



# Aerobic capacity is more important in elite female than in elite male soccer players

Baumgart C., Hoppe M. W., Freiwald J.



Research Center for Performance Diagnostics and Training Advice (FLT) at the University of Wuppertal

## Introduction

Endurance in soccer is characterized as intermittent running performance [1]. Female and male elite soccer players cover a similar total running distance but differ in short high-intensity running activities during matches [5]. However, various endurance performance factors, such as running velocity at fix blood lactate concentrations at 2 (v2) and 4 mmol·l<sup>-1</sup> (v4) as well as interval shuttle run performance, are currently applied to evaluate training status, to predict running match performance and to determine the effects of training in elite soccer players. Therefore, the aims of the present study were 1) to compare v2, v4 and interval shuttle run performance in both genders and 2) to investigate whether a correlation exist between these endurance performance factors in both genders.

## Methods

Eighteen female and fourteen male elite field soccer players participated in this study. Players' completed two different endurance tests until maximum exhaustion within one week at the end of the first quarter of the soccer-season: 1) an incremental-Test (IT) on a 400 m tartan track to determine v2 and v4, and 2) an interval-shuttle-run-Test (ISRT) on grass to determine intermittent endurance performance. The tests were performed under nearly the same weather conditions (temperature 10-17° C; air humidity 62-77%). The endurance test protocols and all equipment specifics were described in detail previously [3]. Gender differences were obtained with the independent two-sample t-test. Pearson product-moment correlation coefficients (r) were used to determine the relationships between v2, v4 and running distance in both tests.

## Results

The results of the assessed gender differences are summarized in Table 1. Male players are heavier and taller than female players. BMI is also significant higher in male soccer players. No differences in age were found between the groups.

The v4 was significant higher in elite male than in elite female soccer players. In contrast, there were no significant differences in v2 between both genders. Furthermore, elite male players covered greater distances at the ISRT and IT than elite female soccer players (p<.05).

Table 1. Anthropometric and endurance characteristics of female and male elite soccer players

Parameter	Female	Male	p value	
	Mean ± SD	Mean ± SD		
Age [years]	21.3 ± 4.1	22.9 ± 2.8	.223	
Body height [m]	1.67 ± .05	1.81 ± .06	.000	
Body weight [kg]	61.3 ± 6.3	76.8 ± 6.6	.000	
Body mass index [kg·m <sup>-2</sup> ]	22.0 ± 2.1	23.3 ± 1.5	.046	
ISRT	Maximal heart rate [beats·min <sup>-1</sup> ]	190 ± 6.7	192 ± 6.3	.430
	Distance [m]	1499 ± 288	2245 ± 247	.000
	Velocity at lactate 2 mmol·l <sup>-1</sup> [km/h]	12.0 ± 1.3	13.4 ± 1.1	.132
	Velocity at lactate 4 mmol·l <sup>-1</sup> [km/h]	13.4 ± 1.1	14.6 ± 0.7	.002
IT	Distance [m]	5640 ± 836	6686 ± 775	.002
	Maximal lactate [mmol·l <sup>-1</sup> ]	8.04 ± 2.06	9.42 ± 2.72	.135
	Maximal heart rate [beats·min <sup>-1</sup> ]	184 ± 6.5	188 ± 6.5	.130

Table 2. Correlation coefficients between endurance performance factors in female and male elite soccer players.

		ISRT distance	IT v2	IT v4	IT distance
		females			
ISRT distance	males		.82**	.86**	.88**
IT v2		.41		.97**	.75**
IT v4		.55	.93**		.81**
IT distance		.02	.40*	.41*	

\*\* p < .01; \* p < .05; ISRT – Interval shuttle run test; IT – Incremental test; v2 – Velocity at lactate 2 mmol·l<sup>-1</sup>; v4 – Velocity at lactate 4 mmol·l<sup>-1</sup>

The correlation analysis revealed that v2 and v4 were significant correlated with ISRT-performance in elite female (best r=.88, p<.01) but not in elite male soccer players (best r=.55, p>.05) (Table 2).

## Discussion

The results of the present study show significant differences between selected endurance performance factors in elite female and elite male soccer players. Based on our experiences, these differences contribute not only to biological aspects. The infrastructural level (e.g. trainer team, training volume) in both genders should also be taken into account to explain the endurance performance differences [2].

Furthermore, the results indicate that intermittent endurance capacity is strongly correlated with aerobic capacity in elite female but not in elite male soccer players. One explanation for these observations could be that female soccer players have a lower anaerobic capacity than male soccer players [4], and realize therefore, intermittent endurance capacity predominantly with their aerobic capacity.

Future research is necessary to clarify if elite female soccer players can improve their intermittent endurance capacity more by increasing their aerobic or anaerobic capacity. From a practical point of view, endurance training and performance assessment should be different in both genders in soccer.

## References

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## Contact

Dipl.-Sporting. C. Baumgart,  
Fuhlrottstraße 10, 42119 Wuppertal (Germany)  
[baumgart@uni-wuppertal.de](mailto:baumgart@uni-wuppertal.de) - [www.flt.uni-wuppertal.de](http://www.flt.uni-wuppertal.de)