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The physical exercise in the space: Microgravity environments

Dario Furnari *
Department of Biomedical Sciences-Aesthetic Medical-Sport Scientist, University of Catania

Abstract

The human body has a great capacity for adaptation, even in the case of significant changes in environmental conditions; like prolonged microgravity. The force of gravity on the earth produces an acceleration of 1 g (g is the symbol that indicates the acceleration due to gravity). The term microgravity indicates a reduced force of gravity and is therefore used to describe conditions in which the force of gravity is less than that on the earth's surface (less than one g). For example, the gravity force of the moon is only 17% of that of the earth, or 0.17g. The term microgravity is often used to describe conditions in space, because the body may not always be in conditions of weightlessness, ie at 0 g.It is interesting to note that most of the physiological changes due to exposure to microgravity are very similar to those observed in athletes, after a period of inactivity or immobilization, or to changes associated with aging that probably derive from a reduction in physical activity. This similarity is corroborated by the data indicating physical exercise performed during exposure to microgravity as an effective means of counteracting the physiological deterioration that occurs in space. For this reason, but also because exploration in space continues, the influence of microgravity on physical activity is an area of growing interest for sports physiology and exercise specialists. the Space Shuttle spacecraft and on the Orbiting Space Station there is an inversion of the normal posture, that is of the position of the body with respect to the center of gravity, which no longer exists and therefore the mass of blood liquid is redistributed in a different way that on earth. While on Earth gravity retains most of the liquid in the lower limbs, in space, since there is no longer gravity, the liquid collects in the small circle, ie at the level of the pulmonary circulation and at the level of the head. Consequences are water retention in the lung and in the face and brain.The adaptation mechanisms ensure that everything works the same, but in the photos this phenomenon is clearly seen in the so-called lunar facies or puffy, roundish and tendentially ruddy face. In short, astronauts live in space as a person who lived upside down on Earth. When they return to Earth, the problems occur at the moment of the transition from microgravity to gravity, that is when they pass from living upside down and suddenly everything turns upside down, at a certain height gravity starts to be felt and astronauts hang from the seat practically they fall on the seat. This step is not gradual because they travel around 27,000 kilometers per hour. The blood from the head flows quickly into the lower limbs and this sudden emptying of blood from the brain causes a short and temporary fall in brain function. It is not a real loss of senses, it does not happen in all the components of the crews but for a few seconds someone does not see us anymore and when this has happened to the pilot of the Shuttle, the first few times he has thought. The definitive return to normality however occurs in a couple of days.

There is no equivalent disease on Earth that causes the same symptoms. Alterations of the musculoskeletal system (in the space in microgravity, there is loss of muscle mass and loss of bone matrix)This loss is caused by the lack of bodily statatism, which is an automatic reflex that keeps man on Earth. The main sensors of this reflex are in the soles of the feet and in the legs, therefore, as gravity is lacking, in space it is as if a person was with his feet in the air and therefore the muscles no longer having the stimulus to contraction to maintain the balance, being inactive, they atrophy. A mechanism of action similar to that which acts on the muscles, is also present in the bones and in microgravity, a hormonal reflex controlled by calcitonin is carried out, so that the bone becomes rarefied, which in technical terms is called osteoporosis. To counteract muscle reabsorption, astronauts are advised to do a lot of gymnastics, ie cycling, but many do not or do not do much, so when they return to Earth, they feel weak and need to do physical rehabilitation. Bone is a complex structure formed by cells that produce bone, osteoblasts and cells that destroy it, the osteoclasts. These cells are placed on a calcium-based trabecular structure, which is the bone matrix. When the bone matrix is destroyed, it is like rust on a piece of iron, it does not reintegrate anymore. This condition is common in older people and is called osteoporosis. Spatial osteoporosis affects all astronauts, dissipating 30 to 70% of the bone, depending on the length of time spent in space. It is an impressive and worrying phenomenon that has affected all Russian astronauts who have remained in space for periods longer than three months. This is the main current limitation to a space journey to Mars, which otherwise would have already been done; von Braun presented a complete and detailed project, since 1951.The administration of hormonal drugs, such as calcitonin, is currently being studied (2005) to reduce the extent of this disease but for example in the elderly it gives poor results.

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Corresponding author: Dario Furnari * Department of Biomedical Sciences-Aesthetic Medical-Sport Scientist, University of Catania. E-mail: Dariofurnari@yahoo.com

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