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Article

Comparison of Kinanthropometric Values in Amateur Athletes of Different Disciplines According to their Sexual Gender

Daniel Jonathan Navas Harrison [1,†], Ana María Pérez Pico [2,†], Julia Villar Rodríguez [3] and Raquel Mayordomo Acevedo [4,*]

[1] Podología Navas, 29640 Fuengirola, España; e-mail@e-mail.com
[2] Department of Nursing, University Center of Plasencia, University of Extremadura, 10600 Plasencia, Spain; e-mail@e-mail.com
[3] Department of Nursing, Physiotherapy and Occupational Therapy, Faculty of Health Sciences, University of Castilla la Mancha, Spain
[4] Department of Anatomy, Cellular Biology and Zoology, University Center of Plasencia, University of Extremadura, 10600 Plasencia, Spain
* Correspondence: rmayordo@unex.es; Tel.: +34-636526498
† These authors contributed equally to this work.

Abstract: Background/Objectives: Kinanthropometry is the science that deals with the measurement of variations of the physical dimensions and composition of the human body, according to the age and different degrees of nutrition of a person. This discipline postulates that all the measurements obtained in statics will have an impact on the dynamics. This study's objective was to evaluate the kinanthropometric differences according different variables; **Methods**: The study was done in a population of 403 persons, aged between 18 and 42 years, who were categorized based on their biological sex and in what sport they usually practiced in a purely recreational way. Measurements and indices were obtained following the protocol of the International Society for the Advancement of Kinanthropometry (ISAK); **Results**: We observed significant differences in most of the values, for example, men use the presented higher values in relation to weight, height and size of some circumferences, in addition to Body Weight Index (BMI), Relative Index of the Lower Limbs (RILL), percentage of muscle weight (%M) and percentage of residual weight (%R). On the other hand, women presented higher values in most body folds, in addition to the Cormic Index (CI), Body Density Index (BDI), percentage of fat weight (%F) and percentage of bones weight (%B); **Conclusions**: This work could be useful for people to choose what kind of sport will be better for them according to their morphotype.

Keywords: Kinanthropometry; anthropometric index; gender; amateur athletes, physical activity

1. Introduction

Anthropometry is a useful tool to establish differences between population groups based on the different measurements and compositions of their bodies [1]. Each person has a series of morphological characteristics that define them anatomically [2,3]. Thanks to the methodology proposed by the International Society for the Advancement of Kinanthropometry (ISAK), the results obtained can be interpreted [2,4]. In this article we will focus on locating differences, based on their biological sex, between people who practice a specific sport modality recreationally or other. This could be useful for many things, for example, reduce the risk of suffering from a multitude of pathologies [4].

2. Materials and Methods

2.1. Legal Documents

People who collaborated as a sample in this study previously had to sign an informed consent. They were informed about that the results obtained would be used for research purposes, always preserving their right to privacy. This informed consent was approved by the Bioethics Committee of the University of Extremadura (169/2019).

2.2. Inclusion Criteria

The inclusion criteria for the subjects to participated was not to suffer any type of pathology or injury when the measurements were taken. Also, they had to be between 18 and 42 years old. They should not have been on any type of special diet or ingesting any type of food supplement, understanding the Mediterranean diet as standard, based on our geographical location [5]. To be considered suitable for our study, they also must pass the Piercy criteria [3]. That means that they had to do at least 150 minutes of moderate physical exercise or 90 minutes of intense physical exercise. (Figure 1).
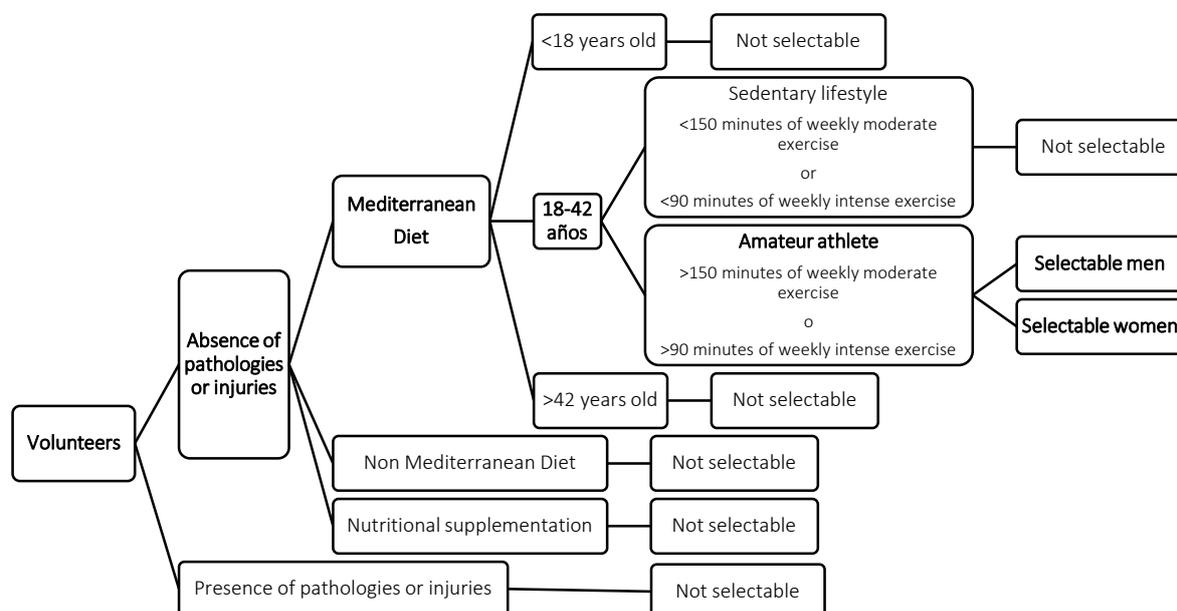
Figure 1. Flow chart with the inclusion criteria of the participants in this study.

2.3. Exclusion Criteria

Several exclusion criteria were considered when we collected the sample. If the subject suffered from any type of pathology or injury, if they had some type of diet different to the Mediterranean diet, if they were not between 18-42 years old, if they did not meet the Piercy criteria, or if they practiced more than one sport modality on a regular basis or even if they were competing at the federative level.

2.4. Study Sample

We analysed 403 individuals with an average age of 25.03±4.65 years. The sample was divided into groups based on their biological sex and the type of sport they regularly practiced, in a recreational way (Table 1):

- Basketball: This group comprised 53 people, 27 men and 26 women, with an average age of 22,15±3,08.

- Handball: This group comprised 48 people, 26 men and 22 women, with an average age of 22,79±2,74.

- Walking: This group comprised 64 people, 32 men and 32 women, with an average age of 25,36±2,54.

- Running: This group comprised 49 people, 40 men and 9 women, with an average age of 30,18±6,00.

- CrossFit: This group comprised 49 people, 38 men and 11 women, with an average age of 26,59±4,14.

- Football: This group comprised 69 people, 52 men and 17 women, with an average age of 25,14±4,34.

- Gym: This group comprised 31 people, 16 men and 15 women, with an average age of 25,39±4,98.

- Volleyball: This group comprised 40 people, 16 men and 24 women, with an average age of 22,28±3,34.

Table 1. Category of the subjects studied based on their biological sex.

Sport	Total		Men		Women	
	N	%	N	%	N	%
Basketball	53	13,15%	27	10,93%	26	16,67%
Handball	48	11,91%	26	10,53%	22	14,10%
Walking	64	15,88%	32	12,96%	32	20,51%
Running	49	12,16%	40	16,19%	9	5,77%
CrossFit	49	12,16%	38	15,38%	11	7,05%
Football	69	17,12%	52	21,05%	17	10,90%
Gym	31	7,69%	16	6,48%	15	9,62%
Volleyball	40	9,93%	16	6,48%	24	15,38%
TOTAL	403	100,00%	247	100,00%	156	100,00%

2.5. Study Variables

This work follows the ISAK considerations and protocols [4], so we started with some sociodemographic and lifestyle questions, like; their biological sex, age, hours and days of weekly training and how many years they have been doing the same sport in a recreational way. Then, we decided to collect some anthropometric measure; weight (kg), height (cm) in standing and sitting position, the arm span (cm), the perimeter (cm) of the contracted arm, waist, hip, thigh and calf, the diameter (cm) of the styloid of the wrist and the bicondylar of the femur, and the folds (mm) of the biceps, triceps, male pectoral, subscapular, abdominal, suprailiac, thigh and calf. With all this measures we calculated some kinanthropometric indexes; Body Weight Index (BMI), Ponderal Index (PI), Cormic Index (CI), Relative Index of Lower Limbs (RILL), Body Density Index (BDI), and some body composition measurements; Fat percentage (F%), Muscle percentage (M%), Bone percentage (B%) and the Residual percentage (R%).

It is important to highlight that the pectoral fold was only analysed in men because we didn't want to create any uncomfortable situation with any women, and we considered that it wasn't necessary for our study.

2.6. Methodology

Following the ISAK considerations [4], each measurement was performed by the same person, who haves the ISAK level 1 accreditation. To try to minimize a possible measurement mistake, all the measurements were done three times. All the instruments that were used are homologated: electronic scale with a height rod (model SECA701®), tape measure (model Lawton18-0160®) and a digital calliper (model Trimmeter H3001®).

2.7. Statistical Analysis

IBM-SPSS Statistics 25.0® software was used to analyse all the results, with a confidence interval of 5% ($p<0.05$) and a high level of significance on 1% ($p<0.001$). The qualitive variables were analysed using the Chi-square Test or Fisher's exact Test if more that 5% of the expected square were less than

five. Meanwhile, for the quantitative variables, we used the Shapiro-Wilk and Levene Test, besides the Student's T-Test for independent samples or the Mann-Whitney U Test in case for dependent samples [6].

3. Results

The different results obtained in this investigation are reflected below.

3.1. Sociodemographic and Lifestyle Results of the Participants

The sociodemographic and lifestyle results of the participants show the existence of several statistically significant differences depending on sex in terms of age ($p<0.001$) and hours of weekly physical activity (p 0.023), being in both cases higher among men than among women (Table 2).

If we evaluate the differences based on sex in each of the sports modalities, we did not observe statistically significant differences in the sociodemographic values between those people who practiced basketball and handball, but we did observe them in the rest of the sports analyzed. In the age variable, differences were observed between those people who ran ($p<0.001$) and those who practiced volleyball (p 0.011), being higher among men. Regarding the hours of physical activity per week, differences were observed between people who walked, ran, went to the gym and those who played volleyball ($p<0.001$ in all cases). The values were higher among men in all cases except in the case of those that go to the gym. If we analyzed the days of training per week, we observed statistically significant differences between those who played football (p 0.001) and volleyball (p 0.002), being the values higher among women and men respectively. Regarding years of regular training, statistically significant differences were observed between those who walked (p 0.015), those who ran (p 0.015), those who did CrossFit (p 0.035) and those who played volleyball (p 0.047), being higher among men in all cases except among the group of those who walked (Table 2).

Table 2. Sociodemographic and lifestyle results of the participants. ♂= Masculine, ♀= Feminine, * = statistically significant results.

Analyzed Variable	Total		Basketball		Handball		Walking		Running		CrossFit		Football		Gym		Volleyball	
	25.03±4.65		22.15±3.08		22.79±2.74		25.36±2.54		30.18±6.00		26.59±4.14		25.14±4.34		25.39±4.98		22.28±3.34	
			♂		♂		♂		♂		♂		♂		♂		♂	
	♂ 25.90 ±4.89		22.89 ±2.89		23.08 ±2.76		25.38 ±2.34		31.65 ±5.33		26.50 ±4.09		25.35 ±4.67		24.69 ±5.61		23.88 ±2.47	
Age		<0.001*		0.075		0.440		0.961		<0.001*		0.776		0.504		0.428		0.011*
	♀ 23.64 ±3.86		♀ 21.38 ±3.14		♀ 22.45 ±2.76		♀ 25.34 ±2.77		♀ 23.67 ±4.36		♀ 26.91 ±4.48		♀ 24.53 ±3.12		♀ 26.13 ±4.27		♀ 21.21 ±3.46	
	4.65±1.91		5.45±1.08		5.60±0.49		2.27±0.78		3.63±1.87		5.18±0.86		5.75±1.97		3.26±1.34		6.00±1.75	
			♂		♂		♂		♂		♂		♂		♂		♂	
Training hours per week	♂ 4.68 ±1.90		5.37 ±1.45		5.62 ±0.50		2.28 ±0.68		3.93 ±1.82		5.24 ±0.94		5.35 ±2.11		2.88 ±0.89		7.00 ±0.00	
		0.023*		0.578		0.583		<0.001*		<0.001*		0.142		0.650		<0.001*		<0.001*
	♀ 4.60 ±1.94		♀ 5.54		♀ 5.59		♀ 2.25		♀ 2.33		♀ 5.00		♀ 7.00		♀ 3.67		♀ 5.33	

			±0.51	±0.50	±0.88	±1.58	±0.45	±0.00	±1.63	±2.01
	3.65±1.36	3.62±0.95	4.21±0.92	2.30±0.84	4.65±1.63	3.41±0.64	4.04±1.42	2.81±1.04	4.25±1.32	
Training days per week	♂ 3.73 ±1.41	0.138	♂ 3.67 ±1.21	♂ 4.23 ±0.99	♂ 2.25 ±0.72	♂ 4.85 ±1.51	♂ 3.45 ±0.60	♂ 3.73 ±1.51	♂ 2.63 ±1.02	♂ 5.00 ±0.00
			0.73	0.866	0.071	0.071	0.408	0.001*	0.341	0.002*
	♀ 3.53 ±1.28		♀ 3.58 ±0.58	♀ 4.18 ±1.01	♀ 2.34 ±0.90	♀ 3.78 ±1.86	♀ 3.27 ±0.65	♀ 5.00 ±0.00	♀ 3.00 ±1.13	♀ 3.75 ±1.51
	5.02±4.99	7.31±3.79	7.40±4.75	0.26±0.59	3.04±2.54	1.49±0.56	9.19±6.10	1.81±2.54	6.11±3.44	
Years of training	♂ 5.14 ±5.18	0.584	♂ 7.50 ±4.00	♂ 7.04 ±4.50	♂ 0.23 ±0.51	♂ 3.47 ±2.47	♂ 1.57 ±0.57	♂ 8.94 ±6.85	♂ 1.00 ±1.56	♂ 7.38 ±2.63
			0.724	0.569	0.015*	0.015*	0.035*	0.563	0.170	0.047*
	♀ 4.83 ±4.68		♀ 7.12 ±3.63	♀ 7.89 ±5.16	♀ 0.29 ±0.66	♀ 1.22 ±2.11	♀ 1.00 ±0.00	♀ 9.94 ±2.97	♀ 2.55 ±3.08	♀ 5.10 ±3.73

3.2. Anthropometric Results of the Participants

The anthropometric results of the participants show the existence of statistically significant results between men and women. Men had greater weight ($p<0,001$), standing height ($p<0,001$), sitting height ($p<0,001$) and arm span ($p<0,001$), also greater circumferences in the arm ($p<0,001$), the waist ($p<0,001$) and the calf ($p<0,001$), besides the styloid diameter of the wrist ($p<0,001$). On the other hand, women tended to have greater measurements in the folds, especially on the tricipital ($p<0,001$), subscapular ($p<0,001$), abdominal ($p<0,001$), suprailiac ($p<0,001$) and thigh (p 0,008) (Table 3).

Among amateur athletes who played basketball, we observed statistically significant results that indicated higher values in men compared to women in; weight ($p<0,001$), standing height ($p<0,001$), arm span ($p<0,001$), waist (p 0,004) and the thigh circumference (p 0,001), styloid diameter of the wrist (p 0,004) and bicondyle diameter of the femur (p 0,024). Women had significantly higher values in some folds, like the tricipital ($p<0,001$), subscapular (p 0,006), abdominal (p 0,001) and the calf (p 0,048) (Table 3).

Among amateur athletes who played handball, we observe statistically significant results that indicated higher values in men compared to women in; weight ($p<0,001$), standing height ($p<0,001$), sitting height ($p<0,001$), arm span ($p<0,001$), some circumferences like; the arm ($p<0,001$), waist (p 0,023), hip (p 0,008), thigh ($p<0,001$), calf (p 0,016), and the biceps fold (p 0,028). Women had significantly higher values in some folds, like the subscapular (p 0,002), abdominal ($p<0,001$) and the suprailiac (p 0,007) (Table 3).

Among amateur athletes who walked regularly, we observed statistically significant results that indicated higher values in men compared to women in; weight ($p<0,001$), standing height ($p<0,001$), sitting height ($p<0,001$), arm span ($p<0,001$), some circumferences like the arm (p 0,005) and the waist (p 0,001). Women had significantly higher values in some folds, like the tricipital (p 0,030) and the suprailiac (p 0,039) (Table 3).

Among amateur athletes who ran regularly, we observed statistically significant results that indicated higher values in men compared to women in; weight (p 0,001), standing height ($p<0,001$), arm span (p 0,001) and the circumference of the waist (p 0,015). Women had significantly higher values in some folds, like the tricipital (p 0,001) and the suprailiac ($p<0,001$) (Table 3).

Among amateur athletes who did CrossFit, we observed statistically significant results that indicated higher values in men compared to women in; weight ($p<0,001$), standing height ($p<0,001$), sitting height ($p<0,001$), arm span ($p<0,001$), some circumferences like the arm (p 0,001) and the calf (p 0,042), and the bicondyle diameter of the femur (p 0,019) (Table 3).

Among amateur athletes who played football, we observed statistically significant results that indicated higher values in men compared to women in; weight ($p<0,001$), standing height ($p<0,001$), sitting height ($p<0,001$), arm span ($p<0,001$), some circumferences like the arm (p 0,008), waist (p 0,006) and calf (p 0,002), also in the styloid diameter of the wrist (p 0,002). Women had significantly higher values in the circumference of the tight (p 0,014), and some folds, like the tricipital ($p<0,001$), subscapular (p 0,001), abdominal (p 0,031) and the suprailiac ($p<0,001$) (Table 3).

Among amateur athletes who go regularly to the gym, we observed statistically significant results that indicated higher values in men compared to women in; weight ($p<0,001$), standing height ($p<0,001$), sitting height ($p<0,001$), arm span ($p<0,001$), the circumference of the arm ($p<0,001$) and the bicipital fold (p 0,011). Women had significantly higher values in some folds, like the tricipital (p 0,012), subscapular (p 0,003), abdominal (p 0,001), suprailiac (p 0,024) and the tight ($p<0,001$) (Table 3).

Among amateur athletes who played volleyball, we observed statistically significant results that indicated higher values in men compared to women in; weight ($p<0,001$), standing height ($p<0,001$), sitting height ($p<0,001$) and the circumference of the arm ($p<0,001$). Women had significantly higher values in some circumferences like the tight (p 0,003) and the calf (p 0,035), the bicondyle diameter of the femur (p 0,042) and the tight fold (p 0,009) (Table 3).

Table 3. Anthropometric results of the participants. ♂= Masculine, ♀= Feminine, * = statistically significant result.

Analyzed Variable	Total	Basketball	Handball	Walking	Running	CrossFit	Football	Gym	Volleyball
Weight	73.70±11.86	80.69±8.83	76.85±15.80	71.79±11.56	69.57±8.90	78.99±11.03	71.93±11.12	70.85±11.23	67.52±8.71
	♂ 78.92±10.44 $p<0,0001*$ ♀ 65.43±8.90	♂ 86.16±6.35 ♀ 75.02±7.37	♂ 86.29±5.07 $<0,001*$ ♀ 65.68±6.86	♂ 79.23±7.65 $<0,001*$ ♀ 64.35±9.92	♂ 71.52±8.07 $<0,001*$ ♀ 60.90±7.39	♂ 83.09±8.57 0.001* ♀ 64.82±5.29	♂ 75.46±9.84 $<0,001*$ ♀ 61.12±7.24	♂ 77.45±9.11 $<0,001*$ ♀ 63.81±8.86	♂ 75.39±4.51 $<0,001*$ ♀ 62.27±6.60
Standing height	173.98±9.38	180.75±6.61	177.10±9.31	168.78±7.36	174.16±8.23	174.41±6.87	174.65±9.26	170.52±9.06	170.40±7.12
	♂ 178.10±7.97 $<0,0001*$ ♀ 167.47±7.60	♂ 184.02±6.13 $<0,001*$ ♀ 177.35±5.30	♂ 184.73±12.16 $<0,001*$ ♀ 168.09±7.94	♂ 173.86±4.68 $<0,001*$ ♀ 163.70±5.93	♂ 176.10±7.64 $<0,001*$ ♀ 165.56±.45	♂ 176.45±5.97 $<0,001*$ ♀ 167.35±4.97	♂ 178.02±7.69 $<0,001*$ ♀ 164.35±5.17	♂ 177.44±4.76 $<0,001*$ ♀ 163.13±6.21	♂ 175.63±4.30 $<0,001*$ ♀ 166.92±6.50

Measurement		G1	G2	G3	G4	G5	G6	G7	G8	G9
	Total	90.60±5.18	93.15±4.65	92.90±6.94	88.54±3.87	86.57±5.08	91.94±4.17	90.79±4.54	90.16±3.93	171.05±9.38
Sitting Height	♂	92.18±5.10	93.59±5.87	96.85±5.58	90.88±2.72	87.08±5.15	93.09±3.83	92.24±4.04	92.63±2.47	177.94±6.73
	p	<0,001*	0.486	<0,001*	<0,001*	0.146	<0,001*	<0,001*	<0,001*	<0,001*
	♀	88.11±4.28	92.69±2.96	88.23±5.35	86.19±3.42	84.33±4.33	87.95±2.53	86.35±2.76	87.53±3.48	163.70±5.29
	Total	174.78±11.68	182.70±7.45	178.27±9.71	169.45±8.14	174.95±10.14	175.54±8.37	176.58±10.93	91.10±4.41	167.28±16.94
Arm Span	♂	179.37±9.47	186.93±6.55	186.35±12.40	174.66±5.83	177.13±9.27	177.75±7.55	179.96±10.08	94.69±2.94	173.63±4.57
	p	<0,001*	<0,001*	<0,001*	<0,001*	0.001*	<0,001*	<0,001*	<0,001*	0.052
	♀	167.52±11.17	178.31±5.60	168.73±7.83	164.23±6.68	165.28±8.27	167.91±6.50	166.24±5.73	88.71±3.53	163.04±8.65
	Total	32.25±4.40	32.76±3.78	33.77±5.91	31,77±4.18	29.54±3.12	36.56±2.79	31.93±3.75	30.48±3.89	30.46±3.27
Arm perimeter	♂	33.54±4.32	33.31±3.46	36.58±6.11	33.22±4.01	29.89±3.11	37.22±2.14	32.61±3.87	33.09±2.74	33.56±2.34
	p	<0,001*	0.284	<0,001*	0.005*	0.102	0.001*	0.008*	<0,001*	<0,001*
	♀	30.20±3.71	32.19±4.08	30.45±3.53	30.33±3.89	28.00±2.83	34.27±3.61	29.88±2.47	27.70±2.89	28.40±1.84
	Total	83.83±9.55	88.64±8.71	84.00±6.44	88.19±11.48	78.86±8.77	86.29±7.80	84.33±8.30	77.65±8.84	77.33±7.05
Waist perimeter	♂	85.57±8.89	91.93±7.64	85.92±6.14	93.00±7.01	80.28±8.46	85.74±7.85	85.87±8.78	79.88±5.26	77.06±5.11
	p	<0,001*	0.004*	0.023*	0.001*	0.015*	0.366	0.006*	0.150	0.850
	♀	81.08±9.92	85.23±8.58	81.73±6.16	83.38±13.08	72.56±7.63	88.18±7.68	79.65±3.98	75.27±11.22	77.50±8.20
	Total	94.10±6.67	97.28±5.19	95.17±8.08	97.16±8.17	90.94±5.63	93.00±5.22	92.30±5.33	92.84±6.69	93.00±5.17
Hip perimeter	♂	94.20±7.13	97.00±.0	97.96±9.40	98.53±8.51	90.50±5.65	93.58±5.54	92.19±5.99	93.88±6.14	92.25±4.28
	p	0.707	0.690	0.008*	0.180	0.256	0.151	0.762	0.381	0.461

	±6.18 ♀ 97.58±4.01								
	♀ 93.94±5.87	♀ 91.86±4.42	♀ 95.78±7.69	♀ 92.88±5.40	♀ 91.00±3.38	♀ 92.65±2.47	♀ 91.73±7.25	♀ 93.50±5.72	
Thigh perimeter	50.62±6.38	55.16±4.05	47.77±6.31	49.55±6.61	51.24±3.53	52.87±3.64	48.7±7.90	52.21±4.08	48.30±8.06
	♂ 50.15±6.28	♂ 53.43±4.09	♂ 50.77±6.19	♂ 48.75±6.60	♂ 50.83±2.81	♂ 53.29±3.68	♂ 47.35±8.56	♂ 52.72±4.41	♂ 43.81±3.80
p	0.065	0.001*	<0,001*	0.334	0.079	0.133	0.014*	0.483	0.003*
	♀ 51.35±6.48	♀ 56.96±3.19	♀ 44.23±4.39	♀ 50.36±6.62	♀ 53.11±5.60	♀ 51.41±3.22	♀ 52.72±2.93	♀ 51.67±3.77	♀ 51.29±8.79
Calf perimeter	35.34±3.47	36.07±2.49	34.78±2.78	36.40±4.38	35.07±3.18	35.32±3.38	35.04±3.31	34.97±5.19	34.53±2.39
	♂ 35.70±3.77	♂ 35.72±2.30	♂ 35.65±2.95	♂ 37.38±4.65	♂ 34.93±3.06	♂ 35.84±3.52	♂ 35.74±3.41	♂ 36.03±7.00	♂ 33.56±2.99
p	0.008*	0.310	0.16*	0.074	0.494	0.42*	0.02*	0.245	0.035*
	♀ 34.77±2.84	♀ 36.42±2.67	♀ 33.75±2.20	♀ 35.42±3.92	♀ 35.72±3.47	♀ 33.50±2.06	♀ 32.88±1.73	♀ 33.83±1.57	♀ 35.17±1.66
Styloid diameter of the wrist	7.76x0.78	8.17x0.78	8.00x0.65	7.50x0.77	7.80x0.68	7.68x0.73	7.86x0.79	7.50x0.85	7.45x0.72
	♂ 7.89±0.76	♂ 8.46±0.83	♂ 8.00±0.63	♂ 7.67±0.74	♂ 7.83±0.67	♂ 7.76±0.64	♂ 8.03±0.80	♂ 7.71±0.72	♂ 7.31±0.70
p	<0,001*	0.004*	1.000	0.084	0.595	0.161	0.02*	0.160	0.33
	♀ 7.57±0.77	♀ 7.87±0.59	♀ 8.00±0.69	♀ 7.34±0.79	♀ 7.69±0.78	♀ 7.41±0.97	♀ 7.35±0.49	♀ 7.28±0.94	♀ 7.54±0.74
Bicondylar diameter of the femur	14.15±1.25	14.48±1.16	14.46±0.85	13.60±1.43	14.42±1.55	13.92±1.01	13.97±1.27	13.93±0.90	14.66±1.22
	♂ 14.24±1.26	♂ 14.83±1.08	♂ 14.588±0.95	♂ 13.92±1.41	♂ 14.44±1.56	♂ 14.11±1.05	♂ 14.01±1.33	♂ 13.99±0.94	♂ 14.19±0.98
p	0.056	0.024*	0.298	0.067	0.846	0.019*	0.578	0.673	0.042*
	♀ 14.00±1.22	♀ 14.12±1.14	♀ 14.32±0.72	♀ 13.27±1.39	♀ 14.33±1.30	♀ 13.27±0.79	♀ 13.88±0.73	♀ 13.85±0.89	♀ 14.98±1.27

Variable		C1	C2	C3	C4	C5	C6	C7	C8	C9
	Total	8.83±367	966±3.92	9.50±3.34	11.36±3.98	8.41±4.06	6.51±2.65	8.67±3.15	8.26±3.04	6.93±1.76
Biceps fold	♂	8.72±3.76	8.93±3.67	10.46±3.65	12.16±3.51	8.10±4.17	6.05±2.47	8.37±3.09	9.56±3.24	6.88±1.71
	p	0.468	0.166	0.028*	0.110	0.267	0.202	0.167	0.011*	0.886
	♀	8.99±3.54	10.42±4.09	8.36±2.57	10.56±4.31	9.78±3.38	8.09±2.77	9.59±3.26	6.87±2.13	6.96±1.83
	Total	14.15±5.37	16.38±5.20	13.31±4.54	18.16±5.11	12.67±3.99	11.86±4.78	12.00±4.99	15.19±6.05	13.35±4.73
Triceps fold	♂	12.41±4.73	12.93±4.27	12.42±4.09	16.78±4.44	11.80±3.77	11.84±4.80	10.19±4.08	12.63±5.60	12.69±5.00
	p	<0.001*	<0.001*	0.142	0.030*	0.001*	0.968	<0.001*	0.012*	0.477
	♀	16.91±5.18	19.96±3.32	14.36±4.90	19.53±5.42	16.56±2.30	11.91±4.93	17.53±3.14	17.93±5.40	13.79±4.60
	Total	12.02±4.95	13.93±5.19	12.42±4.18	13.88±3.85	13.95±4.99	7.29±2.66	10.65±4.52	12.38±5.52	15.00±4.10
Male pectoral fold	♂	12.02±4.95	13.93±5.19	12.42±4.18	13.88±3.85	13.95±4.99	7.29±2.66	10.65±4.52	12.38±5.52	15.00±4.10
	p	-	-	-	-	-	-	-	-	-
	♀	-	-	-	-	-	-	-	-	-
	Total	16.55±7.07	20.04±5.79	17.00±5.69	23.75±7.36	13.78±4.42	12.69±5.00	12.49±4.89	18.16±8.22	13.70±5.03
Subscapular fold	♂	14.78±6.15	17.93±6.38	14.69±4.25	22.91±4.92	13.20±4.00	12.29±5.43	11.42±4.47	14.13±6.34	14.75±5.21
	p	<0.001*	0.006*	0.002*	0.363	0.054	0.297	0.001*	0.003*	0.287
	♀	19.35±7.52	22.23±4.20	19.73±6.06	24.59±9.18	16.33±5.50	14.09±2.81	15.76±4.76	22.47±7.95	13.00±4.89
	Total	16.95±7.23	20.08±6.47	15.94±5.43	23.36±7.61	14.71±4.90	14.35±6.17	13.06±6.62	19.19±8.46	14.65±4.56
Abdominal fold	♂	15.14±6.58	17.19±7.03	13.27±4.38	22.66±5.18	14.25±4.96	14.16±6.70	12.13±6.39	14.69±5.20	14.50±5.03
	p	<0.001*	0.001*	<0.001*	0.464	0.164	0.695	0.031*	0.001*	0.868
	♀									

	19.81 ±7.30	23.08 ±4.17	19.09 ±4.90	24.06 ±9.48	16.78 ±4.27	15.00 ±4.02	15.88 ±4.90	24.00 ±8.76	14.75 ±4.33
Suprailiac fold	16.68±7.47	21.94±7.13	16.56±5.23	23.38±8.51	12.63±4.26	12.33±4.43	13.23±6.21	17.61±7.11	14.68±4.84
	♂ 14.60 ±6.51	♂ 20.30 ±8.38	♂ 14.73 ±5.05	♂ 21.19 ±5.80	♂ 11.63 ±3.40	♂ 11.88 ±4.35	♂ 11.52 ±5.56	♂ 14.88 ±5.44	♂ 15.31 ±4.57
	<0,001*	0.087	0.007*	0.039*	<0,001*	0.135	<0,001*	0.024*	0.504
	♀ 19.99 ±7.72	♀ 23.65 ±5.17	♀ 18.73 ±4.66	♀ 25.56 ±10.18	♀ 17.11 ±4.99	♀ 14.09 ±4.44	♀ 18.47 ±5.11	♀ 20.53 ±7.67	♀ 14.25 ±5.07
Thigh Fold	16.44±8.03	46.79±6.41	13.35±6.63	21.69±8.36	19.88±6.24	14.14±8.05	13.93±7.70	20.81±8.20	10.85±4.88
	♂ 15.69 ±7.44	♂ 16.15 ±5.94	♂ 12.81 ±6.03	♂ 20.63 ±6.78	♂ 19.10 ±6.06	♂ 14.66 ±8.20	♂ 14.60 ±8.07	♂ 14.50 ±5.39	♂ 8.44 ±4.15
	0.018*	0.461	0.540	0.313	0.065	0.411	0.209	<0,001*	0.009*
	♀ 17.63 ±8.77	♀ 17.46 ±6.91	♀ 14.00 ±7.36	♀ 22.75 ±9.69	♀ 23.33 ±6.18	♀ 12.36 ±7.61	♀ 11.88 ±6.18	♀ 27.53 ±4.37	♀ 12.46 ±4.74
Calf Fold	12.78±4.97	13.77±4.60	12.54±3.98	15.61±5.85	14.14±4.83	10.96±3.97	1.36±5.57	11.55±2.86	11.18±3.86
	♂ 12.40 ±5.04	♂ 12.56 ±4.68	♂ 13.31 ±3.84	♂ 15.25 ±5.35	♂ 13.68 ±4.67	♂ 10.92 ±4.23	♂ 11.33 ±6.06	♂ 11.38 ±3.34	♂ 9.81 ±4.04
	0.054	0.048*	0.149	0.627	0.155	0.902	0.927	0.734	0.067
	♀ 13.38 ±4.81	♀ 15.04 ±4.24	♀ 11.64 ±4.04	♀ 15.97 ±6.38	♀ 16.22 ±5.24	♀ 11.09 ±3.08	♀ 11.47 ±3.81	♀ 11.73 ±2.34	♀ 12.08 ±3.53

3.3. Kinanthropometric Results of the Participants

The kinanthropometric results of the participants show the existence of statistically significant results between men and women inn all the categories that we analysed. If we only compare between men and women, we found statistically significant results in the BMI, CI, RILL and BDI ($p<0,001$ in all of them) (Table 4).

- For the BMI variable we observed statistically significant differences between men and women, the results were higher among men in; basketball (p 0,003), handball (p 0,002), people who walked (p 0,003), CrossFit ($p<0,001$) and volleyball (p 0,001) (Table 4).

- For the PI variable we observed statistically significant differences between men and women in CrossFit (p 0,017). The results were higher among women (Table 4).
- For the CI variable we observed statistically significant differences between men and women in; basketball (p 0,003), gym (p 0,012) and volleyball (p 0,022). Except in volleyball, the results were always higher in women than in men (Table 4).
- For the RILL variable we observed statistically significant differences between men and women in; basketball (p 0,005), gym (p 0,012) and volleyball (p 0,021). Except in volleyball, the results were always higher in men than in women (Table 4).
- For the BDI variable we observed statistically significant differences between men and women in; basketball ($p<0,001$), handball ($p<0,001$), the ones that walked ($p<0,001$), running ($p<0,001$), CrossFit ($p<0,001$), football ($p<0,001$) and volleyball ($p<0,001$). The results were higher among women (Table 4).

Table 4. Kinanthropometric results of the participants. ♂= Masculine, ♀= Feminine, * = statistically significant result, BMI= Body Weight Index, PI= Ponderal Index, CI= Cormic Index, RILL= Relative Index of Lower Limbs, BDI= Body Density Index.

Analyzed Variable	Total	Basketball	Handball	Walking	Running	CrossFit	Football	Gym	Volleyball
	24.24±2.65	24.67±2.12	24.25±2.14	25.11±3.21	22.90±2.28	25.90±2.79	23.48±2.31	24.26±2.58	23.20±2.18
BMI	♂ 24.85±2.65	♂ 25.49±2.12	♂ 25.09±2.07	♂ 26.26±2.86	♂ 23.06±2.22	♂ 26.70±2.55	♂ 23.77±2.41	♂ 24.53±2.07	♂ 24.49±2.02
	<0,0001*	0.003*	0.002*	0.003*	0.322	<0,001*	0.061	0.547	0.001*
	♀ 23.28±2.36	♀ 23.82±1.79	♀ 23.24±1.81	♀ 23.96±3.17	♀ 22.22±2.54	♀ 23.14±1.54	♀ 22.57±1.72	♀ 23.96±3.07	♀ 22.34±1.87
	41.65±1.57	41.91±1.31	41.83±1.27	40.80±1.76	42.45±1.61	40.78±1.47	42.12±.30	41.35±1.51	41.95±1.38
PI	♂ 41.63±1.60	♂ 41.70±1.45	♂ 41.94±1.15	♂ 40.56±1.65	♂ 42.51±1.61	♂ 40.51±1.47	♂ 42.22±1.39	♂ 41.72±1.03	♂ 41.60±1.34
	0.781	0.257	0.538	0.290	0.592	0.017*	0.255	0.173	0.205
	♀ 41.67±1.52	♀ 42.11±1.12	♀ 41.71±1.42	♀ 41.03±1.86	♀ 42.19±1.66	♀ 41.70±1.10	♀ 41.80±0.95	♀ 40.97±1.86	♀ 42.18±1.39
	52.10±2.00	51.54±1.80	52.47±1.52	52.48±1.48	49.76±2.94	52.72±1.35	52.01±1.50	52.92±1.65	53.46±1.04
CI	♂ 51.78±2.21	♂ 50.83±2.09	♂ 52.47±1.47	♂ 52.28±0.96	♂ 49.50±3.13	♂ 52.76±1.37	♂ 51.84±1.68	♂ 52.22±1.58	♂ 53.91±0.73
	<0,0001*	0.003*	0.994	0.290	0.196	0.680	0.095	0.012*	0.022*
	♀ 52.36±1.47	♀ 52.27±1.04	♀ 52.48±1.61	♀ 52.67±1.86	♀ 50.91±1.52	♀ 52.57±1.31	♀ 52.54±0.43	♀ 53.67±1.42	♀ 53.15±1.11
RILL	92.22±7.88	94.29±7.53	90.73±5.59	90.71±5.4	101.66±12.30	89.81±4.87	92.42±5.71	89.13±5.92	87.14±3.66

Analyzed Variable		Total	Basketball	Handball	Walking	Running	CrossFit	Football	Gym	Volleyball
	♂	93.52 ±8.86	97.10 ±9.10	90.72 ±5.41	91.34 ±3.49	102.81 ±13.08	89.65 ±4.94	93.10 ±6.39	91.65 ±5.82	85.53 ±2.52
		<0,001*	0.005*	0.993	0.358	0.172	0.688	0.083	0.012*	0.021*
	♀	90.17 ±5.42	91.37 ±3.80	90.74 ±5.92	90.08 ±6.87	96.57 ±6.22	90.33 ±4.83	90.34 ±1.54	86.44 ±4.89	88.21 ±3.95
BDI		18.22±8.20	21.38±8.00	16.39±6.41	25.17±9.05	17.94±5.95	12.95±4.74	14.34±6.82	21.59±10.31	15.90±4.32
	♂	13.85 ±4.92	15.08 ±4.45	11.94 ±3.18	18.96 ±3.76	16.08 ±4.27	11.48 ±3.68	11.84 ±5.60	13.22 ±3.68	11.82 ±2.13
		<0,001*	<0,001*	<0,001*	<0,001*	<0,001*	<0,001*	<0,001*	<0,001*	<0,001*
	♀	25.14 ±7.56	27.91 ±5.03	21.66 ±5.14	31.38 ±8.52	26.20 ±5.42	30.53 ±6.90	22.11 ±3.60	30.53 ±6.90	18.62 ±3.06

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3.4. Body Composition Results of the Participants

The body composition results of the participants show the existence of statistically significant results between men and women in all the categories that we analysed; %F, %M, %B, %R ($p<0,001$ in all of them) (Table 5).

In the %F variable we observed statistically significant results between men and women in; basketball ($p<0,001$), handball ($p<0,001$), those who walk (p 0,003), running (p 0,003), football ($p<0,001$), gym (p 0,003), being always higher among women (Table 5).

In the %M variable we observed statistically significant results between men and women in; handball (p 0,003), gym (p 0,001) and volleyball (p 0,047), being always higher among men (Table 5).

In the %B we observed statistically significant results between men and women in; handball ($p<0,001$), CrossFit (p 0,015) and volleyball ($p <0,001$), being always higher among women (Table 5).

In the %R we observed statistically significant results between men and women in; basketball ($p<0,001$), handball ($p<0,001$), those who walk ($p<0,001$), running ($p<0,001$), CrossFit ($p<0,001$), football ($p<0,001$) and volleyball ($p <0,001$), being always higher among men (Table 5).

Table 5. Body composition results of the participants. ♂= Masculine, ♀= Feminine, * = statistically significant result, %F= Fat percentage, %M= Muscle percentage, %B= Bone percentage, %R= Residual percentage.

Analyzed Variable		Total	Basketball	Handball	Walking	Running	CrossFit	Football	Gym	Volleyball
		15.63±.74	17.78±3.07	15.39±2.46	19.35±3.94	14.01±2.29	13.62±2.51	13.55±3.11	16.52±4.35	14.41±2.57
%F	♂	14.49 ±3.22	16.24 ±3.32	14.22 ±1.91	18.56 ±2.53	13.57 ±2.09	13.45 ±2.70	12.71 ±2.86	14.40 ±3.17	14.54 ±2.67
		<0,001*	<0,001*	<0,001*	<0,001*	0.013*	0.003*	0.381	<0,001*	0.003*	0.792
	♀	17.42 ±3.82	19.39	16.79 ±2.33	20.13 ±4.88	16.00 ±2.21	14.21 ±1.69	16.13 ±2.38	18.78 ±4.38	14.32 ±2.56

	±1.72								
	35.21±3.24	33.22±2.59	35.06±3.14	33.64±2.09	34.43±2.74	38.92±2.51	36.24±3.09	34.29±3.69	35.88±2.43
%M	♂ 35.82±3.25	♂ 33.22±2.77	♂ 36.26±2.83	♂ 333.68±2.15	♂ 34.58±2.84	♂ 38.89±2.08	♂ 36.53±3.43	♂ 36.30±2.79	♂ 36.81±2.01
	$<0,001*$	0.999	0.003*	0.874	0.432	0.874	0.183	0.001*	0.047*
	♀ 34.24±3.00	♀ 33.22±2.44	♀ 33.64±2.92	♀ 33.60±2.05	♀ 33.77±2.25	♀ 39.03±3.75	♀ 35.37±1.40	♀ 32.15±3.36	♀ 35.26±2.53
	26.19±3.29	26.44±2.94	26.88±2.95	24.51±3.75	28.02±2.48	24.01±2.89	26.83±2.28	25.63±3.78	27.52±3.23
%B	♂ 25.57±2.91	♂ 26.45±3.19	♂ 25.43±2.44	♂ 23.66±2.85	♂ 27.72±2.24	♂ 23.48±2.41	♂ 26.65±2.29	♂ 25.17±2.72	♂ 24.60±2.09
	$<0,001*$	0.993	$<0,001*$	0.070	0.069	0.015*	0.252	0.501	$<0,001*$
	♀ 27.19±3.60	♀ 26.44±2.73	♀ 28.58±2.59	♀ 25.36±4.35	♀ 29.38±3.15	♀ 25.85±3.74	♀ 27.38±2.22	♀ 26.11±4.71	♀ 29.47±2.23
	22.97±1.67	22.56±1.59	22.67±1.57	22.50±1.60	23.531.30	23.44±1.46	23.37±1.31	23.56±2.66	22.19±1.56
%R	♂ 24.12±.024	♂ 24.10±0.08	♂ 24.09±0.10	♂ 24.09±0.08	♂ 24.14±0.13	♂ 24.18±0.53	♂ 24.11±0.15	♂ 24.13±0.07	♂ 24.05±0.32
	$<0,001*$	$<0,001*$	$<0,001*$	$<0,001*$	$<0,001*$	$<0,001*$	$<0,001*$	0.230	$<0,001*$
	♀ 21.15±1.30	♀ 20.96±0.15	♀ 20.99±0.21	♀ 20.91±0.09	♀ 20.84±0.23	♀ 20.90±0.21	♀ 21.11±0.15	♀ 22.96±3.80	♀ 20.95±0.16

4. Discussion

The objective of this study was to define a population of amateur athletes taking into a count a sociodemographic, anthropometric and kinanthropometric aspects, the main purpose was to define the existence of differences between them based on their biological sex and what kind a sport modality they practiced. As other authors believe, like Oja [6], we think this could be used to promote the health benefits or regular physical exercise. In addition, it could also be used to establish personal training plans based on their morphological characteristics [7], or even in recruiting sporting talent at an early age [8].

Based on Piercy criteria [3] and ISAK methodology [4], we analysed a population of 403 individuals, aged between 18 and 42 years. All of them were characterized by not having any kind of relevant pathology or injury, also, because of our geographical location, we decided that they should be following a Mediterranean diet [5]. We did all this because we were looking to avoid any extrinsic factor that could affect the results of our sample.

The results obtained in our research reflected that, on average, men tended to perform more hours of physical activity per week than women. There are other studies that obtained different results [9], but that could be motivated for many reasons. Probably is a consequence of the size of the sample and the sociodemographic characteristics of the area where the data was collected. We believe

that being a man or a woman does not affect the amount of exercise that an individual can performance. As other authors, like Palmer [10], we consider that this depends more on variables as disparate as age, geographical location, local culture, the existence or absence of sports facilities, promotion of sport by government entities and media, etc.

Some people believe that men tend to practice team sports in order to socialize and compete among themselves [11], while women tend to practice individual sports to seek the goal of feeling physically well [12]. In our opinion, this hypothesis is outdated, even we could argue if it is sexist. It is true that in our sample we observe a greater presence of men in team sports, but we cannot say that this is a universal true, we should analyze a larger sample to confirm or deny these hypotheses.

Anthropometric and kinanthropometric differences were also observed between men and women in our sample. In general, men tended to present higher values in terms of weight, height, size of circumferences and skinfolds, as well they used to have higher values of %M. Women tended to present higher values in indexes like BMI and percentage of body composition, especially in %F and %B. These results were also observed by other authors in their research, like it happened Bredella [13].

Strengths and limitations of Study. We believe that one of the greatest strengths of this study is that we used an international standardized methodology, which is what the ISAK proposes. Also, we use Piercy's criteria to define a person as an amateur athlete. This allows us to compare our results with other researchers who use the same methodology. Regarding the limitations of this study, although the sample is big, it's always advisable to try to increase it, so it would be interesting to continue expanding the data collection and even, it would be interesting to carry out in other geographical locations. Because, that way, we could obtain more and better conclusions.

5. Conclusions

Anthropometry can be used to measure differences between populations groups taking into a count many variables, in this case we decided to use the biological sex within different groups that were categorized by the sport modality they usually performance in a recreational way.

We consider that it's necessary to follow the guidelines stipulated by the ISAK and Piercy's criteria, because that helps to have a standardized protocols and definitions between all the researchers of the world.

Statistically differences were observed in all the sports modalities we study between men and women. This can be useful, not only to define a group, also if we're trying to personalize training or even to advise a person of which sport modality may best suit them based on their morphology.

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