

PERSONALISED DIETARY PLANS AND HEALTH EFFECTS ON ASTRONAUTS IN EXTRA-TERRESTRIAL HABITATS.

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Introduction: Astronaut nutrition is an important aspect to consider for extra-terrestrial missions. It encompasses microbiological risks for humans, individual nutritional needs and the social well-being of astronauts. During a two-week analogue astronaut mission to the Moon, research focusing on the dietary needs and health of each crew member was performed. A crew of six analog astronauts, from the EuroMoonMars IMA HI-SEAS II (EMMIHS-II) mission followed a pre-prepared personal menu based on their intolerances and daily activities.

Environment and dietary conditions at the IMA-HI_SEAS Moon base :



Fig.1 : Five crew members at meal time. [1]



Fig:2 : Typical meal. [1]

EMMIHS II Dietary research: The first things that needed to be considered was the sanitary aspect of the missions, as it severely limits food choices. Fresh foods that are consumed on Earth are microbiologically fragile and occupy an important conservation space because of their richness in water and air. In order to ensure food safety and optimize storage space, the only food taken on the EMMIHS-II mission was freeze-dried, and the temperature and hygrometric of the food storage area remained constant.

Prior to the mission, the food rations and distribution amongst crewmembers was determined according to the average nutritional and calorific needs of the group. To maintain a basal metabolism, a balanced nutrition is required. A healthy and sufficient food intake is of high importance, particularly due to the regular physical activity each crewmember performs during Extra Vehicular Activities (EVAs) that the crew performed daily. In order to adapt the food plan to each crewmember, the menu proposed alternatives according to food intolerances and aversions. Thus, comfort of the crew with their food intake was studied primarily on their gustatory and digestive levels.

It was not possible to determine the actual amount of energy consumed on a daily basis during this mission for logistical reasons. It was also not possible to weigh out the food for each individual crewmember, as it would have taken up too much of the mission time. In the future, portions could be determined in terms of “cup sizes” per person, as this would be the most realistic measure for the preparation of freeze-dried food.

Furthermore, various digestive problems have been identified throughout this mission. Possible explanations for these issues could be a too abrupt change of eating habits including the lack of consumption of fresh fruits, fresh vegetables and the lack of fiber-rich cereals. Indeed, some analog astronauts who used to eat more fresh vegetables before the mission did not react in the same way as those who rarely ate them before. In order to avoid this on future missions, the next strategy could be to first estimate the dietary intake of vegetable fibre for each individual before the mission start, in order to individually adapt the fruit and vegetable ration recommendations.

A diverse distribution of culinary recipes is also recommended for the preparation of future missions, in order to improve the taste of the meals for the crew. Taste is an important part of the pleasure of eating and as a result, it heavily influences the intake of food. This inevitably has an effect on the physical and mental well-being of the crew. During this mission, almost all of the analog astronauts felt that their appetite was reduced at some point. This may be a reason why half of them reported losing weight over the course of the mission. On the other hand, the other half of the crew said that they felt stronger than before the mission start.

Finally, the social and psychological aspect of food plays an important role in the mental well-being of the astronauts. As a result, the mission was subject to a sociological study as well. In this context, it was found that the food preparation and meal-sharing moments enabled the team to strengthen their social ties, which was in favour of personal and therefore collective fulfilment. However, on the other hand, pleasure from eating and each crewmembers’ appetite did often not correspond to this. Hence, it was found that the freeze-dried food did not contribute to the emotional well-being of the astronauts.

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References:

- [1] Charlotte R. Pouwels, analog astronaut from the EMMIHS-II mission.