Research Paper Physical Education

Study of The Kinematic Indicators in Combat Sports Athletes in A Pre-Competitive Dehydrated Status

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ABSTRACT

The aim of this study was to analyse during the three training stages, the athlete's levels of dehydration and their influence in body composition and muscle strength variables. Sixty-four international athletes (n=64) participated in this study; thirty-eight were Olympic wrestling athletes (n=38) and twenty-six were judo athletes. By means of Inbody Biospace 230 bio-impedance method, to know body weight, skeletal muscular mass, body water and fat mass percent. For the measurements of the muscle strength manifestations, the Isocontrol system was used. Results: One out of every four athletes is usually dehydrated, being women those who tend to dehydrate more than men; (2) wrestlers tend to dehydrate more than judo athletes; (3) hydrated athletes have better indicators in the muscle strength manifestations. The most affected indicators in the dehydrated ones are: muscle power and muscle strength production average; (4) the dehydrated ones have smaller values of skeletal muscular mass.

KEYWORDS Sport combat, dehydration, body composition

The hydration and dehydration athletes' expectations at physiological level must be very concrete. Any type of imbalance in this sense could be harmful to their performances and health [8, 9]. Weight loss methods and other strategies are usual acts in Combat sports; they combine pre-competitive dehydration and nutritional restriction [10] reducing athletes' body mass index [11].

Kovacs and Yorio [12] enumerate dehydration consequences at physiological level: increase of heart rate, reduction of blood supply, reduction of cardiac output and blood pressure, diminution of maximum oxygen consumption (VO2), and even an attack on athletes' organism immune functions [13].

MATERIAL AND METHODS

Participants

The athletes sample was composed by sixty-four Combat sports competitors (n= 64) aged between 17 and 35 years old. This study started with forty Greco-roman, Olympic wrestling and female wrestling (n=40) from the Spanish wrestling team, and finally it finished with thirty-eight of them (those who fulfilled all the necessary requirements). The requirements were: evaluations at three different moments of the season; two wrestlers were excluded for not complimenting the specific data gathering, as for instance: absence during training and/or competition due to any kind of injury or situation and so they were dismissed.

Also we relied on forty judo athletes (n=40) from senior and junior categories from the national Portuguese team, but fourteen were dismissed for very similar reasons to the previously mentioned. The subjects sample diminished considerably in the judo modality. Some of them had sports commitments or were injured, so they were dismissed at the moment of the data gathering (Table #1)

Table #1: Contingency Table. Discipline: Wrestling and Judo * Gender

Male		Gender		TOTAL
		Female		
Discipline:	Wrestling	27	11	38
	Judo	18	8	26
TOTAL		45	19	64

The data gathering was made during three specific moments in judo athletes and wrestlers' sporting season: Preliminary Period, training base stage (Base): (Development Mesocycle). Preliminary Period, Specific stage: (Control Mesocycle). Competitive Period: in a dehydration condition, previous weigh-in, in the pre-competitive moment.

Tools

Within this study we distinguish two sorts of fundamental tools: to evaluate muscle strength different symptoms we used the Isocontrol 5.2 System (Quasar Control. Madrid, Spain). Second tool we used to control and to know body composition values was the Inbody Biospace 230 System (CA, USA). By means of this system we can get the variables of: body weight, skeletal muscular mass, body fat index and body water percent, and body mass index among others.

We enclose to these tools a third one, the SPSS 19.0 data sheet including variables extracted from systems files, licensed by the Universidad de Castilla-La Mancha (Spain).

Data Gathering Protocol

Wrestlers evaluation testing was made during the preliminary hours to the evening training sessions, coinciding with the competition weigh-in time during wrestling championships. To judo athletes, evaluation testing was made before the morning training sessions, close to this discipline weigh-in

time.

For the accomplishment of muscles strength test by means of the Isocontrol system through 1 RM in bech press exercise, we count on an encoder of 200 cm and 2 n of resistance at the bar shifting level vertical. Protocol to obtain muscle strength and time till the acquisition of maximum strength values during the 1RM shifting is: the first load is 200 grams to obtain the maximum velocity of execution. The load is gaining every 2, 5, 10 or 20 Kg weight depending on the evaluated athletes and execution velocity [28].

Statistical Analysis

For the data analysis, different tests were made with the investigation variables, explaining in detail the fundamental importance in hydrated and dehydrated athletes group during training shapes, and also a descriptive analysis of the studied variables.

Table #2: HYDRATED AND DEHYDRATED group Descriptive Statistical and of the variables depending on body composition and muscle strength, during the three phases of the study

		Base Training	Specific T.	Pre competitiveT
BODY COMPOSITION				
WEIGHT	Average	73.58	72.92	70.38
	Typical Deviation	14.99	14.79	14.84
SKELETAL MUSCULAR MASS	Average	34.85	35.29	35.27
	Typical Deviation	8.33	8.29	8.65
BODY WATER %	Average	62.40	62.67	62.88
	Typical Deviation	4.82	4.19	4.70
BODY FAT MASS %	Average	16.86	15.08	13.47
	Typical Deviation	9.57	5.57	5.87
		Base Training	Specific T.	Pre competitiveT
MUSCLE STRENGTH				
ACCELERATION	Average	17.98	20.18	19.83
	Typical Deviation	4.54	4.19	3.98
MUSCLE STRENGTH AVERAGE	Average	864.68	995.01	942.06
	Typical Deviation	479.69	539.94	502.15
MUSCLE POWER AVERAGE	Average	487.33	550.75	524.66
	Typical Deviation	207.89	196.03	192.11
MUSCLE STRENGTH PRODUCTION	Average	31045.71	52926.23	73419.89
	Typical Deviation	29698.20	57551.17	164755.63

For the averages differences we made the statistical analysis test T Student for independent samples during the three study phases: base, specific and precompetitive, with the study variables, those of body composition and muscle strength as it is displayed into next tables (Tables: #3, #4 and #5). We can observe in all of them the results for the hydrated and dehydrated athletes group, the number of subjects, their averages, the typical deviation parameters and the statistical significance levels for 0.01 and 0.05.

Table #3: Averages differences during the Base Stage (T Student test for independent samples) depending on the athletes hydration levels

	Hydration Levels	N	Average	Typical Deviation	p
BODY COMPOSITION					
Base Weight	Hydrated	36	75.36	14.52	.482
	Dehydrated	18	70.17	16.52	
Base Skeletal Muscular Mass	Hydrated	36	37.22	7.69	.860
	Dehydrated	18	30.25	8.01	
Base Body Water %	Hydrated	36	65.29	2.54	.993
	Dehydrated	18	56.62	2.48	
Base Body Fat Mass %	Hydrated	36	14.51	10.54	.394
	Dehydrated	18	22.75	3.86	
MUSCLE STRENGTH					
Base Acceleration	Hydrated	34	18.58	4.44	.901
	Dehydrated	18	17.26	5.10	
Base Muscle Strength Average	Hydrated	34	1043.92	534.21	.129
	Dehydrated	18	592.88	226.99	
Base Muscle Power Average	Hydrated	34	584.63	186.77	.077
	Dehydrated	18	343.43	141.30	
Base Muscle Strength Production	Hydrated	34	39929.76	36551.21	.010
	Dehydrated	18	17864.03	12799.16	

Table #4: Averages differences during Specific Stage (T Student test for independent samples) depending on the athletes hydration levels

	Hydration Levels	N	Average	Typical Deviation	p
BODY COMPOSITION					
Specific Weight	Hydrated	42	73.69	14.85	.967
	Dehydrated	14	70.60	14.89	
Specific Skeletal Muscular Mass	Hydrated	42	36.85	8.14	.432
	Dehydrated	14	30.60	7.07	
Specific Body Water %	Hydrated	42	64.71	2.18	.951
	Dehydrated	14	56.56	2.41	
Specific Body Fat Mass %	Hydrated	42	12.55	3.31	.946
	Dehydrated	14	22.67	3.76	
MUSCLE STRENGTH					
Specific Acceleration	Hydrated	40	20.42	4.41	.083
	Dehydrated	14	18.98	3.05	
Specific Muscle Strength Average	Hydrated	40	1096.52	588.62	.061
	Dehydrated	14	695.32	204.33	
Specific Muscle Power Average	Hydrated	40	589.53	194.29	.158
	Dehydrated	14	425.24	146.74	
Specific Muscle Strength Production	Hydrated	40	61059.88	60437.65	.027
	Dehydrated	14	32092.28	45185.96	

Table #5: Averages differences during the Pre-competitive Stage (T Student test for independent samples) depending on the athletes hydration levels

	Hydration Levels	N	Average	Typical Deviation	p
BODY COMPOSITION					
Precompetitive Weight	Hydrated	47	71.79	15.00	.511
	Dehydrated	15	65.96	13.91	
Precompetitive Skeletal Muscular Mass	Hydrated	47	37.05	8.61	.124
	Dehydrated	15	29.70	6.19	

Precompetitive Body Water %	Hydrated	47	64.91	3.02	.910
	Dehydrated	15	56.53	3.06	
Precompetitive Body Fat %	Hydrated	47	11.29	3.70	.022
	Dehydrated	15	20.31	6.27	
MUSCLE STRENGTH					
Precompetitive Acceleration Dehydrated	Hydrated	42	20.00	3.87	.522
	13	19.28	4.44		
Precompetitive Muscle Strength Average Dehydrated	Hydrated	42	1023.22	541.45	.015
	13	679.82	188.35		
Precompetitive Muscle Power Average Dehydrated	Hydrated	42	565.53	192.02	.032
	13	392.62	123.91		
Precompetitive Muscle Strength Production Dehydrated	Hydrated	42	81165.57	185928.06	.420
	13	48395.38	56124.04		

RESULTS

The Table #3 with hydrated and dehydrated athletes global group results, show how within the body composition parameters comparing the study stages, the body weight is one of the variables tending to diminish, as the preparation stages to the competition advance.

(e.g.: Base: 73.58±14.99; e.g.: Specific: 72.92±14.79; e.g.: Precompetitive: 70.38±14.84) the same as it is with body fat mass percent values (e.g.: Base: 16.86±9.57; e.g.: Specific: 15.08±5.57; e.g.: Precompetitive: 13.47±5.87). Skeletal Muscular Mass value (SMM) increases from the base stage to the specific stage (e.g.: Base: 34.85±8.33; e.g.: Specific: 35.29±8.29), this is basically because the muscle strength training base stage in this type of athletes is the work of maximum dynamic muscle strength via the muscular hypertrophy. As pre-competitive stage approaches, this variable level diminishes as a consequence of body weight decrease searching for the right competition weight (e.g.: Specific: 35.29±8.29; e.g.: Precompetitive: 35.27±8.65). The body water percent increases as the training stages follow one another because we find a global descriptive where hydrated athletes percent is bigger than the dehydrated ones percent.

Within kinematic indicators from the base stage to the specific stage, there is a considerable improvement in all muscle strength variables and all of them thoroughly diminish during the precompetitive stage, except muscle strength production, which increases, because the global addition of hydrated and dehydrated athletes' data make indicators grow as it happened with body water percent.

The Table #3 shows the averages differences during wrestlers and judo athletes' base training stage. We can observe that there are no significant differences in body composition variables, nevertheless there are in muscle strength production (p= 0.01), being the number of the hydrated athletes bigger than the number of the dehydrated ones (Hydrated n=36; Dehydrated n= 16).

The Table #4 shows that during the specific stage, the Student T test reflects muscle strength production as an important value, with a significant value of p= 0.027. In the same way, the hydrated athletes group exceeds the dehydrated one at all the variables (Hydrated n= 42; Dehydrated n= 14, for body composition variables; Hydrated n=40; Dehydrated n= 14, for muscle strength variables).

The table #5 shows the last study phase in which we can observe that, as within body composition variables, the body fat mass percent shows a significance value of p= 0.022. We equally find that, as much muscle strength as muscle power have relevant differences at this study phase, being their p values 0.015 and 0.032 respectively. The athletes number in the hydration level keeps being higher than dehydrated athletes number, as much for body composition variables as for muscle strength variables (Hydrated n= 47; Dehydrated n= 15, for body composition; Hydrated n= 42; Dehydrated n=13, for muscle strength variables).

CONCLUSSION

These results agree with the investigations made by García et al. [28] where it is shown that values bigger than 25% of the body weight in judo athletes suppose a confirmed damage to the muscle resistance values as to the muscle strength ones. In the same way Kalman and Lepeley [17] come to the same conclusions observing that a diminution of 2% of the body weight loss as a search for the competition weight, diminishes the athletes performance related to muscle strength, muscle resistance and coordination.

Regarding the conclusions related to the study specific phase: (1) muscle strength variables improvements are bigger in the hydrated athletes than in the dehydrated ones. (2) The changes in body composition variables are bigger on SMM (Skeletal Muscular Mass), and this one increases in hydrated athletes, being better the wrestlers values that the judo athletes ones.

Finally, the last conclusions in this study are for the pre-competitive stage: (1) the SMM (Skeletal Muscular Mass) in dehydrated athletes diminish as they get close to the competition. (2) During this stage and with same conditions, the SMM losses in the dehydrated women are bigger than the men ones. (3) Muscle strength and muscle power variables decrease in the athletes, as much in wrestlers than in judo athletes and these variables are smaller than the specific stage ones [31, 32].

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