Changes in anthropometric, biochemical, hematological, hormonal and cardiac markers in a group of late-adult amateur cyclists, after continuous and prolonged exercise on an uncontrolled diet

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Abstract:

Purpose: to describe and compare the main biochemical and hematological parameters, markers of cardiac and stress suffering (cortisol), in an amateur group of 8 late-adult cyclists (average age 60.9 years s.d. 4.1 years) before and after a continuous bicycle course of 9 days with an actual duration of 7 days and a daily average of 103.5 Km (total of 725 km) on an uncontrolled diet.

Results: body weight, BMI, systolic and diastolic pressure did not vary significantly in pre- and post-cycling performance (p> 0.05). There was no significant change in the pre- and post-red blood cell count in the hemochromocytometric hematological parameters (p = 0.57), while hemoglobin values decreased significantly after pedaling (p = 0.03), as did the average cellular hemoglobin values and the average cell concentration of hemoglobin (p = 0.002 and p = 0.0006, respectively). The number of platelets, white blood cells, the absolute number of neutrophils, lymphocytes, eosinophils, basophils and monocytes, and the percentage of neutrophils, eosinophilic lymphocytes, basophils and monocytes did not change significantly (p> 0.05). With regard to basic biochemistry, there was no significant variation in the values of glucose, urea, creatinine, alanine amino transferase, alkaline phosphatase, cholinesterase and creatinine kinase (p> 0.05). Aspartate amino transferase was found to be significantly greater after pedaling (p = 0.03). The values of albumin, total proteins, lactate dehydrogenase, total calcium, inorganic phosphorus, total magnesium, total iron, sodium and potassium were statistically non-significant between pre and post phases. The lipid profile, total cholesterol, triglycerides, lipases, HDL and LDL were also statistically non-significant even if HDL values increased on average after cycling performance (before 48.9 ± 9.5 and after 53.8 ± 12.4) while LDL values decreased on average (before 118.5 ± 28.8 and after 101.6 ± 10.3). In the hormone-labeling and vitamin group, ferritin was statistically non-significant. Pre and post changes in the stress hormone cortisol, PSA, vitamin B12 and natriuretic B-type NT-proBNP peptide were statistically non-significant. Instead, folate decreased significantly following the cycling performance (p = 0.017). In protein biochemistry, apolipoprotein A1 was statistically significant (p = 0.038) increasing after pedaling, while apolipoprotein B, C-reactive protein and transferrin were statistically non-significant. CK MB mass and troponin I in the cardiac markers did not undergo significant changes between pre and post phases.

Conclusions: despite the small size of the chosen sample, parameters analyzed between pre and post continuous physical effort lead to the conclusion and confirmation of many data in the literature and, that is, that sporting activity conducted in an important way can improve the biochemical/functional state and,

therefore, the health of practising subjects even in late adults and/or the elderly. This could postpone physical psychic decline caused by the natural progression of years.

Introduction

Physical inactivity associated with a high calorie and unhealthy diet are often the cause of obesity and type 2 diabetes, and chronic and degenerative diseases that are very widespread, ubiquitous and constantly increasing (1).

It is proven that physical activity should therefore be increased together with an adequate caloric intake and micronutrients. This leads to benefits in the health of individuals and society. Today, more and more people are dedicated to long-distance sports such as marathons, long bike rides and triathlons. However, both the positive and negative health mechanisms remain unclear.

A high level of physical activity is associated with a reduction in low-grade inflammatory states and therefore less likely to develop obesity and type 2 diabetes (2,3,4).

There is evidence that physical activity combined with weight loss attenuates low-grade inflammation (5) and it has also been shown that 15 weeks of lifestyle change consisting in a low-calorie diet and physical activity in obese subjects decrease low-grade inflammation and the density of macrophages in adipose tissue together with an increase in insulin sensitivity and an improvement in metabolic activity (6). From a meta-analysis study in patients with coronary artery disease, it appears that C-reactive protein and fibrinogen undergo a strong reduction as a result of exercise (7)

Cycling is considered to be a physical activity that has the ability to improve the quality of life of those who practise it. All this is particularly true in those who practise it at amateur level. However, performance decreases with longevity, and particularly in relation to prolonged efforts in resistance performance. There are few data in literature that represent the biochemical state of repeated and prolonged exercises in elderly people over time (8).

The aim of this study was to describe the main biochemical parameters, markers of cardiac and stress suffering (cortisol) in an amateur group of 8 late adult cyclists (mean age 60.9 years sd 4.1 years) before and after a continuous cycling route of a total of 725 km.

Materials and methods

Study design

8 amateur cyclists (7 males and 1 female aged 60.9 ± 4.1 years and height of 174.5 ± 14.4 cm) participated in the project which included a total route of 725 km divided into 7 stages whose characteristics are shown in Table 7. All participants had carried out cycling activities 2-4 times a week in the months prior to departure and no special dietary measures were taken during the trial. Of the 8 participants, 3 participants took medications for: heart disease, arterial hypertension, epilepsy and hypothyroidism. Dietary bars and saline supplements were taken before, during and after the ride. All subjects were tested by means of fasting venous blood on the day before and after the cycling performance. Analytical tests included main anamnestic data, blood count, basic biochemistry, some hormone-markers and vitamins, biochemistry of proteins and cardiac markers (Tables 1-6)

Ethical Approval

All participants gave their informed consent.

Analytical procedures

Serum glucose, creatinine, total cholesterol, HDL and LDL cholesterol, ALT, AST, testosterone, prolactin and 17-beta-estradiol were commercially available using Vitros 5500 (Ortho Clinical Diagnostic, Milan, Italy). Cortisol was measured by Radio Immuno Assay, Beckman Coulter S.P.A. Cassina de Pecchi, Milan Italy.

Statistical analysis

Data were analyzed using the IBM SPSS Statistics 24 statistical program. The two-tailed t-test was used to verify any changes before and after the study, taking $P \leq 0.05$ as significant.

Results

The results of the various biochemical parameters and anthropometric data are shown in Tables 1-6. With regard to anthropometric data (Tab.1), body weight and BMI did not change significantly ($p = 0.29$ and $p = 0.31$, respectively), nor did the physiological values of diastolic and systolic blood pressure ($p = 0.66$ and $p = 0.74$, respectively). Analyzing hematology parameters (tab.2), the pre and post red blood cell count did not change significantly ($p = 0.57$), while hemoglobin values decreased significantly after pedaling ($p = 0.03$), as did the average cellular hemoglobin values and the average cell concentration of hemoglobin ($p = 0.002$ and $p = 0.0006$, respectively). There was no significant variation in the number of platelets, white blood cells, the percentage of neutrophils, eosinophilic lymphocytes, basophils and monocytes ($p> 0.05$). There was also no significant variation with regard to the absolute number of neutrophils, lymphocytes, eosinophils, basophils and monocytes ($p> 0.05$).

There was no significant variation in the values of glucose, urea, creatinine, alanine amino transferase, alkaline phosphatase and cholinesterase ($p> 0.05$) in the basic biochemistry (Tab. 2). Aspartate amino transferase was found to be significantly greater after pedaling ($p = 0.03$). Creatinine kinase increased after cycling (before 134.6 ± 31.4 and after 159.1 ± 40.1), although there is no statistically-significant difference ($p = 0.09$). The pre and post-values of albumin, total proteins, lactate dehydrogenase, total calcium, inorganic phosphorus, total magnesium, total iron, sodium and potassium were statistically non-significant. Iron-binding capacity and chloride are at the limit of statistical significance ($p = 0.069$ and $p = 0.07$, respectively). With regard to the lipid profile, total cholesterol, triglycerides, lipases, HDL and LDL, these were statistically non-significant even if HDL values increased on average (before 48.9 ± 9.5 and after 53.8 ± 12.4) while LDL values decreased on average (before 118.5 ± 28.8 and after 101.6 ± 10.3). In the hormone-markers and vitamins group analysis (Tab.4), ferritin was statistically non-significant, although it showed a significant increase after pedaling (ferritin before 134.7 ± 112.8 and after 158.7 ± 108.2). The stress hormone cortisol was not significantly different pre and post-pedaling. Instead, there was a significant post-pedaling decrease in folate ($p = 0.017$). Vitamin B12 remained unchanged in the pre and post-pedaling phases. The B-type natriuretic peptide (NT-proBNP) did not differ statistically even if there is a marked decrease in post-pedaling values (before 84.9 ± 66.5 and after 46.6 ± 35.3). The prostatic activity marker (PSA) was not significantly different pre and post-pedaling.

As regards the biochemistry of proteins (Tab.5), apolipoprotein A1 structural component of HDL was significantly different ($p = 0.038$) in structural proteins of the lipid component, which increased after pedaling. However, apolipoprotein B structural component of VLDL and LDL was not statistically different. C-reactive protein increased after cycling while remaining statistically insignificant. Transferrin was not significantly different even though there was an increase between pre and post-pedaling (before 220.4 ± 51.4 after 260.4 ± 12.7).

In cardiac markers (Tab.6), pre and post muscle damage measured by CK MB mass and troponin I were not statistically different.

Conclusions

Overall data (Tables 1-6) conclude that there are no major differences between pre and post physical exertion which demonstrates that late adults and/or elderly people can also undertake a good level of physical activity. This can lead to improved metabolism with a possible slowing down of the pathophysiological processes typical of aging. Participants' mood also definitely improved thus proving that

physical activity helps to deal with problems related to depression and the decline of psycho-physical energies (9).
The uncontrolled diet did not result in any significant weight loss as pressure values and pulsations per minute did not change significantly pre and post-pedaling.
From the data it emerges that there was a slight statistically-significant decrease between pre and post-pedaling in hemoglobin ($p = 0.035$), in the average cellular hemoglobin ($p = 0.006$) and in the mean cellular hemoglobin concentration ($p = 0.002$). This may be due to the so-called "sports anemia" which some authors consider to be a false anemia and, rather, a pseudoanemia which is an adaptation of the athlete's organism linked to sports activity; it can also be explained as an anemia by dilution; in fact, hemoglobin levels are lower than normal because the aerobic activity causes an expansion of the blood volume which results in a decrease in the concentration of erythrocytes (10).
As regards enzymes of hepatic origin, only aspartate amino transferase showed a significant increase in values ($p = 0.03$) although all the other enzymes (ALT, γGT, alkaline phosphatase, cholinesterase and albumin) show a compatible increase tendency with prolonged effort but not at statistically-significant levels. Creatinine kinase, which is a marker of tissue damage in skeletal muscle, showed an increase in values (before 134.6 ± 31.4, after 159.1 ± 40.1) while not achieving statistical significance ($p = 0.09$). With regard to folic acid, this resulted in a significant decrease ($p = 0.017$) which can be explained because folic acid is more metabolized in athletes.
As for the lipid profile, there is a significant increase in apolipoprotein A1, the main protein component of high-density lipoproteins (HDL, called "good" cholesterol) ($p = 0.037$). The relationship between apolipoprotein A1 and apolipoprotein B increases after cycling (from 1.82 to 1.91) and this is correlated with a reduction in cardiovascular risk. LDL values decrease after pedaling (from 118.5 ± 28.8 to 101.6 ± 10.3) and HDL increases (from 48.9 ± 9.5 to 53.7 ± 12.4), while not presenting a significant difference. This demonstrates that the lipid profile improves significantly after physical activity even in the elderly.
As far as cardiac markers (troponin I and PCK-MB) are concerned, no significant differences are noted between pre and post-pedaling. Values remained approximately unchanged even in the cardiopathic subject. No significant difference was shown in all other parameters. Despite the small chosen sample, the general framework of analyzed parameters leads to the conclusion and confirmation of many data in the literature and, that is, that sporting activity conducted in an important way can improve the biochemical/functional state and, therefore, the health of the practising subjects even in late adults and/or the elderly. This could postpone the physical psychic decline caused by the natural progression of years.

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