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COMPARATIVE ANALYSIS OF ALBANIAN FEMALE VOLEYBALL PLAYERS WITH ANTHROPOMETRIC, PERFORMANCE AND HEMATOLOGICAL PARAMETERS

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Abstract

Purpose. Profile and compare, female volleyball players with anthropometric characteristics, performance indicators and haematological parameters.

Methods. 24 subjects of two volleyball teams, from elite and university, were assesses for 5 anthropometric characteristics, 6 performance tests and 10 hematological markers.

Results and Discussion Elite players display better values for physical, body composition and generic jump parameters, but lower specific performance abilities than counterpart college players. Blood markers revealed normal mean team values while the RBC shows low or tendent to low values for 5 out of 11 parameters, which call for special attention to anemia problems as well.

Conclusion. The results could be used to identify eventual health or performance related problems, help and guide coaches for professional evaluation, selection, as well as for planning of the most appropriate traning programs to better fit the players and the team as a whole.

Key words. Albanian volleyball, performance indicators, haematological profiling.

Introduction

Anthropometric characteristics and morphological parameters, in combination with the physiological and biochemical tests are becoming more and more subject of diverse studies in the field of sports especially in the last two decades (U. Hartmann, J. Mester, 2000; G. Cometti, D. Cometti, 2009). They can be used on one side, to assess the physical growth and nutritional status of sport exercisers and on the other hand as a reliable individual specific profile for the prediction and improvement of the physical performance. An appropriate and wise approach and use of these indicators and tests both in quantitavive and qualitative terms, a reliable interpretation and integration of the relative values alone or in combination, can be utilized to project the performance level of the elite sportpersons. The ongoing monitoring of such parameters, the identification of eventual health and/or perfomative problems, can help not only for the healthy maintainance of the sportpersons, but at the same time for planning and undertaking of the proper measures for the continuos improvement of the physical fitness, performance and physiological profile both at individual and group/team level. (A. Claenssens, J. Lefevre, G. Beunen, R.M. Malina, 1999).

While individuals in general respond and adapt to different exercise levels and types in different and through various biological, biochemical and physiological mechanisms, exercise and sport training and level seem to be among the most important factors that influence such responses (S. Fleck, et al., 1985). Physical acitivity and sport induces stress on the body and influences not only modifications in physical and physiological parameters, but brings about a number of blood cells alterations and related blood parameters as well (C. Petibois, G. Cazorla, G. Deleris, 2003). From their side, alterations of haematological parameters can influence differently the physical and sport performance in different types of sport (F.D. Descorges, M. Testa, C. Petibois, 2008). The type and dynamics of the response patterns indicates the appropriateness of the exercising and training to different individuals,. The biochemical indicators alterations are quicker than the physical changes, showing this way, a strong correlation with the overall health status, the physical and sport performance; being so, they can be used to rapidly check and follow eventual health problems or adverse training response, that can arise or experience different sportpersons particularly during nonpersonalized and unapproppriate training programs. (M. Withold, 1996, G. Lombardi, et al., 2011).

Recent contextual studies performed in the sport of volleyball show that, a number of anthropometric and physical characteristics (such as Body Height, Body Weight, %Body Fat,) and specific physical-performance parameters seem to be advantageous to the volleyball players and positively correlated with higher performance (K. Shyamal, J. Singh, J.S. Sandhu, 2010). But despite the popularity of this sport worldwide, there are gaps or poor data on players profiles, particularly related to adolescent and young female competitors of different ages (M.J. Duncan, L. Woodfield, Y. Al-Nakeeb, 2006).

It is also known, that young-aged sport females go against rapid and visible physical, physiological and hormonal changes and these factors higly influence their sport performance along this quick developing period, becoming at the same time

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causes for health problems such as anemia and other abnormalities (N. Tsunawake, Y. Tahara, K. Moji, S. Muraki, K. Minowa, V. Yukawa, 2003, D.P. Ferris et al, 1995).

In the above context, the aim of the present study was to profile and compare, on a set of basic anthropometric characteristics, specific volleyball performance indicators and a number of haematological parameters, young elite female volleyball players (Albanian Youth National Team 2011) with college counterparts in Albania.

Worth to mention, that for Albania, this is a pioneer study where physical, performance tests and blood markers and comparisons within age-groups become part of an integrative and profiling study in young female volleyball players.

Methods

The participants in this study were 24 subjects in total: 12 female volleyball players of the Youth National Volleyball Team 2011 and 12 from an university team ("M. Barleti" University of Tirana). The age range of the elite players was from 17 to 19 years and of the university team from 17-21 years old. The 24 females, subjects of this study, were assessed for 5 anthropometric parameters, 6 specific performance tests and 10 blood markers (M.J. Duncan et al, 2006; T. Gabbett et al. 2007).

The assessed anthropometric variables were: Body Height (BH), Body Weight (BW), the Body Mass Index (BMI). The Percent Body Fat (%BF) and Percent Lean Body Mass (%LBM) for each subject was calculated based on the individual value of the relative BMI.

Body height was measured during inspiration with a traditional stadiometer to the nearest 0.1-0.2 cm and Body Weight was measured with a digital standing scale approximated to the nearest 100 g. The Body Mass Index (BMI) was calculated as the rate between the Body Weight value and Body Surface BW/BS, where $BS = BH^2$, or $BMI = BW/BH^2$.

For the calculation of the Percent Body Fat was used the method according to Deurenberg et al., confirmed for its reliability also from other authors (A.A. Jackson, P.R. Stanforth, J. Gagnon et al. 2002). According to the above, the formula to predict the Body Fat Percentage is calculated taking into account the current individual BMI value, age and gender (P. Deurenberg, J.A. Weststrate, J.C. Seidell, 1991). In its appropriate corrected form for adult females this formula is as the follows:

Adult Body Fat% = (1.20 x BMI) – 0.23 x age) – 5.4

The Percent Lean Body Mass was calculated as the difference from 100 of the individual relative %BF value (K. Shyamal, J. Singh, J.S. Sandhu, 2010).

6 specific volleyball performance tests were performed and assessed; one physical-performance parameter, height of the arm (HA), Jump with one hand (a specific attack volleyball test); Jump with two hands (specific block volleyball test), Squat Jump (SJ), Counter Movement Jump (CMJ), and Repetitive Jump for 15 sec (RJ15sec). Based on the last three tests data (SJ, CMJ and RJ15sec), (CMJ-SJ)x100/CMJ and RJ15sec/CMJ were calculated.

SJ is a vertical jump test starting with the knees flexed at 90 degrees, and hands resting on hips; it provides a measure of the ability of rapid casting to develop a fast explosive force. CMJ is similar to the SJ, but the athlete starts in a standing position, and squats down to the 90 degree leg bend position before immediately jumping up; it constitutes a quick measure of strength to JUMP. RJ15sec are continuous jumps with a duration of 15 seconds; this test can be used to assess the functional characteristics of athletes, being the explosive power, a determinant component for realizing their optimal performance.

(CMJ-SJ)x100/CMJ is the difference in percentage between SJ and Cmj; this index shows the untapped reserves of elastic energy from muscle athletes, is a measure of the elasticity coefficient and a capacity indicator of the energy accumulated as a result of tensile elongation of muscle that precedes muscular contraction. RJ15sec/CMJ is the ratio ratio between the average height and bounces within 15 sec: these values should be approached to 1, where, in the case of commitment in team sports preferable from 0.90 to 0.95,

Previous studies have shown that these specific parameters correlate positively with the general performance in a team and can be also related and used accordingly to the particular role of each team player (G. Cometti, et a., 1999).

The haematological profiling was performed using the following 10 generic blood markers: White Blood Cells-WBC, Lymphocyte count-Lymph, Mid Sized Cell %-Mid (Basophiles, Eosinophils and Monocytes), Granulocytes-Gran, Red Blood Cells-Rbc, Haemoglobin Concentration-Hgb, Haematocrit-Hct, Mean Corpuscular (erythrocyte) Volume-MCV, Mean Cell (erythrocyte) Hemoglobin-MCH, and Mean Cell (erythrocyte) Hemoglobin Concentration-MCHC.

Blood sampling took place under standard conditions, in the morning with an empty stomach. The blood from the cubital vein was collected in tubes containing K_3EDTA. The abovelisted variables were analysed with an Automatic cell counter (Haemoanalyzer "Mindray BC- 3000 Plus).

Anthropometric parameters and performance tests were performed indoor, in normal temperature and pressure conditions, at the premises of the National Sport Palace in Tirana. The blood was taken and analysed at the Laboratory of Sport&Exercise Biochemistry at Tirana University of Sport. The tests and analysis were performed on full consent of the participants and the relative team coaches.

Standard statistical methods (Mean and Standard Deviation) were used for the direct measures and calculated parameters. One way variance analysis

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for the comparison of data between the elite, local and university teams was applied. A 5% probability level was determined as statistical significance of differences calculated for each parameter.

Results

Physical and Body Composition Parameters. The values of both measured and calculated parameters regarding anthropometric and body composition data are given in Table 1 for both teams under investigation. Each indicator has been reported through the mean team value and the relative standard deviation.

Table 1: Values of anthropometric parameters and body composition of Albanian female volleyball teams

Parameters	National Youth Team		University Team	
	Mean	SD	Mean	SD
Age in years	18.25	10.5	21.2	3.4
Body Height (BH) in cm	179.8	7.73	176.1	6.32
Body Weight (BW) in kg	66.5	8.52	63.55	8.4
Body Mass Index (BMI) in kg/m^2	20.53	1.48	20.39	2.40
Body Fat (BF) in %	23.43	1.69	23.95	2.99
Body Lean Mass (BLM) in %	76.57	1.69	76.05	2.99

The comparative data for the 5 body parameters between the teams of the study are shown on the diagram of Figure 1 below.

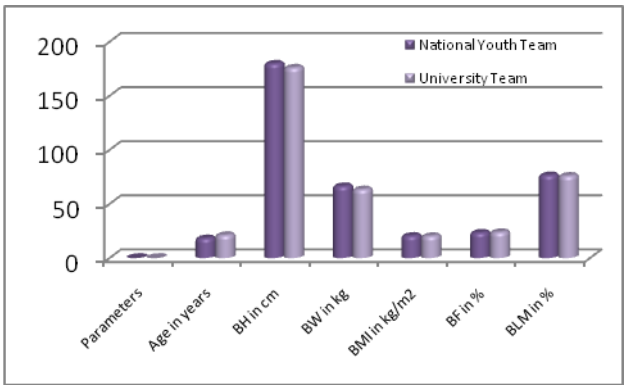

Figure 1: Comparison of Anthropometric Parameters between the National (Youth and Junior), local and university teams of Albanian female volleyball players

The volleyball players of the National Youth Team displays an insignificant higher Body Height (around 2%), higher BW (5%), higher BMI value (around 7%), but very similar BF% and BLM%. Interesting to notice the high variance and heterogeneity for the body weight values for both national and university teams.

These results can be explained based on the age and the playing and training experience of the teams, but they should be utilized anyway to drive the coaches and the players themselves for the planning and implementing of the special and specific nutritional and training programmes which better fit to the team in general and to the individuals in particular, aiming the improvement of such parameters.

Performance tests parameters. The results of the jump tests for both teams under investigation are given in Table 2 and comparatively on the diagram of Figure 2 below.

Table 2: Values of specific volleyball jump tests of Albanian female volleyball teams

Parameters	National Youth Team		University Team	
	Mean	Standard Deviation	Mean	Standard Deviation
Height of the Arm (HA) in cm	231.4	9.8	227.5	6.9
Jump with one hand (JOH) in cm	288.2	11.0	284.6	7.0
Jump with two hands (JTH) in cm	277.3	9.3	273.1	5.5
SJ in cm	25.34	3.4	26.8	3.8
CMJ in cm	30.69	3.8	33.5	3.2
RJ15sec in cm	26.9	4.2	28.4	4.5
(CMJ-SJ)x100/CMJ	17.3	3.3	19.25	4.06
RJ15sec/CMJ	0.8	7.2	0.8	9.1

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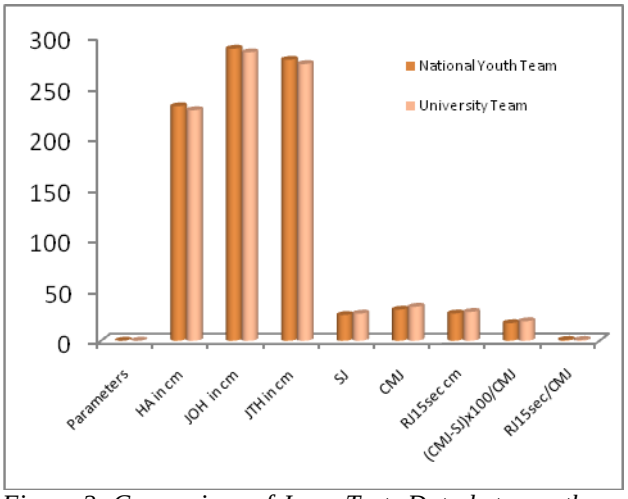

Figure 2: Comparison of Jump Tests Data between the National and Local and University teams of Albanian female volleyball players

From the comparison of the jump tests between the teams, the elite team displays slightly higher absolute values of HA, JOH and JTH and equal differences for the all three. The difference in HA is equally reflected in the two jump tests, JOH and JTH (4 cm: 1.4-1.7%). As for more specific performance parameters (RJ, CMJ and RJ15sec and calculated CMJ-SJ)x100/CMJ and RJ15sec/CMJ), the university team shows instead better values both in absolute and relative terms; the differences range from +5.5% for SJ and RJ15sec, to 10-11% for CMJ and the calculated (CMJ-SJ)x100/CMJ. No difference was found for RJ15sec/CMJ, but university team has a higher variance for this indicator.

A comparative analysis between two sets of performance /jump parameters, (HA, JOH, JTH and SJ, CMJ, RJ15sec, (CMJ-SJ)x100/CMJ, RJ15sec/CMJ) for each and comparatively between the teams are presented in Figures 3, 4 and 5 below.

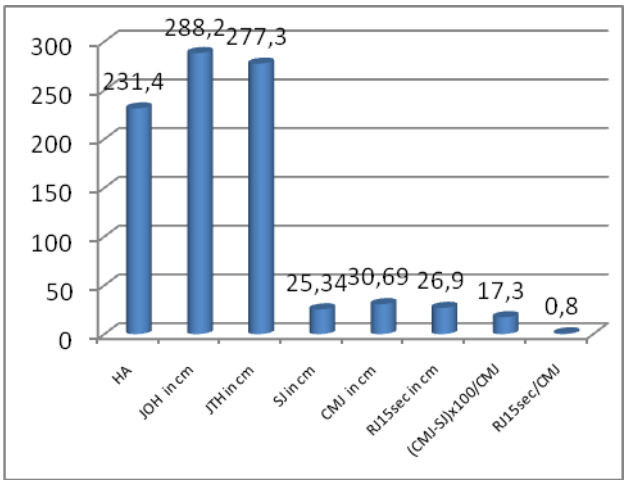

Figure 3: Comparison between Jump and specific performance Parameters in Youth Albanian female volleyball team

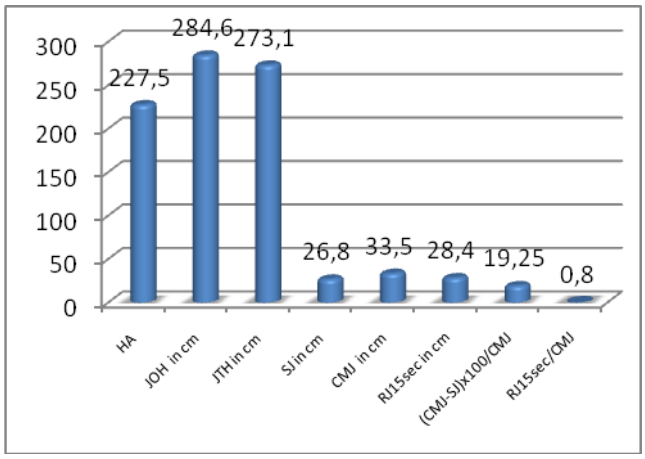

Figure 4: Comparison between Jump and specific performance Parameters in university Albanian female volleyball team

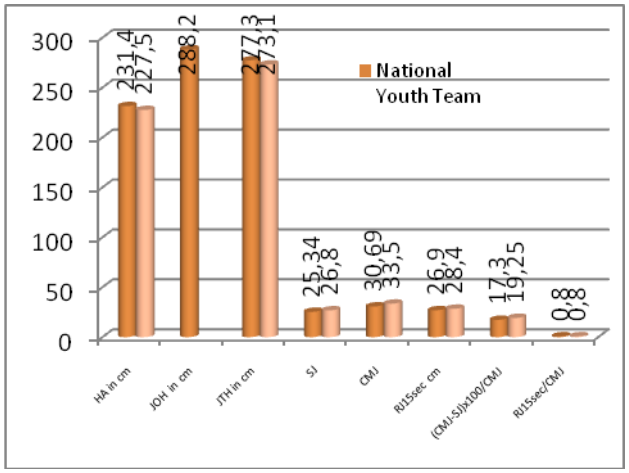

Figure 5: Comparison Jump/Specific performance Parameters between the Youth and University female volleyball team

The comparison reveals surprisingly, but in line with the previous interpretation and discussion, that the elite team which presents better physical parameter values, i.e. higher BH and HA, as well as generic performance tests data, displays lower values for more specific performance characteristics SJ, CMJ, RJ15sec, (CMJ-SJ)x100/CMJ, RJ15sec/CMJ.

Despite the differences between the teams, the results of this study in terms of absolute values, the deviation range and the differences between the teams, show however a continuous improvement of the physical and performance parameters in our volleyball teams, compared especially to the last 5-10 years (A. Pogoni, E. Pashai, 2003). The differences call however, the need for reflection and planning of specific, team and individual oriented training and nutritional programs, in order to improve both anthropometric and body composition values which are under training

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influence and at the same time directly reflect on the physical performance (S. Fleck, et al., 1985).

It is up to the coaches to further analyse these parameters, understand the individual and training factors and also elaborate appropriate programmes aiming the improvement of such parameters; these analyses should stand on the basis of the preselection and selection processes and procedures for the elite players of any level.

Haematological ProfilingMarkers.

Table 3: *Haematological markers analysed in Youth and university fenale volleyball teams*

		National Youth Team		University Team		Normal Values
	Parameters	Mean	Standard Deviation	Mean	Standard Deviation	
1	WBC $x10^9$/L	5.41	1.08	5.48	1.49	4.0 - 10.0
2	Lymph $x10^9$/L	1.81	0.2	1.98	0.48	0.8 - 4.0
3	MID x 10^9/L	0.46	0.1	0.42	0.12	0.1 - 0.9
4	Gran x 10^9/L)	3.14	0.9	3.07	1.11	2.0 - 7.0
5	Hgb g/L	119.5	10.83	122,28	13.12	110 - 150
6	RBC x 10^{12}/L	4.18	0.23	4.38	0.38	3.50 - 5.00
7	Hct %	36.35	2.35	37.22	3.37	37.0 - 48.0
8	MCV fL	87.08	6.3	87.65	5.66	82.0 - 95.0
9	MCH pg	28.53	2.7	27.81	2.04	27.0 - 31.0
10	MCHC g/L	327.9	10.6	327.28	10.02	320 - 360

The haematological profiling was performed through analysis of the 10 blood markers in all 24 individuals under investigation. The data of such parameters for both teams are shown in Table 3 below through the team mean and the relative standard deviation for each parameter.

The investigation and analysis of the 10 blood markers revealed mean values within the norm for most of the White Blood Cell population for both teams, considering gender and age. WBC population shows also lower differences between the groups.

The situation shows different for the red blood cell population: teams values show low or tendency to the lowest norm levels for 5 out of 7 parameters of RBC population and markers to them related (Rbc, Hgb, Hct, MCH, and MCHC). Haematocrit shows a lower level than the norm for both teams, Hgb is at the lowest level of the norm, MCH and MCHC around the lowest norm levels for these parameters. Although no significant differences were found between the teams means, the youth team display slightly lower values (around the lowest normal limits) for Hct, Hgb, MCH and MCV. Worth also to mention the high variance of the Hgb values among individuals for both teams. These data, combined to low levels of Haematocrit, relative low RBC counts and tendency to lower levels of MCH, MCV and MCHC should call for special attention to anemia problems within the teams. As a matter of fact the youth team, having a younger age range, which could probably explain the above results in this particular group/team and which, should be taken into consideration for this group and the players individually.

The above results at both team and individual level could be used firstly, to identify eventual health or performance related problems and secondly help and guide the coaches and players themselves to take the proper measures and plan the most appropriate traning programs to better fit the players and the team as a whole.

Discussion and Conclusion

This study evaluated the anthropometric, performative and haematological parameters of two

representative groups of female volleyball players in Albania; one national, youth and a collegial/university team. The present investigation provides an insight into these characteristics, makes an overall analyses and group profiling through such parameters with respect to age and comparisons between the teams in function of individual and group profiling as well as for the performance based selection process and criteria.

The obtained results show that the national youth team displays better values for physical, body composition and generic jump tests parameters but special and specific abilities could be found and appreciated in the university team although with less better starting anthropometric and physical characteriscs. However both teams display mean performance values which under the referent homologue European teams of same level and of national and/or local representance.

The physical parameters are colineary correlated to jump performance tests in both teams but with better values in the university team, which is different from the expectations. Age, trainability, quality of training programs as well as commitment or other factors may lie under these differences whish should be extendely and more in depth analysed both at team and individual level.

Haematological profiling does not show evident differences between the team groups; however these markers signal for eventual health or performance related abnormalities especially those related to anemia, which is a predictable and expectable health problem for this gender and age group. Additional markers and further and more detailed analysis at individual levels will be performed, in order to identify eventual positive or abnormal alterations which could involve both health and/or sport performance for the players and in relation to their team role as well.

The parameters of this study, alone and in combination with each other, at both team and individual level could be used to identify eventual health or performance related problems, help and guide coaches to identify and assess the physical and performance characteristics specific to the age groups for purposes of professional evaluation, selection, monitoring and continuous development, as well as for planning of the most appropriate traning programs to better fit the players and the team as a whole.

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