

# Changes in Body Composition during the Macrocycle and Correlation with Playing Position and Markers of Fatigue in Young Elite Soccer Players

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## Introduction

The aim of this research was to investigate changes in body composition (BC) and its correlation with playing position and fatigue markers (testosterone/ cortisol) during the macrocycle.

## Methods

Twenty-nine elite young soccer players (4 goalkeepers, 9 defenders, 8 midfielders, 8 forwards) participated (age:  $20.1 \pm 1.4$  years, height:  $181.0 \pm 7.9$  cm, body mass:  $76.0 \pm 8.9$  kg) and underwent body composition measurements according to the ISAK protocol. Body fat mass (kg) (FM), fat percentage (%), muscle mass (kg) (MM), and fat-free mass (kg) (FFM) were assessed. Measurements were taken at five time points, at the beginning of the preparation and at the end of it, at the start of the competitive season, in the middle and at the end of it. Biochemical examinations were conducted before the start of the preparation and midway through the macrocycle in order to assess testosterone, cortisol levels and their ratio (T/C) (n=11 from all positions). Changes in BC were examined using repeated measures ANOVA, while correlation with position was assessed using factorial ANOVA. Correlation between BC and fatigue markers were assessed by Pearson and Spearman analyses.

## Results

An increase in body mass ( $73.6 \pm 8.4$  kg to  $74.9 \pm 8.9$  kg), MM ( $33.5 \pm 2.6$  to  $34.8 \pm 3$  kg), and FFM ( $66 \pm 7.1$  to  $67.6 \pm 7.3$  kg) was found ( $p < 0.010$  for all), accompanied by a decrease in FM ( $7.6 \pm 1.6$  to  $7.3 \pm 1.9$  kg) and fat percentage ( $10.3 \pm 1.3$  to  $9.6 \pm 1.4$  %) during the macrocycle ( $p < 0.010$  for all). Position was significantly correlated with body mass, FM, MM, and FFM ( $p < 0.050$ ). Goalkeepers exhibited a higher fat percentage compared to defenders ( $p = 0.029$ ) and higher values for all BC parameters than other positions ( $p < 0.050$ , except MM compared to midfielders).

Defenders had higher body mass, MM, and FFM than midfielders and forwards ( $p < 0.050$ ). There was no significant change in fatigue markers, neither any correlation with BC parameters (Testosterone:  $561.9 \pm 85.2$  to  $522.6 \pm 101.1$  ng/dl; Cortisol:  $18.1 \pm 6.4$  to  $18.2 \pm 3.3$   $\mu$ g/dl; T/C:  $38.8 \pm 27.5$  to  $30.0 \pm 10.0$ ).

**Table I:** Correlation of body composition with playing position (n=29)

Body composition parameters	Mean $\pm$ SD	F	p-value
<b>Weight (kg)</b>			
Goalkeepers	$84.5 \pm 6.7$	4,076	0,017
Defenders	$80.8 \pm 7.4$		
Midfielders	$72.9 \pm 7.5^{*,\#}$		
Forwards	$72.0 \pm 7.9^{*,\#}$		
<b>% fat</b>			
Goalkeepers	$11.7 \pm 2.3$	2,907	0,054
Defenders	$9.9 \pm 1.4^*$		
Midfielders	$9.6 \pm 0.7^*$		
Forwards	$9.6 \pm 0.9^*$		
<b>BF (kg)</b>			
Goalkeepers	$10.0 \pm 2.5$	4,076	0,017
Defenders	$8.1 \pm 1.8$		
Midfielders	$7.0 \pm 1.1^{**}$		
Forwards	$6.9 \pm 1.1^{**}$		
<b>MM (kg)</b>			
Goalkeepers	$37.0 \pm 1.5$	3,941	0,020
Defenders	$37.0 \pm 2.9$		
Midfielders	$34.2 \pm 2.5^{\#}$		
Forwards	$33.2 \pm 2.9^{*,\#\#}$		
<b>LM (kg)</b>			
Goalkeepers	$74.6 \pm 4.6$	3,756	0,024
Defenders	$72.8 \pm 6.0$		
Midfielders	$65.9 \pm 6.6^{*,\#}$		
Forwards	$65.0 \pm 7.1^{*,\#}$		

Abbreviations: SD: standard deviation, \*: significant difference to goalkeepers, #: significant difference to defenders, \*\*: difference to goalkeepers, at significance level of  $p < 0.010$ , ##: difference to defenders, at significance level of  $p < 0.010$

## Conclusions

In conclusion, BC improved during the macrocycle and correlated with playing position but not with fatigue markers.