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Investigation of Some Anthropometric and Motoric Characteristics of Paramedic Students

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Abstract
Aim: This research aimed to analyze the vocational adjustment of paramedic students in health sciences in terms of some anthropometric and motoric features. Material and Method: The research is a cross-sectional study, which is one of the quantitative research methods aimed at paramedic students. The study group consisted of 60 (n_{Male}=34, n_{Female}=110) first-year students (n_{Male}=16, n_{Female}=44; male: 19.63±1.36 years, female: 19.57±1.15 years) receiving education at Kirsehir Ahi Evran University (KAEU) Health Services Vocational School in the First and Emergency Aid Program who agreed to participate in the research voluntarily. To determine the descriptive statistics of the study group, gender and age variables were collected through the direct data collection method. After this process, required measurements, including somatotype measurements, were performed to determine the height, body weight (BW), hand grip strength (HGS), and arm mass values. After determining descriptive statistics, the Wilcoxon comparison test and Spearman correlation statistical test were performed, and the significance level was taken as $p<0.05$. In addition, relevant ethical permissions were obtained for the research. Findings: In addition to some differences with reference to the gender variable (Table 2), several significant correlations between hand grip strength and upper extremity (Tables 3-5) were identified. Moreover, a highly significant positive correlation was found between relative arm force (RAF) and hand grip strength ($r_{RAF-HGS}$ = .707; $p<0.001$). When their somatotype structures were analyzed, male students were determined to have balanced ectomorph (1.77-1.96-3.05), while female students had meso ectomorph (0.08-1.09-2.24) and overall (males & females) had meso ectomorph component (0.53-1.32-2.46). Conclusion and Suggestions: It was observed that the height values of the students were below some minimum value criteria for occupations such as police work, while their body mass index (BMI) values were within the normal range. Although the results were close to sedentary health professionals in terms of HGS, they were at a lower level than those of athletes. It is obvious that the students had different somatotype components regarding athletes. Based on this research, the conduct of further qualitative research on field workers is recommended as well as introducing some certain physical competence criteria in the recruitment of paramedic students.

Keywords: Morphological and Motoric Features, Paramedic, Vocational Adjustment

1. Introduction

Just like individuals make evaluations for choosing the appropriate profession for themselves, it is known that some professions recruit individuals by stipulating the individual's eligibility for the profession. Thus, two concepts, which are choice of profession and vocational adjustment, come forward. It is observed that studies on occupational choice are conducted through survey-type data collection tools (scale, questionnaire, etc.) (Onler &

Varol Saracoglu, 2010) that measure vocational adjustment within the quantitative research types. Here, *vocational adjustment* (Tureng, 2022), as stated in the relevant dictionary category, deals with the individual's perspective on the profession from a psychological aspect. In a study conducted from this perspective, Tosunoz et al. (2019) state that the vocational adjustment of those who choose a profession willingly is more effective. Using reverse logic, this can be interpreted that "those who are eligible for the profession will be more effective in the profession". Vocational adjustment, emerging as another concept, is based rather on the physical evaluation of the individual. Some professions such as police work, military service and firefighting can be given as examples. In the context of the study group, this research includes a paramedics-oriented investigation suggesting that high school graduates, Emergency Medical Technicians (EMT), and associate degree graduates are not subjected to any physical adequacy assessment prior to the start of their recruitment.

Following this conceptual framework, some terms and methods need to be addressed concerning physical evaluations. Strength, speed, and endurance make up the base of motor features (Sahin, 2006; Muratli et al., 2007; Ozdemir, 2009). The strength factor is stated to have a special importance among these features (Sevim et al., 1996). Concurrently, strength is, directly and indirectly effective in improving athlete performance (Aydos et al., 2004; Hekim and Hekim, 2015; Gunay et al., 2017). Hand Grip Strength (HGS) measurement is performed to determine the strength of individuals (Gencay et al., 2017). As one of the regional strength measurements, HGS is a reliable measurement method. HGS is also used to evaluate overall body strength as well as upper extremity performance (Erdogan et al., 2016; Kecelioglu and Akcay, 2019). Relative strength, one of the strength types, is described as the greatest strength that an individual can develop against their own body weight (BW) and is used to compare the strength of both individuals and athletes (Sevim, 2006; Katch et al., 2011). As a novel approach to determining relative strength, the Relative Arm Force (RAF) method is an important measurement tool (Marangoz, 2022a). Besides these motor features, anthropometric factors are highly effective in the correlation between development and motor performance (Akcakaya, 2009). Anthropometric techniques can be employed to evaluate the effects of body structure differences and physical training on anthropometric characteristics in all sports branches (Yildirim and Ozdemir, 2010).

Considering the above-given information, this research, focusing on paramedic students in health sciences, aimed to examine the vocational adjustment of the study group concerning some anthropometric and motor features. Thus, the secondary aim of our research was to provide recommendations for both the students studying in the field and the recruitment methods in Turkey.

2. Materials and Methods

2.1. Type of Research

This research, conducted as an example of the quantitative research methods regarding paramedic students, is cross-sectional. Besides, it includes comparative and correlational statistical tests.

2.2. Place and Time of Research

The study was conducted at Kirsehir Ahi Evran University (KAEU) Health Services Vocational School (HSVS) in the First and Emergency Aid Program (FEAP) in the spring semester of the 2021-2022 Academic Year in the KAEU Sports Science Faculty (SSF).

2.3. Study Group

The study group comprised 60 (n_{Male}=16, n_{Female}=44; N=60) first-year students studying at KAEU HSVS in the FEAP (n_{Male}=34, n_{Female}=110; N=144) who agreed to take part in the study voluntarily. In addition, as a result of the G*Power analysis based on the study of Turkmen et al. (2010), which is considered relevant to our research, it was determined that 45 people would suffice as the study sample.

2.4. Data Collection Tools and Features

The data representing gender and age variables were collected through the direct data collection method, and subsequently, the following measurements were made to determine the descriptive statistics of the study group.

2.4.1. Height, Body Weight (BW) and Body Mass Index (BMI)

Height was measured through a stadiometer (Seca, Germany) with an accuracy of ± .1 mm (millimeter) for each student wearing light sports clothes and no shoes. The measurements were recorded in cm (centimeters) while their backs leaned on the wall, the heads were in the Frankfort horizontal plane, and the hair was pressed down onto the top of their heads (Norton, 2018).

In body weight (BW) measurement, the data were recorded in kg (kilogram) by measuring each student in light sportswear and with no shoes (Turkmen et al., 2010) using an electronic scale with ± .1 g (gram) precision (Tanita BC-418 Segmental, Japan).

Body mass index $(BMI = kg \div height^2)$ was calculated using these two measurements (Turkmen et al., 2010).

2.4.2. Hand Grip Strength

Before the HGS measurement, time was given both for the trial measurement and warm-up. Then, the hand dynamometer (Baseline 12-086, USA) was adjusted in conformity with the proximal phalanx length of the middle finger so that the dominant arm stands at an angle of 10-15° to the body in the anatomical stance (Turan, 2019). Then, as the student was ready, two successive measurements within a 1-minute interval were performed, and the best result was recorded as HGS.

2.4.3. Determination of Arm Mass

2.4.3.1. Calculation of Upper Arm Mass

In the method calculated according to the Hanavan model, the distance between the acromion bone and the olecranon (radiale) bone and the values of the location yielding the largest girth measurement of this distance were used (Hanavan Jr., 1964; Miller & Morrison, 1975; Kwon, 1998; Norton, 2018). A segmometer (Cescorf, Brazil) was used for length measurements while width measurements were performed through tape measure (Lafayette Gulick, USA).

Upper Arm Mass Sum=0.007xBody Weight+0.092xUpper Arm Girth+0.050xUpper Arm Length–3.101

2.4.3.2. Calculation of Lower Arm Mass

In the method calculated in accordance with the Hanavan model, the distance between the olecranon (radiale) bone and the ulnar styloid bone was determined, and the values of the place giving the largest girth measurement of this distance were used (Hanavan Jr., 1964; Miller & Morrison, 1975; Kwon, 1998; Norton, 2018).

Lower Arm Mass Sum=0.081xBody Weight+0.052xLower Arm Girth–1.65

2.4.3.3. Calculation of Hand Mass

In the calculation method performed following the Hanavan model, wrist-girth and wrist-width values were used (Hanavan Jr., 1964; Miller & Morrison, 1975; Norton, 2018).

Hand Mass Sum=0.038xWrist Girth+0.080xWrist Widths–0.660

2.4.4. Method of Calculation Relative Arm Force

The following method was used to determine the RAF:

- Arm (hand, lower arm, and upper arm) measurement was made.
- The arm mass total (AMS) was calculated with the arm mass computation program.
- HGS was measured.
- The relative arm force (weight of the arm [in kg] divided by the force value yielded on the hand grip tool) was found by division of HGS by AMS.

Relative Arm Force=Hand Grip Strength/Arm Mass (Marangoz, 2022).

2.4.5. Somatotype Measurement

The height, body weight, circumference, diameter, and skinfold thickness measurement values of the students were used to measure somatotypes. Girth measurement values were taken through a tape measure (Lafayette Gulick, USA) on the right side of the students from the biceps and calf areas in flexion (Heyward & Stolarczyk, 1996; Fox et al., 2012). Diameter measurements were performed through a caliper (Bicondylar Vernier-Holtain, London) sliding from the humerus and femur epicondyles (Callaway et al., 1988; Wilmore et al., 1988; Roche et al., 1996). Skinfold thickness measurement values were taken from triceps, subscapula, suprailiac, and calf (while sitting) zones on the right side of the student's standing body (Marangoz, 2019) through a skinfold caliper (Holtain, London). The "*SOMATOTURK Calculation Program*" developed by Marangoz and Ozbalcı (2017) was employed in the calculation of somatotypes.

2.5. Statistical Analysis

The Statistical Package for the Social Sciences (SPSS) 26 program was employed to analyze the obtained data. A normality test was applied to scale variables to decide on the analyses. Since the number of participants in the research was greater than 30 ($n \geq 30$), the researchers ran a normality test, and the Kolmogorov-Smirnov normality test, which is appropriate for the current research, was performed (Cevahir, 2020; Alpar, 2020). Since the test result was found significant ($p<0.05$), nonparametric analyses were applied. A descriptive test (Table 1) was applied in descriptive statistics, while the Wilcoxon test (Table 2) was performed for comparative analysis, and the bivariate Correlate-Bivariate (Spearman) correlation test (Table 3, Table 4, Table 5) was run for correlation analysis. The significance value of the tests was taken as $p<0.05$.

2.6. Ethical Aspect of the Research

For this research, written permissions were obtained from KAEU SSF Dean's Office (Number: E-51788177-000-00000411037; 29.03.2022), KAEU HSVS Directorate (Number: E-45595862-000-00000405127; 08.03.2022) and KAEU Faculty of Medicine, Clinical Research Ethics Committee (Decision No: 2022-07/68 Date: 05.04.2022).

3. Results

Descriptive and inferential statistics of the study group are presented in the tables below.

Table 1: Descriptive statistics of the study group variables

Variables	**Male (n=16)** x̄±sd	**Female (n=44)** x̄±sd	**Total (N=60)** x̄±sd
Age (year)	19.63±1.36	19.57±1.15	19.58±1.20
BW (kg)	68.38±10.43	60.41±10.09	62.53±10.70
Height (cm)	174.81±6.26	163.64±4.87	166.62±7.22
BMI (kg/cm^2)	22.51±4.37	22.55±3.64	22.54±3.81
Upper Arm Girth (UAG) (cm)	27.84±3.36	26.38±3.10	26.77±3.21
Upper Arm Length (UAL) (cm)	37.22±1.69	33.26±1.85	34.32±2.52

Upper Arm Mass Sum (UAMS) (kg)	1.80±0.40	1.41±0.39	1.52±0.43
Lower Arm Girth (LAG) (cm)	25.81±1.59	23.63±1.75	24.21±1.96
Lower Arm Mass Sum (LAMS) (kg)	5.23±0.91	4.48±0.89	4.68±0.95
Wrist Girth (WG) (cm)	16.41±0.64	15.33±0.85	15.62±0.93
Wrist Widths (WW) (cm)	5.49±0.35	5.65±0.35	5.61±0.35
Hand Mass Sum (HMS) (kg)	0.40±0.04	0.37±0.06	0.38±0.05
Arm Mass Sum (AMS) (kg)	7.43±1.32	6.26±1.29	6.58±1.38
HGS (kg)	44.34±9.94	28.98±4.76	33.08±9.41
RAF (kg)	5.97±0.83	4.77±1.06	5.09±1.13
Endomorphy	1.77±0.94	0.08±0.14	0.53±0.90
Mesomorphy	1.96±1.94	1.09±1.13	1.32±1.42
Ectomorphy	3.05±1.53	2.24±1.32	2.46±1.41

N/n: Number of subjects; x̄: Average; sd: Standard deviation; Upper Arm Girth: UAG; Upper Arm Length: UAL; Upper Arm Mass Sum: UAMS; Lower Arm Girth: LAG; Lower Arm Mass Sum: LAMS; Wrist Girth: WG; Wrist Widths: WW; Hand Mass Sum: HMS; Arm Mass Sum: AMS

The relevant data of the study group variables, which respectively are the age of the study group (male: 19.63±1.36 years; female: 19.57±1.15 years), BW (male: 68.38±10.43 kg; female 60.41±10.09 kg); height (male: 174.81±6.26 cm; female: 163.64±4.87 cm); BMI (male: 22.51±4.37 kg/cm^2; female 22.55±3.64 kg/cm^2); UAG (male: 27.84±3.36 cm; female: 26.38±3.10 cm), UAL (male: 37.22±1.69 cm; female 33.26±1.85 cm), UAMS (male: 1.80±0.40cm; female: 1.41±0.39 cm), LAG (male: 25.81±1.59 cm; female 23.63±1.75 cm), LAMS (male: 5.23±0.91 kg; female: 4.48±0.89 kg), WG male: 16.41±0.64 cm; female: 15.33±0.85 cm), WW (male: 5.49±0.35 cm; female: 5.65±0.35 cm), HMS (male: 0.40±0.04 kg; female: 0.37±0.06 kg), AMS (male: 7.43±1.32 kg; female: 6.26±1.29 kg), HGS (male: 44.34±9.94 kg; female: 28.98±4.76 kg), RAF (male: 5.97±0.83 kg; female 4.77±1.06 kg), Endomorphy (male: 1.77±0.94 kg; female .08±0.14), Mesomorph (male: 1.96±1.94; female: 1.09±1.13) and Ectomorphy (male: 3.05±1.53; female 2.24±1.32) are as depicted in Table 1.

Table 2: Comparison of anthropometric and motoric variables of the study group

Variables	Gender	n	z	p
Age (year)	Male	16	-.035	.972
	Female	44		
BW (kg)	Male	16	-2.657	***.008*****
	Female	44		
Height (cm)	Male	16	-4.863	***.000*****
	Female	44		
BMI (kg/cm^2)	Male	16	-4.85	.628
	Female	44		
UAG (cm)	Male	16	-1.216	.224
	Female	44		
UAL (cm)	Male	16	-5.151	***.000*****
	Female	44		
UAMS (kg)	Male	16	-3.126	***.002****
	Female	44		
LAG (cm)	Male	16	-3.810	***.000*****
	Female	44		
LAMS (kg)	Male	16	-2.809	***.005****
	Female	44		
WG (cm)	Male	16	-4.325	***.000*****
	Female	44		
WW (cm)	Male	16	-2.377	.017
	Female	44		
HMS (kg)	Male	16	-1.898	.058
	Female	44		

AMS (kg)	Male	16	-3.042	***.002*****
	Female	44		
HGS (kg)	Male	16	-5.300	***.000******
	Female	44		
RAF (kg)	Male	16	-3.778	***.000******
	Female	44		
Endomorphy	Male	16	-5.801	***.000******
	Female	44		
Mesomorphy	Male	16	-1.423	.155
	Female	44		
Ectomorphy	Male	16	-2.040	***.041****
	Female	44		

$^{*}p<0.05$; $^{**}p<0.01$; $^{***}p<0.001$

Upper Arm Girth: UAG; Upper Arm Length: UAL; Upper Arm Mass Sum: UAMS; Lower Arm Girth: LAG; Lower Arm Mass Sum: LAMS; Wrist Girth: WG; Wrist Widths: WW; Hand Mass Sum: HMS; Arm Mass Sum: AMS

Looking at Table 2, the variables BW (z = -2.657; p<0.01), height (z = -4.863; p<0.001), UAL (z = -5.151; p<0.001), UAMS (z = -3.126; p<0.01), LAG (z = -3.810; p<0.001), LAMS (z = -2.809; p<0.01), WG (z = -4.325; p<0.001), AMS (z = -3.042; p<0.01), HGS (z = -5.300; p<0.001), RAF (z = -3.778; p<0.001), Endomorphy (z = -5.801; p<0.001) and Ectomorphy (z = -2.040; p<0.05) turn out to be statistically significant.

Table 3: The relationship between anthropometric and motoric variables of male students

Variables		Age	BW	Height	BMI	UAG	UAL	UAMS	LAG	LAMS	WG	WW	HMS	AMS	HGS
BW (kg)	r	.199													
Height (cm)	r	.020	.054												
BMI (kg/cm^2)	r	.159	.913***	-.258											
UAG (cm)	r	.282	.926***	-.024	.868***										
UAL (cm)	r	-.008	.168	.255	-.002	.304									
UAMS (kg)	r	.229	.915***	.071	.831***	.981***	.414								
LAG (cm)	r	.234	.862***	.003	.817***	.931***	.355	.922***							
LAMS (kg)	r	.243	.995***	.004	.929***	.942***	.169	.924***	.896***						
WG (cm)	r	.044	.013	.274	.504*	.020	.171	.011	.007	.011					
WW (cm)	r	.318	.353	.287	.241	.226	-.008	.221	.148	.332	.495				
HMS (kg)	r	.473	.558*	.386	.419	.468	.140	.494	.426	.545*	.842***	.819***			
AMS (kg)	r	.235	.973***	.059	.893***	.970***	.288	.965***	.931***	.979***	.679**	.349	.587*		
HGS (kg)	r	.201	.622*	-.093	.640**	.695**	.509*	.733**	.787***	.658**	.548*	.051	.223	.690**	
RAF (kg)	r	.014	-.009	.000	.044	.035	.378	.112	.136	.012	.077	-.102	-.174	.024	.689**

$*p<0.05$; $**p<0.01$; $***p<0.001$

Upper Arm Girth: UAG; Upper Arm Length: UAL; Upper Arm Mass Sum: UAMS; Lower Arm Girth: LAG; Lower Arm Mass Sum: LAMS; Wrist Girth: WG; Wrist Widths: WW; Hand Mass Sum: HMS; Arm Mass Sum: AMS

Looking at Table 3, a significant correlation was found between respectively BMI with height ($r_{BMI\text{-}Height}$ = .913; p<0.001), UAG with BW ($r_{UAG\text{-}BW}$ = .926; p<0.001) and BMI ($r_{UAG\text{-}BMI}$ = .868; p<0.001), UAMS with BW ($r_{UAMS\text{-}BW}$ = .915; p<0.001), BMI ($r_{UAMS\text{-}BMI}$ = .831; p<0.001) and UAG ($r_{UAMS\text{-}BW}$ = .981; p<0.001), LAG with BW ($r_{LAG\text{-}BW}$ = .862; p<0.001), BMI ($r_{LAG\text{-}VKA}$ = .817; p<0.001), UAG ($r_{LAG\text{-}UAG}$ = .931; p<0.001) and UAMS ($r_{LAG\text{-}UAMS}$ = .922; p<0.001), LAMS with BW ($r_{LAMS\text{-}BW}$ = .995; p<0.001), BMI ($r_{LAMS\text{-}BMI}$ = .929; p<0.001), UAG ($r_{LAMS\text{-}UAG}$ = .942; p<0.001), UAMS ($r_{LAMS\text{-}UAMS}$ = .924; p<0.001) and LAG ($r_{LAMS\text{-}LAG}$ = .896; p<0.001), WG with BMI ($r_{WG\text{-}BMI}$ = .504; p<0.05), HMS with BW ($r_{HMS\text{-}BW}$ = .558; p<0.05), LAMS ($r_{HMS\text{-}LAMS}$ = .545; p<0.05), WG ($r_{HMS\text{-}WG}$ = .842; p<0.001) and WW ($r_{HMS\text{-}WW}$ = .819; p<0.001), AMS with BW ($r_{AMS\text{-}BW}$ = .973; p<0.001), BMI ($r_{AMS\text{-}BMI}$ = .893; p<0.001), UAG ($r_{AMS\text{-}UAG}$ = .970; p<0.001), UAMS ($r_{AMS\text{-}UAMS}$ = .965; p<0.001), LAG ($r_{AMS\text{-}LAG}$ = .931; p<0.001), ($r_{AMS\text{-}LAMS}$ = .979; p<0.001), WG ($r_{AMS\text{-}WG}$ = .679; p<0.01) and HMS ($r_{AMS\text{-}HMS}$ = .587; p<0.05), HGS with BW ($r_{HGS\text{-}BW}$ = .622; p<0.05), BMI ($r_{HGS\text{-}BMI}$ = .640; p<0.01), UAG ($r_{HGS\text{-}UAG}$ = .695; p<0.01), UAL ($r_{HGS\text{-}UAL}$ = .509; p<0.05), UAMS ($r_{HGS\text{-}UAMS}$ = .733; p<0.01), LAG ($r_{HGS\text{-}LAG}$ = .787; p<0.001), LAMS ($r_{HGS\text{-}LAMS}$ = .658;

p<0.01), WG ($r_{HGS\text{-}WG}$ = .548; p<0.05) and AMS ($r_{HGS\text{-}AMS}$ = .690; p<0.01), RAF with HGS ($r_{RAF\text{-}HGS}$ = .689; p<0.01).

Table 4: The relationship between anthropometric and motoric variables of female students

Variables		Age	BW	Height	BMI	UAG	UAL	UAMS	LAG	LAMS	WG	WW	HMS	AMS	HGS
BW (kg)	r	.174													
Height (cm)	r	.070	.274												
BMI (kg/cm^2)	r	.098	.907***	-.093											
UAG (cm)	r	.163	.593***	.056	.625***										
UAL (cm)	r	.005	.352*	.455**	.198	.349*									
UAMS (kg)	r	.130	.630***	.151	.618***	.953**	.562***								
LAG (cm)	r	.027	.671***	.099	.668***	.720***	.326*	.759***							
LAMS (kg)	r	.124	.682***	.191	.646***	.825***	.370*	.869***	.850***						
WG (cm)	r	.079	.554***	.309*	.470**	.577***	.331*	.598***	.737***	.662***					
WW (cm)	r	.068	.477**	.231	.406**	.421**	.210	.436**	.549***	.456**	.695***				
HMS (kg)	r	.099	.560***	.298*	.465**	.516***	.291	.538***	.674***	.583**	.926***	.898***			
AMS (kg)	r	.134	.676***	.171	.648***	.886***	.430**	.927***	.833***	.983***	.672***	.496**	.611**		
HGS (kg)	r	-.018	.034	-.086	.069	.137	.064	.089	.091	.054	.216	.231	.264	.067	
RAF (kg)	r	-.089	-.464**	-.185	-.431**	-.549***	-.316*	-.626***	-.515***	-.684***	-.323*	-.155	-.227	-.688***	.611***

**p<0.05; **p<0.01; ***p<0.001*

Upper Arm Girth: UAG; Upper Arm Length: UAL; Upper Arm Mass Sum: UAMS; Lower Arm Girth: LAG; Lower Arm Mass Sum: LAMS; Wrist Girth: WG; Wrist Widths: WW; Hand Mass Sum: HMS; Arm Mass Sum: AMS

Looking at Table 4, a significant correlation was found between respectively BMI with BW ($r_{BMI\text{-}BW}$ = .907; p<0.001), UAG with BW ($r_{UAG\text{-}BW}$ = .593; p<0.001) and BMI ($r_{UAG\text{-}BMI}$ = .625; p<0.001), UAL with BW ($r_{UAL\text{-}BW}$ = .352; p<0.05), Height ($r_{UAL\text{-}Height}$ = .455; p<0.01) and UAG ($r_{UAL\text{-}UAG}$ = .349; p<0.05), UAMS with BW ($r_{UAMS\text{-}BW}$ = .630; p<0.001), BMI ($r_{UAMS\text{-}BMI}$ = .618; p<0.001), UAG ($r_{UAMS\text{-}UAG}$ = .953; p<0.001) and ($r_{UAMS\text{-}UAL}$ = .562; p<0.001), LAG with BW ($r_{LAG\text{-}BW}$ = .671; p<0.001), BMI ($r_{LAG\text{-}BMI}$ = .668; p<0.001), UAG ($r_{LAG\text{-}UAG}$ = .720; p<0.001), UAL ($r_{LAG\text{-}UAL}$ = .326; p<0.05) and UAMS ($r_{LAG\text{-}UAMS}$ = .759; p<0.001), LAMS with BW ($r_{LAMS\text{-}BW}$ = .682; p<0.001), BMI ($r_{LAMS\text{-}BMI}$ = .646; p<0.001), UAG ($r_{LAMS\text{-}UAG}$ = .825; p<0.001), UAL ($r_{LAMS\text{-}UAL}$ = .370; p<0.05), UAMS ($r_{LAMS\text{-}UAMS}$ = .869; p<0.001) and LAG ($r_{LAMS\text{-}LAG}$ = .850; p<0.001), WG with BW ($r_{WG\text{-}BW}$ = .554; p<0.001), height ($r_{WG\text{-}Height}$ = .309; p<0.05), BMI ($r_{WG\text{-}BMI}$ = .470; p<0.05), UAG ($r_{WG\text{-}UAG}$ = .577; p<0.001), UAL ($r_{WG\text{-}UAL}$ = .331; p<0.05), UAMS ($r_{WG\text{-}UAMS}$ = .598; p<0.001), LAG ($r_{WG\text{-}LAG}$ = .737; p<0.001) and LAMS ($r_{WG\text{-}LAMS}$ = .662; p<0.001), WW with BW ($r_{WW\text{-}BW}$ = .477; p<0.01), BMI ($r_{WW\text{-}BMI}$ = .406; p<0.01), UAG ($r_{WW\text{-}UAG}$ = .421; p<0.01), UAMS ($r_{WW\text{-}UAMS}$ = .436; p<0.01), LAG ($r_{WW\text{-}LAG}$ = .549; p<0.001), LAMS ($r_{WW\text{-}LAMS}$ = .456; p<0.01) and WG ($r_{WW\text{-}WG}$ = .695; p<0.001), HMS with BW ($r_{HMS\text{-}BW}$ = .560; p<0.001), height ($r_{HMS\text{-}Height}$ = .298; p<0.05), BMI ($r_{HMS\text{-}BMI}$ = .465; p<0.01), UAG ($r_{HMS\text{-}UAG}$ = .516; p<0.001), UAMS ($r_{HMS\text{-}ÜKT}$ = .538; p<0.001), LAG ($r_{HMS\text{-}LAG}$ = .674; p<0.001), LAMS ($r_{HMS\text{-}LAMS}$ = .583; p<0.01), WG ($r_{HMS\text{-}WG}$ = .926; p<0.001) and WW ($r_{HMS\text{-}WW}$ = .898; p<0.001), AMS with BW ($r_{AMS\text{-}BW}$ = .676; p<0.001), BMI ($r_{AMS\text{-}BMI}$ = .648; p<0.001), UAG ($r_{AMS\text{-}UAG}$ = .886; p<0.001), UAL ($r_{AMS\text{-}UAL}$ = .430; p<0.01), UAMS ($r_{AMS\text{-}UAMS}$ = .927; p<0.001), LAG ($r_{AMS\text{-}LAG}$ = .833; p<0.001), LAMS ($r_{AMS\text{-}LAMS}$ = .983; p<0.001), WG ($r_{AMS\text{-}WG}$ = .672; p<0.001), WW ($r_{AMS\text{-}WW}$ = .496; p<0.01) and HMS ($r_{AMS\text{-}HMS}$ = .611; p<0.01), RAF with BW ($r_{RAF\text{-}BW}$ = -.464; p<0.01), BMI ($r_{RAF\text{-}BW}$ = -.431; p<0.01), UAG ($r_{RAF\text{-}UAG}$ = -.549; p<0.001), UAL ($r_{RAF\text{-}UAL}$ = -.316; p<0.05), UAMS ($r_{RAF\text{-}UAMS}$ = -.626; p<0.001), LAG ($r_{RAF\text{-}LAG}$ = -.515; p<0.001), LAMS ($r_{RAF\text{-}LAMS}$ = -.684; p<0.001), WG ($r_{RAF\text{-}WG}$ = -.323; p<0.05), AMS ($r_{RAF\text{-}AMS}$ = -.688; p<0.001) and HGS ($r_{RAF\text{-}HGS}$ = -.611; p<0.001).

Table 5: The relationship between anthropometric and motoric variables of male and female students

Variables		Age	BW	Height	BMI	UAG	UAL	UAMS	LAG	LAMS	WG	WW	HMS	AMS	HGS
BW (kg)	r	.169													
Height (cm)	r	.027	.366**												
BMI (kg/cm^2)	r	.125	.814***	-.159											
UAG (cm)	r	.172	.660***	.101	.675***										
UAL (cm)	r	.023	.427**	.650***	.046	.322*									
UAMS (kg)	r	.143	.722***	.356**	.562***	.921***	.618***								
LAG (cm)	r	.056	.744***	.386**	.553***	.740***	.529***	.844***							
LAMS (kg)	r	.137	.770***	.338**	.619***	.831***	.452***	.895***	.885**						
WG (cm)	r	.153	.596***	.522**	.332**	.548***	.553***	.676***	.791**	.699***					
WW (cm)	r	.127	.272*	-.048	.377**	.274*	-.114	.193	.218	.253	.323*				

HMS (kg)	r	.187	.570***	.359**	.416**	.513***	.345**	.565***	.657**	.611***	.868***	.711***			
AMS (kg)	r	.136	.767***	.353**	.602***	.881***	.516***	.950***	.892**	.984***	.721***	.253	.627***		
HGS (kg)	r	.015	.336**	.393**	.090	.289*	.522***	.411**	.482**	.356**	.544***	-.092	.369**	.395**	
RAF (kg)	r	-.049	-.151	.195	-.332**	-.290*	.198	-.203	-.064	-.286*	.073	-.357**	-.082	-.254*	.707***

$*p<0.05$; $**p<0.01$; $***p<0.001$

Upper Arm Girth: UAG; Upper Arm Length: UAL; Upper Arm Mass Sum: UAMS; Lower Arm Girth: LAG; Lower Arm Mass Sum: LAMS; Wrist Girth: WG; Wrist Widths: WW; Hand Mass Sum: HMS; Arm Mass Sum: AMS

Looking at Table 5, a significant correlation was found between respectively height with BW ($r_{Height-BW}$ = .366; p<0.01), BMI with BW (r_{BMI-BW} = .814; p<0.001), UAG with (r_{UAG-BW} = .660; p<0.001) and BMI ($r_{UAG-BMI}$ = .675; p<0.001), UAL with BW (r_{UAL-BW} = .427; p<0.01), height ($r_{UAL-Height}$ = .650; p<0.001) and UAG ($r_{UAL-UAG}$ = .322; p<0.05), UAMS with BW ($r_{UAMS-BW}$ = .722; p<0.001), height ($r_{UAMS-Height}$ = .356; p<0.01), BMI ($r_{UAMS-BMI}$ = .562; p<0.001), UAG ($r_{UAMS-UAG}$ = .921; p<0.001) and UAL ($r_{UAMS-UAL}$ = .618; p<0.001), LAG with BW (r_{LAG-BW} = .744; p<0.001), height ($r_{LAG-Height}$ = .386; p<0.01), BMI ($r_{LAG-BMI}$ = .553; p<0.001), UAG ($r_{LAG-UAG}$ = .740; p<0.001), UAL ($r_{LAG-UAL}$ = .529; p<0.001) and UAMS ($r_{LAG-UAMS}$ = .844; p<0.001), LAMS with BW ($r_{LAMS-BW}$ = .770; p<0.001), height ($r_{LAMS-Height}$ = .338; p<0.01), BMI ($r_{LAMS-BMI}$ = .619; p<0.001), UAG ($r_{LAMS-UAG}$ = .831; p<0.001), UAL ($r_{LAMS-UAL}$ = .452; p<0.001), UAMS ($r_{LAMS-UAMS}$ = .895; p<0.001) and LAG ($r_{LAMS-LAG}$ = .885; p<0.001), WG with BW (r_{WG-BW} = .596; p<0.001), height ($r_{WG-Height}$ = .522; p<0.001), BMI (r_{WG-BMI} = .332; p<0.01), UAG (r_{WG-UAG} = .548; p<0.001), UAL (r_{WG-UAL} = .533; p<0.001), UAMS ($r_{WG-UAMS}$ = .676; p<0.001), LAG (r_{WG-LAG} = .791; p<0.001) and LAMS ($r_{WG-LAMS}$ = .699; p<0.001), WW with BW (r_{WW-BW} = .272; p<0.05), BMI (r_{WW-BMI} = .377; p<0.01), UAG (r_{WW-UAG} = .274; p<0.05) and WG (r_{WW-WG} = .323; p<0.05), HMS with BW (r_{HMS-BW} = .570; p<0.001), height ($r_{HMS-Height}$ = .359; p<0.01), BMI ($r_{HMS-BMI}$ = .416; p<0.001), UAG ($r_{HMS-UAG}$ = .513; p<0.001), UAL ($r_{HMS-UAL}$ = .345; p<0.01), UAMS ($r_{HMS-UAMS}$ = .565; p<0.001), LAG ($r_{HMS-LAG}$ = .657; p<0.01), LAMS ($r_{HMS-LAMS}$ = .611; p<0.001), WG (r_{HMS-WG} = .868; p<0.001) and WW (r_{HMS-WW} = .711; p<0.001), AMS with BW (r_{AMS-BW} = .767; p<0.001), height ($r_{AMS-Height}$ = .353; p<0.01), BMI ($r_{AMS-BMI}$ = .602; p<0.001), UAG ($r_{AMS-UAG}$ = .881; p<0.001), UAL ($r_{AMS-UAL}$ = .516; p<0.001), UAMS ($r_{AMS-UAMS}$ = .950; p<0.001), LAG ($r_{AMS-LAG}$ = .892; p<0.001), LAMS ($r_{AMS-LAMS}$ = .984; p<0.001), WG (r_{AMS-WG} = .721; p<0.001) and HMS ($r_{AMS-HMS}$ = .627; p<0.001), HGS with BW (r_{HGS-BW} = .336; p<0.01), height ($r_{HGS-Height}$ = .393; p<0.01), UAG ($r_{HGS-UAG}$ = .289; p<0.05), UAL ($r_{HGS-UAL}$ = .522; p<0.001), UAMS ($r_{HGS-UAMS}$ = .411; p<0.01), LAG ($r_{HGS-LAG}$ = .482; p<0.01), LAMS ($r_{HGS-LAMS}$ = .356; p<0.01), WG (r_{HGS-WG} = .544; p<0.001), HMS ($r_{HGS-HMS}$ = .369; p<0.01) and AMS ($r_{HGS-AMS}$ = .395; p<0.01), RAF with BMI ($r_{RAF-BMI}$ = -.332; p<0.01), UAG ($r_{RAF-UAG}$ = -.290; p<0.05), LAMS ($r_{RAF-LAMS}$ = -.286; p<0.05), WW (r_{RAF-WW} = -.357; p<0.01), AMS ($r_{RAF-AMS}$ = -.254; p<0.05) and HGS ($r_{RAF-HGS}$ = .707; p<0.001).

4. Discussion

This research was aimed at students who would start their careers as paramedics in KAEU and included the aim of examining the study group's physical-vocational adjustment. When the relevant literature was reviewed, it was observed that interest and attitude scales were applied to the participants in order to determine the vocational adjustment level in the profession choice-related research (Onler and Varol Saracoglu, 2010). Yet, one can hardly come across any study that measured physical variables such as the height and body weight of the participants. Therefore, the current research is considered to have a unique place in the literature with regard to its data. Moreover, the originality of this research, in a way, connotes its limitations as well.

Not only do the individuals choose the profession that suits them, but the security units employing professionals like soldiers and police officers also perform physical assessments to determine eligibility. Like the members of those professions, it is known that specifically EMTs (Emergency Medical Technicians) and paramedics take part in field work (accidents, patient pickup/drop-off from buildings with no elevators, and all situations where emergency assistance is required in extraordinary circumstances). Thus, it is thought that the members of these professions should also have specific physical competencies. The study by Turan (2019) conforms with this idea. Turan (2019) states that paramedic students do not have a healthy physical fitness and nutritional profile. That study also recommends increasing their physical activity levels.

Returning to the subject mentioned above, it will make sense to look at the physical qualifications in the pre-selection phase of the careers. The Police Vocational School 2022 application guide indicates that the height should be at least 167 cm for men and at least 162 cm for women. In addition, BMI values should be in the reference range of 18-27. In the research, the minimum (min) and maximum (max) heights measured for males were 160 cm and 182 cm (174.81±6.26) for males; while the min and max values were measured as 155 cm and 175 cm for females (163.64±4.87 cm). In addition, BMI was calculated as 22.51±4.37 kg/cm2 in men and 22.55±3.64 kg/cm2 in women. In terms of World Health Organization BMI values, it is seen that this research yielded values within the normal range. However, although the height in the police profession is not different in terms of mean values, some students do not comply with the min values required. Kok and Izgi (2020) state that although there are individual differences within the 0-22 age range, the bone age can be determined from the hand-wrist area. Furthermore, it is also noted that bone development continues until approximately 18 years of age in females and 21-22 in males (Koc and Yuksel, 2003). Thus, although the mean age (19.58±1.20) in this research was at the point of self-preservation in terms of height, BW leads one to the conclusion that BMI may vary. Considering this information, it is considered that departments delivering such vocational education should bring a certain standard in the physical aspect. The study by Marangoz (2022b), stating to pay attention to physical characteristics in order to set a certain standard in military units, is in conformity with the findings of this study in terms of standardizing physical features from the institutions' perspective.

Since the differences observed in reference to the gender variable are within the expected value ranges, they have not been discussed in this research. In addition, specifically for female students, the absence of a significant correlation between the variables in terms of HGS was attributed to muscle structures (Koc and Yuksel, 2003). Therefore, fat densities should be checked besides BMI in women. Analyzing the study group from the gender aspect, the reason BMI is more related to BW is just that BW is one of the calculation formula variables and affects BMI. Again, considering the study group in terms of gender, apart from the association between RAF and HGS, the fact that they are generally associated with upper extremity length and mass totals is because RAF is an upper extremity performance evaluation method (Erdogan et al., 2016; Kecelioglu and Akcay, 2019). HGS was calculated as 44.34±9.94 kg in men and 28.98±4.76 kg in women. The studies conducted by Narin et al. (2009) and Turan (2019) are on healthcare professionals, and the findings of these studies are close to the HGS research results. Based on the research (Eler & Eler, 2018) on male racquet players (age $\bar{x}$ = 23.82 years; right HGS $\bar{x}$ = 47.63), the results obtained in this research lead to the conclusion that they are close to sedentary health professionals' values, but lower than those of athletes. Since it is a general acceptance that male students' HGS values are higher than those of female students, no comparison with the studies in the literature has been made. Sener et al. (2018) state that paramedics need to increase their physical activity levels to be successful in their profession. Thus, it is considered that paramedics should have better HGS values than sedentary individuals, although not as much as athletes.

When the somatotype structures of the study group were examined, the male students (1.77-1.96-3.05) were noted to have balanced ectomorph component while female students (0.08-1.09-2.24) had meso-ectomorph, and the overall group (male-female) (0.53-1.32-2.46) had meso-ectomorph. It is a general belief that athletes are morely mesomorphic. The study by Marangoz and Mavi Var (2018) supports this opinion by stating that the somatotype structures of students studying in different departments of sports sciences have mesomorph components. Likewise, in a similar study, Marangoz and Koc (2021) stated that male students of the Department of Coaching Education were ectomorphic and female students were predominantly meso ectomorphic and balanced ectomorphic. Although there exist similarities between the studies, it is known that sports science students are subjected to a special talent test (parkour). From this point of view, paramedic students stand far from the athlete component, but close to sports science students. It should also be noted that biomechanically, segmental proportional distribution makes a difference in terms of work/performance and is ergonomically more important.

5. Conclusion and Suggestions

It was observed that some data obtained from the study group were below the minimum acceptance value of professions such as policing in terms of the height variable. On the other hand, it was noted that the data obtained in accordance with the BMI variable were compatible with the prerequisites of the policing profession. Although the data obtained concerning the HGS variable are close to the data of sedentary healthcare professionals, they are yet at a lower level than those of the athletes. Additionally, it was observed that the somatotype components of the study group differed from those of the athletes.

Thus, it is recommended that

- In recruiting students to university paramedic departments, height and BMI requirements should be similar to those stipulated by the policing profession.
- Paramedics' HGS values should be better than those of sedentary individuals, although not as high as those of athletes.
- The somatotype structures of paramedics should be suitable for athletes or SSF students.
- Paramedics should increase their physical activities and improve their physical competencies.

Finally, in order to support this research conducted in a quantitative research design, it is also recommended that relevant qualitative studies should also be conducted to determine whether the healthcare professionals in the field have the required physical competence.

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