PREPARATION OF PERCENTILE TABLES THROUGH ANTHROPOMETRIC, PERFORMANCE, BIOCHEMICAL, HEMATOLOGICAL, HORMONAL AND PSYCHOLOGICAL PARAMETERS IN PROFESSIONAL SOCCER PLAYERS

EXERCISE AND SPORTS MEDICINE CLINIC

ORIGINAL ARTICLE

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ABSTRACT

Introduction: The lack of reference values of anthropometric, performance, biochemical, hematological, hormonal and psychological parameters is an important limitation in the investigations with soccer players. Objective: To elaborate percentile tables to be used as comparison reference for further studies. Methods: 82 professional soccer players were evaluated approximately 30 days after the beginning of the main competition played by their teams. On the first day of evaluation, fast blood samples were collected for measurement of hematological parameters (i.e. erythrocytes, hemoglobin, hematocrit, mean corpuscular volume - MCV, mean corpuscular hemoglobin - MCH, mean corpuscular hemoglobin concentration - MCHC, leukocytes, eosinophils, lymphocytes, monocytes and platelets) and of concentrations of adrenaline, cortisol, creatine kinase, creatinine, norepinephrine, testosterone and urea. Subsequently, the soccer players had their anthropometric characteristics and psychological parameters assessed. In addition, the evaluation of the lactic anaerobic system efficiency was performed on a 400-m track. On the second day, both the alactic anaerobic and aerobic system efficiency was measured. Results: The percentile distribution (P_0, P_{15}, P_{30}, P_{50}, P_{70}, P_{85} e P_{100}) was used to present the results. Conclusion: The elaboration of the percentile tables can be used as comparison reference for further studies.

Keywords: professional soccer players, POMS, hormones, biochemical, hematological and hormonal variables.

INTRODUCTION

According to Bangsbo *et al.*[1], over 90% of the energy spent during an official soccer match is supplied by the aerobic metabolism. During the 90min of the game, the professional players cover approximately 10km[1,2] with intensity close to the anaerobic threshold Lan), that is to say, 80-90% of the maximum heart rate. Thus, it is possible to state that the metabolic grounding of a soccer match is aerobic; however, the majority of the actions used to decide a match, such as kicking, dribbling and heading, is of anaerobic nature[3].

It is known that performance maximization of a professional soccer athlete is based on the suitable development of a set of tactical, nutritional, psychological and physical factors[4]. In order to have this fact occurring, it is necessary that during training the athletes present balance between exercise demand and the period given to their recovery[5]. In order to evaluate the efficiency of soccer training programs, in the last five years our investigations have focused on the responses of performance, biochemical, hematological, hormonal and psychological parameters[6-9].

Besides our studies, further authors have also demonstrated interest in the same theme[10-13]. There is a set of limitations in the effects of soccer specific training in the variables previously mentioned. The lack of control of the training loads as well as the difficulty in measuring the athletes' performance during a soccer match are classical examples of problems faced in the development of this kind of research. Although Foster[14] has described a simple methodology for training load control which includes the subjective exertion scale and the total time of the training session, culturally, in Brazil the majority of coaches and physical trainers does not apply this kind of scientific instrument in the training routine.

Regarding the difficulty in evaluating the sports performance of the professional soccer players, Filaire *et al.*[10] suggested the use of the percentage of wins in relation to the total of matches played during a training period. Although we have used this evaluation method[8], we know that the quantity of matches won by a team depends on the level of the opponent, the place and importance of the match.

Another limitation in investigations with professional soccer athletes is the lack of reference values which allow the comparison of the results of the anthropometric, performance, biochemical, hematological, hormonal and psychological parameters. Usually, the authors compare their data with reference values obtained in non-athletes or with other studies in the literature. Thus, the main aim of the present study was to design percentile tables (P_0, P_{15}, P_{30}, P_{50}, P_{70}, P_{85} and P_{100}) of the results concerning the anthropometric, performance, biochemical, hematological, hormonal and psychological variables which are able to serve as comparison reference for further studies.

MATERIAL AND METHODS

Participants

The sample of the present study was composed of 82 male athletes (12 goalkeepers, 14 fullbacks, 14 lateral defenders, 14 stoppers, 14 midfielders and 14 forwards) from three professional teams affiliated with the Soccer Federation of São Paulo State. After complete description of the methods which would be applied, the athletes or legal tutors signed a Free and Clarified Consent Form approved by the Ethics in Research Committee of the Biosciences Institute of the Júlio de Mesquita Filho State University of São Paulo, Rio Claro campus, which authorized the participation in the study.

Experimental outlining

The professional soccer players were evaluated approximately 30 days after the beginning of the main competition played by the teams and the evaluations were carried out in two days. On the first day at 7h30min blood samples were collected (25mL) at fasting, and the athletes were subsequently submitted to the anthropometric and psychological evaluation. Afterwards, the athletes had breakfast and after approximately 90min the evaluation of the efficiency of the alactic anaerobic system was performed on official athletic track. On the second day at 8h30min the evaluations for determination of the alactic anaerobic and aerobic systems were performed.

Anthropometric evaluation

The athletes were submitted to the anthropometric evaluation which was composed of measurement of stature (S; cm), total body mass (TBM; kg), body mass index (BMI = S/BM^2; kg/m^2), fat percentage (FP; %), obtained through four skinfolds[15], and lean body mass [LBM = TBM – (FP * BM); kg].

Psychological evaluation

The psychological evaluation of the athletes was performed through the application of the translated and validated for the Portuguese language version of the POMS questionnaire (*Profile of Mood States*) previously used by our group[8]. This questionnaire provides measurements of tension, depression, anger, vigor, fatigue, confusion and total mood disorder (TMD). The TMD is calculated through the subtraction of the sum of the measurements of tension, depression, anger, fatigue and confusion by the measurement of vigor.

Blood collection

Blood collections were performed in a private laboratory, after 8-hour fast and minimum interval of 12h after performance of the last training session. Prior to the procedures, the athletes remained at full rest during 30min. The collections were performed through venipuncture with disposable material, using a vacuum system in two tubes with EDTA-K3 (Vacuette®, Greiner BioOne, SP, Brazil) and two tubes for serology without anticoagulant (Vacuette®, Greiner BioOne, SP, Brazil).

After the collections, the two tubes free from anticoagulant were placed in water bath at 37ºC during 45min and centrifuged for 10min at 480g for serum collection, which was stored in Eppendorf tubes (1.5mL) at –10ºC. The 10mL tube with EDTA-K3 was previously refrigerated and centrifuged for 10min at 480*g* (refrigerated centrifuge) for the heparinized plasma acquisition, which was stored at –70ºC.

Determination of the hematological parameters

The hematological parameters (erythrocytes, hemoglobin, hematocrit, mean corpuscular volume - MCV, mean corpuscular hemoglobin - MCH, mean corpuscular hemoglobin concentration - MCHC, leukocytes, eosinophils, lymphocytes, monocytes and *platelets*) were determined in an automatized instrument (Coulter T890; Coulter, Hialeah, FL, USA), in which internal quality control (For 12® Extend, Streck, Omaha, NE, USA) is daily performed. Moreover, the National Program of Quality Control (PNCQ) of the Brazilian Society of Clinical Analyses (SBAC) is responsible for the monthly performance of the external quality control of the Coulter T890.

Serum analyses

The serum samples dosing was performed twice and a spectrophotometer (Spectrophotometer B442, Micronal, Brazil) was used for determination of the cortisol concentrations (Kit Coat-a-Count®, USA), creatine kinase[16], creatinine[17], testosterone (Kit Coat-a-Count®, USA) and urea[18].

Plasma analyses

The plasma samples dosing was performed twice and the adrenaline and noradrenaline concentrations were determined through high performance liquid chromatography with electrochemical detection as described by Smedes *et al.*[19].

Evaluation of the efficiency of the lactic anaerobic system

The efficiency of the lactic anaerobic system of the soccer players was measured as proposed by Silva *et al.*[9] and comprised the performance of maximal exertion of 250m with blood sample collections for analysis of lactacidemia on the third, fifth and seventh minutes at the end of the protocol.

Mean velocity (Vm_{250m}; m.s^{-1}), peak concentration of blood lactate ($[Lac]_{250m}$; mM) and the product between the Vm_{250m} and $[Lac]_{250m}$ (m.s^{-1}.mM) were recorded as parameters of lactic anaerobic performance.

Evaluation of the efficiency of the alactic

The efficiency of the alactic anaerobic system of the soccer players was measured by a previously described protocol[6] and comprised the performance of five maximal exertions of 30m, with one minute of passive pause, and blood sample collections for analysis of the lactacidemia on the first, third and fifth minutes at the end of the protocol.

Mean velocity (Vm; m.s^{-1}), peak concentration of blood lactate ($[Lac]_{peak}$; mM) and the ratio between the $[Lac]_{peak}$ and the Vm (mM/m.s^{-1}) were recorded as alactic anaerobic performance parameters.

Evaluation of the aerobic performance

The aerobic performance of the soccer players was measured by a previously described protocol[6-9] and it comprised the performance of four submaximal exertions of 800m with intensities corresponding to 12.4, 13.3, 14.4 and 15.7km.h^{-1}, which were controlled by sound stimuli at every 100m.

Passive intervals of approximately 45s occurred for the samples collection for analysis of the lactacidemia between the submaximal sets. The blood lactate concentrations regarding the submaximal

intensities of exercise ([La]-12.4km.h^{-1}; [La]-13.3km.h^{-1}; [La]-14.4km.h^{-1}; [La]-15.7km.h^{-1}) were used as aerobic performance parameters[8]. Moreover, the aerobic performance of the soccer players was obtained through the determination of the running intensity (km.h^{-1}) corresponding to the anaerobic threshold (iLan). The iLan corresponded to the lactate steady concentration of 4mM and was determined through the exponential interpolation of the lactacidemia versus exercise intensity curve[6,7,9].

Determination of the blood lactate concentration

25µl of artery blood samples were collected from the earlobe through heparinized and calibrated glass capillaries. The blood was placed in 1.5mL tubes for microcentrifuges containing 50µl of sodium fluoride (NaF – 1%), for subsequent determination of blood lactate concentration (mM) in an electrochemical lactimeter *Yellow Spring Instruments* (YSI), model 1500 Sport.

STATISTICAL ANALYSIS

According to the *Shapiro Wilk's W* test, the data collection presented normal distribution and homogeneity was verified with the *Levine's test*. The percentile distribution (P_0, P_{15}, P_{30}, P_{50}, P_{70}, P_{85} and P_{100}) was used to present the results of the parameters of the 82 professional soccer players. In addition to that, the data were expressed in mean ± standard deviation.

RESULTS

Table 1 presents the mean, standard deviation (SD) values as well as the percentile distribution of age and anthropometric characteristics of 82 professional soccer players. According to table 2, it is possible to observe the mean, standard deviation (SD) and percentile distribution of the psychological parameters of the POMS of 82 professional soccer players. Table 3 presents the mean, standard deviation (SD) and percentile distribution (P_0, P_{15}, P_{30}, P_{50}, P_{70}, P_{85} and P_{100}) values of the hematological parameters of 82 professional soccer players.

According to table 4, it is possible to observe the mean and standard deviation (SD) values and percentile distribution of the creatine kinase, creatinine, urea, cortisol, testosterone, testosterone/cortisol (T/C), adrenaline and noradrenaline concentrations of 82 professional soccer players. Table 5 presents the mean, standard deviation (SD) values and percentile distribution of the lactic anaerobic and alactic performance parameters 82 professional soccer players. Table 6 presents the mean, standard deviation (SD) values and percentile distribution of the aerobic performance parameters of 82 professional soccer players.

Table 1. Mean, standard deviation (SD) and percentile of age and anthropometric characteristics of 82 professional soccer players.

	Mean	SD	P_0	P_{15}	P_{30}	P_{50}	P_{70}	P_{85}	P_{100}
Age (years)	24.8	3.0	19.0	22.0	23.0	25.0	26.0	27.0	36.0
Height (cm)	179.2	6.8	160.0	172.0	176.0	180.0	183.0	185.0	196.0
TBM (kg)	76.1	7.6	57.3	67.0	71.0	76.2	80.9	85.1	89.0
BMI (kg/m2)	23.7	1.9	19.5	21.7	23.0	23.9	24.6	25.2	29.4
% Fat	9.2	3.1	4.5	5.9	7.5	8.1	10.7	13.6	18.1
LBM (kg)	68.8	6.5	49.3	61.6	65.2	68.7	73.2	75.8	80.0

TBM: total body mass; BMI: body mass index; LBM: lean body mass.

Table 2. Mean, standard deviation (SD) values and percentile distribution of the psychological parameters of POMS of 82 professional soccer players.

	Mean	SD	P_0	P_{15}	P_{30}	P_{50}	P_{70}	P_{85}	P_{100}
Tension	9.7	5.6	0.0	5.0	7.0	8.0	11.0	14.0	27.0
Depression	4.9	5.7	0.0	0.8	2.0	3.5	6.0	7.0	29.0
Anger	9.1	8.8	0.0	2.0	4.0	7.0	11.0	15.3	34.0
Vigor	22.4	3.9	13.0	19.0	21.0	22.5	24.0	26.3	29.0
Fatigue	4.3	3.8	0.0	1.0	2.0	3.0	5.5	8.0	16.0
Confusion	4.2	3.3	0.0	1.0	2.0	4.0	5.5	6.3	13.0
TMD	10.0	21.9	–15.0	–7.0	–3.5	3.5	13.5	28.3	82.0

TMD: total mood disorder.

Table 3. Mean, standard deviation (SD) values and percentile distribution of the hematological parameters of 82 professional soccer players.

	Mean	SD	P_0	P_{15}	P_{30}	P_{50}	P_{70}	P_{85}	P_{100}
Erythrocytes (million/mm^3)	4.9	0.4	4.0	4.5	4.7	4.9	5.0	5.2	5.7
Hemoglobin (g.dL^{-1})	14.6	0.9	12.5	13.7	14.0	14.5	15.0	15.4	16.5
Hematocrit (%)	43.3	2.3	38.8	40.3	42.1	43.2	44.5	45.7	48.6
MCV (fl)	88.9	5.2	77.2	83.3	85.3	89.1	92.8	94.4	97.9
MCH (pg)	29.9	1.3	26.6	28.2	29.5	30.1	30.6	31.2	32.0
MCHC (g.dL^{-1})	33.6	1.2	31.3	32.3	32.7	33.5	34.3	35.2	36.4
Leucocytes (x 10^3/mm^3)	6.5	1.6	2.8	5.2	5.6	6.3	7.1	8.1	12.1
Neutrophils (x 10^3/mm^3)	3.4	1.1	1.0	2.6	2.7	3.1	3.7	4.3	7.6
Eosinophils (/mm^3)	190.3	76.6	48.0	114.8	156.0	186.0	222.6	251.4	484.0
Lymphocytes (x 10^3/mm^3)	2.8	0.6	1.7	2.1	2.4	2.7	3.2	3.4	4.7
Monocytes (/mm^3)	178.6	55.4	76.0	124.2	150.0	168.0	201.0	242.1	363.0
Platelets (x 10^3/ mm^3)	245.9	60.1	141.0	186.1	206.2	240.0	270.6	304.4	388.0

MCV: mean corpuscular volume (MCV); MCH: mean corpuscular hemoglobin; MCHC: mean corpuscular hemoglobin concentration.

Table 4. Mean, standard deviation (SD) values and percentile distribution of the creatine kinase, creatinine, urea, cortisol, testosterone, testosterone/cortisol ratio (T/C), adrenaline and noradrenaline concentrations of 82 professional soccer players.

	Mean	SD	P_0	P_{15}	P_{30}	P_{50}	P_{70}	P_{85}	P_{100}
Creatine kinase (UI.L^{-1})	337.6	283.7	16.9	125.2	183.2	251.0	365.2	558.8	1616.0
Creatinine (mg.dL^{-1})	1.1	0.1	0.9	1.0	1.0	1.1	1.1	1.2	1.4
Urea (mg.dL^{-1})	31.6	3.4	25.0	28.1	30.0	31.0	33.0	36.0	39.0
Cortisol (nmol.L^{-1})	463.2	107.3	267.3	349.0	382.8	478.5	537.8	582.0	685.6
Testosterone (nmol.L^{-1})	21.7	4.9	14.0	16.0	18.4	21.4	24.2	26.2	36.7
T/C ratio (x 10^{-3})	49.0	14.8	25.6	35.1	39.5	46.7	53.6	67.3	79.4
Adrenaline (pg.mL^{-1})	56.8	18.8	22.0	32.0	44.0	59.0	69.0	78.0	90.0
Noradrenaline (pg.mL^{-1})	198.6	92.6	70.0	107.4	134.0	175.0	250.2	296.2	440.0

Table 5. Mean, standard deviation (SD) values and percentile distribution of the lactic and alactic anaerobic performance parameters of 82 professional soccer players.

	Mean	SD	P_0	P_{15}	P_{30}	P_{50}	P_{70}	P_{85}	P_{100}
Vm_{250m} ($m.s^{-1}$)	6.7	0.4	6.1	6.3	6.4	6.8	6.8	6.9	7.7
$[Lac]_{250m}$ (mM)	14.1	2.4	9.8	12.0	12.6	14.0	15.1	16.5	20.9
Vm_{250m}*$[Lac]_{250m}$ ($m.s^{-1}$.mM)	93.8	15.3	65.9	78.0	86.2	90.4	102.9	110.5	133.6
Vm ($m.s^{-1}$)	6.6	0.2	6.2	6.4	6.5	6.6	6.8	6.9	7.0
$[Lac]_{peak}$ (mM)	7.5	1.9	3.1	5.6	6.6	7.3	8.8	9.3	11.5
$[Lac]_{peak}$/Vm ($mM/m.s^{-1}$)	1.1	0.3	0.5	0.9	1.0	1.1	1.3	1.4	1.7

Vm_{250-m}: mean velocity of the maximal exertion of 250m; $[Lac]_{250-m}$: peak concentration of blood lactate of maximal exertion of 250m; Vm: mean velocity of the five efforts of 30m; $[Lac]_{peak}$: peak concentration of blood lactate of the five maximal efforts of 30m.

Table 6. Mean, standard deviation (SD) values and percentile distribution of the aerobic performance parameters of 82 professional soccer players.

	Mean	SD	P_0	P_{15}	P_{30}	P_{50}	P_{70}	P_{85}	P_{100}
[Lac] – 12,,4km.h^{-1}	3,0	0,8	1,5	2,1	2,5	2,9	3,3	3,4	5,6
[Lac] – 13.3km.h^{-1}	3.6	0.8	2.3	2.8	3.3	3.6	3.9	4. 3	6.5
[Lac] – 14.4km.h^{-1}	5.0	1.2	3.4	3.7	4.3	4.6	5.6	6.4	8.4
[Lac] – 15.7km.h^{-1}	6.5	1.6	4.2	5.0	5.3	6.3	6.9	8.2	10.3
iLan (km.h^{-1})	13.5	1.1	11.4	12.9	13.1	13.6	14.1	14.6	15.3

[Lac]: blood lactate concentration; iLan: running intensity corresponding to the anaerobic threshold.

DISCUSSION

Over the last five years, during the analyses of our results on the effects of soccer training on the responses of the anthropometric, performance, biochemical, hematological, hormonal and psychological parameters[6-9], we confirmed the lack of reference values measured in professional soccer players which allowed us compare and discuss our data. Thus, we analyzed anthropometric, performance, biochemical, hematological, hormonal and psychological variables in 82 professional soccer players with the aim to design percentile tables which could serve as comparison reference for further studies on the same theme.

In order to exemplify the applicability of the percentile tables of the present investigation, we will consider some studies carried out with professional soccer players[7-12,20]. Filaire *et al.*[10] verified the responses of the salivary concentrations of cortisol and testosterone, of the psychological variables of the POMS and of the sports performance of 17 French soccer players in four moments of a competitive season. When the psychological parameters found by Filaire *et al.*[10] (tension: between 37.1 and 45.4; depression: between 42.1 and 47.1; anger: between 46.4 and 54.3; vigor: between 46.2 and 63.5; fatigue: between 43.3 and 45.6; confusion: between 39.8 and 41.2) were compared with the table 2 of the present study, it is possible to verify that our sample of Brazilian soccer players presented maximal values (P_{100}) lower than the minimal values obtained by Filaire *et al.*[10] for all the POMS variables. In this specific case, table 2 would not be applicable to classify the results obtained in French soccer players.

On the other hand, Silva *et al.*[8] investigated the responses of the POMS parameters at three moments during 12 training weeks specific to soccer (tension: range between 9.1 and 10.6; depression: range between 2.3 and 5.0; anger: range between 4.3 and 8.3; vigor: range between 18.5 and 22.4; fatigue: range between 1.8 and 5.3; confusion: range between 3.1 and 5.3; DTH: range between –5.6 and 14.2). When these findings are compared with the table 2 of the present investigation, it is possible to observe that the values for tension, depression, anger, fatigue, confusion and DTH obtained by Silva *et al.*[8] remained between the following percentile ranges: P_{50}-P_{70}, P_{50}-P_{70}, P_{30}-P_{70}, P_0-P_{50}, P_{15}-P_{70}, P_{30}-P_{70} and P_{15}-P_{85}, respectively. It is important to highlight that the data presented by Silva *et al.*[8] and those used for the designing of the present percentile tables are from different samples.

Filaire *et al.*[11] verified the behavior of hematological, hormonal and psychological variables in French soccer players in four moments during a competitive season. When the variations of the hematological parameters (hemoglobin: 14.4-15.4g.dL^{-1}; hematocrit: 45.3-46.9%; leukocytes: 5.8-6.2 x $10^3/mm^3$; lymphocytes: 2.2-2.3 x $10^3/mm^3$; neutrophils: 3.1-3.3 x $10^3/mm^3$) are compared with the table 3 of the present study, it is possible to conclude that the hemoglobin, hematocrit, leukocytes, lymphocytes and neutrophils concentrations determined by Filaire *et al.*[11] remained between the following percentile ranges: P_{30}-P_{70}, P_{70}-P_{100}, P_{30}-P_{50}, P_{15}-P_{30} and P_{50}-P_{70}, respectively. However, when the same variables analyzed by Silva *et al.*[7] are classified in Brazilian soccer players (hemoglobin: 14.2-15.3g.dL^{-1} = P_{30}-P_{85}; hematocrit: 40.7-43.3% = P_{15}-P_{70}; leukocytes: 5.4-5.5 x $10^3/mm^3$ = P_{15}-P_{30}; lymphocytes: 1.9-2.0 x $10^3/mm^3$ = P_0-P_{15}; neutrophils: 3.2-3.3 x $10^3/mm^3$ = P_{50}-P_{70}), only the neutrophils concentration was distributed in the same percentile range.

Kraemer *et al.*[12] investigated the responses of the cortisol (C; between 525-650nmol.L^{-1}) and testosterone (T; between 12.3-17.nmol.L^{-1}) concentration in experienced soccer players during six moments of the same competitive season with total duration of 11 weeks. When these results are compared with the table 4 of the present investigation, it is possible to verify that the C and T concentrations remained between the following percentile ranges: P_{50}-P_{100}, P_0-P_{30}, respectively. Nevertheless, the minimum testosterone concentration (12.3nmol.L^{-1}) observed by Kraemer *et al.*[12] is below the P_0 of table 4. It is possible that this fact had occurred due to the age difference between the group analyzed by Kraemer *et al.*[12] and the one used for the designing of the present percentile tables (19.9 ± 0.9 *versus* 24.8 ± 3.0 years). On the other hand, the hormonal concentrations (cortisol: between 442.9-612.2nmol.L^{-1}; testosterone: between 23.5-33.6nmol.L^{-1}; T/C ratio: between 43-59 x 10^{-3}; adrenaline: between 57.4-68.2pg.mL^{-1}; noradrenaline: between 95.2-218.8pg.mL^{-1}) obtained by Silva *et al.*[9] remained within the following percentile ranges: P_{30}-P_{100}, P_{50}-P_{100}, P_{30}-P_{85}, P_{30}-P_{70} and P_0-P_{70}, respectively.

We consider that the main limitation of the present study is related to the elaboration of the percentile 5 table. In fact, when the proposed parameters for evaluation of lactic and alactic anaerobic efficiency are analyzed, we will observe that the majority of the investigations which have used these variables come from our research group[6,8,9]. However, according to Valquer *et al.*[21], 96% of the maximal efforts performed during an official soccer match are lower than 30m. Thus, the Vm and $[Lac]_{peak}$ determination obtained after maximal exertion of 30m seem to be interesting parameters for the evaluation of professional soccer players.

Concerning the table 6 of the present study, the expression of the aerobic performance in our athletes through the

iLan is justified due to the wide use of the anaerobic threshold to determine the aerobic capacity of professional soccer players[4,6,7,9,20,22-25]. Chmura and Nazar[20] verified that the iLan determined in 13 professional soccer players ranged between 13.4 and 14.3km.h^{-1} before and after six weeks of training. In comparison with our results, it is possible to classify the findings by Chmura and Nazar[20] in the following percentile range: P_{30}-P_{85}.

According to the results of the present study, it can be concluded that the elaboration of percentile tables which can be used as comparison reference for future investigation was possible from the determination of the anthropometric, performance, biochemicl, hematological, hormonal and psychological variables of 82 professional soccer players. Moreover, the applicability of these tables was exemplified along the discussion. Interestingly, only table 2 presented use limitations when compared to the results obtained by Filaire *et al.*[10].

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