

**DIFFERENTIATION OF BODY COMPOSITION OF PLAYERS
OF THE POLISH NATIONAL BASEBALL TEAM**
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Annotation. The purpose of the study is to identify the differentiation of body composition among players of Polish national baseball team in comparison to persons of the same population not professionally engaged in sport. The study involved Polish baseball representatives (n=20). Competitors' age was 18-28 years, body mass from 67.7 kg to 114 kg (85±10.3 kg), and body height 173-196 cm (185.1±4.8). The training experience was 7-14 years and it was highly differentiated. The stoutness factor is the dominant factor among "infielders" and "pitchers", and among "outfielders" – the length one. The proportions of the features within the factors show that players are characterized by a strongly muscled forearm and a shank and by a clear predominance of the elbow width with a disproportionately – to the overall size of the factor – small knee and shoulder width. In the length factor an even contribution of the upper and lower extremity length with lower sitting body height can be noted. Depending on the position on the field there is a differentiation of the internal proportions of the body.

Key words: body composition, baseball, national, team.

Introduction

The problem of differentiation of body composition among top class athletes is one of the most topical problems in the theory of sports training [1, 2, 11].

As a result of years of research, a thesis has been formulated that with the increase in sports championship and hence also training experience, there is a reduction in the variability of somatic indices. In this respect, athletes within a given discipline or event become more homogenous.

In the light of the above, the main aim of the study was an attempt to identify morphological differentiation among baseball players with reference to the position on the field and to answer the following research questions:

1. What somatic factors determine the athletes' specific body composition?
2. What internal proportions of body composition are characteristic of them?

Material and methods

The study involved competitors from the Polish national team in men's baseball (n=20). Competitors' age was 18-28 years, body mass 67.7 kg to 114 kg (85±10.3 kg), body height 173-196 cm (185.1±4.8). The training experience was 7-14 years and it was highly differentiated.

Table 1.

Features of the body build of Polish men's baseball representatives (n=20) and a comparative group [10].

Features	Comparative group, n=153		Infielders, n=8		Outfielders, n=6		Pitchers, n=6	
	X	SD	X	SD	X	SD	X	SD
Body mass [kg]	72.11	8.96	88.68	14.8	83.67	5.76	81.50	5.10
Body height [cm]	179.36	6.19	186.1	7.47	184.67	1.51	184.33	2.07
Sitting body height [cm]	93.86	3.06	94.50	4.11	92.17	1.57	92.25	1.78
Length of upper extremity [cm]	78.30	3.51	81.35	3.21	79.30	0.80	79.68	1.59
Length of lower extremity [cm]	85.50	4.10	89.65	3.13	86.57	1.05	87.25	1.23
Shoulder width [cm]	40.67	1.59	40.59	2.13	39.97	2.20	39.58	2.06
Pelvic width [cm]	28.44	1.41	30.01	2.81	27.92	0.95	27.80	0.77

Elbow width [cm]	6.98	0.34	7.58	0.50	7.52	0.52	7.53	0.51
Knee width [cm]	9.82	0.45	9.96	0.72	9.18	0.72	9.15	0.69
Forearm perimeter [cm]	26.02	1.80	29.96	2.09	29.50	0.86	29.12	1.00
Shank perimeter [cm]	36.86	2.30	40.58	2.58	39.12	1.56	39.60	1.22
Sum of three fat skinfolds [mm]	33.4	14.3	8.83	1.38	24.52	2.82	24.90	2.33

Methods

The assessment of internal proportions of the body build was achieved by means of Perkal's [9] natural indicators with Milicerowa's modifications [7]. For this purpose the following were determined:

- Composition factors m – through adding values standardized within each factor and dividing the sum by the number of features identifying the given factor. The adiposity factor, which is a standardized value of fat and skin folds was an exception: $Z = m$;
- The indicator of the overall body size (M) of the group: $M = m_1 + m_2 + m_3 / 3$;
- The assessment of internal proportions of the body composition as achieved by calculating Perkal's natural indicators for each factor of the composition: $m_1 - M$; $m_2 - M$; $m_3 - M$;
- The evenness of the composition was determined by means of the intrapersonal variability indicator – the difference between the natural indicator of the highest numerical value and the natural indicator of the lowest numerical value;
- The code of internal group proportions on the basis of the point scale of Perkal's natural indicators (Table 2);
- The assessment of internal proportions of the composition features within each of the factors was made by deducting the value of the m factor from the standardized features.

The reference group was made up of students of Warsaw University of Technology [10]. Numerous scientific publications [8, 10, 12] emphasize specific comparative values of this social group in studies on the body build of Polish sportsmen. Students of the University of Technology are characterized by the greatest biological development (height and body mass) among Polish academic youth. Thus, it is the part of the population which constitutionally is the closest to sportsmen (who, as it is known, come from the most physically perfect youth).

Table 2.

<i>Point scales of Perkal's natural indicators</i>		
Points	Values of Perkal's natural indicators	
1	X do -1.07	
2	-1.06 do -0.57	values less than average
3	-0.56 do -0.18	
4	-0.19 do 0.18	average value
5	0.19 do 0.57	
6	0.58 do 1.06	values greater than average
7	1.07 do X	

Results

As a result of the study, values of body composition have been specified, which confirm in a more generalized way the observations made on the values of the standardized individual features [4] – Tab. 3.

Stoutness is the dominant factor in the body composition among "infielders" and "pitchers" (respectively: 1.16 and 0.32). "Outfielders" are characterized by a slight predominance of the length factor ($m_1 = 0.21$). Low adiposity and, in the case of "infielders", greater overall body size ($M = 0.76$) is a distinguishing factor in baseballers' body composition.

Table 3.

Factor	<i>Standardized features of the body composition of Polish men's baseball representatives (n=20)</i>		
	Positions on the field		
	infielders	outfielders	pitchers
Length m_1	0.79	0.21	0.27

Stoutness m_2	1.16	0.18	0.32
Adiposity m_3	0.32	-0.63	-0.60
Overall size index M	0.76	-0.08	0

While analyzing mutual proportions between factors of body composition in Polish baseball representatives, differences in individual groups of composition features become clear (Figure 1). "Infielders" are the most proportionately built, and the value of the intra-group variability index amounts to 0.84 with the code of internal proportions – 4-5-3. "Outfielders" also have the intra-group variability index value of 0.84, but the code of internal proportions is 5-5-3. "Pitchers" are the least proportionately built – the intra-group variability index is 0.92 and is determined by the disproportionately low contribution of the adiposity factor to the overall size of the body. The code of internal proportions is 5-5-2.

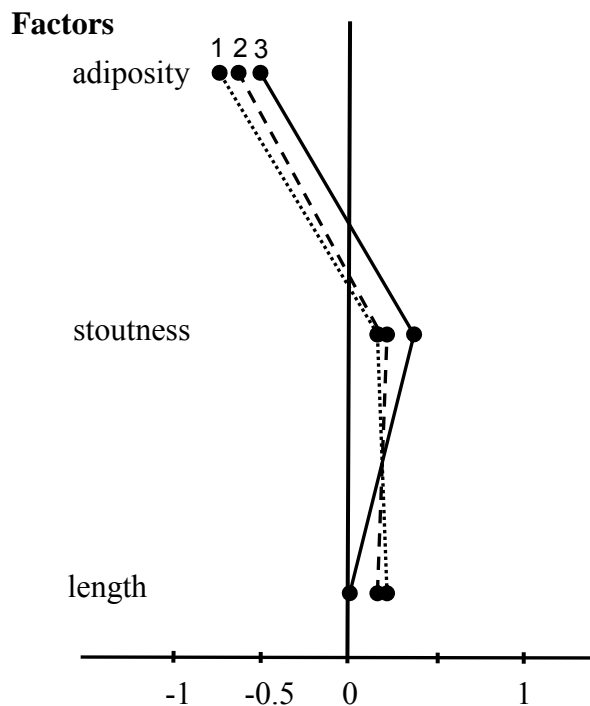


Fig. 1. Natural indicators of body composition factors among baseball players, $n = 20$. Denotation: 1-pitchers, 2-outfielders, 3- infielders

Calculations of internal proportions of composition features within each of the factors provide very important information on baseballers' body composition (Figure 2). All representatives (regardless of their position on the field) are characterized by a strongly muscular forearm and shank. In the features expressing skeletal stoutness there is a clear predominance of the elbow width and disproportionately to the overall size of the factor small width of knees and shoulders.

In the length factor, an even contribution of the upper and the lower extremity length with a lower sitting body height can be noted. The body height has a dominant contribution to this factor among "infielders" and "pitchers". Among "outfielders" the body height has a small contribution to the overall size of this factor.

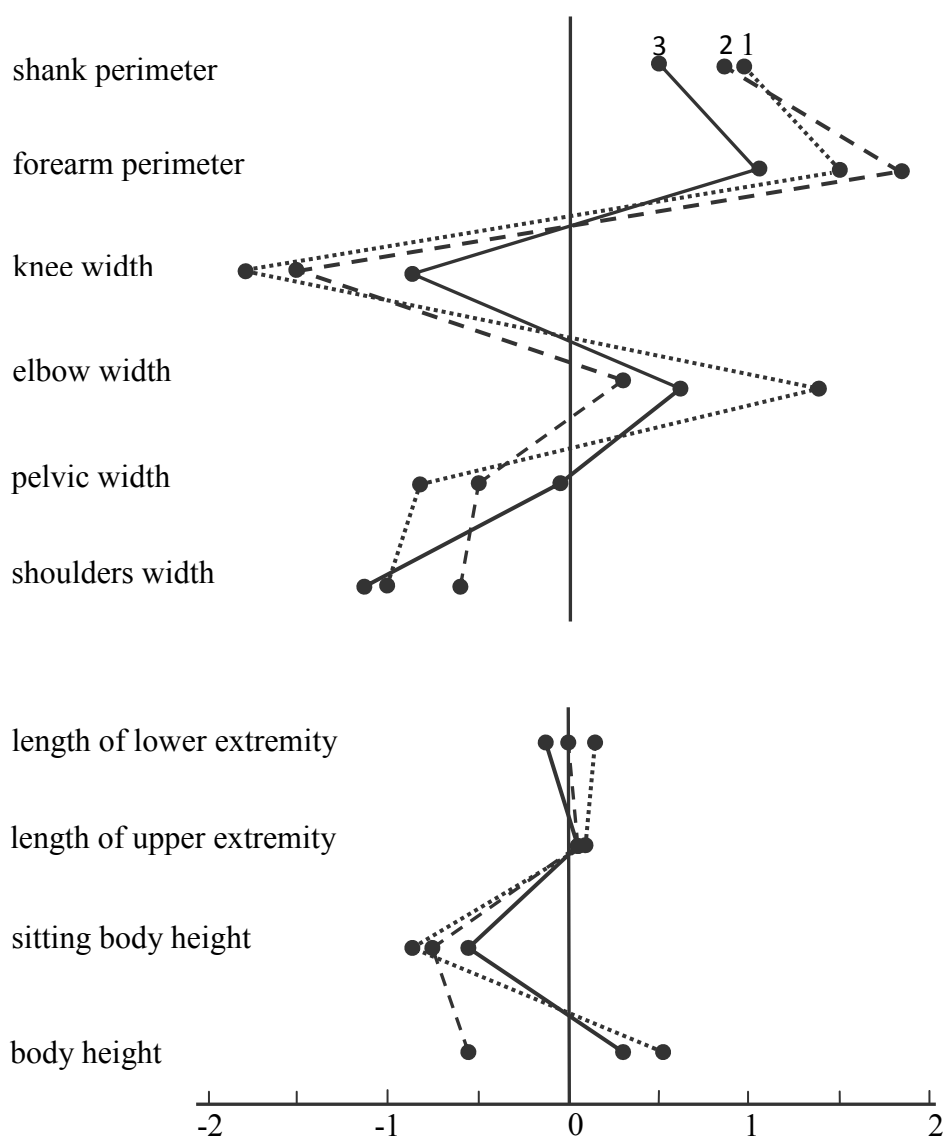


Figure 2. Natural indicators of somatic features within factors of the body composition among baseball players, $n = 20$. Denotation as in Figure 1.

Discussion

Baseball players' morphological differentiation revealed in the study is a resultant of two processes: on the one hand – the selection process, on the other hand – the effect of adaptation of the organism to the external factors affecting it. Baseballers are characterized by the correct weight and are considered long-legged [4].

In terms of the overall body size ($M=0.76$), only "infielders" significantly outweigh the comparative group (students of Warsaw University of Technology). In studies using Perkal's natural indicators method only judokas of heavy-weight categories [3] and wrestlers [6] outweigh "infielders" with the overall body size ($M=3.4$ and $M=1.8$, respectively). However, in terms of the specificity of the composition these are "pitchers" who are a group of the most specific composition among baseballers. The difference between the highest and the lowest natural indicator is 0.92. Taking into account other studies of this type, only Polish modern pentathlon representatives [5] and wrestlers of light-weight categories [6] have a more proportional composition (the indicator value: 0.33 and 0.65, respectively).

Natural indicators of somatic features within the factors provide important information on the specifics of baseballers' body composition. In the stoutness factor, the circumference of the forearm and the predominance of the elbow width over the knee are clearly marked. In the length factor, the contribution of somatic features is more harmonious. However, the small contribution of the sitting body height draws attention.

Conclusions

1. Functions which baseballers players perform during the game are an important factor in determining their morphological differentiation. Stoutness is the dominant factor in body composition of "infielders" and "pitchers". On the other hand, "outfielders" are characterized by a slight predominance of the length factor. Low adiposity and, in the case of "infielders", greater overall body size are a factor distinguishing baseballers' body composition.

2. "Infielders" are the most proportionately built –the code internal proportions amounts to 4-5-3, and "outfielders" – 5-5-3. "Pitchers" are less proportionately built – 5-5-2. The large value of the intra-group variability index is determined by the disproportionately low contribution of the adiposity factor to the overall body size.

3. All baseball players are characterized by the strongly muscled forearm and shank and a clear predominance of the elbow width and disproportionately – to the overall size of the stoutness factor – small width of the knees and shoulders.

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