

# BODY COMPOSITION IN VOLLEYBALL PLAYERS.



## PHYSIOLOGY OF SPORT EDUCATION



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## **INTRODUCTION: Body composition as a determinant of fitness and sport performance**

The body composition is an important fundamental of individual's motion, for sporting population, as much for general. To monitor values of basic somatic characteristics is the simplest way to assess health and nutrition state of an individual or a group of population.<sup>1</sup>

Current studies focus on changes in body composition associated with growth, maturation, ageing, changes associate with physical load and sport training, which means in early ages the body composition will not determinate the adult one, since this will be modify by the environment, nutrition, physical activity, etc.<sup>2, 3, 4</sup>. Anyway several studies support that children who are overweight at prepubescent age, usually have a high risk of being overweight or obese in their adulthood.<sup>1</sup>

Optimal and healthy body composition is determined by age, gender, somatotype, genetic factor, level of physical activity and other variables. It's not only important the proportion of fat mass, but also the distribution of this in the body; for example, the intra-abdominal fat mass in adults, refers a major risk of having undesirable health problems, which can end in type 2 diabetes mellitus<sup>5</sup>.

In athletes, body composition is not only considered a health prerequisite, if not the key for developing a proper quality of human motion, getting the highest level of performance<sup>6</sup>. Monitoring body composition in athletes provides us with an athlete detailed physiological profile, which helps to estimate the optimal body weight<sup>7</sup>.

Athletes, generally, are slimmer than people with sedentary way of life, the same way than female athletes have more fat mass than male athletes, while proportion of inactive mass depends on the specific sport discipline. There is no an optimal body composition for each particular sport discipline, but the most of them control their caloric intake daily, getting a better control of their body weight. Sport performance is not only determined by percentage proportion of fat mass, but also by other components, such height, weight, circumferential measures, length of body segments, lean body mass, muscles mass, intracellular mass, and extracellular mass.<sup>6</sup>

Individuals with lower body weight tend to be more successful in middle-distance and long-distance runs; taller ones, with long segments, have an advantage in jumping and throwing; while the smaller ones are successful in diving<sup>8</sup>.

The degree of changes in body composition depends on the type of exercise as well as on frequency, intensity and duration of training, then, we can speak about the typical body composition in some specific disciplines.

## BODY COMPOSITION OF ELITE FEMALE VOLLEYBALL PLAYERS.

The issues connected with body composition and volleyball have been studied for several years<sup>9, 10, 11, 12</sup>, the most of them suggest that in volleyball, as in other sports, the most important factor in a success team, are technical and tactical skills, anthropometric characteristics and individual physical performances. The fat free mass (muscles and bones) is important for the quality of speed, strength and power, and to prevent injuries.<sup>13</sup>

To determine a general body composition is difficult because is not possible to compare results from various studies, because the use of different methods for body composition assessment: dual energy x-ray absorptiometry, air displacement plethys-mography, bioelectrical impedance analysis, skinfolds, hydro densitometry...

The results are different depending on the gender and ages, but using some studies results is possible to compare are perceive the differences.

	Minimum	25% Percentile	Median	75% Percentile	Maximum	Mean	Std. Deviation
<b>Height (cm)</b>	168	169.5	178	180	188	176.7	6.21
<b>Weight (Kg)</b>	48.8	56.25	65.6	74.3	81.7	65.66	10.53
<b>Body mass index (Kg/m<sup>2</sup>)</b>	15.2	18.9	20.5	23.35	25.2	20.97	2.843
<b>Body Fat Mass (Kg)</b>	6.7	11.2	12.9	19.75	22.4	14.3	4.695
<b>Percent Body Fat (%)</b>	13.6	18.3	20.7	24.4	29.4	21.31	4.335
<b>Soft Lean Mass:</b>							
<b>Right Arm (Kg)</b>	1.83	2.245	2.6	2.965	3.28	2.573	0.4449
<b>Left Arm (Kg)</b>	1.91	2.165	2.51	2.895	3.18	2.54	0.4278
<b>Trunk (Kg)</b>	17.9	20	22.4	24.5	26.1	22.18	2.67
<b>Right Leg (Kg)</b>	6.69	7.425	8.52	9.255	10.3	8.452	1.165
<b>Left Leg (Kg)</b>	6.72	7.395	8.57	9.36	10.36	8.441	1.154
<b>Intracellular Water</b>	19.1	20.7	23.6	26.1	28.3	23.41	3.146
<b>Extracellular Water</b>	11.7	12.65	14.2	15.6	17	14.18	1.719

Table 1. Anthropometric measurements and body composition characteristics of a female cadet volleyball players, using the statistical program GraphPad Prism 6.<sup>14</sup>

For female senior players the results are:

Variables	WUT (n=150)	Volleball (n=12)	F	p	$\eta^2$
	Mean $\pm$ SD	Mean $\pm$ SD			
Age (years)	20.0 $\pm$ 1.1	21.6 $\pm$ 1.5	19.33	0.000	0.108
Training (years)	-	8.4 $\pm$ 3.4			
Body height (cm)	166.50 $\pm$ 6.37	177.27 $\pm$ 6.24	31.84	0.000	0.166
Bicondylar humerus breadth (cm)	6.06 $\pm$ 0.27	6.39 $\pm$ 0.36	16.26	0.000	0.092
Wrist breadth (cm)	5.05 $\pm$ 0.28	5.28 $\pm$ 0.21	7.18	0.008	0.043
Bicondylar femur breadth (cm)	8.99 $\pm$ 0.50	9.27 $\pm$ 0.30	3.51	0.063	0.022
Biacromial breadth (cm)	36.46 $\pm$ 1.67	39.17 $\pm$ 0.97	30.95	0.000	0.162
Bicristal breadth (cm)	28.68 $\pm$ 1.85	29.59 $\pm$ 1.73	2.72	0.101	0.017
Arm girth relaxed (cm)	26.74 $\pm$ 2.83	26.90 $\pm$ 2.32	0.035	0.851	0.000
Arm girth flexed and tensed (cm)	27.06 $\pm$ 2.43	29.04 $\pm$ 2.13	7.490	0.007	0.045
Arm girth corrected (cm)	24.58 $\pm$ 1.82	26.93 $\pm$ 1.86	4.52	0.035	0.028
Waist girth (cm)	70.06 $\pm$ 5.59	73.27 $\pm$ 4.66	3.741	0.055	0.023
Hip girth (cm)	95.70 $\pm$ 6.39	98.88 $\pm$ 3.31	2.88	0.092	0.018
WHR index	0.73 $\pm$ 0.04	0.74 $\pm$ 0.04	0.66	0.419	0.004
Calf girth corrected (cm)	34.55 $\pm$ 2.22	35.96 $\pm$ 2.10	4.52	0.035	0.028
Calf girth (cm)	36.17 $\pm$ 2.46	37.27 $\pm$ 2.21	2.25	0.136	0.014
$\Sigma$ 3SKF(cm)	5.10 $\pm$ 1.65	4.59 $\pm$ 1.02	1.13	0.290	0.007
$\Sigma$ 3SKFcorrected (mm)	52.26 $\pm$ 17.03	44.21 $\pm$ 10.37	2.60	0.109	0.016
Body mass (kg)	59.71 $\pm$ 8.44	70.98 $\pm$ 6.49	20.41	0.000	0.113
BMI index	21.53 $\pm$ 2.75	22.63 $\pm$ 2.53	1.81	0.181	0.011

Table 2. Anthropometrical characteristics of volleyball players and students of Warsaw University of Technology.<sup>15</sup>

Variables	Muscle torque [N·m]	ENDO	MESO	ECTO
SUER	200.6 $\pm$ 27.3	0.53	0.50	-0.47
SUEL	174.0 $\pm$ 20.9	0.43	0.64*	-0.51
SUE	374.6 $\pm$ 46.9	0.50	0.57*	-0.50
SLER	731.1 $\pm$ 107.9	0.31	0.08	-0.11
SLEL	709.0 $\pm$ 95.1	0.04	-0.18	0.11
SLE	1440.1 $\pm$ 198.0	0.19	-0.04	-0.01
ST	552.6 $\pm$ 74.1	0.50	-0.05	-0.18
TOTAL	2367.4 $\pm$ 272.6	0.36	0.05	-0.14

Table 3. Mean values ( $\pm$ SD) of the sums of the maximal muscle torque of the right (R) and left (L) upper extremity (SUE), lower extremity (SLE), trunk (ST) and all ten muscle groups (TOTAL), and Pearson's linear correlation coefficients between muscle torque and endomorphy (ENDO), mesomorphy (MESO) and ectomorphy (ECTO).<sup>15</sup>

And for male volleyball players:

Subjects	Total (n = 280)		Group 1-4 (n = 48)		Group 21 (n = 43)		Poland (n = 12)	
	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD
Age	26.53	3.90	27.40	3.32	27.86	4.74	27.58	3.90
Body height (cm)	198.41	6.05	199.73	7.14	196.14	6.67	200.08	5.88
Body weight (kg)	89.40	8.43	91.21	9.00	87.35	9.76	87.08	5.35
Spike reach (cm)	344.08	13.37	345.27	12.66	336.02	16.84	347.00	11.67
Block reach (cm)	326.68	13.09	323.57	11.45	321.19	15.54	324.09	10.86
Rohrer's index	1.15	0.10	1.15	0.10	1.16	0.10	1.09	0.07

$\bar{x}$  = mean, SD = standard deviation

Table 4. Numeric characteristics of the examined features and Rohrer's index of participants in the 2014 FIVB Volleyball Men's World Championship<sup>16</sup>.

Subjects	Total (n = 280)		Group 1-4 (n = 48)		Group 21 (n = 43)		Poland (n = 12)	
	n	%	n	%	n	%	n	%
Body type								
Leptosomatic	253	90.36	42	87.50	38	88.37	12	100.00
Athletic	26	9.28	6	12.50	5	11.63	-	-
Pyknic	1	0.36	-	-	-	-	-	-

n = number of subjects, % = percentage value

Table 5. Body types of the examined volleyball players participating in the 2014 FIVB Volleyball Men's World Championship.<sup>16</sup>

For men I found the percent of players that have each kind of somatotype, instead of the median of all of them. But these results can help to make an idea about the best somatotype for a volleyball player.

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