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Case study of effect induced by physical effort on urinary protein level on the unschooled young male (smoker and non-smoker)

Radu MD[1,2], Chirică R[3] , Munteanu Anca[4], Balașoiu Maria[5], Băcănoiu Manuela[5], Șapte Elena[6]
[1]Faculty of Natural and Agricultural Sciences, Ovidius University of Constanta, Romania, [2]Faculty of Pharmacy, Ovidius University of Constanta, Romania, [3]Faculty of Medicine, Ovidius University of Constanta, Romania, [4]National Public Hygiene, Bucharest, Romania, University of Medicine and Pharmacy Craiova, Romania [5]Faculty of Dental Medicine, Ovidius University of Constanta, Romania

Abstract. The excretory system is responsible for eliminating post-effort metabolism products. Otherwise, the components of renal parenchyma are subject to additional stress, both, during exercise as a result of the post-ischemic reperfusion process and post-exercise as a result of the elimination of excess metabolic products.The mechanism of inducing proteinuria during exercise is not fully known. nstead, a series of events that occur as a result of physical effort is a cause of the proteinuria phenomenon. The experimental data obtained revealed that in our experimental model the physical effort, induces the increase of urinary protein level in two experimental groups that was studied. This information indicates that from a functional point of view, the excretory system of smokers or non-smokers can suffer functional deterioration as a result of the new physiological requirements imposed by physical effort. Repetitive physical effort has led to the downgrading of the proteinuria phenomenon, a parameter that indicates the state of renal integrity and functional adaptation to physical effort, a physiological aspect that indicates the body's inability to adapt within 7 days to the new demands imposed by physical effort. The physiological response of the excretory system to the physical exertion of the two categories studied is the same. **Key words:** *exercise, proteinuria, urinary protein.*

Introduction

The beneficial effects of physical effort were first reported in the writings of Hipocrates, which refers to the fact that active people are much healthier than sedentary (1). Clinical and non-clinical experimental studies of the benefits of physical exercise on modern human health have been summarized over the last 10 years in molecular studies of physical effort and their implications in cardiovascular pathology, metabolic diseases (diabetes and obesity), various cancers and the phenomenon of aging.

In cardiovascular disease the most common trigger factor is chronic hypertension (2). Blood hypertension is not a fundamental feature of the aging process but the sum of factors such as; hypercaloric diet, weight gain and sedentarism (3). Clinical experimental studies have shown that moderate exercise over 16-32 weeks has led to lowering blood pressure in hypertensive individuals, even after a 33% reduction of antihypertensive drugs (1,4,5).

Obesity and overweight are risk factors for a range of chronic pathologies such as; high blood pressure, coronary artery disease and premature mortality (1). In the case of overweight people, regular exercise of moderate intensity leads to a relatively modest reduction in body weight. It is certain that regular exercise is associated with a lower risk of mortality in normal, overweight and obese men (6,7). Recent studies on mice have shown that during physical exercise the skeletal edge releases into the vascular torrent a series of peptide-inducing factors involved in the body's resistance to the onset of metabolic diseases (diabetes, obesity) (8). More epidemiological data show that physical effort reduces the risk of cancer (9). During and after physical exercise, a series of changes occur in nature; biological, epigenetic, metabolic and inflammatory. However, it is not known exactly whether the unitary changes or their combination, influence the pathways of genesis or maintenance of cancerous processes (9-11). An intense problem studied in the last decade in medical context is early aging, strongly covered by the scientific community. Aging is in a multifactorial process that includes variables such as; individual's genetics, social status and lifestyle (12). An aspect dependent on the individual's lifestyle is the loss of functional capacity that is associated with sedentaryism and contributes to the onset of cardiovascular disease, type II diabetes and colon cancer (12-

14). There is clear evidence that regular exercise reduces the development and progression of chronic diseases in the elderly (12-14).
In the above-mentioned information, we refer to the beneficial aspects of physical effort and new bio-medical research trends. Over the last 5 years, physical physiology studies have crossed the cellular border and have reached the molecular domain. Appearance showing the evolution and degree of interest in the physical effort of the scientific community. However, physical effort is also an important source of transient pathophysiological events whose role is not fully known. Thus, physical effort not only causes changes in the molecular dynamics of the skeletal muscle (15), but also changes the functional activity of the organs involved in post-exercise metabolic recovery or the elimination of the resulting metabolic products. The excretory system is responsible for eliminating post-effort metabolism products. Otherwise, the components of renal parenchyma are subject to additional stress, both, during exercise as a result of the post-ischemic reperfusion process and post-exercise as a result of the elimination of excess metabolic products.
During physical exercise, as a reversible process, urinary protein excretion can be increased, a process called proteinuria (16). Proteinuria is a predictive marker of renal pathology (17). The mechanism of inducing proteinuria during exercise is not fully known. Instead, a series of events that occur as a result of physical effort is a cause of the proteinuria phenomenon. Thus, during physical exercise, the blood flow decreases in the kidney, as a result of targeting the vascular flow to the muscles in activity and increases the filtration fraction, an event that could facilitate the passage of proteins in the ultrafiltrate (18-19). Post effort the mechanism of induction of the proteinuria phenomenon is the increase in glomerular permeability that exceeds the tubular resorption capacity (18,21). The presented physiological mechanisms explain theoretically the mechanism of induction of proteinuria as a result of physical exercise, but are unable to explain how the proteinuria phenomenon can persist and 72 hours post-exercise. The experimental study quantifies the functional response of the male, unschooled, smoker and non-smoker adult, excretory system subjected to moderate physical effort for seven days.

Material and Method

Urine samples were collected as follows: In the first step (Step 1), urine samples were collected for 7 days before following the training cycle, and total protein content was determined from the urine; In the second phase (Step 2), urine specimens were collected 24 hours post-exercise after each of the 7 exercises conducted according to the physical exercise pattern, and the urine samples were determined for total protein content.
Biochemical parameters determined: Urinary protein level - Total urine protein levels were assayed by the spectrophotometric technique described by Lowry et al. (1951) and values expressed as mg/mL urine.
The experimental model was composed of two lots, a smoker's batch and a non-smoking batch. Urine samples were collected before following the training cycle and during the first 7 days of training. During the seven days of training the urine samples were collected after the effort, to get a clear picture of the exertion response to physical effort. The experiment aimed analyzing the response of the excretory device to the physical effort and not comparing the biochemical status of smokers with non-smokers.
Physical effort model. The study comply with all the ethical rules. Before completing the training cycle, subjects were subjected to specific clinical investigations that targeted both, the cardiovascular and the respiratory system. The subjects underwent physical exercise according to the protocol - easy running on tape for 30 minutes and progressively pedaling at medium intensity for 20 minutes/day/seven days.
Statistical Analysis. Data were processed in the program *OriginPro7.5*. The significance threshold was set at $p \leq 0.05$.

Results

Table 1**.** Protein concentration in urine expressed in mg /ml urine

	Statistical Analysis	**Smoker`s Group/ urinary protein level expressed as mg/mL urine**	**Non-smoker`s Group/ urinary protein level expressed as mg/mL urine**
Step 1. Urinary protein level – *pre - workout*	X±ES	0.76 ± 0.04	0.43 ± 0.05
	n	6	6
Step 2. Urinary protein level – ***post -*** *workout*	X±ES	1.25 ± 0.08	0.89 ± 0.06
	n	6	6
	t	5.31	3.76
	p≤	0.01 ↑	0.01 ↑

X±ES = mean ± standard error; n = the number of individual samples that represented the arithmetic mean in the end; t = the value of the "t" test taken by the Student; p ≤ the threshold of significance established on the basis of the "t" value.

Discussions

Non-invasive or minimally invasive monitoring of organs during physical exercise has been particularly prominent in the last decade. Until 1990, most physiological studies focused on physiological behavior of the skeletal muscle and heart muscle, today studies target organs directly involved in supporting physical effort and organs involved in the post-exercise metabolic recovery or product elimination of metabolism. Aspects that concern the body's ability to perform a workout of the same intensity and time, at a time interval, set by the amateur or performance sportsman. Recent studies have shown that there is a direct relationship between the intensity of physical effort and post-exercise recovery time. The excretory system is involved in the recovery of the post-effort body. The normal functioning of the excretory system is involved in the compatibility between the type of exercise and the individual's ability to physiologically adapt to the type of exercise. The degree of adaptation means the physiological ability of the individual to move from amateur to performance. Post-exercise proteinuria is a parameter of renal function integrity and degree of adaptation to new demands imposed by physical effort. As mentioned before, the literature shows the possible physiological mechanisms by which proteins can reach ultrafiltered during and after the training. From the analysis of the data presented in the literature it appears that the post-effort proteinuria phenomenon occurs both in experimental models on laboratory animals and at performance athletes who perform mainly intensive workouts (23). Post-exercise proteinuria is a transient and reversible physiological event but with a direct implication on the adaptation of the organ to physical effort, knowing the role of the kidneys in maintaining the balance of the internal environment. An aspect of triggering the proteinuria phenomenon can be the oxidative stress (24). It is known that high concentrations of free oxygen radicals that can inactivate the antioxidant defense system and, implicitly, the oxidative stress phenomenon are generated during physical exercise (16,25). Recent studies show that the excretory system of performance athletes can adjust their functional activity through umoral mechanisms, and also the activity of the antioxidant defense system. However, functional and antioxidant adjustment may occur as a result of a longer workout cycle compared to the reporting time for our study. In our experimental model we studied a biochemical parameter that indicates the state of functioning of the excretory system and which may have clinical valency. We studied both smokers and non-smokers for practical reasons, without making a comparison between the physiological response of the excretory system of the two categories studied. The experimental data obtained revealed that in our experimental model the physical effort induces the increase of urinary protein level, in the two experimental groups that was studied. This information indicates that from a functional point of view, the excretory system of smokers or non-smokers can suffer functional deterioration as a result of the new physiological requirements imposed by physical effort. Our experimental data opens up a topical area for researchers but especially for clinicians who face a number of challenges from practitioners of different sports. Summarizing our study, the phenomenon of proteinuria appears as a result of the physical effort and it can have the source of the oxidative stress phenomenon. Administration of antioxidant compounds under the same study conditions, could provide valuable practical information on the hypothesis launched. At the same time, the proteinuria correlation with the oxidative stress parameters could supplement the information and explain to a better extent, that the proteinuria source is oxidative stress.

Conclusion

The conclusion of the experimental study was that after a unitary effort, the phenomenon of proteinuria is correlated with the installation of the oxidative stress phenomenon.The physiological response of the excretory system to the physical exertion of the two categories studied is the same. Repetitive physical effort has led to the downgrading of the proteinuria phenomenon, a parameter that indicates the state of renal integrity and functional adaptation to physical effort, a physiological aspect that indicates the body's inability to adapt within 7 days to the new demands imposed by physical effort.

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Corresponding author
Radu Marius-Daniel
Faculty of Natural and Agricultural Science/Faculty of Pharmacy, Ovidius University
Constanta, Romania
Phone: +40731682470
E -mail: *drd_maryus @yahoo.com*

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