01	23.34 ± 4.61

Descriptive characteristics of the subjects across body composition are shown in Table 1. According to this table, the highest rate was reached in % fat for male and the lowest rate in female university students. Results indicated that the subjects have normal body mass index, but high body fat percentage.

Table 2: Physical Fitness Characteristics Values of University Students

	BS (kg)	KS (kg)	RGS (kg)	LGS (kg)	F (cm)	TS (repeat)	10m (sec)	20m (sec)	30m (sec)
Female (n:149)	45.19 ± 6.52	44.70 ± 28.33	30.27 ± 5.96	28.18 ± 4.29	17.91 ± 8.49	20.58 ± 7.29	2.57 ± 0.28	3.83 ± 0.32	5.25 ± 0.43
Male (n:171)	110.84 ± 106.9	103.03 ± 35.67	44.81 ± 7.85	42.15 ± 6.97	21.67 ± 10.29	32.26 ± 9.76	2.14 ± 0.29	3.31 ± 0.29	4.55 ± 0.43
Male and Female (n: 320)	79.95 ± 87.13	75.51 ± 43.92	39.13 ± 10.21	36.67 ± 9.27	20.42 ± 9.81	26.80 ± 10.53	2.38 ± 0.35	3.69 ± 0.41	5.02 ± 0.55

Table 2 indicates that university students had good physical fitness performance. Sprint performance and strength is fundamental activity for many sports and also sports performance is the outcome of several variables, including physical fitness. Differentiated physical fitness profiles might, therefore, be considered as a parameter of sports ‑ specific demands, and as such contribute to an enhanced knowledge of the level of performance [21].

Table 3: Coronary Risk Factors Values of University Students

	Heart Rate (rest) (beats per min)	SBP (mm Hg)	DBP (mm Hg)	TG (mg)	TC (mg/dL)	HGB (g/dL)	HT (%)
Male (n:171)	84.13 ± 10.72	112.87 ± 13.11	73.45 ± 11.81	101.3 ± 63.9	173.96 ± 32.29	12.99 ± 0.77	42.17 ± 5.68
Female (n:149)	91.30 ± 10.85	127.53 ± 11.70	78.66 ± 8.33	70.6 ± 38.2	173.31 ± 33.20	14.73 ± 0.97	48.83 ± 7.36
Male and Female (n: 320)	87.97 ± 11.43	120.61 ± 14.49	76.10 ± 10.44	85.9 ± 51.05	173.62 ± 32.72	13.89 ± 1.23	46.62 ± 7.53

According to Table 3, the mean values for HR, SBP, DBP, TG, TC, HGB, and HT were in the normal range for both male and female students. In agreement with national and international literature, the data from the present study shows a considerable prevalence of cardiovascular risk factors among young adults. A family history of chronic diseases was reported by many of the university students. Several studies have revealed a greater prevalence of cardio vascular risk factors in relatives of individuals with cardiovascular diseases and type 2 diabetes mellitus when compared with those without family history of these diseases.

Table 4: Mean and standard deviation of scores of the healthy life-style behavior among the study participants

	Male and Female (n: 320)	Female (n:149)	Male (n:171)
Self-actualization	38.45 ± 7.10	36.02 ± 5.99	40.51 ± 7.33
Health responsibility	23.89 ± 7.17	21.10± 6.53	26.29 ± 6.85
Exercise	10.56 ± 4.05	10.25 ± 4.03	10.82 ± 4.06
Nutrition	17.66 ± 3.66	15.50 ± 2.86	19.52 ± 3.05
Interpersonal support	21.11 ± 3.65	20.07 ± 3.08	22.00 ± 3.58
Stress management	18.63 ± 4.42	17.22 ± 3.55	19.85 ± 4.75
Total score of the healthy and life-style behavior	130.36 ± 24.55	119.78± 20.54	139.12 ± 24.22

Table 4 shows the healthy life-style behaviors of the university students. According to this table, the highest rate was reached in self-actualization sub-scale, and the lowest rate in exercise. This finding depicts the contradictory attitude of university students towards exercise.

Correlations between physical fitness and coronary risk factors of university students are presented in Table 5.

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Table 5: Correlations between physical fitness and coronary risk factors of university students

	BS	KS	F	TS	RPS	LPS	10m	20m	30m
HR	,244**	,430**	,409**	,178**	,202**	,195**	-,277**	-,408**	-,426**
SBP	,171**	,363**	,130*	,265**	,403**	,421**	-,296**	-,387**	-,340**
DBP	NS	,160**	NS	,151*	,246**	,254**	-,175*	NS	NS
TG	NS	,261**	NS	NS	,310**	,263**	-,203*	-,290**	-,290**
TC	NS	NS	NS	NS	NS	NS	NS	NS	NS
HT	,155*	,219**	NS	,212**	,374**	,366**	-,287**	-,275**	-,240*
HGB	,385**	,485**	NS	,367**	,482**	,565**	-,385**	-,316**	-,396**

**p<0.01, * p<0.05

As seen in Table 5, Results of Pearson's Product Moment Correlation Analyses indicated significant positive correlations between physical fitness and coronary risk factors of university students in the present study (p<0.05). The findings of this study indicated that physical fitness was an indicator of coronary risk factors of university students.

Correlations between physical fitness and coronary risk factors of male and female university students are presented in Table 6 and 7.

Table 6: Correlations between physical fitness and coronary risk factors of male university students

	BS	KS	F	TS	RPS	LPS	10m	20m	30m
HR	,176*	,446**	NS	NS	,495**	NS	NS	-,404**	-,345*
SBP	NS	NS	NS	NS	NS	NS	NS	NS	NS
DBP	NS	NS	NS	NS	NS	NS	NS	NS	NS
TG	NS	NS	NS	NS	NS	NS	,326**	,316*	NS
TC	NS	NS	NS	NS	NS	NS	,326**	,316*	NS
HT	NS	NS	NS	NS	NS	NS	NS	NS	NS
HGB	,221*	NS	NS	NS	NS	NS	NS	NS	NS

**p<0.01, * p<0.05

As seen in Table 6, results of Pearson's Product Moment Correlation Analyses indicated significant positive correlations between physical fitness and coronary risk factors of male university students (p<0.05). The findings of the present study indicated that physical fitness was an indicator of coronary risk factors of male university students.

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Table 7: Correlations between physical fitness and coronary risk factors of male university students

	BS	KS	F	TS	RPS	LPS	10m	20m	30m
HR	NS	NS	NS	NS	NS	NS	NS	NS	NS
SBP	**,364****	**,265****	NS	**,219****	**,380****	**,401****	NS	NS	NS
DBP	NS	NS	NS	NS	**,184***	**,253****	NS	NS	NS
TG	NS	NS	NS	NS	**,319****	**,337****	NS	NS	NS
TC	NS	NS	**,171***	NS	NS	NS	NS	NS	NS
HT	NS	NS	NS	**,193***	**,394****	**,408****	NS	NS	NS
HGB	**,349****	**,328****	NS	**,307****	**,458****	**,580****	NS	**,228***	NS

**p<0.01, * p<0.05

As seen in Table 7, results of Pearson's Product Moment Correlation Analyses indicated significant positive correlations between physical fitness and coronary risk factors of female university students in the study subjects (p<0.05). The findings of the present study indicated that physical fitness was an indicator of coronary risk factors of female university students in the Bartin University of Turkey.

Correlations between the healthy life-style behaviors and coronary risk factors of male and female university students are presented in Table 8 and 9.

Table 8: Correlations between healthy life-style behaviors and coronary risk factors of male university students

	SA	HR	E	N	IS	SM	HLSB
HR	**.208****	**.245****	NS	**.355****	**.265***	**.278****	**.287****
SBP	NS	NS	**.134***	**.262****	**.123***	NS	NS
DBP	NS	NS	NS	NS	NS	NS	NS
TG	NS	**.247****	**.125****	**225****	**.187***	**.162***	**.214****
TC	NS	**.126****	**.205***	NS	NS	NS	**.153***
HT	**.128***	**248****	**.297***	**293****	**.189***	**.176***	**.234***
HGB	**.248****	**.282****	**.239****	**369****	**.215***	**.232****	**.258***

**p<0.01, * p<0.05

As seen in Table 8, results indicated significantly positive correlations between healthy life-style behaviors and coronary risk factors of male university students in the study subjects (p<0.05). The findings of the present study indicated that healthy life-style behaviors was an indicator of coronary risk factors of male university students in the Bartin University of Turkey.

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Table 9: Correlations between healthy life-style behaviors and coronary risk factors of female university students

	SA	HR	E	N	IS	SM	HLSB
HR	.210**	.203**	NS	.334**	.214*	.267**	.275**
SBP	NS	NS	.145*	.245**	.153*	NS	NS
DBP	NS	NS	NS	NS	NS	NS	NS
TG	.102*	.252**	.152**	227**	.179*	.141*	.206**
TC	NS	NS	.148*	NS	NS	NS	NS
HT	.149*	256**	.298*	289**	.176*	.149*	.211**
HGB	.217*	.276**	.248**	387**	.146*	.228**	.295**

**p<0.01, * p<0.05

As seen in Table 9, results indicated significantly positive correlations between healthy life-style behaviors and coronary risk factors of female university students in the study subjects ($p<0.05$). The findings of the present study indicated that healthy life-style behaviors were an indicator of coronary risk factors of female university students in the Bartin University of Turkey.

4. Discussion

The findings of the present study indicated that physical fitness plays a determinant role in coronary heart disease risk factors for male and female students from a university. In addition, PAL was found to be an important factor in coronary heart disease risk factors of university students. Coronary heart disease risk factors (CHDRF) included mean arterial blood pressure (systolic (SBP) and diastolic (DBP)), fasting blood levels of triglycerides (TG), low-density lipoprotein cholesterol (LDL-C), high-density lipoprotein cholesterol (HDL-C) and total cholesterol (TC) in this present study [1]. Further, the pattern of loadings in boys and girls remarkably similar in this sample (Table 3) suggesting that sex differences in the relationship between PAL and CHDRF are small if they exist. And also the findings of the present study are consistent with previous studies that have demonstrated relationships between PAL and CHDRF, particularly for blood lipids [3, 12]. Although physical fitness (PF) was the best predictor of SBP, DBP, TG, LDL-C, HDL-C, TC, while PAL were not shown to be significant predictors. The result indicate that F, KS, BS, TS, VO_{2max}, BMI and %fat are important determinants of CHDRF in university students, with PF exhibiting a slightly stronger relationship than PAL. However, this result must be tempered by the limitations of the study. Although physical record used is a reliable measure of habitual activity levels, the error associated with the indicators of physical activity is undoubtedly greater than error

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associated with the measurements of PF [3]. Another explanation for the greater relationship between fitness and CHDRF may be genetics. Perhaps genes which are influencing physical fitness also influence CHDRF (genetic pleiotropy) [3]. Eisenmann et al [11] reported that a significant relationship between adolescent cardiorespiratory fitness and adult body fatness and a lack of an association between adolescent cardiorespiratory fitness and adult cholesterol, blood pressure, and glucose levels. Adolescent body fatness is moderately related to selected adult CHDRF and this could be influencing the pattern of loading for PF, independent of chronological age [3].

5. Conclusion

To sum up, an important prevalence of cardiovascular risk factors was observed in the university students included in the present study. Considering that some of the cardiovascular risk factors are modifiable by changes in lifestyle, educational programs aimed at motivating the adoption of healthy lifestyle choices would be helpful, especially in upcoming health care professionals, as it is them who will be taking care of the health of the population in the future [22].

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Author Contributions:

Ali Ozkan was the primary one shaping the main text and Mutlu Turkmen formatted the last version of the text in English. All the other authors contributed to the article equally in gathering data, scanning the literature, formatting the research, and finally revising the text.

Corresponding Author:

Bartin University, School of Physical Education and Sports, Bartin, Agdaci Kampusu, 74100, TURKEY, E-mail: mutluturkmen@bartin.edu.tr; Tel: +905325057565

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