

The Influence of Body Mass of Water Level on Cardiovascular and Urinary Parameters at Athlete Students

ADELA BADAU¹, DANA BADAU^{1*}, RAZVAN SANDU ENOIU², MARIUS NECULOIU³, CARMEN DANIELA NECULOIU³, VIRGIL TUDOR⁴, RADU CRISTIAN SASU¹, CARMEN ENE VOICULESCU⁵, VIRGIL ENE VOICULESCU⁶, STEFAN TERIS⁷, CLAUDIU MEREUTA^{7,8}, COSTIN EUGEN DAN⁸, ADRIANA CLIPA⁹, DINA CONSTANTIN⁹

¹University of Medicine, Pharmacy, Sciences and Technology, Faculty of Medicine, 38 Gh. Marinescu Str., 540072, Targu Mures, Romania

²Transilvania University of Brasov, Faculty of Physical Education and Mountain Sports, 29 Eroilor Str., 500036, Brasov, Romania

³Transilvania University of Brasov, Faculty of Medicine, 29 Eroilor Str., 500036, Brasov, Romania

⁴National University of Physical Education and Sport, Faculty of Physical Education and Sports, 140 Constantin Noica Str., 060057, Bucuresti, Romania

⁵Ovidius University of Constanta, Faculty of Physical Education and Sport, 124 Mamaia Blvd., 900527, Constanta, Romania

⁶Mircea cel Batran Naval Academy, Faculty of Military Marine, 1 Fulgerului Str., 900218, Constanta, Romania

⁷Dunarea de Jos University, Doctoral School of Socio-Human Sciences, 47 Domneasca, 800008, Galati, Romania

⁸Dunarea de Jos University, Faculty of Physical Education and Sport, 63-65 Garii Str., 800003, Galati, Romania

⁹Ovidius University of Constanta, Faculty of Medicine, 1 Universitatii Alley, 900470, Constanta, Romania

The main purpose of study was to gain more comprehensive information about the influence of body mass of water level on some cardiovascular and urinary parameters for the student athletes. Cardiovascular and urinary parameters analysis does not reflect the significant differences between the two samples, but most parameters do not fit into the normal reference values.

Keywords: water body mass, muscular mass, cardiovascular and urinary parameters, sport students.

Water is an essential component of the human body which influences major optimal functionality of the organism, maintains health and physical fitness level. Optimizing health is a prerequisite for optimizing human functional of locomotor, cardio-circulatory, respiratory, excretory, digestive and nervous, endocrine and lymphatic systems and motor capacities [1-9]

Numerous studies have addressed the topic of hydration and dehydration in performant sports, focusing on the predominantly levels of knowledge and habits [10-15]. A number of studies have showed how the body water mass parameters are influencing the cardiac functionality and athletic performance on different types of sports: Ironman distance, triathlon competition [16], team sports [17-19] and combat and other sports [20-22].

Numerous studies have shown that insufficient hydration of the body, during and after exercise, determine the incapacity of maintaining the optimum parameters of the in cardiovascular and urinary capacity and thus lower athletic performance [22-27].

An inappropriately level of hydration of the body, especially for a long time, can cause: blood thickening, decreased blood flow, increased blood pressure and increased production of cholesterol to reduce further loss of fluid from the cells and prevent the risk of some heart or brain strokes [28-29]. The level of water mass is related to body weight and muscle mass which includes the skeletal muscles, smooth muscles and the water contained in these muscles [20,30]. The main parameters of the mass of water that are influencing the cardiovascular equipment are: blood viscosity, vascular resistance, vascular elasticity, myocardial blood demand and myocardial oxygen consumption. Blood Viscosity represents the ability to flow through vasculature; it is the basic indicator of hemorheology which refers to the internal friction among blood molecules [31-33]. Vascular Resistance: dividing pressure gradient by volume flow, the longer the length

and size of blood vessels is the higher the vascular resistance is and making it better [33-35].

Vascular Elasticity: expandability of arterial vascular elasticity during systolic ejection, and low elasticity is often associated with the existence or not, with a predisposition to develop other cardiovascular diseases [33,36-38]. Myocardial Blood Demand represents the blood demand per minute of coronary artery perfusion of heart [33]. Myocardial Blood Perfusion Volume it is determining the ratio of the actual blood demand per minute of coronary artery perfusion of heart [33]. Myocardial Oxygen Consumption represents the quantity of oxygen consumed by heart per minute, expressed in milliliters, depending on the heart rate, blood pressure, myocardial contractility, myocardial contraction time [33,39-40].

Physical exercise causes increased protein excretion; transient urinary proteinuria phenomenon manifesting itself as a reversible physiological processes [41-45]. Practicing sports facilitates increased concentration of oxygen free radicals that cause oxidative stress installation inevitable phenomenon, which contributes to the emergence of post-exercise proteinuria [46].

There are relatively few studies that focused on highlighting the differences between female athletes and males as well as how the body by water mass influences a number of functional parameters in order to optimize health and sports performance.

The main purpose of the current study was to gain more comprehensive information about the influence of the mass of water on the cardiovascular and urinary parameters on the student athletes. First aim to highlight the differences between samples focused female and males athletes, in terms of mass by water and on some urinary and cardiovascular parameters, were influenced by the supply of oxygen and water levels in the body. Second targets aim to highlight the correlation between body mass by water and some cardiovascular and urinary parameters in student athletes.

*email: dana.badau@umfst.ro

Experimental part

Materials and methods

The study took place from May to June 2018 on a sample of 142 students who volunteered from the program of physical education and sport. In the study we have used the following devices and measuring software: electronic scales with talimetre to investigate weight (kg) and height (cm); Tanita Health Ware - Software [47], for evaluation: BMI, fluid mass (kg%) and muscle mass (Kg%); The Quantum Resonance Magnetic Analyzer equipment [33], for investigation: blood viscosity, vascular resistance, vascular elasticity, myocardial blood demand, myocardial blood perfusion volume, myocardial oxygen consumption. In human blood plasma has a high uric acid level which represents an indicator of the incidence of development of the high blood pressure, heart disease or chronic kidney disease [48-49]. Proteinuria Index target protein concentration in urine is an indicator of kidney functionality, lower values being associated with good functionality of the kidneys, but there are situations where it grows as appropriate exercise [50-51]. All assessments were conducted between the hours 10 to 12 am for all subjects. Experimental procedures performed in this study were consistent with the principles specific ethical scientific research as 2008 Helsinki Declaration.

We mention that in preparing this article all authors contributed equally.

Subjects

The study sample consisted of 144 students of physical education and sport program, active practitioners of sports performance at the University of Medicine, Pharmacy, Sciences and Technology of Targu Mures (48 students) and Transilvania University of Brasov (96 students). The sample consisted of 72 students male athletes, 20.3611 years old $X \pm SD .87702$; 178.2361 cm high $x \pm SD 7.89454$; 72 student athletes females age $x \pm SD 19.6667$ years, $SD .87702$; 165.4306 cm high $x \pm SD 7.40922$.

Statistical analyses

The research results were processed in SPSS 24. calculating the statistical indicators: arithmetic mean ($\bar{X}$), standard deviation (SD), Student test (t), Skewness index differences Between male and female results ($\bar{A} - (\bar{X} - \bar{M})$), Pearson correlation (r). the Skewness values for normal distribution have to be considered to be less than ± 1.0 . Significance was set at

$p < 0.05$ for all analysis. The reference values specific to the study are presented in table 1.

Results and discussions

In Table 1 are shown the results of the descriptive study, and Table 2 shows the correlation between the parameters investigated for the two samples - male (normal font) and females (italics).

The analysis of the results included in Table 1 show a normal distribution of data for most parameters investigated, Skewness value fits between the values of $.028 \pm .283$ and $.807 \pm .283$, the only exception being for BMI female sample recorded a value greater than the reference value ± 1 . Df sample Student's test values (71) male / female, reveals that the differences between the two samples are statistically significant for the following parameters: BMI, body weight, muscle mass by water, uric acid index for $p < 0.05$. Also, the following parameters are not statistically significant after analyzing the results of the two samples, namely: blood viscosity, vascular resistance, vascular elasticity, myocardial blood demand, myocardial blood perfusion and myocardial oxygen consumption volume index and proteinuria.

Reporting the results recorded in the study with reference values, it was found that both samples fall within normal reference values to the following parameters: weight, BMI, muscle mass, water mass. Instead, cardiovascular parameters investigated, except blood viscosity which is within normal limits, others do not fall between the reference values, normally being higher than Vascular Resistance, Myocardial Blood Demand and Myocardial Oxygen Consumption and lower than normal values for Vascular elasticity and Myocardial Perfusion Blood Volume. The mean values of the parameters investigated are in the normal urination in the case of the female sample, and the sample of male athletes is higher than the recorded values of the reference parameters.

Analyzing the sample of male (normal font) and the female (italic font), there is a statistically significant correlation between: weight, BMI, muscle mass, water mass (Table 3). Regarding cardiovascular parameters by mass hydrous we find a significant correlation in the sample of male blood viscosity only .297, and if female blood sample viscosity .335 and -.313 with vascular resistance. We found no significant correlation between urinary and anthropometric parameters and body mass by water (Table 3).

Table 1
BENCHMARKS OF THE STUDY

Testing Item	Normal Range	
	Female	Male
Ideal weight (IW)(Lorintz formula [52])	$IW \text{ Female} = [H - 100 - (H - 150) / 2.5] + ((A - 20) / 6)$	$IW \text{ Male} = [H - 100 - (H - 150) / 4] + ((A - 20) / 4)$
IMC	18-24.9	18-24.9
Muscle mass (% from body weight for 18-39 age) [53]	63-75.5%	75-89%
Water mass (% from body weight)	45-60%	50-65%
Blood Viscosity	48.264 - 65.371	
Vascular Resistance	0.327 - 0.937	
Vascular Elasticity	1.672 - 1.978	
Myocardial Blood Demand	0.192 - 0.412	
Myocardial Blood Perfusion Volume	4.832 - 5.147	
Myocardial Oxygen Consumption	3.321 - 4.244	
Uric acid Index	1.435 - 1.987	
Proteinuria Index	1.571 - 4.079	

H - height (cm), A - age (years).

Table 2
DESCRIPTIVE STATISTIC OF THE ANTHROPOMETRIC AND CARDIOVASCULAR PARAMETERS.

Testing Item	Groups	X±SD	Skewness	Δ(XF-XM)	Student test	
			X±SD	X±SD	t	p
Weight (kg)(W)	F	58.050±7.822	.564±.283	-16.279	-11.005	.000
	M	74.329±9.174	.160±.283	±12.551		
IMC	F	21.054±2.031	1.342±.283	-2.240	-6.139	.000
	M	23.294±2.226	-.154±.283	±3.096		
Muscle mass (%) (MM%)	F	73.912±5.995	.046±.283	-6.890	-8.535	.000
	M	80.802±3.924	.028±.283	±6.850		
Muscle mass (kg)(MM)	F	42.545±3.542	.807±.283	-17.729	-21.367	.000
	M	60.275±6.127	.370±.283	±7.040		
Water mass (%) (WM%)	F	54.262±4.295	.189±.283	-5.426	-8.306	.000
	M	59.688±3.493	.356±.283	±5.543		
Water Mass (kg)	F	31.372±2.625	.410±.283	-13.029	-25.407	.000
	M	44.401±3.437	.330±.283	±4.351		
Blood viscosity (BV)	F	62.880±7.230	-.390±.283	1.944	1.592	.116
	M	60.935±6.449	.147±.283	±10.365		
Vascular Resistance (VR)	F	1.137±.417	.135±.283	-.075	-1.051	.297
	M	1.212±.493	-.050±.283	±.611		
Vascular Elasticity (VE)	F	1.524±.208	-.217±.283	.010	.333	.740
	M	1.513±.223	-.183±.283	±.278		
Myocardial Blood Demand (MBD)	F	.517±.120	-.279±.283	.038	1.977	.052
	M	.478±.113	.272±.283	±.166		
Myocardial Blood Perfusion Volume (MBPV)	F	4.767±.339	-.621±.283	-.018	-.381	.704
	M	4.786±.329	-.727±.283	±.417		
Myocardial Oxygen Consumption (MVO2)	F	4.555±.818	.147±.283	-.113	-.831	.409
	M	4.669±.816	-.195±.283	±1.159		
Uric acid Index (UAI)	F	1.901±.203	-.640±.283	-.188	-4.596	.000
	M	2.090±.278	-.142±.283	±.348		
Proteinuria Index (PI)	F	4.043±1.037	-.121±.283	-.263	-1.678	.098
	M	4.306±.872	-.513±.283	±1.329		

t – value of Student test. p – probability significant level

Table 3
CORRELATIONS BETWEEN ANTHROPOMETRIC AND CARDIOVASCULAR PARAMETERS FOR BOTH SAMPLES

	W	IMC	MM%	MM	WM%	WM	BV	VR	VE	MBD	MBPV	MVO2	UAI	PI
W	-	.539**	-.511**	.896**	-.777**	.875**	-.189	.160	-.068	-.249*	.026	-.238*	.626	.790
IMC	.711**	-	-.850**	.280*	-.713**	.355**	-.174	.324**	.048	-.011	-.118	.026	.894	.650
MM%	-.802**	-.730**	-	-.221	.882**	-.244*	.245*	-.373**	-.114	-.032	.190	.059	.460	.580
MM	.802**	.379**	-.309**	-	-.366**	.972**	-.189	.071	-.093	-.254*	.013	-.260*	.931	.775
WM%	-.816**	-.660**	.906**	-.434**	-	-.316**	.335**	-.313**	-.041	.120	.151	.196	.530	.452
WM	.850**	.451**	-.402**	.977**	-.438**	-	-.128	.015	-.082	-.235*	-.004	-.216	.862	.712
BV	.003	-.095	.282*	.279*	.297*	.285*	-	.010	-.074	.213	.085	-.153		
VR	-.084	-.063	-.067	-.180	-.095	-.192	-.200	-	.014	.217	.045	-.128		
VE	-.020	.130	-.001	-.021	.051	-.002	.380**	.095	-	.187	-.004	.164		
MBD	.116	.084	-.002	.182	-.053	.165	-.083	-.286*	-.309**	-	-.149	-.058		
MBPV	.000	.045	-.020	-.067	-.077	-.086	-.217	.201	-.198	.041	-	.092		
MVO2	.057	.186	-.220	-.138	-.226	-.136	-.364**	.100	.011	-.237*	.093	-		
UAI	.593	.258	.964	.419	.977	.297								
PI	-.008	-.094	.033	-.030	-.017	-.073								

* Correlation is significant at the 0.05 level (2-tailed); ** Correlation is significant at the 0.01 level (2-tailed); With Italic font annotated correlations for the female sample, with normal font are highlighted correlations for the male sample.

Conclusions

The study findings highlight the significant differences between sample student athletes male and the female to the following anthropometric parameters investigated: weight, BMI, muscle mass, water mass, but note that all mean scores fall between the values of referent normal.

The analysis of the differences between the two samples, male and female, of cardiovascular and urinary parameters, makes no differences, but most parameters are not within the normal reference values. The results of the parameters: Vascular Resistance, Myocardial Blood Demand and Myocardial Oxygen Consumption, Proteinuria Index are higher than normal reference for both samples and parameters; Vascular Elasticity and Myocardial Perfusion Blood Volume are below normal reference values. Study highlights a significant correlation between anthropometric parameters and mass hydrates, but for

two minor exceptions, cardiovascular parameters on the viscosity and vascular resistance of the blood correlates significantly to the mass of water resources. Among other cardiovascular parameters was found no significant correlation. Urinary indicators do not correlate with hydrous body weight for neither of the two samples of both female and male athletes.

The activity of sport and the maintainance of the optimal health by focusing on recovery after exercise; and hydrous rebalancing; should represent major preoccupations for the athletes. The values of cardiovascular and urinary parameters were recorded; and the results were higher or lower compared with the normal reference values which require more complex investigations in order to prevent the occurrence or development of cardiovascular diseases. Long training with intensity, complexity and

duration of the effort varied, specific sports activities can cause cardiovascular and renal system request.

Maintaining fluid levels and rebalance the body by water after exercise are essential for preventing cardiovascular and kidney overload, for maintaining health in order to optimize exercise capacity and hence the sport performances.

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