unloaded leg will be discussed. CONCLUSION: The preliminary results of this investigation suggest when HRE is optimized for muscle anabolism during unloading muscle size and strength are preserved (or enhanced) at the expense of muscle endurance. In contrast, when BFR exercise is optimized for muscle anabolism during unloading muscle endurance is preserved (or enhanced) at the expense of muscle size and strength.

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Changes of Healthy Human Urine And Serum Proteome Profile During 5-Day "Dry" Immersion

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The study of protein composition, which is capable to change under the influence of environmental factors, may help to understand the mechanisms of homeostasis. Purpose of this work was to estimate the changes of proteomic profiles of urine and serum in volunteers participated in 5-day "dry" immersion (DI). We investigated the second morning urine voids and the blood serum of 14 volunteers aged 19 to 26 years. The volunteers were not subjected to any additional impacts, aimed to prevent adaptive changes in physiological systems. Purification and concentration of urine and serum proteins were carried out using ClinProt robot by the set of magnetic particles MB-HIC and the MB-WCX (Bruker Daltonics). The spectra were obtained on the mass spectrometer Autoflex III (Bruker Daltonics) in automatic mode. For analysis of proteomic profiles, we used the program ClinProTools 2.1 and Statistica 6.0. With the t-test (p <0,05), we found significant differences between experimental and background urine samples in 34 of the 143 peaks obtained after processing of samples (23.7% of all peaks proteomic profile). In the serum after treatment with magnetic particles MB-WCX we detected 175 peaks. It was found significant differences in 48 peaks (27.4% of all proteomic profile peaks) in comparison with the background period. Significantly increased complement C3 fragments (m/z = 1779, 1449 Da) on the 3rd and 5th (m/z = 1866,0) days of DI. On the 1st and 3rd days rehabilitation period, it was observed the significant increase of protein C4a (m/z = 1741,33; 3208,87 Da). This fact may indicate the development of acute-phase reaction. On the 7th day of rehabilitation period, it was found the change of high kininogen fragment peak area (m/z = 2134,8 Da). This protein belongs to the major proteins of the hemostatic system. In all samples, we found the significant increase in fibrinogen fragment (m/z = 1617Da) on the 2nd day of DI and on the 1st and 7th day rehabilitation period. Fibrinogen fragment peak area (m/z = 2863,54 Da) was significantly increased in the 3rd and 5th day of DI. This can be explained by the intensification of proteolysis, or by significant increase of fibrinogen concentration. Significantly increased of platelet factor IV (m / z = 7765 Da), which is an important component of the coagulation cascade on the 5th day of DI and on the 3d day of recovery period, evidenced by increased activity of the hemostatic system in the blood. Thus, all of the above proteins are proteins of the immune system, the "acute phase" and the coagulation system, which can be detected in serum and other biological fluids and have different physiological functions. It is possible that these proteins are the most plastic parts of the serum proteome. Most of the peaks in the urine proteome will require identification and physiological interpretation in the future using bioinformatics resources.

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Ventricular Repolarization Adaptation to Abrupt Changes in Heart Rate after Microgravity Simulation by 5-days Head-Down Bed Rest

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Microgravity exposure induces cardiac deconditioning. It is reported that spaceflight may be related to an increased susceptibility to ventricular dysrhythmias. Due to those changes, the beat-to-beat relationship between the QT and the RR interval could also be affected, as signatures of this increased risk of acquired ventricular tachyarrhythmia. In this work, microgravity was simulated by a 6° Head Down (HD) Bed Rest (BR) maneuver. Our aim was to test if it induces alterations on the dynamics of QT/RR intervals, by characterizing the QT interval adaptation lag to abrupt heart rate (HR) changes. 22 male subjects (age range 21-43 years) were enrolled with a cross-over design in two 5-days HDBR experiments, conducted at MEDES (Toulouse, France) and DLR (Koln, Germany) as part of the European Space Agency BR studies. High fidelity (1000 Hz) 12-leads ECG (Mortara Instrument) was acquired during a 30' head-up tilt (HUT) performed before (PRE), and at the conclusion of BR (R+0). Beat-to-beat QTapex and RR variability series were extracted from the ECG. The dynamics of QTapex interval adaptation in response to HUT-induced HR changes was evaluated using a patient-specific regression model characterized by parameter "α". The model estimates the adaptation lag (i.e., the QT memory to previous RR values) measured by the parameter M90, as the number of beats needed to achieve the 90% of the QT adaptation to the HR change. Subjects with unreliable QTapex delineation or too short (<4') orthostatic tolerance time (OTT) were excluded from the analysis. Subjects with OTT >4' were arbitrarily divided into two groups: OTT, both at PRE and R+0, between 4' and 7'30" (GShort), and OTT>7'30" (GLong). For each group, changes in M90 and α between PRE and R+0 were tested by Wilcoxon signed-rank test (p<.05). Based on the above criteria, 5 subjects were excluded, thus resulting in 5 subjects in GShort and 12 in GLong. Results. Compared to PRE, at R+0 in GShort a significant decrease of M90 (median|interquartile difference) was found from (145|17 beats) to (106|44), while in GLong a significant increase of this parameter from (108|41) to (117|16) beats was visible. Nevertheless, only in GLong α showed a significant decrease from (0.5|0.3) to (0.35|0.11) while in GShort its values remained stable (PRE: 0.46|0.02; R+0: (0.39|0.09). In conclusion, a different mechanism in QT memory adaptation to BR according to the OTT was observed: subjects with poor tolerance (GShort) showed results going in opposite direction compared with subjects in the GLong group. A possible explanation is that in GLong the observed changes at R+0 of M90 and α, which have been previously reported as associated to an increased risk of arrhythmias, were related to the cardiac deconditioning induced by HDBR. On the contrary in GShort, having a reduced OTT even at PRE, the shortening in M90 should not be related to cardiac deconditioning but to other mechanisms still to be determined. Additional studies are required in order to clarify its cause.

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Echocardiography as a Reference for Ballistocardiograpy in parabolic Flight: preliminary Results from the ESA B3D Project.

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Ballistocardiography (BCG) is a technique that had a large interest in cardiology between the fifties and eighties and which provides beat-by-beat information on the cardiac contractility. Echocardiography was performed to provide gold standard reference values for comparison with cardiac function determination by Ballistocardiography. Recent hardware developments in Echocardiography have made it a powerful noninvasive and portable diagnostic tool that allows it to be used during parabolic flights maneuver (PF). The present paper will focus on the preliminary results obtained with Ecocardiography during the ESA 55th parabolic flight campaign while the results on BCG will be detailed in a second paper.

Four subjects were observed during free floating periods of parabolic flight manoeuvre (ESA 55th campaigns conducted on-board the A300-zéroG airplane of NOVESPACE). Echocardiographic measurements (Vivid Q™, General Electrics) were taken at least at two different periods of the microgravity phase of the parabola: early phase (first 10 seconds) and late phase (last 10 seconds). Subjects were maintained in the supine position, lying on the floor of the cabin during the entire period of the parabolic manoeuvre. Cardiac output (CO), stroke volume (SV), early (E) and late diastolic filling (A) and E/A ratio were obtained. Timing of aortic valve opening (AVo) and closure (AVc) and mitral valve opening (MVo) and closure (MVc) were also measured.

During parabolic flights, CO increases from 5,69±1,36 L/min to 6,91±1,40 between the 1-G and and late phase of micro-G conditions, whereas no changes of CO occurs in the early phase. SV increases from 92±10,7 mL to 100±4,4 mL leaving HR unchanged. Our results are somehow discordant with Lonnie [1] who did not observe an increase of SV; the increased CO was entirely caused by an increase of HR [1]. In our experiment, increased CO is explained by a higher SV component in micro-G without changes of HR. We suggest that discrepancies with previous studies are related to the different timing of echocardiographic measurements in the highly transient conditions of PF as shown by Gauger et al [2]. Thus, our preliminary results suggest that cardiac output does indeed increase as a result of microgravity, and that this adaptive mechanism in supine position can be detected only following the first 10 seconds of the parabola.

1. Lonnie G. Petersen, Morten Damgaard, Johan C. G. Petersen and Peter Norsk. Mechanisms of increase in cardiac output during acute weightlessness in humans. J Appl Physiol 111:407-411, 2011.

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A Model to predict Time to presyncope with lower body negative Pressure

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Lower body negative pressure (LBNP) simulates central hypovolemia associated with hemorrhage or orthostatic hypotension, and thus provides a test bed for evaluating the factors which affect an individual's ability to compensate to blood loss or orthostatic stress. Previous