EVALUATION OF LBNP AS COUNTERMEASURE TO CARDIAC DECONDITIONING. K. Yajima(1), M. Inagaki(2), A. Miyamae(3), M. Itou(4), K. Hirayama(5), T. Nakaizato(6), S. Yunikura(7), M. Doi(8) and C. Sekineghi(9). 1)Nihon University, Tokyo, Japan, 2)NASDA.

PURPOSE AND METHOD: To evaluate the effects of LBNP as a countermeasure for cardiac deconditioning in space, seven young male volunteers were admitted to the hospital and experienced 6-degree head-down tilt (HDT) for 3 days. Passive 60-degree head-up tilt (HUT) was performed before and after HDT. Four volunteers received 30 min HBP for 30 minutes to induce fluid shift to the lower body twice a day (every morning and afternoon) during HDT for 3 days, while 3 of 7 volunteers (the control group) did not receive HBP. Continuous blood pressure monitoring, heart rate, and impedance plethysmogram were measured during the HUT test before and after HDT. RESULTS: One volunteer became hypotensive during the first LBNP and also became hypotensive again during the HUT test after HDT. The other LBNP volunteers (3 out of 4) did not show undesirable conditions. One volunteer of control group had become hypotensive during the HUT test before HDT. However, he did not become hypotensive during the HUT test after HDT for 3 days.

CONCLUSION: 30 min HBP loading for 30 minutes twice a day did not seem to prevent cardiac deconditioning induced by 3 days of 6-degree HDT.

DISUSE OSTEOPOROSIS: CHANGES IN BIOCHEMICAL PARAMETERs DURING AND FOLLOWING SIMULATED MICROGRAVITY OF DIFFERENT DURATION. K. Lohn*, DLR Cologne, Germany; S.R. Mohler**, E. Powers*, T. Hangerter, Wright State University, Dayton, OH.

A limiting factor for prolonged human exposure to microgravity is the loss of bone mass. Immobilization and bed rest have proved to be useful interventions to study bone loss under weightlessness conditions. To our knowledge the long-term effects of immobilization on bone turnover and on bone mineral density have not been studied in the ground control. Thus, the present study was performed to evaluate the effects of immobilization during a 120 day duration space flight. 12 healthy male volunteers, divided into three groups. Group I (9 subjects) experienced 3 days of bed rest, Group II (5 subjects) bed rest for 1 week, and Group III (7 subjects) were controls.

RESULTS: Serum and urine samples of Group I showed increased concentrations of bone-specific alkaline phosphatase (BAP) and osteocalcin, decreased concentrations of urine and serum creatinine, and increased concentrations of urine and serum creatinine. The Group II showed no significant changes. Conclusion: Immobilization and bed rest have proved to be useful interventions to study bone loss under weightlessness conditions. MICRORAD OF DIFFERENT DURATION. DISUSE OSTEOPOROSIS: CHANGES IN BIOCHEMICAL PARAMETERs DURING AND FOLLOWING SIMULATED MICROGRAVITY. J. Vernikos*, D. A. Loly*, and V. A. Convertino*. Life Science Division, NASA/Ames Research Center, Moffett Field, CA 94035 and NASA Kennedy Space Center, 32899, FL.

INTRODUCTION. Saline loading (SL) within hours of reentry is currently used as a countermeasure against postflight orthostatic hypotension in astronauts. However, its effect on blood volume expansion is not fully understood. The purpose of the present study was: 1) to quantify the effects of SL on plasma volume and orthostatic tolerance following exposure to simulated microgravity and 2) to compare these effects with the use of a pharmacological fluid expander, fludrocortisone (F). METHODS: Eleven men (30-45 yr) underwent a 15-min stand test before, immediately after, and 7 days after simulated bed rest (BR). Five of the subjects ingested SL (8 g salt tablets with 1 liter of water) 2 hr before standing at the end of bed rest while the other 6 subjects received 0.2 mg oral doses of F at 0800 and 2000 hours the day before and 0800 hours the day the subject got out of bed (i.e., 2 hr before standing). Plasma volume (PV) was measured before BR, on day 7 of BR, and after the final SL or F treatment just before the post-BR stand test. Blood pressure and heart rate was measured continuously during the stand tests. RESULTS: PV decreased from 40±4.3 ml/kg to 39±2.7 ml/kg (p<0.05) immediately after 7 days of BR and returned to 39±3.1 ml/kg while F returned PV to 39±1.6 ml/kg. The post-BR stand test was completed without syncope in all subjects treated only by SL. CONCLUSION. SL may be ineffective in restoring PV to preflight levels and may provide inadequate protection against postflight orthostatic hypotension. In contrast, F may provide a promising countermeasure to prevent orthostatic hypotension.


INTRODUCTION. Prolonged space flight may produce bone density loss of sufficient magnitude to adversely impact long-term space crews. Trabecular bone density change which occurs early in space flight has not been adequately measured due to the limited accuracy of current techniques. METHODS. The OsteoQuant gamma computed tomography device, with 0.5% change in trabecular bone density detection ability, was used to characterize changes in the bone density of healthy male bed rest subjects. Three groups of five subjects received periodic measurements of trabecular bone density of the distal radius and distal tibia. Five had three weeks bed rest, five had one week bed rest, and five were controls. RESULTS. Trabecular bone density changes in the bed rest groups approached 1%. There was an unexpected rise in trabecular bone density of both bed rest groups in the first week of bed rest, followed by a decline in bone density during the bed rest period. CONCLUSION. The initial rise in trabecular bone density at the onset of bed rest may represent a new finding. The OsteoQuant could be used to measure changes in bone density in connection with current space shuttle missions.

THE SPATIAL DISORIENTATION TRAINING SYSTEM BUILT IN AIR FORCE CHINA. Liuhua X, Institute of Aviation Medicine AF, Beijin-100011 China. INTRODUCTION. To reduce the incidence of the Spatial Disorientation (SD) accidents a 3D training system was built in AF of China. METHODS. This System consists of a). Education, through which the pilots should acquire adequate knowledge about the SD, its etiology, manifestation and the methods for coping with it; b) Ground-Based training, through which the pilots are trained to safely experience the SD simulators by baralts and simulator and to acquire adequate skills through virtual training with the 3D SD simulators; c) In-Flight Training, through which the pilots are trained to safely experience the SD simulators by baralts and simulator and to acquire adequate skills through virtual training with the 3D SD simulators. RESULTS. After the training, the SD incidence is reduced from 24 to 3.5%. CONCLUSION. The SD training System is realizable and effective for avoiding SD fatal accident.
COMPARISON OF SIMULATOR SICKNESS SYMPTOMATOLOGY IN TWO FIXED-WING AND TWO ROTARY-WING SIMULATORS. Michael G. Ljungblad, Ph.D.* Naval Systems Command, Naval Air Systems Center, Patuxent River, MD. INTRODUCTION. Studies have found that moving-base simulators of rotary-wing aircraft are associated with higher reports of simulator sickness than those of fixed-base simulators, as measured by self-report, postural, and visual tests. A standardized scoring technique was developed which facilitates comparison between simulators and a factor analysis revealed three distinct factor clusters corresponding to oculomotor, visual-vestibular, and neurovegetative systems. METHOD. Four simulators were examined in the present experiment. Two "sister" moving-base simulators (2F114 and 2F143) for the AH-64 and E-6A. The helicopter simulator employs CR1 flight dynamics and the other two were dome projection systems. The 2F143 was a fixed base. Approximately 100 observers were examined in each simulator. RESULTS. Simulator sickness was found in all simulators when total scores were taken into account, with the highest incidence in the helicopter simulators. When the symptomatology was scored according to the three factor clusters, it was found that the CR1-based helicopter simulators had the highest reports of eyestrain and the fixed-base simulator had the lowest reports of disorientation. Nausea was reported equally in all three of the motion-base simulators. CONCLUSION. Different symptom clusters which occur in specific simulators with sufficient regularity suggest using this method of analysis in an attempt to identify specific equipment features that relate to simulator sickness.

NUTRITION AND ACCELERATION TOLERANCE: CURRENT UNDERSTANDING. G. H. Evans and J. P. Knick* Valparaiso University, Valparaiso, IN 46383 and Armstrong Laboratories, Brooks AFB, TX 78235-5000. INTRODUCTION. Nutritional status and the influence of diet on individual ability to perform in the increased acceleration environment is an important aeromedical concern. Although a number of studies have been performed regarding the nutritional needs of the infantry soldier, little data is available for the special case of high performance pilots (HPP). METHODS. Approximately 50 military subjects were examined using an incomplete block design, where all simulators were run under operational conditions were reviewed. Interviews, computer data base searches, and maintenance records of the clothing and equipment features that relate to simulator sickness. It was found that the CR1-based helicopter simulators had the highest incidence in the helicoper simulators. When the symptomatology was scored according to the three factor clusters, it was found that the CR1-based helicopter simulators had the highest reports of eyestrain and the fixed-base simulator had the lowest reports of disorientation. Nausea was reported equally in all three of the motion-base simulators. CONCLUSION. Different symptom clusters which occur in specific simulators with sufficient regularity suggest using this method of analysis in an attempt to identify specific equipment features that relate to simulator sickness.