SESSION I

MUSCLE FUNCTION
MUSCLE EXERCISE

Wednesday (September 15, 2021; 10:30 – 11:55)
Thursday (September 16, 2021; 9:00 – 10:05)

Chair:

Prof. Jerzy Zoladz
Department of Muscle Physiology, University School of Physical Education, Krakow, Poland

Prof. Jan Gorski
Department of Physiology, Medical University of Bialystok, Bialystok, Poland

Prof. Adrian Chabowski
Department of Physiology, Medical University of Bialystok, Bialystok, Poland

DETAILED SESSION I SCHEDULE

Opening lecture (Wednesday, September 15, 10:30 – 10:50; *virtual stream A*):

S1.L1 THE FIRST CONCEPT OF FATIGUE THRESHOLD IN HUMANS AS PROPOSED BY HENRY BRIGGS A 100 YEARS AGO. **J.A. Zoladz** (Department of Muscle Physiology, Institute of Basic Sciences, Faculty of Rehabilitation, University School of Physical Education in Krakow, Krakow, Poland).

Oral presentations (Wednesday, September 15, 10:50 – 11:55; *virtual stream A*)

S1.L2 EFFECT OF 8-WEEK SUPPLEMENTATION WITH VITAMIN D3 ON PATIENTS WITH CHRONIC LOW BACK PAIN ELIGIBLE FOR NEUROSURGERY INTERVENTION. **P.A. Chromiec[3], P. Kurlandt[2], M. Czechlowska-Nabozna[3], A. Glinska[3], W.R. Skrobot[1], D. Korewo[1], S. Pietrzak[1], A. Zdun-Ryzewska[3], E. Szurowska[3], W. Kloc[2], J.J. Kaczor[1*]** ([1]Gdansk University of Physical Education and Sport, [2]Department of Neurosurgery Copernicus Healing Entity, Gdansk, [3]Faculty of Health Sciences with the Division of Nursing and Institute of Maritime and Tropical Medicine, Medical University of Gdansk, Poland).

S1.L3 EFFECTS OF A LINEAR BLOCK PROGRESSION STRENGTH TRAINING PROGRAM ON CARDIAC REMODELING PARAMETERS IN RATS. **L. Gomes Dias, M.R. Ramos Paunksnis, A.P. Lima-Leopoldo, A.S. Leopoldo, M.R. Holanda Da Cunha, D.S. Bocalini** (Universiade Federal do Espirito Santo, UFES, Vitoria/ES Brasil).

S1.L4 RELATIONSHIPS BETWEEN PLASMA CONCENTRATIONS OF ANGPTL4 AND OTHER CYTOKINES REGULATING LIPID METABOLISM DURING MARATHON RUNNING IN HEALTHY MEN. **M. Gorecka, K. Krzeminski, M. Buraczewska, A.W. Ziemba** (Department of Applied Physiology, Mossakowski Medical Research Institute, Polish Academy of Sciences, Warsaw, Poland).

S1.L5 IMPACT OF ENDURANCE TRAINING ON THE NITRIC OXIDE BIOAVAILABILITY IN RAT SKELETAL MUSCLES – RELATIONSHIP TO MUSCLE MITOCHONDRIA BIOGENESIS. **J. Majerczak[1], H. Drzymala-Celichowska[1], A. Kij[2], M. Grandys[3], J. Celichowski[1], S. Chlopicki[2,4], J.A. Zoladz[3]** ([1]Department of Neurobiology, Poznan University of Physical Education, Poznan, Poland, [2]Jagiellonian Centre for Experimental Therapeutics (JCET), Jagiellonian University, Krakow, Poland, [3]Department of Muscle Physiology, Chair of Physiology and Biochemistry, University School of Physical Education, Krakow, Poland, [4]Department of Experimental Pharmacology, Chair of Pharmacology, Jagiellonian University Medical College, Krakow, Poland.)

Session summary

Poster session (September 16, 2021; 9:00 – 10:05, *virtual stream D, interactive*)

S1.P1 THE FACTORS THAT MODULATE GROWTH HORMONE RESPONSES TO A PHYSICAL EFFORT. **B.H. Opaszowski** (Department of Endocrinology, Institute of Sport - National Research Institute, Warsaw, Poland)

S1.P2 EFFECT OF S-EQUOL, SELECTIVE ESTROGEN RECEPTOR β AGONISTS, ON MDX MUSCLE FIBERS. **F. Figueiredo[1], F. Yoshimura[1], J. Suh[1], A. Silva Neto[1], F. Fonseca[2], D. Feder[1], M. Sato[1], T. Hermes[3]** ([1]Department of Morphology and Physiology, Centro Universitario FMABC, Santo Andre, SP, Brazil, [2]Laboratory of Clinical Analysis, Centro Universitario FMABC, Santo Andre, SP, Brazil, [3]Department of Anatomy, Federal University of Alfenas (UNIFAL-MG), Alfenas, MG, Brazil).

S1.P3 FUNCTIONAL OUTCOMES OF DISTAL RADIUS FRACTURES MANAGED WITH VARIOUS METHODS OF FRACTURE STABILIZATION. **J. Olech[1], G. Konieczny[2], P. Morasiewicz[3]** ([1]Orthopedic Surgery Department, Provincial Specialist Hospital in Legnica, Legnica, Poland; [2]Faculty of Health Sciences and Physical Education, The Witelon State University of Applied Sciences in Legnica, Legnica, Poland; [3]Department of Orthopaedic and Trauma Surgery, University Hospital in Opole, Institute of Medical Sciences, University of Opole, Opole, Poland).

S1.P4 CHANGES IN SERUM LIPID PROFILE CAUSED BY FASTING AND PHYSICAL EXERCISE. **K. Pilis, A. Kosior-Lara, K. Leszczynski, A. Pilis** (Department of Health Sciences, Jan Dlugosz University in Czestochowa, Czestochowa, Poland).

S1.P5 RELATION BETWEEN RECTUS FEMORIS AND VASTUS MEDIALIS PASSIVE MECHANICAL PROPERTIES AND BODY MASS INDEX AFTER TOTAL KNEE REPLACEMENT. **D. Lenciauskiene** (Klaipeda State University of Applied Sciences, Klaipeda, Lithuania).

S1.P6 EFFECT OF SODIUM BICARBONATE SUPPLEMENTATION ON MUSCLE PERFORMANCE AND DAMAGE: A DOUBLE BLIND, RANDOMIZED CROSSOVER STUDY. **C. Leite[1], R. Battazza[2], M. Kalytczak[2], M. Lamolha[2], R. Rica[3], J. Baker[4], F. Politti[2], D. Boccalini[1]** ([1]Universidade Federal do Espirito Santo, Vitoria, Espirito Santo, Brazil, [2]Universidade Nove de Julho, Sao Paulo, Brazil, [3]Faculdade Estacio de Sa, Vitoria, Espirito Santo, Brazil, [4]Hong Kong Baptist University Kowloon Tong, Hong Kong, China).

S1.P7 MITOCHONDRIAL ADENOSINE TRIPHOSPHATE-SENSITIVE POTASSIUM CHANNELS OPENING IS CRITICAL FOR ENERGY METABOLISM UNDER PHYSICAL STRESS. **O. Akopova, I. Mankovska, V. Nosar, L. Kolichynskaya, V. Sagach.** (A. Bogomoletz Institute of Physiology, NAS of Ukraine, Kiev, Ukraine).

S1.P8 EFFECT OF LOSS OF MIR-23-27-24 CLUSTER MICRO-RNAS ON MUSCLE REGENERATION. **T. Kato[1], S. Oikawa[2], M. Lee[2], T. Akimoto[2]** ([1]Graduate School of Sport Sciences, Tokorozawa, Japan; [2]Faculty of Sport Sciences, Waseda University, Tokorozawa, Japan)

S1.L2

EFFECT OF 8-WEEK SUPPLEMENTATION WITH VITAMIN D3 ON PATIENTS WITH CHRONIC LOW BACK PAIN ELIGIBLE FOR NEUROSURGERY INTERVENTION

P.A. CHROMIEC[3], P. KURLANDT[2], M. CZECHLOWSKA-NABOZNA[3], A. GLINSKA[3], W.R. SKROBOT[1], D. KOREWO[1], S. PIETRZAK[1], A. ZDUN-RYZEWSKA[3], E. SZUROWSKA[3], W. KLOC[2], J.J. KACZOR[1]

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Chronic pain in the lumbar spine (CLBP) is the second most common complaint in adults. The complex function of paraspinal muscles in CLBP leads to macroscopic degeneration of the multifidus muscles. Numerous studies have shown a decreased cross-sectional area of this muscle in patients with CLBP compared to healthy muscles. Also, it has been proven that vitamin D deficiency is correlated with chronic pain in the lumbar region of the spine. In addition, as a result of vitamin D deficiency, mitochondrial dysfunction and paraspinal muscle atrophy occur. The study aimed to evaluate the effects of 8-week supplementation with vitamin D3 with an average dose of 6 000 IU/day in patients with CLBP before surgery and 8-week physical activity after neurosurgery intervention. Patients depending on the BMI were supplemented with vitamin D3 (19–25/4000; 25–29.9/6000; and >30/8000 IU; SUPD) or placebo (vegetable oil; PLG). Each patient has been done three times MRI scan of the lumbar spine, first before supplementation, second 2 weeks after end supplementation, and about 6–8 weeks after surgery. Patients performed functional tests, and blood was collected for later analysis at every examination. We found an increase in serum of vitamin D3 concentration in the SUPD as compared to the PLG. There was an improvement in two of the three functional tests in the SUPD. Data indicate that supplementation with vitamin D had a positive response in well-being and pain sensations. Even in one case, there was a reversal of morphological changes, confirmed by MRI.

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S1.L3

EFFECTS OF A LINEAR BLOCK PROGRESSION STRENGTH TRAINING PROGRAM ON CARDIAC REMODELING PARAMETERS IN RATS

L. GOMES DIAS, M.R. RAMOS PAUNKSNIS, A.P. LIMA-LEOPOLDO, A.S. LEOPOLDO, M.R. HOLANDA DA CUNHA, D.S. BOCALINI

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Strength training (ST) is an effective strategy for increasing muscle strength, inducing important changes in both performance and health parameters. However, even though many studies show positive responses with the practice of TF in skeletal muscle parameters, the effects on cardiac remodeling still remain inconclusive. Thus, the aim of the study was to evaluate the effects of strength training program with linear progression in block on parameters of cardiac remodeling in rats. Methods: Twenty rats were distributed in two groups: control (C, n:10) and trained (T, n:10). The training protocol (12 climbs with 90 seconds of interval) was organized in three mesocycles of four weeks, with load increment in a linear way (60%, 65%, 70% and 75%) at each block, considering the established weight in the test of maximum strength. The parameters evaluated: muscle strength, ventricular function by echocardiogram, ventricular hemodynamics and changes in cardiac mass. The Student t test was used with a significance level of $p < 0.05$ with values presented as mean ± standard error of the mean. Training induced a 45 ± 4% increase in muscle strength. There were no significant changes ($p > 0.05$) in ventricular function by FEAT (C: 61 ± 3, T: 63 ± 5; %) and diastolic areas (C: 2.83 ± 0.01, T: 2, 94 ± 0.07; mm) and systolic (C: 1.07 ± 0.07, T: 1.07 ± 0.01) between groups. Regarding hemodynamic parameters, no differences were found ($p > 0.05$) in LVSP (C: 122 ± 5, T: 119 ± 4; mmHg), PD2LV (C: 5.1 ± 0.3, T: 5 .3 ± 0.3; mmHg), +dP/dt (C: 11800 ± 1200, T: 14416 ± 1120; mmHg/s) and –dP/dt (C: 8523 ± 493, T: 8415 ± 499; mmHg /s). As well as in the atrial mass (C: 0.17 ± 0.02, T: 0.15 ± 0.02; mg/g), RV (C: 0.56 ± 0.01, T: 0.59 ± 0.03; mg/g), LV (C: 2.27 ± 0.06, T: 2.22 ± 0.03, mg/g) and cardiac mass (C: 3.06 ± 0.05; T: 3.01 ± 0.09 mg/g). In conclusion the realization of a linear strength training program in block for 12 weeks promoted an increase in muscle strength, without promoting significant changes in cardiac morphofunctional parameters.

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S1.L4

RELATIONSHIPS BETWEEN PLASMA CONCENTRATIONS OF ANGPTL4 AND OTHER CYTOKINES REGULATING LIPID METABOLISM DURING MARATHON RUNNING IN HEALTHY MEN

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Angiopoietin-like protein 4 (ANGPTL4), tumour necrosis factor-α (TNF-α) interleukin 6 (IL-6) and interleukin 10 (IL-10) regulates lipid metabolism and inflammation. The aim of this study was to find out whether the marathon running influences plasma ANGPTL4 and whether it is related to plasma changes of IL-6, IL-10, TNF-α and lipids. Ten healthy men (age 33.7 ± 1.2 years) completed a marathon running. Plasma ANGPTL4, IL-6, IL-10, TNF-α, free fatty acids (FFA), triacylglycerols (TG), glycerol (Gly), total cholesterol (TC), low (LDL-C) and high (HDL-C) density lipoprotein-cholesterol were determined before, immediately after the run and after 90 min of recovery. Plasma ANGPTL4 increased during exercise from 55.5 ± 13.4 to 78.1 ± 15.0 ng/ml ($p < 0.001$). This was accompanied by significant increases in plasma concentrations of IL-6, TNF-α, IL-10, FFA, Gly and decreases in plasma TG ($p < 0.01$). After 90 min of recovery, plasma ANGPTL4 and TG did not differ significantly from the exercise values, while plasma IL-6, TNF-α, IL-10, FFA and Gly were significantly lower than immediately after the run, but still higher than at baseline. TC, TC/HDL-C and TG/HDL-C molar ratios after the recovery were significantly lower than before the run. Positive correlations were found between exercise-induced increases in plasma ANGPTL4 and those of TNF-α ($r = 0.83$; $p < 0.01$), IL-6 ($r = 0.71$; $p < 0.02$) and FFA ($r = 0.71$; $p < 0.02$). Increases in plasma ANGPTL4, IL-6 and TNF-α correlated positively with those of Gly ($r = 0.78$, $r = 0.75$ and $r = 0.81$; $p < 0.01$; respectively). After 90 min of recovery plasma concentrations of IL-6 and TNF-α correlated positively with plasma FFA ($r = 0.74$, $p < 0.01$; $r = 0.61$, $p < 0.05$; respectively) and Gly ($r = 0.60$, $r = 0.61$; $p < 0.05$; respectively). The present data suggest that the exercise-induced increases in plasma FFA, IL-6 and TNF-α during marathon running may be involved in plasma ANGPTL4 release and that increase in ANGPTL4 secretion may be a compensatory mechanism against fatty acid induced oxidative stress. The data also suggest that ANGPTL4, IL-6, TNF-α can stimulate adipose tissue lipolysis during marathon run. Additionally, the exercise-induced significant increases in plasma IL-6, TNF-α and IL-10 may reflect both immunological changes in skeletal muscle and exercise-induced endotoxemia.

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S1.L5

IMPACT OF ENURANCE TRAINING ON THE NITRIC OXIDE BIOAVAILABILITY IN RAT SKELETAL MUSCLES - RELATIONSHIP TO MUSCLE MITOCHONDRIA BIOGENESIS

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Nitric oxide ($NO^{\bullet}$) is considered to be a multifunctional signalling molecule that is found in almost all living cells. It is postulated that $NO^{\bullet}$ is involved among others in the training-induced intensification of mitochondrial biogenesis. Skeletal muscles has been found to be a reservoir of the $NO^{\bullet}$ in the form of nitrate and nitrite. The aim of the present study was to determine the changes in the nitrite and nitrate concentration in soleus muscle in relation to the changes of mitochondrial electron transport chain (ETC) proteins after 1, 2, 4 and 8 weeks of endurance training. The ETC proteins were determined using Western immunoblotting. Muscle nitrate and nitrite has been evaluated using HPLC. We have found that the endurance training as soon as after 1 week decreased muscle nitrite concentration ($p < 0.05$), which remained attenuated until the 8th week of training. On the other hand the level of muscle nitrate concentration was less sensitive to endurance training and remained unchanged until the 8th week of training, with the exception of its temporal attenuation ($p = 0.05$) found after the 2nd week of training. Moreover, an increase ($p < 0.05$) in the ETC proteins content has been found not sooner than at the 8th week of the training. Endurance training rapidly diminishes muscle nitrite concentration but its effect on muscle nitrate concentration is less evident. The training-induced decrease in the muscle nitrite concentration is a much faster muscle adaptive response than the training-induced increase of the ETC proteins content.

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S1.P1

THE FACTORS THAT MODULATE GROWTH HORMONE RESPONSES TO A PHYSICAL EFFORT

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Exercise is a strong stimulator of growth hormone secretion (GH). Its increase release takes place during increased anaerobic processes, large O_2 deficit and oxygen debt. The GH response mechanism is complex. Data indicate, that a crucial contribution to exercise response of GH have the adrenergic and cholinergic systems. This research aimed to assess an impact of 'warm up' and cholinergic preparation on the GH response to exercise. Eight students of age 22–25 and VO_{2max} 5.019 ± 0.301 l O_2/min volunteered in this study. They performed 3 separated supra-maximal runs on a treadmill (22 km/h) until exhaustion, without information about the time completing of the effort. On the first visit the effort was preceded by 10-min warm-up. On the two next visits prior to the efforts without warm-up, placebo or cholinergic preparation (DMAE) were administered in a randomized order. Physiological parameters, such as: like heart rate (HR), oxygen uptake (VO_2), O_2 deficit and oxygen debt were recorded. Pre- and post-effort capillary blood were sampled for determination of lactate and GH levels. Run 'ad maximum' lasted on average 132 s with placebo, 146 s with cholinergic preparation and 149 s with warm-up. It was found, that the longer the time, the higher contribution the aerobic processes. The effort with warm up was characterized by the lower O_2 deficit as compared to two other runs. The highest lactate peak 14.8 mm was recorded after run with cholinergic preparation, followed by placebo 13.7 mM and with warm up 12.6 mM. GH_{max} concentration after the 'ad maximum' run without warm-up was 63.4 μU/ml, with cholinergic preparation 47.4 μU/ml and with the warm-up 32 μU/ml and appropriate areas under curves (AUCs) were 2462, 2055 and 1597 μU × min × ml^{-1}. GH correlated with O_2 deficit (r = 0.656), with LA (r = 0.866) and GH_{max} with time of run. (r = –0.880). Warm-up and DMAE reduce the exercise response of growth hormone after supramaximal exertion. Sub-maximal warm-up performed prior to supra-maximal effort increases oxygen availability, activates oxidative processes and cholinergic system, thus in turn moderates GH response to supra-maximal effort and protects the 'secretory reserve' of the pituitary gland.

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S1.P2

EFFECT OF S-EQUOL, SELECTIVE ESTROGEN RECEPTOR B AGONISTS ON MDX MICE MUSCLE FIBERS

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Duchenne muscular dystrophy (DMD) is the most prevalent human dystrophinopathy. It is a recessive disease characterized by progressive and irreversible degeneration of the skeletal striated musculature. As a X chromosome-linked disease, it is more common in males, affecting approximately 1 in every 3500–6000 live births. We investigated the effects of S-equol, a selective ligand for estrogen receptor (ER)-β, on muscle fibers of mdx mice. Mdx mice (14-days-old) were randomly divided in groups: treated with S-equol (20 mg/kg dissolved in DMSO, i.p.), DMSO (vehicle, i.p.), and control group (without drug treatment). After 14 days of daily treatment, the animals were euthanized for morphological analyzes of different skeletal muscles. We obtained different results depending on the muscle studied. The group treated with S-equol showed an increase in cells with central nucleus in the *quadriceps* and *biceps brachii* muscles compared to the other experimental groups. The vehicle treated group (DMSO) demonstrated a statistically significant reduction in the total number of cells with a central nucleus of the *quadriceps* muscle in comparison to the control and S-equol groups. No significant difference was observed in the percentage of central nucleus for the *tibialis anterior* muscle, however we observed an increase in the inflammatory area of the control group. In the *extensor digitorum longus* and *sternomastoid* muscles, a reduction in the percentage of cells with central nucleus in the group treated with S-equol was observed. *Extensor digitorum longus* muscle also showed a decrease in the inflammatory area in the vehicle treated group (DMSO). No significant changes were observed in the *diaphragm* muscle comparing the different groups. Conclusions: Both S-equol and DMSO treatments reduced muscle fiber degeneration. Although the positive results were not observed in all skeletal muscle studied, either S-equol or DMSO can be promising in the treatment of DMD, suggesting a possible novel therapeutic approach, given the current lack of satisfactory treatments and its several adverse effects.

Acknowledgments: NEPAS.

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S1.P3

FUNCTIONAL OUTCOMES OF DISTAL RADIUS FRACTURES MANAGED WITH VARIOUS METHODS OF FRACTURE STABILIZATION

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The purpose of our study was to assess the functional parameters following distal radius fractures (DRF) treatment with three different fracture stabilization methods. Fifty patients (33 women and 17 men), the mean age at the beginning of treatment was 56.5years. The mean duration of follow-up was 2 years and 8 months. The first subgroup (n = 14) were the patients treated with volar plating, another subgroup (n = 23) were the patients with cast immobilization and the third subgroup (n = 13) were the patients treated with closed reduction and K-wire fixation. We assessed: 1) muscle strength, 2) range of motion, 3) pain severity. The mean relative grip power values in the volar-plate, cast and K-wire subgroups were 56%, 79% and 56% respectively. These differences were statistically significant ($p = 0.0028$). The best range of flexion (75.7°) was achieved in the cast subgroup and the most limited flexion (59.9°) was observed in the volar-plate subgroup. By far the lowest pain severity was reported by patients in the volar-plate subgroup (VAS score of 1.9). The most severe pain was reported by patients from the K-wire group (score 4.1), whereas the patients from the cast subgroup rated their pain severity as 3. The greatest muscle strength in the affected limb, similar to that in the uninjured limb and the greatest mean range of wrist flexion was achieved in the cast subgroup. The lowest pain severity was reported in the volar-plate subgroup. The best functional outcomes were achieved in the cast subgroup.

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S1.P4

CHANGES IN SERUM LIPID PROFILE CAUSED BY FASTING AND PHYSICAL EXERCISE

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Fasting causes specific adaptive changes in the body. Therefore, it was decided to investigate what changes occur in the serum lipid profile after 8-days of fasting in middle-aged men under conditions of rest and exercise. To this end, 13 volunteered for 8-days of total fasting, during which the subjects drank only any amount of moderately mineralized water. Before and after the fasting intervention, venous blood was collected from men under resting conditions and immediately after the exercise test, in which the concentration of β-hydroxybutyrate (β-HB), total cholesterol (Ch-T), high-density lipoprotein cholesterol (Ch-HDL), low-density lipoprotein cholesterol (Ch-LDL), and triglycerides (TG) was determined. The mutual relations of the individual plasma lipid fractions were also calculated, that is: R_1 = Ch-T/Ch-HDL, R_2 = Ch-LDL/Ch-HDL, R_3 = TG/Ch-HDL. The applied fasting together with exercise resulted in significant changes in the concentration of the following variables: β-HB ($p < 0.001$), Ch-T ($p < 0.001$), Ch-HDL ($p < 0.001$), Ch-LDL ($p = 0.018$), TG ($p < 0.001$), and R_3 coefficient ($p = 0.036$), with the upper limits of the reference values being exceeded for Ch-T, Ch-LDL and the R_1 coefficient. Post hoc analysis showed that the applied fasting increased only the concentration of β-HB, both at rest and under the conditions of the ergocycle test ($p < 0.001$). Serum concentration of Ch-T ($p = 0.009$), Ch-HDL ($p = 0.004$), Ch-LDL ($p = 0.038$) obtained after exercise under the conditions of a standard diet, as well as post-exercise Ch-HDL concentrations ($p = 0.011$) and TG ($p = 0.038$) measured after the applied fasting was significantly higher than the values obtained, respectively, under resting conditions. In conclusion, it was found that the 8-day fasting coupled with exercise changed the serum lipid profile, with physical exercise playing a more important role in this change than the fasting intervention.

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S1.P5

RELATION BETWEEN RECTUS FEMORIS AND VASTUS MEDIALIS PASSIVE MECHANICAL PROPERTIES AND BODY MASS INDEX AFTER TOTAL KNEE REPLACEMENT

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More than 50 percent patients undergoing total knee arthroplasty are obese. Obesity has influence on healing process complications after surgery of tendons. There is deficit of studies justifying correlation between body mass index (BMI) and rectus femoris (RF) and vastus medialis (VM) muscles passive mechanical properties after knee arthroplasty. Aim of the study was to determine the relation between RF and VM muscles passive mechanical properties and BMI after total knee arthroplasty. Calculation of BMI was used to classify the patient weight status and to assign to one of the experimental group, miotonometry of RF and VM was used to assess stiffness, elasticity, tone. Statistical data analysis was carried out using SPSS 25.0 statistical analysis package. Data compliance with the normal distribution was verified using Kolmogorov-Smirnov test. Regularity of data differences was checked by non-parametric analysis tests: Mann-Whitney, Kruskall-Wallis. Non-parametric Spearmen correlation coefficient *r* was used to determine relation between parameters. Level of significance was determined as $p < 0.05$. The sample consisted of n = 21 patients after total knee arthroplasty. Patients were divided into three groups according BMI: overweight group (BMI 25.0–29.9 kg/m^2, n = 7), obesity class I group (BMI 30–34.9 kg/m^2, n = 7), obesity class II group (BMI 35.0–39.9 kg/m^2, n = 7). Examination was carried out 1 weak after knee arthroplasty. The results of present study has revealed that overweight was strongly inversely related to RF muscle tone ($r = –0.82$ $p < 0.05$), elasticity ($r = –0.75$ $p < 0.05$). Obesity class I was strongly inversely related to RF muscle stiffness ($r = –0.75$ $p < 0.05$). We have not detected relation between obesity class II and RF and VM muscles passive mechanical properties ($p > 0.05$). BMI was strongly inversely related to RF muscle stiffness ($r = –0.79$ $p < 0.01$), moderately related to RF muscle tone ($r = –0.66$ $p < 0.01$), elasticity ($r = –0.50$ $p < 0.05$), VM muscle tone ($r = –0.48$ $p < 0.05$), stiffness ($r = –0.56$ $p < 0.05$). BMI statistically significantly was inversely related to RF, VM muscles tone, stiffness and RF elasticity after total knee arthroplasty, therefore the relation between obesity class and passive mechanical RF and VM muscles mechanical properties should be further investigated involving larger sample size.

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S1.P6

EFFECT OF SODIUM BICARBONATE SUPPLEMENTATION ON MUSCLE PERFORMANCE AND DAMAGE: A DOUBLE BLIND, RANDOMIZED CROSSOVER STUDY

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This study investigated the effects of sodium bicarbonate ($NaHCO_3$) supplementation on parameters related to the external and internal exercise load in trained individuals submitted to fatigue induction using an isokinetic dynamometer. Ten subjects were tested on two occasions: after ingesting 0.3 g.kg^{-1} of body mass of $NaHCO_3$ or placebo. Maximum voluntary isometric contraction tests were performed before and after a dynamic protocol consisted of 10 series of 10 movements of unilateral extension (concentric phase) and flexion (eccentric phase) of the knee extensors at 120° s-1 at an interval of 60 seconds between series. Performance was assessed using peak torque values. Muscle damage was assessed prior and 24 hours post exercise. The subjective perceptions of effort, pain and recovery were assessed at different times and the internal load of the session was assessed 30 minutes post-effort. Although significant ($p < 0.05$) reductions in peak torque were noted both in isometric ($NaHCO_3$: –20.5 ± 4.1%; Placebo: –17.9 ± 3.0%) and isokinetic strength (NaHCO3: –23.0 ± 13.9%; Placebo: –19.6 ± 9.1%), there was no effect of supplementation on performance ($p > 0.05$). There were no significant differences ($p > 0.05$) between conditions in blood creatine kinase concentrations ($NaHCO_3$ - pre: 225.3 ± 135.9 U/L, post: 418.4 ± 318.4 U/L; Placebo - pre: 238 ± 94.03 U/L, post: 486 ± 336.6 U/L). Curiously, only perception of recovery enhanced ($p < 0.05$) after supplementation. The findings indicate that $NaHCO_3$ supplementation did not attribute benefits in performance or in parameters related to the internal load of the exercise.

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S1.P7

MITOCHONDRIAL ADENOSINE TRIPHOSPHATE-SENSITIVE POTASSIUM CHANNELS OPENING IS CRITICAL FOR ENERGY METABOLISM UNDER PHYSICAL STRESS

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The modulation of mitochondrial ATP-sensitive potassium (mKATP) channel activity by pharmacological means is known to have a great impact on energy metabolism in a living organism. In multiple studies it was shown that mKATP channels openers were effective for the recovery of cardiac and neuronal tissues from ischemia and the risks of oxidative damage after reperfusion. The aim of this work was to examine the impact of endogenous activity of mKATP channel on physical endurance of the rats subject to compulsory swimming. Male Wistar rats were separated in two groups exhibiting high and low resistance to physical stress and subject to compulsory swimming with a load. Swimming time (ST) was monitored till the fatigue, and KATP channel activity was determined *ex vivo* in liver mitochondria. ST was higher in high resistance group, which reliably coincided with higher endogenous mKATP channels activity. Administration of mKATP channels blockers, glibenclamide and 5-hydroxydecanoate, dramatically reduced ST in both high- and low-resistant groups, and completely blocked mKATP channel *in vivo*, which indicated the dependence of physical endurance on mKATP channel activity. To find a mechanistic basis for observed dependence, we studied the direct effects of mKATP channel opening by diazoxide and blocking by glibenclamide on mitochondrial functions *in vitro*. Diazoxide stimulated state 4 respiration, reduced RCR and the rate of phosphorylation, but increased phosphorylation efficiency (P/O). Glibenclamide reduced the rates of state 3 and 4 respiration, and dramatically suppressed phosphorylation, which was exhibited by reduced P/O and the rate of phosphorylation. Based on the experiments, we came to the conclusion of the correlation between the physical endurance and P/O ratio, both dependent on mKATP channels activity. Thus, mKATP channels blocker dramatically reduced P/O and increased oxygen consumption by mitochondria as well as energy expense for ATP synthesis. Unlike this, mKATP channels opener increased phosphorylation efficiency and reduced oxygen consumption by oxphos system, which helped to avoid oxygen depletion under the conditions of oxygen shortage during exercise training. *In vivo* this resulted in the reduction of fatigue and improvement of the endurance in the animals with elevated endogenous mKATP channel activity.

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S1.P8

EFFECT OF LOSS OF MIR-23-27-24 CLUSTER MICRO-RNAS ON MUSCLE REGENERATION

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Recent studies have revealed that microRNAs (miRNAs) inhibited translation and/or promoted degradation of their target mRNAs, which in turn regulated various biological processes. It was shown that specific interactions between muscle-specific transcriptional factors and miRNAs controlled muscle development. Previous studies have reported several miRNAs in miR-23-27-24 cluster regulated myogenic differentiation *in vitro*. However, function of miR-23-27-24 cluster miRNAs *in vivo* has not been elucidated. We conducted a functional analysis of miR-23-27-24 cluster miRNAs in muscle regeneration process. We generated mice lacking miR-23-27-24 cluster miRNAs in a muscle-specific manner using MyoD promoter. Mice were dissected to harvest muscles. Tibilias anterior (TA) muscle was injured using cardiotoxin and harvested 7 days after the injection to evaluate regeneration ability. Primary myoblasts were isolated from muscles and differentiated for 5 days to analyze differentation capacity. We found that significant decreases in body weight, muscle weights as well as muscle cross sectional area from knockout mice. We also confirmed that a decreased cross sectional area of myofibers with centralized nuclei in TA from knockout mice. In addition, myoblast from the knockout mice showed a decrease in fusion index, suggesting inhibited differentiation capacity. These results suggest that miR-23-27-24 cluster miRNAs play an important role in muscle regeneration.

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