Int. J. Morphol.,
40(2):460-465, 2022.

Examination of Anthropometric Characteristics of Police Academy Students

Examen de las Características Antropométricas de los Estudiantes de la Academia de Policía

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SUMMARY: Anthropometric data, which is highly correlated with health and high level of physical capacity, is very important for police officer. The aim of this study was to examine the anthropometric data of police college students and compare in terms of gender. Fifty-two police college students (32 females and 20 males) participated in the present study. Index calculations were made by applying anthropometric test measurements to all participants. The data included anthropometric (length measurements, width measurements, circumference measurement) and index [Body Mass Index (BMI), Cormic Index (C-Index), Body Adiposity Index (BAI), Ponderal Index (PI), Conicity Index (Con-Index) Waist-to-Height Ratio (WHtR)] parameters. The Independent Sample T-Test was used to analyze the difference in groups. A statistically significant difference was found in all parameters except leg length in length measurements ($p<0.05$). The mean of all width measurements except shoulder width of females was higher than that of male participants. Differences were obtained in all variables except hand and hip-width ($p<0.05$). In circumference measurements, there was a difference between the groups in the measurement values of the relaxed arm, maximum arm, wrist, shoulder, chest, and hip circumferences ($p<0.05$). The BAI, PI, WHtR, and Con-Index values were significantly different between groups ($p<0.05$). In conclusion, the length, width, circumference, and kinanthropometric indexes of male and female police candidates differ. Although male have higher mean values in length and circumference measurements, female have a higher mean for width measurements. Females have higher mean values in general in terms of index values and they are inincreased risk group in terms of WHtR index. It can be recommended for all participants, especially females, to participate in regular physical activity after they start working.

KEY WORDS: Police officer, Anthropometric measures, Kinanthropometry indexes.

INTRODUCTION

The police profession is a physically and psychologically very stressful and high-risk profession (Dawes *et al*., 2016). The police officers must be healthy, vigorous, and have a high level of physical capacity, with their mobility, adapted tactics, and modern equipment, while struggling with the adverse conditions and crimes brought about by these risks with great effort (Anderson *et al*., 2001). For this reason, physical adequacy tests are conducted in many countries before entering the police force.

A good police officer should exercise and do sports regularly to maintain physical and mental health and efficiently serve many years to be prepared and resistant to all kinds of difficulties while having a healthy body (Anderson *et al*.). Police officers who are physically well prepared and of adequate morphological status are less prone to illness in the workplace, are more productive, and are better able to tolerate stress (Zorec, 2001; Yao *et al*., 2016; Simenko, 2018). Anthropometric factors such as body mass and body composition impact a person's ability to perform basic tasks required for the job (Dawes *et al*.). As in many occupational groups where physical performance is important, physical fitness and anthropometric parameters are considered essential in the police profession. This feature

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Received: 2021-07-07 Accepted: 2022-02-11

is a serious criterion in determining an individual's athletic ability (Mondal *et al*., 2011). In addition, police officers may have to use guns and rifles during their operations. It is known that postural balance, time to fix the target, and a certain level of strength are critical for successful performance, especially in shooters (Peljha *et al*., 2018). Anthropometric dimensions and morphological characteristics are very important in determining the performance of an athlete or an individual engaged in physical activity. The results obtained indicate that a certain somatotype significantly affects reaching a high profile in physical activity (Gutnik *et al*., 2015).

In previous studies, it has been stated that body fat mass increases the risk rate of diseases such as cardiovascular diseases, high blood pressure, diabetes, and mortality (Ashwell *et al*., 2012). In this context, the study aims to determine the anthropometric characteristics of police academy students who will work in intense physical activity and a tiring work tempo.

MATERIAL AND METHOD

This study included 52 police college students (32 females and 20 males). Overall mean±SD for age, height, weight, and BMI were 19.98±1.35 y, 170.69±8.13 cm, 67.81±9.22 kg, and 23.21±2.27 kg/m^2, respectively (Table I). The same researcher obtained all measurements on the same day in the sports science laboratory. Written informed consent was obtained from all participants. Approval was obtained from a local clinical research ethics committee.

Anthropometric measurements were made according to standardized measuring instruments and measuring techniques recommended by the International Society for Advancement of Kinanthropometry (ISAK) (Marfell-Jones *et al*., 2012). The following measurements were registered: a) bust-length (BL), arm length (AL), forearm length (FL), arm span (AS), hand length (HL), thigh length (TL), and leg length (LL); b) shoulder width (SW), elbow width (EW), wrist width (WRW), hand width (HW), waist width (WAW), hip-width (HW), knee width (KW) and ankle width (AW); c) relaxed arm circumference (RAC), maximum arm circumference (MAC), wrist circumference (WRC), shoulder circumference (SC), chest circumference (CC), waist circumference (WAC), hip circumference (HC), thigh circumference (TC), mid-calf circumference (MC) by measuring in cm with anthropometry kit (Holtain Limited, UK). Bodyweight was measured with a scale with a precision of 0.1 kg (without clothes and shoes), and height was measured to the nearest 0.1 cm with a stadiometer (anatomical position) (SECA, Germany) according to standardized procedures (Marfell-Jones *et al*.).

Each participant was calculated Body Mass Index (BMI)=(weight / height2), Cormic Index (C-Index)=[(sitting height / standing height) x 100], Body Adiposity Index (BAI)=[(hip circumference / height1.5) – 18], Ponderal Index (PI)=(height x weight-0.333), Conicity Index (Con-Index)=[waist circumference / (0.109 x square root of weight / height)], Waist-to-Height Ratio (WHtR)=waist / height.

All data were analyzed with SPSS (SPSS for Windows, 2008, SPSS Inc., Chicago, Illinois, ABD), and statistical significance was set at $p \leq 0.05$. The Kolmogorov-Smirnov test was used to assess normality. The data were expressed as the mean, standard deviation, and effect size. We interpreted the effect sizes according to Cohen (1992) guideline; d = 0.20 “small” effect size, d = 0.50 “medium” effect size, and d = 0.80 “large” effect size. The Independent Sample T-Test was used to analyze the difference in groups.

RESULTS

When the length measurements of the groups were compared, all length parameters except thigh-length had higher mean values in male subjects, and a statistically significant difference was found in all parameters except leg length ($p<0.05$) (Table II).

Width measurement analyzes of women and men are presented in Table III. It is an important finding that the mean of all width measurements except shoulder width of women is higher than that of male participants. In addition, differences were obtained in all variables except hand and hip-width ($p<0.05$).

Table I. Descriptive characteristics of subjects (Mean ± SD).

Variables	Male (n=20)	Female (n=32)	Total (n=52)	p-value
Age (year)	21.00 ± 1.34	19.34 ± 0.90	19.98 ± 1.35	<0.05
Height (cm)	179.25 ± 6.13	165.34 ± 2.98	170.69 ± 8.13	<0.05
Weight (kg)	75.25 ± 7.53	63.16 ± 6.85	67.81 ± 9.22	<0.05

SD, standard deviation.

Table II. Comparison of length measurements between male and female groups.

	Male (n=20)	Female (n=32)		95 % CI	
Variables	Mean ± SD	Mean ± SD	ES	LB	UB
Sitting-length (cm)	97.50 ± 5.40[a]	89.34 ± 2.52	1.94	5.50	10.81
Arm length (cm)	75.20 ± 3.75[a]	71.00 ± 2.15	1.37	2.31	6.09
Forearm length (cm)	28.20 ± 2.91[a]	25.48 ± 1.11	1.24	1.31	4.12
Arm span (cm)	178.25 ± 7.91[a]	168.97 ± 4.84	1.42	5.26	13.30
Hand length (cm)	19.85 ± 1.09[a]	18.52 ± 2.01	0.82	0.35	2.32
Thigh length (cm)	32.85 ± 2.76[a]	50.41 ± 1.83	-7.50	-18.83	-16.28
Leg length (cm)	42.05 ± 3.66	41.88 ± 1.86	0.06	-1.64	1.99

SD, standard deviation; ES, effect size; CI, confidence interval; LB, lower bound; UB, upper bound; a, significant difference between male and female groups.

Table III. Comparison of width measurements between male and female groups.

	Male (n=20)	Female (n=32)		95% CI	
Variables	Mean ± SD	Mean ± SD	ES	LB	UB
Shoulder width (cm)	48.75 ± 2.34[a]	44.23 ± 4.57	1.25	2.58	6.45
Elbow width (cm)	10.80 ± 0.83[a]	14.63 ± 5.00	-1.07	-5.66	-1.99
Wrist width (cm)	6.95 ± 0.39[a]	9.56 ± 3.34	-1.10	-3.83	-1.40
Hand width (cm)	11.00 ± 0.56	12.85 ± 5.14	-0.51	-10.06	1.04
Waist width (cm)	34.35 ± 2.46[a]	36.16 ± 2.53	-0.73	-3.24	-0.37
Hip-width (cm)	49.60 ± 3.30	50.83 ± 3.14	-0.38	-3.06	0.60
Knee width (cm)	13.35 ± 1.42[a]	19.23 ± 1.43	-4.13	-6.70	-5.07
Ankle width (cm)	10.60 ± 1.73[a]	12.36 ± 0.80	-1.31	-2.61	-0.91

SD, standard deviation; ES, effect size; CI, confidence interval; LB, lower bound; UB, upper bound; a, significant difference between male and female groups.

Table IV. Comparison of circumference measurements between male and female groups.

	Male (n=20)	Female (n=32)		95% CI	
Variables	Mean ± SD	Mean ± SD	ES	LB	UB
Relaxed arm circumference (cm)	30.10 ± 3.77[a]	26.38 ± 2.21	1.20	1.82	5.63
Maximum arm circumference (cm)	33.00 ± 3.21[a]	28.11 ± 2.05	1.82	3.43	6.35
Wrist circumference (cm)	17.20 ± 0.70[a]	14.93 ± 3.92	0.81	0.83	3.72
Shoulder circumference (cm)	112.50 ± 6.15[a]	97.36 ± 16.34	1.23	7.46	22.82
Chest circumference (cm)	96.75 ± 6.36[a]	85.72 ± 4.14	2.06	8.11	13.95
Waist circumference (cm)	85.00 ± 4.51	86.06 ± 6.05	-0.20	-4.22	2.10
Hip circumference (cm)	101.15 ± 3.90 [a]	96.06 ± 11.25	0.61	0.71	9.47
Thigh circumference (cm)	57.35 ± 3.54	57.67 ± 3.86	-0.09	-2.46	1.82
Mid-calf circumference (cm)	36.90 ± 2.53	36.30 ± 2.32	0.25	-0.77	1.98

SD, standard deviation; ES, effect size; CI, confidence interval; LB, lower bound; UB, upper bound; a, significant difference between male and female groups

Table V. Comparison of index measurements between male and female groups.

	Male (n=20)		Female (n=32)			95% CI	
Variables	Mean ± SD	Evaluation	Mean ± SD	Evaluation	ES	LB	UB
BMI	23.37 ± 1.72	Normal	23.12 ± 2.58	Normal	0.11	-0.95	1.45
C-Index	54.39 ± 2.29	Medium-sized trunk	54.04 ± 1.56	Medium-sized trunk	0.18	-0.84	1.54
BAI	24.22 ± 2.44[a]	Normal	27.19 ± 5.28	Normal	-0.72	-5.14	-0.79
PI	42.58 ± 1.38[a]	Normal	41.68 ± 1.65	Normal	2.56	0.01	1.79
WH_tR	0.47 ± 0.03[a]	No increased risk	0.52 ± 0.04	Increased risk	-1.41	-0.67	-0.03
Con-Index	1.21 ± 0.06[a]	Normal	1.28 ± 0.05	Normal	-1.27	-0.02	-0.04

BMI, Body Mass Index; C-Index, Cormic Index; BAI, Body Adiposity Index; PI, Ponderal Index; WHtR, Waist-to-Height Ratio; Con-Index, Conicity Index; SD, standard deviation; ES, effect size; CI, confidence interval; LB, lower bound; UB, upper bound; a, significant difference between male and female groups

The comparison of the circumference measurement values of the subjects by sex is presented in Table IV. There was a difference between the groups in the measurement values of the relaxed arm, maximum arm, wrist, shoulder, chest, and hip circumferences ($p<0.05$).

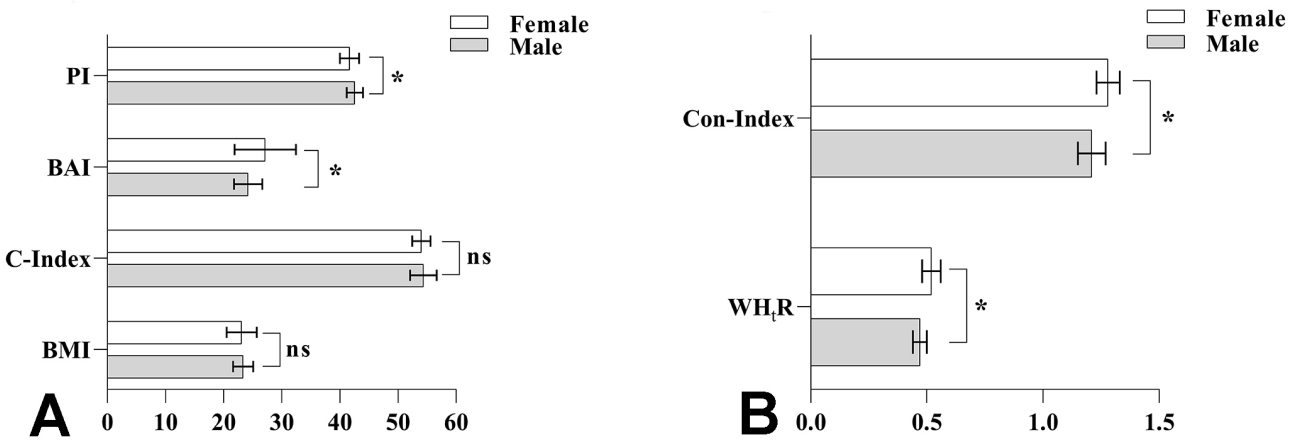

Fig. 1. Comparison of index measurements between male and female groups. * p<0.05; ns, non-significant; BMI, Body Mass Index; C-Index, Cormic Index; BAI, Body Adiposity Index; PI, Ponderal Index; WHtR, Waist-to-Height Ratio; Con-Index, Conicity Index

In Table V, the index values by gender were compared. Accordingly, BAI (es= -0.72; 95% CI= -5.14 to -0.79), PI (es= 2.56; 95% CI= 0.01 to 1.79), WHtR (es= -1.41; 95% CI= -0.67 to -0.03) and Con-Index (es= -1.27; 95% CI= -0.02 to -0.04) values were significantly different (p<0.05). BMI (es= 0.11; 95% CI= -0.95 to 1.45) and C-Index mean values (es= 0.18; 95% CI= -0.84 to 1.54) were similar (p>0.05) (Fig. 1).

DISCUSSION

The study aimed to examine the effects of gender on anthropometric parameters by evaluating the anthropometric data of police academy students. As a result of the research, major findings were obtained. When these findings are evaluated, although men have higher mean values in all parameters except thigh length in length measurements, women have higher mean values in all data except shoulder width in width parameters. In circumference measurements, men have wider circumference measurements in all parameters except waist and thigh circumferences. When the kinanthropometric indexes were evaluated, significant differences emerged in the BAI, PI, WHtR, and Con-Index indexes, but when evaluated in terms of norm ranges, it was seen that women were in the increased risk group in the WHtR index. The very limited number of studies on police academy students increases the importance of all the findings.

Studies examining anthropometric factors on police officers and candidates indicate that anthropometric data and the factors affecting these data are directly related to professional performance, disease risks, and quality of life in police officers. When some of the findings in the literature are evaluated, Da Silva *et al*. (2014) found high levels of significance between police officers' fat percentage, Con-indexes, daily working hours, years of service, physical activity levels, and coronary disease risk and quality of life. It is emphasized by the researchers that as the duration of professional experience in police officers increases, there is a significant increase in body mass, fat percentages, and fat masses (Boyce *et al*., 2008). In this respect, it is thought that it may be beneficial for police academy students to undergo some physical adequacy tests every year to encourage them to do sports after starting their profession. In another study, it was reported that there was a significant increase in body weight and waist circumference as the years of work increased. Researchers have reported that, on average, police officers with 15 years of professional experience have an increased rate of overweight, with waist circumferences increasing by >94 cm in approximately two-thirds and >102 cm in one-third (Sörensen *et al*., 2000). For this reason, it is thought that it is very important to examine the anthropometric characteristics of police academy students who have not yet started their professional life, considering the expected increase.

Studies argue that the body types of police officers should be in a mesomorphic structure due to the intense use of power and speed components under dangerous working conditions. It has been reported that the ectomorph structure should not be dominant, especially in police officers other than those working in office duties (Santos & Fernandes Filho, 2007; Simenko *et al*., 2016). It is stated that the fact that the body structure and anthropometric characteristics are so important in the police officers in terms of their ability to neutralize suspects, detain them, separate conflicts and control the masses, as required by their profession (Anderson

et al.; Vuckovic *et al*., 2011). In addition, some studies have determined that the police officers, who are in all these situations that require strength and power, have similar anthropometric characteristics with martial arts athletes such as jiu-jitsu, judo, and wrestling (Simenko). It is thought that these results are similar since the police officers often encounter situations that require combat, just like in martial arts. Considering all these aspects, it is seen in our current study that the anthropometric characteristics of police candidates show similarities with the data in the literature. However, they are lower but between normal values than police officers with more professional experience. The high results of the anthropometric data of the police officers with high professional experience may occur since they cannot eat regularly during work-life and shifts, do not do regular sports, and go above the normal ranges depending on the age factor.

Studies examining the anthropometric values of candidates and police officers with professional experience in terms of gender show that female and male police officers or candidates have similar BMI rates (Charles *et al*., 2008). Although the BMI values revealed in these studies are statistically similar, it is also seen that men have higher BMI values than female police officers or candidates. A study stated that although the males among female and male police candidates tend to gain weight and bulk up by increasing their nutritional tendencies, the female candidates' nutritional tendency decreases, and they do not tend to gain weight or bulk up (Jankovic *et al*., 2008). Charles *et al*. reported that male police officers had higher BMI, waist circumference, waist to hip and height ratio, and abdominal height ratios than female police officers in their study. In addition, in this study, it is seen that male police officers consume more alcohol and have lower physical activity levels than females. As Jankovic *et al*. emphasized, the results support the tendency of male police officers to gain weight and bulk up. Our research showed that male candidates outperformed females in most length and circumference measurements. In width measurements, women have higher mean values. It is also seen that women have similar results with men in the waist, hip, thigh, and mid-calf regions. It is thought that this situation arises from the anatomically congenital pelvis width of women and the waist and hips depending on estrogen hormones, and therefore, they reveal similar findings with men only in these regions.

Indexes generally show more reliable data than BMI, showing body fat distribution and muscle mass (Ashwell *et al*.; Usha Shenoy, 2017). In some studies, although BMIs are normal, an increase in indexes indicates obesity (Liu *et al*., 2011; Helal, 2014). Therefore, with the help of indexes, it is possible to determine whether the obesity in the individual is cylindrical or biconal, and appropriate measures can be taken to lose weight. In addition, studies have stated that indexes are a better indicator of coronary risk (Da Silva *et al*.; Usha Shenoy). Pitanga & Lessa (2004) determined a threshold value of 1.25 in the Conicity Index for men to predict cardiovascular risk. While the Conicity Index value in this study is close to the recommended range for men, it is above the threshold value for women. Another important finding is that women are in the increased risk group in the WHtR index, which is used to detect abdominal obesity. Women are shorter in stature, waist parameters have higher mean values than men in width, and circumference measurements explain this ratio. However, according to these results, it can even be recommended to update the anthropometric conditions of the academy, taking into account the less active life of the students in the following years.

As a result, in our current study, the length, width, circumference, and kinanthropometric indexes of female and male police candidates differ. Men have a higher mean value for length and circumference measurements, while women have a higher mean for width measurements. The women's width measurements being higher and the waist circumference being wider increased the Conicity Index value, while it revealed an increased risk results in the WHtR index. In this respect, it is recommended that all police academy students, especially women, participate in regular physical activity after starting their professional life. In addition, it is thought that the indexes in the current research should be used before the physical adequacy tests in the police academy entrance exams.

KABADAYI, M.; MAYDA, M. H.; YILMAZ, A. K.; KARADUMAN, E.; ERAIL, S.; BOSTANCI, Ö.; KARAKAS¸, F.; TILEKLI, M. M. & YILMAZ, C. Examen de las características antropométricas de los estudiantes de la academia de policía. *Int. J. Morphol., 40(2)*:460-465, 2022.

RESUMEN: Los datos antropométricos que están fuertemente correlacionados con la salud y el alto nivel de capacidad física, son muy importantes para el oficial de policía. El objetivo de este estudio fue examinar los datos antropométricos de estudiantes universitarios de policía y compararlos en relación al género. En el estudio participaron 52 estudiantes universitarios de policía (32 mujeres y 20 hombres). Los cálculos de los índices a los participantes se realizaron aplicando mediciones de pruebas antropométricas. Los datos antropométricos incluyeron (medidas de longitud, ancho y circunferencia) además de índice [Índice de masa corporal (IMC), Índice córmico (Índice C), Índice de adiposidad corporal (IAC), Índice ponderal (IP), Índice de conicidad (Con- Índice) y Relación cintura-altura (WHtR)]. Se utilizó la prueba T para muestras independientes para analizar la diferencia entre los grupos. Se encontró una diferencia

estadísticamente significativa en todos los parámetros excepto en la longitud de las piernas (p<0,05). La media de todas las medidas de ancho excepto el ancho de los hombros de las mujeres fue mayor que la de los hombres. Se obtuvieron diferencias en todas las variables excepto en el ancho de manos y caderas (p<0,05). En las medidas de circunferencia, hubo diferencia entre los grupos en el brazo relajado, brazo máximo, muñeca, hombro, pecho y cadera (p<0,05). Los valores de BAI, IPI, WHtR y Con-Index fueron significativamente diferentes entre los grupos (p<0,05). En conclusión, los índices de largo, ancho, circunferencia y cineantropométricos de los candidatos a policías difieren entre hombres y mujeres. Aunque los hombres tienen valores medios más altos en las medidas de longitud y circunferencia, las mujeres tienen una media más alta en las medidas de ancho. Las mujeres tienen valores medios más altos en general, en términos de valores de índice, y se encuentran en un grupo de mayor riesgo en términos de índice WHtR. Se puede recomendar a todos los candidatos y candidatas a policía, especialmente a las mujeres, que participen en actividades físicas regularmente después de comenzar a trabajar.

PALABRAS CLAVE: Policía; Medidas antropométricas; Índices cineantropométricos.

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