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Neuroscience, Psychomotor and Exercise Sciences in Military Air Force

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Abstract

To challenge the great opportunities, to explore the fatigue, the limits, the stress of a human being. Develop new fitness, training, cognitive programs for particular environments or specialist roles such as air forces or astronauts. find out how to improve decision-making, deep skills and bring out the hidden potential within a military, special forces man or war veteran. The aim of this study was to extrapolate, through scientific evidence and previous work on the effects of microgravity, on the role of neuroscience, physical exercise and psychomotor skills. Through verbal and non-verbal language, tonic-emotional communication, one is able to help the person in his uniqueness, exploiting the communicative, emotional and motor potential of the latter which, remained latent, led him to isolation; therefore trying to develop a harmonious relationship with himself and with the world. I hope that this work can provide food for thought with respect to the essential need of each individual to be satisfied. They must take into account and take a "look" into the needs, desires and potential of the individual.

Within this thesis, the theory and practice of this science has been briefly described, its application, in the specific case, in the isolation of the special forces, in the cognitive and postural adaptation capacity of the military air force. described the techniques, such as Psychocontact and the motor-muscular relaxation methods that I have mostly used in this path, still in progress. I conclude my thesis with personal considerations on this experience that involved me personally, no longer looking only with the eyes of a rehabilitation therapist, but with those of a professional, of a health scientist whose training is based on a egodynamic conception, centered on the subject in its entirety and in its complexity.) Through this new science, I was able to appreciate my inner change, which opened up new perspectives to help the person; no longer patient, but as a person understood in his uniqueness and identity. Furthermore, I was able to find a notable change in the subject in its becoming and in the reality that surrounds it. There is, of course, still a lot of work to be done and this little dissertation only wants to enrich or eventually fill where classical medicine fails to reach; always to meet and help the person. I hope that this science and methodology can continue to expand more and more in the world and that it can continue to have a social and dignified role in society.

Keywords: neuroscience; deep skills; recognition memory; spatial memory; physical activity; psychomotor skills; quantum physics; LagreeFitness; mental health; neuroplasticity; cognitive exercise; exercise physiology; neurophysiology; psychology; psychophysiology

Introduction

The reduction in life span seems to always have to be traced back to a greater production of free radicals (defined as ROS = Reactive Oxygen Substances).

In reality, a certain amount of ROS is physiologically formed in the cells of the organism, hence the excessive production of these or their poor elimination, has been considered one of the most significant causes of aging due to the fact that these free radicals interact with nucleic acids, with proteins and lipids, altering them structurally and functionally. the only cells that can have a maximum life span equal to that of the organism to which they belong are perennial or post mitotic cells (neurons and muscle cells), i.e. those without replicative activity.

Certainly not all perennial cells live as long as the organism, as is well demonstrated by the fact that the weight of the human brain, which is 1500 g at the age of 30, reduces on average to 1390 g at the age of 90 due to programmed death affecting numerous neurons.

It is currently established that labile and stable cells after having undergone a certain number of mitoses in the culture medium, undergo aging phenomena, which are a prelude to death by apoptosis.

"In vivo" the most important cellular alterations that occur in senescence consist in hypotrophy, which is mainly reflected in the reduction of muscle mass, and in the accumulation inside the cells and also in the intercellular spaces of harmful materials: lipofucsins, substance amyeloid and metals. n contemporary society where the "Hypokinetic Syndrome" with bad eating habits, have led to a significant increase in the incidence of Cardio-Vascular diseases such as heart attacks, strokes, etc. both the medical profession and the Ministry of Health try to sensitize the population to a prevention for these pathologies by advising to improve nutrition and stimulate people to regular physical activity.

"Sport and Nutrition" are the basis of well-being. We often read this statement, never dwell on its meaning. Sports or physical activity are not synonymous.

Physical activity, which is often recommended by doctors, refers to regular "aerobic" motor activity which can vary for each person based on their characteristics and / or pathologies. In practice, this activity can vary from walking with a brisk pace to slow running or cycling both with city bikes for short routes repeated periodically during the week or swimming 2/3 times a week also following regular gymnastics courses or training programs in the gym are to be considered as a good physical activity.

Physical activity aims to improve cardio-circulatory and respiratory functions, tone muscles and improve joint movement skills.

Doing sport means dedicating yourself to a sporting discipline by constantly training to improve both physical performance and technique in athletic gestures and play patterns.Our body constantly needs energy to live. We consume energy to work, study, breathe, sleep, etc .. because each organ or apparatus is made up of billions of cells in which many biochemical processes take place, catalyzed by enzymes, which allow us to live. All this has a significant energy expenditure.

Any mechanical means of travel needs energy that can be supplied, from gasoline, diesel, electricity, etc. our body also needs fuel supplied by food which, once digested, thanks to the biochemical processes mentioned above, are transformed into “ATP” (adenosine-tri-phosphate) and available as an energy source.

As for a racing car, in order to run the engine at its best and to achieve high performance, a lot of fuel and excellent quality are required, in the athlete "the basis of good athletic performance is always excellent nutrition".

To improve every physical performance it is first of all necessary to intelligently follow the training programs and the technical schemes that are given by the coaches, try to correct your mistakes and improve the execution of athletic gestures and keep the "Engine" your body at its best. of the conditions supplying "petrol"

Food of excellent quality.

"Each engine is designed to work up to certain levels, if they are exceeded the engine breaks"

Each athlete has athletic characteristics Genetically determined to overcome them means having often irreparable damage,

"Doping substances exceed these limits, improving performance for a short period of time, with serious damage to the health of the person

Particular Environments; From Flight To Space

The human organism has a great ability to adapt, even in the case of significant changes in environmental conditions; such as prolonged microgravity.

The force of gravity on 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 moon's gravity 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 weightless conditions, i.e. at 0 g.

It is interesting to note that most of the physiological changes due to exposure to microgravity are very similar to those seen in athletes after a period of inactivity or immobilization, or to changes associated with aging that probably result from a reduction in physical activity. This similarity is corroborated by the data that indicate the 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 a growing area of interest for specialists in the physiology of sport and exercise. Gymnastics is an essential factor and each astronaut and air force pilot is required to do specific exercises up to four hours a day, depending on the types of mission. The long stay in space causes a loss of muscle mass and especially of bone mass, especially in the female body. The legs atrophy and the upper body swells, while the bones lose calcium and lose weight at the rate of about 1 percent per month without the reason or the way to block this has yet been discovered. Today the technologies of survival in space have improved so that even the female organism can today resist for long periods in orbiting capsules. The first female astronauts had serious problems so much that sex was thought of as an insurmountable impediment. Physical preparation, in-flight countermeasures and post-flight rehabilitation are gradually becoming basic aspects of space medicine. In fact, due to the progressive increase in duration and complexity of missions, space medicine found itself in the need to incorporate elements from different medical disciplines, moving away from the confined spaces of aeronautical medicine.

Apart from the acute effects of microgravity (displacement of body fluids, and orthostatic intolerance), cardiovascular alterations, the decrease in neuro-muscular capacities, the loss of muscle mass and the decrease in bone tissue represent the real limiting factors of the space flights of long service life and require complex preventive measures. For these reasons, the search for increasingly effective measures constantly engages space agencies all over the world. Currently the main countermeasures used during flights are:

· The use of Lower Body Negative Pressure (LBNP) often associated with exercises;

· Daily aerobic exercises;

· Intake of saline solution before re-entering the earth's atmosphere and subsequent rehydration;

· Anti-g suits worn upon return;

Taking medications.

Low Body Negative Pressure (LBNP)

This countermeasure turns out to be really effective in balancing the effects of weightlessness on the cardiovascular system.

Low Body Negative Pressure can be used to reduce orthostatic intolerance by stimulating a physiological response to a new redistribution of body fluids and also to test and find the limit beyond which vascular conditioning occurs. Periodic use of LBNP helps blood flow from the upper body to the legs. This recreates a situation similar to that which normally occurs on earth when one is in the standing position. The heart is then forced to deal with a lower venous return and consequently there is a greater cardiac response and a regulation of vascular resistance to cope with this new condition.

Taking Saline Solutions And Hydration

Studies carried out in the late 1970s show that drinking a liter of balanced saline solution can lead to an increase in plasma volume of up to 400 ml for a period of at least 4 hours.

The extracellular fluid is mainly made up of 0.9% NaCl (sodium chloride) dissolved in water or a normal saline solution. If an individual is given a normal saline solution intramuscularly or by ingestion (as in the case of astronauts) the volume is distributed mainly through the extracellular compartments. Since the volume of the plasma constitutes a small part of the extracellular fluid, it retains a small part of the saline solution. The rest goes to fill the interstitial spaces of the tissues. Possibly

a part of the fluid can enter the cells and a part can escape. Studies conducted in the mid-1980s found that this time-increasing plasma volume technique could be used by Shuttle astronauts to reduce orthostatic intolerance before landing.

Anti-Ag suits

Although all possible countermeasures are adopted in orbit to have good vascular conditioning upon returning to earth, inevitably, orthostatic intolerance, even if in a reduced form, always occurs.

In the critical period of return and landing, the astronauts of the Shuttle (and of any other space aircraft) must wear anti-G suits.

In fact, some more fragile parts of the body, for example the neck joints, can be affected by the stresses deriving from the high acceleration values, and also some internal organs such as the abdominal ones, can undergo displacements, because they are poorly supported anatomically.

More than the value of the accelerations, their duration is important. In modern military supersonic aircraft the pilot can in fact be subjected to accelerations of up to 20 g, but this happens only for fractions of a second, as when ejected from the seat with a parachute.

These particular garments automatically inflate as the acceleration undergone by the astronaut increases to prevent the stagnation of fluids in the lower extremities of the body and can

also, through an abdominal bladder, help maintain adequate venous return to the heart.

With this suit, therefore, the pilot's or astronaut's body is compressed in the intestines, thighs and legs, preventing blood from accumulating in the lower extremities of the body.

Aerobic Exercises and use of LBNP

As happens on Earth, regular physical activity helps to maintain the

cardiovascular system in good condition even in weightlessness.

Furthermore, carrying out clinical tests while performing aerobic exercises helps to monitor the cardiovascular status and the level of deconditioning achieved by each individual astronaut.

NASA crews during Shuttle flights mainly use an exercise bike and a treadmill.

Obviously, special restraint systems are needed, built up

by belts and bungee cords, to prevent astronauts from floating while

perform these exercises.

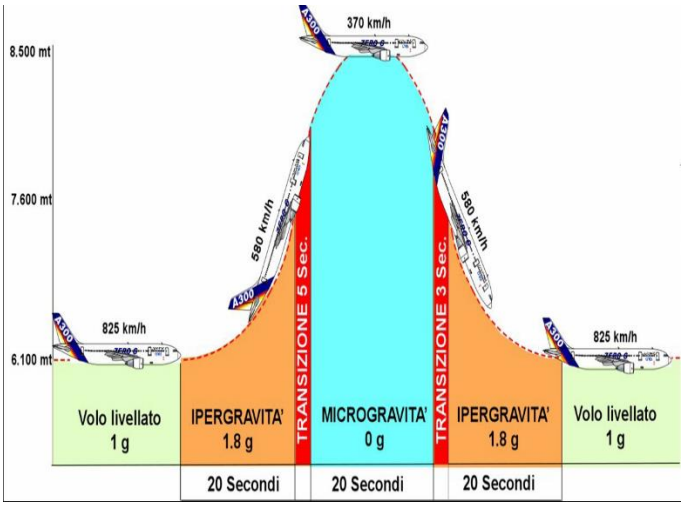
When some crew member is busy carrying out their training session another practical problem arises. In fact, the vibrations produced by the exercises are transmitted to the entire structure of the Shuttle and these could interfere with the other planned activities of the mission. For this reason the training sessions are carried out only when there are no other activities foreseen in the flight plan.

The minimum duration of the exercises to be performed daily by the crews, in order for the astronauts to be able to maintain an acceptable vascular conditioning, is still a source of debate. Russian cosmonauts aboard the MIR space station used the treadmill for about 2 hours every day.

Medication Intake And Future Developments

No drugs are currently being used in orbit to increase blood pressure, induce water retention and increase plasma volume prior to reentry. Only the use of some selected drugs with minimal side effects is proposed as a countermeasure in flight. Among these, midodrine, erythropoietin and ethylephrine have been indicated as valid therapies to combat orthostatic intolerance.

Future developments in the field of countermeasures are linked to advances in research to control and investigate changes in cardiovascular and body fluids under conditions of microgravity. Some of the research areas could be those of the study of baroreceptors, sympathetic nervous system reflexes, hormonal effects, changes in vascular compliance, and capillary permeability and Starling forces.



Summary:

Muscles

The strength and cross section of the ST and FT muscle fibers decrease as a result of exposure to both simulated and real microgravity.

To mitigate the reduction in muscle size and functions, training programs are implemented with more effective resistances to be overcome, in order to minimize the loss of muscle function during periods of microgravity. Since the postural muscles are the most affected, special devices should be designed to perform activities that allow an adequate load for those muscles, in absence of gravity.

Bones

Microgravity causes a loss of bone mineral equal to about 4% in the bones that support body weight, but the extent of this response depends on the duration of exposure to microgravity.

The mechanisms responsible for these changes in the bones have not been elucidated. They could be caused by a slowing down of bone formation, by a greater resorption or by both factors, but it is clear that these modifications derive from the absence of mechanical overload on the bones, when they are not subjected to the normal forces, of gravity or muscle, active on earth. Hence, the need to activate physical exercises or various tools such as the vibration plate, to mechanically stimulate the bones.

Cardiovascular Function

Microgravity cancels most of the hydrostatic pressure effects of an environment at 1 g and causes the body to eliminate a large percentage of the plasma volume. This allows the optimal regulation of cardiovascular function at rest and during exercise

during the stay in space, but causes orthostatic hypotension disorders upon return to the earth's atmosphere.

Research and Protocol applied

Preventive motor activity protocol to an astronaut / pilot who has to carry out a space / flight mission

Physical training

Total body circuit training five times a week:

 there will be a circuit from Monday to Friday which will consist of muscle exercises with postural exercises done on the fitball or with a tilting board for proprioceptive exercises; as an alternative to the latter, the vibrating platform will be used;

 before carrying out the circuit it is important to carry out a functional warm-up as regards the regulation of body temperature and heart rate in addition to the fact that when cold you can get hurt.

It will then be done in this way 5-10 minutes of exercise bike at a normal pace.

Circuit:

it consists of several stations (exercises) in sequence without pauses to be repeated twice:

 1 - reverse abdominals: legs at 90 ° 10 X abdomen

 2 - abdominal crunch: legs at 90 ° 15 X abdomen

 3 - abdominals with legs to the side 12 X abdomen

 4 - back thrusts: 10 X leg buttocks

 5 - glutes with plyometric squat: 10 X leg glutes

 5b- buttocks with legs 10 X buttocks wide

 6 - inner thigh: 10 X with thigh hands

 7 - outer thigh: 12 X leg thigh

 8 - squats: slow underfoot 1.5cm 25 X legs

 8b- light lunges / 10X leg press

 9 - pushups: 10 X chest

 10 - lateral raises: 10 X with shoulder weight

 11 - 90 ° raises: 10 X without shoulder weight

 9b- x chest isometric contractions elbows 10 seconds high

 12 - wall triceps: 10 X arms

 13 - 15 X arm biceps

After the second time, a 5-10 minute cool-down on an exercise bike is performed like the initial warm-up but a little less intense and at the end, in order not to have contracted muscles, we recommend muscle stretching:

thighs - calves - back - shoulders - triceps - neck.

Muscle stretching will be carried out gradually by holding the stretch position for the initial 5 seconds to gradually reach the sensation of stretching; after these 5 you do 20 seconds, without bouncing, but keeping the degree of tension without feeling pain but only tension!

It is important to do this before training as a precaution against injuries to initially stimulate the muscle that is cold and not very elastic, and repeated at the end of the training so as not to make the muscle that has just worked contracted.

Motor activity protocol adapted to an astronaut / flight after a long stay in space / flight hours / veteran

 Man

 Age 35

 Lower limb hypotrophy

 "vastus lateral and medial" affected area

 Training of the rectus femoris

Targets

 Improvement of the postural pattern and balance

 Respiratory education

 Improvement of joint mobility and strengthening of the muscles of the lower limbs

 Maintenance of muscle tone-trophism of the trunk and upper limbs

Procedure for carrying out the protocol

 Neurological examination

 Three weekly meetings (two meetings in the gym and one in the pool)

- Duration of the session: 60 '
- 1st phase: warm-up
- II phase: proprioceptive exercises and respiratory education
- III phase: specific work
- IV phase: cool down

Conclusions

Physical activity is rarely carried out in ideal environmental conditions. The exploration of space revealed that the microgravitational environment represents a unique challenge for the organism.

But why is it necessary to study microgravity?

1. To study the mechanisms of skin and body hydration;

2. To study the phenomena of aging;

3. To study new therapeutic and preventive strategies

These countermeasures essentially consist in guaranteeing the astronauts / pilots, by means of suitable tools, with and without weights, intense physical activity for a few hours a day. Preliminary studies would seem to indicate this is the right way, just as continuous and adequate physical exercise for the individual subject is the right way to combat osteoporosis, loss of strength and orthostatic hypertension, all typical realities of the sedentary elderly and of the disabled.

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