The Space Right to Food & Guarantees

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Private space flights have raised significant legal concerns regarding the granting of fundamental human rights to non-astronauts under international law, including appropriate legal guarantees. This study focuses on one area of non-astronaut rights and guarantees designed for food. The need for an international legal statement on what non-astronauts can expect regarding their right to food and the guarantees they are entitled to, even when flying into space, is justified with experimental data. The author seeks to establish a distinct set of space rights and guarantees that build space tourism's best service accompanied by a fundamental human rights legal core. This will ensure that non-astronauts are afforded the essential legal protection necessary for them to fully experience and uphold happiness during their space journey.

Keywords: *human-manned commercial space flights, space tourism, non – astronauts, space nutrition, food consumption.*

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Introduction

The tradition of presumption recognizes that happiness is something that people experience (Dutta & Mandal, 2021: 44). The architectural factors of the state of space significantly differ from those on Earth, but the fundamental experienced conditions for human well-being stay the same. Humans rely on high-quality, well-balanced, and delicious food to maintain their health and vitality. According to the research vision, food plays a vital role in ensuring happy habitability in isolated spaces. Furthermore, it is a critical facet of the thriving colonization of space. Following six decades of development, the technology of launch vehicles has progressed with respect to the dual action of demand traction and technical promotion, providing increasingly valuable high-tech services for society (Autonomous, 2023). Regardless, the study considers that any economic activity, even if it benefits humanity, must have specific restrictions to prevent abuses being necessary for the desire of the global mass of people to fly into space to affect the orbital sphere of space positively (Bulgakova, 2020a). As a result, the autonomous conservatories would become increasingly apparent. Indeed, they differ substantially from what we are inured to on Earth and depend on various environmental characteristics, including gravity formations, microclimates, and the utilization of known soil, recyclable biomaterials, and the role of international law to shape these challenges. Factually, developers must adhere to legal norms when offering space journey-fly packages and competitive projects, providing the best service possible to customers. This service includes the offer of properly prepared menus to satisfy human hunger during a stay on Mars, the Moon, the International Space Station, or in non-gravity settings for the happiest experience. However, these measures are implemented only on a narrow basis and are relatively straightforward and tailored to trained professionals in space travel disregarding the appetite of non-astronauts'.

Truly found, today's consumer seeks happiness rather than satisfaction (Dutta & Mandal, 2021). Therefore, in addition to the nutritional and life support system applications, the design of space food shall guarantee not only the well-being of the space flight participants but also prioritize the consumer mindset of perspective space tourists. Such habitability-related concessions can be achieved through the foundation of standpoint space rights where the right to space food with further guarantees on enhancement countering the otherwise technical and monotonous spacecraft environment shall contribute to the benefits of human-manned commercial space flights by creating a sense of legal protection for the happy-satisfactory food appliances, allowing participants of space flights to witness their joyful growth and optimistic shift within a journey. Traditionally, the practice of innovations strength, such as developed food prototypes for remote journeys (Mok & Oehlberg, 2017), digital food fabrication (Mueller & Peek, 2016), food by computing devices (Obrist et al., 2018), food-simulating substances (Salamon et al., 2018), artistically made food (Schifferstein et al., 2019), SpaceFood X (Space Food X, 2019) are in the top set of the food industry maturation. Within this tradition, happiness is associated with achieving a set of factors that are believed to be relevant to achieve happiness (Dutta & Mandal, 2021: 44). It is because these developments represent a significant strive for the legal course oversight of the satisfaction of perspective space tourists' consumption checklist of concerns since the lack of legal guarantees potentially could affect journey achievements in happiness, and thus requires urgent attention. If long as the market offers a variety of edibles, it is the target for the research to find out that consumption checklist of concerns and regardless to propose for the international community to sum up the presented specifics and take appropriate actions toward recognition of distinct space right to food with the implementation of trend along guarantees affecting happy-related approach that this research undertake.

For the protection of customers' interests, rights, guarantees, and physiological happy-mood satisfaction, as well as to prevent violations and restrictions in the delivery of space food products, it is proposed attention be paid to recognize the space right to food with guarantees relevant to before, during, and after consumption. To date, most studies on space food and related laws have focused on "earthly" food, and there has been a lack of systematic theoretical research on the perspective of space tourists' experience of food consumption in space with appropriate legal guarantees. This is an important issue that should not be underestimated. For instance, according to Ruut Veenhoven (Veenhoven, 2021: 235), to date, there is only one study on the effect of an induced change to a healthier diet on an individual's happiness. In this study, people were randomly assigned to an experimental group and stimulated in various ways to consume more fruit and vegetables (FV), among other things by providing vouchers for healthy foods and sending e-mail reminders. After two weeks of increased FV consumption, the participant's mood levels had increased more than those of the control group. Additionally, the proposed "happy" ground vision would provide surrogate views having a window to living organisms such as greenhouse techniques with portable plant cultivation subsystems that allow participants of space flights to have personal plant-growing setups leading to the best happy service and enhancing at the same time the happy standard of life in isolated environments. Moreover, alongside the serviceable design of microgravity kitchens and utensils for long-term assignments, personalized and flavorful menus created from freshly grown ingredients prepared on board with recycling features, also guarantee the happiness level in self-sustainability. Indeed, self-sustainability is not inflexible to food display and recycling alone; it is also binding for the success and safety of a longer-term journey. Hence, committing self-sustainability becomes a prerequisite for the conquest of human well-being in space, enabling space flight participants to feed themselves without relying on shallow assets. Consequently, with this guarantee, individuals who are unprepared and unaccustomed to the rigors of space travel may also embark on these flights.

Research methods

This breakdown is a portion of research about space life reinforcement staying for the recognition of distinct space rights for the "consume happy" practice food systems that bring an individual to self-sustainable guarantee during human-manned commercial space flights known as space tourism or private space flights.

The experimental research methodology acknowledges the preferences and concerns of potential consumers (space tourists) with the goal to come up with ideas for new food product guarantees and service features. The informality of collected data outstrips social indicators to have structured and up-to-date respondents' points of view. The empirical results have a hint character to help out lawmakers in identifying ideas, categorizing perspective clients' (space tourists) opinions about research striving themes, placing courses for innovators, and filtering out the most common thoughts through the idea mining grouping method. Thus, through the questionnaire, the research manages open kinds of answers tasks where a potentially considerable large group of perspective space tourists is in charge of giving their own view. As a result, related decision processes are configurable, likewise, by defining the most adorable right to grant with further realization, and by letting know to which extent this right is divined to be guaranteed during human-manned commercial space flights.

The author argues that international legal standards for space nutrition should be developed specifically for non-astronauts, as they are space tourists and cannot be likened to the same food standards as professionals. This statement leads to protect the interests of space flight participants and carry out their space health and happiness satisfaction. Accordingly, by examining recent advancements in space-food interaction design, the author rises the discussion about the correlation of gotten results with the potential nutritional imbalances that could arise from consuming space food by non-astronauts. Hence, the study proposes tips for the maintenance of order in space nutrition. The study also emphasizes the need for developers and international space organizations, space food project innovators, theorists and researchers, and lawmakers to address the phenomenon of the space right to food & guarantees practically implementing, including the urgency to establish specific service-level acts on international food standards for space tourists and shows the overall necessity in international space food law dedicated to human-manned commercial space flights. Hence, this study demonstrates how international law can be utilized to co-create innovative concepts that balance both the specific happiness-related concern and outer space conditions where food availability is limited.

Empirical results toward realization checklist

It is natural for individuals to place great importance on their daily diet, food consumption, and enjoyment for happiness pride. The strive that delights the research call is about the proposal in recognition of singular space right to food & guarantees. Empirical research is proven that reach whereas social indicators are necessary to emphasize and promote the urgency of the respective legal process. The author run a social questionnaire to present the top concern of the space journey checklist fulfilled from October to December of 2019 within the Earth–Space–Earth Trip (ESE) scientific research project at the Faculty of Law of the University of International Business and Electronics (Beijing, People's Republic of China). The survey called the ESE Questionnaire (ESE Q), included responses collected through an online platform Jinshuju and personal interviews (in total 451). During the questionnaire, the author revealed the following problems of food needs in space that acquire satisfaction (Bulgakova, 2020a: 64). Specifically, the survey aimed to gather opinions on the right and guarantees that probable non-astronauts believe they should prioritize during space journeys. The results of the survey were analyzed and presented by analogy to Maslow's pyramid of human needs (Maslow, 1943). Respondents from Africa, Asia, Australia, Europe, North America, and South America were asked to imagine themselves as potential space tourists or non-astronauts of private space flights and respond to the questions without any variable choice. Figures present the recapitulated upshots of responses bonding research specifically to food reference, obtained from the preliminary estimation to question No. 7 of the ESE Q.: "7. Which rights should be granted to you during Space journey?", No. 8: "8. Which guarantees should be provided to you during the Space journey?" The display of derivatives does not demonstrate a statistical ratio concerning the geographical zones of respondents or in comparison to other recognized rights and related guarantees. Instead, it presents the percentage (scaled from 100% in each figure) of the most observed reaction towards rights (refer to Figure 1) and guarantees (refer to Figure 2). Consequently, the figures function as a concise representation of a favorable (positive) social indicator. These figures strongly emphasize the pressing need for the implementation of legal measures to secure the fulfillment of space rights and underscore the critical importance of acting both within the emerging jurisdiction of space, which falls under international enforcement, and within the broader realm of international law with admiration to food.

Figure 1 sheds light on the outcomes of Q7, which focuses on the necessary legal regulations concerning the space rights of non-astronauts during private space flights. Notably, the "Triangle of the Space Right to Food" highlights the significance of formally recognizing space rights, as evidenced by the 60% of respondents who directly expressed their support for the "Right to Food" as a crucial space right.

Shifting our focus to the experimental evidence, Figure 2 "Triangle of the Space Food Guarantees" provides a visual representation of the manifold spectrum of responses obtained in accordance with the prevalent comebacks amassed from Q8 of the ESE Q. The majority of respondents (80% on a 100% scale) expressed the crucial importance of legally ensuring warrants for space food. The pinpointed top food stakes also included anxiety about nutritious meals, three meals a day, want health risks, safety, and high-quality standard of a menu.

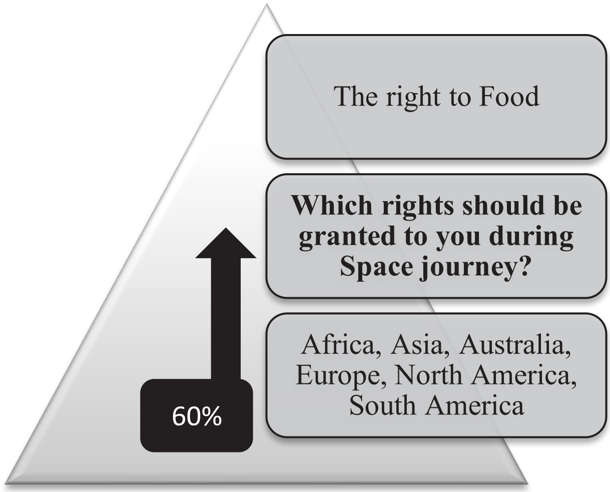

Figure 1. Triangle of the Space Right to Food

Figure 1: The social indicator signifies the legal importance of conferring the Space Right to Food for non-astronauts during private space flights.
Source: Composed by the author Daria Bulgakova

Accordingly, it becomes apparent that over half of potential space tourists have concerns regarding the legal status of space rights to food and the corresponding guarantees during their journey. The juxtaposition of Figures 1 and 2 underscores the need for focused attention on the development of space tourism services concerning guarantees for space food. Respondents exhibited varying viewpoints and uncertainty regarding these guarantees. Some suggested that the right to food should be included as a standard component of space tourism services, while others advocated for its legal mandate and practical enforcement as a fundamental human right. However, it should be noted that incorporating guarantees for space food may introduce further legal complexities, not only in terms of regulation but also in terms of certification and adherence to legal standards. The collective findings suggest a link between human physiological and well-being needs, international human rights, specific space rights to food for non-astronauts, and the corresponding legal guarantees.

The present study advocates the recognition of the right to food, which holds significant importance in international human rights frameworks. It is enshrined as a vital aspect in the Universal Declaration of Human Rights (1948) under Article 25, as well as in the International Covenant on Economic, Social, and Cultural Rights (1966) as part of the International Bill of Human Rights, encompassing various other provisions. Additionally, regional agreements, such as the Protocol of San Salvador (1988), an Additional Protocol to the American Convention on Human Rights, include specific provisions on the right to food in Article 12 and Article 17. National constitutions in many countries also recognize the right to food. Various international treaties, including the Convention on the Rights of the Child (1989), explicitly acknowledge the right to food for individuals across different regions, outlined in Article 24 and Article 27. Also, Comment No. 12 by the Committee on Economic, Social, and Cultural Rights (1999) provides

Figure 2. Triangle of the Space Food Guarantees

Figure 2: The social indicator signifies the significance of the top five Guarantees of Space Food for non-astronauts during private space flights.
Source: Composed by the author Daria Bulgakova

an in-depth understanding of the right to food, which remains fundamental in international law. International human rights law recognizes the right to adequate food and freedom from hunger as a fundamental human right applicable to all individuals, irrespective of their race, color, sex, language, religion, political or other opinions, national or social origin, property, birth, or any other status, as stated by the UN Human Rights (2010). Therefore, the right to food in the context of space travel pertains to the entitlement of participants to access safe, nutritious, and satisfying standard food during their journey under international law. Hence, taking into consideration mentioned, the article also accentuates the differentiation between the right to food and the space right to food presenting a comparative Table 1. The author stresses, that the table is speculative and intended solely to illustrate potential distinctions between two categorizations.

Table 1. The Right to Food VS The Space Right to Food Checklist

#	Criteria	The Right to Food	The Space Right to Food
1	Origin	Congenital	Obtained
2	Basis	Fundamental	Specific and coming from Fundamental
3	Acquisition	Comes from birth	Comes from the legal relationship
4	Irrevocability	Inalienable	Alienable
5	Status	It does not require a status	Requires non-astronaut status

6	Duration	Never end	End with the completion of space flight and (or) the end of the legal relationship with the food service provider
7	Choice	Unlimited	Limited to a specially designed food ration and the number of days of space flight, restricted by the obligatory schedule, mission regime
8	Territory	Food consumption experienced on Earth does not exclude other areas	Food consumption experienced in outer space conditions
9	Enforcement	It is enforced both at the national level and the international level	It is not enforced either at the national or international levels
10	Policy	The policy has been regulated by both national and international authorities	International authorities have regulated the policy
11	Protection	It is protected under national and international law, legal instruments	It is protected under international law first, and national law is supplementary
12	Intervention	If a person cannot feed himself, states authorities may provide a resource	A person uses service-level resources from third parties

Table 1: A comparative table with differentiates between the right to food and the space right to food.
Source: Composed by the author Daria Bulgakova

Additionally, the author underscores the significance of categorizing the space right to food as a distinct subset of rights and advocates for its regulation not only as a part of service level agreement corresponding to space tourism but also for the prioritization of the humanitarian impact by shedding description on the next criteria:

1. *Origin:* The right to food is an inherent human right, whereas the space right to food is derived from the principle of space mission origin. While the right to food is charged to human rights essence applying universally to all individuals, the space right to food is derived from the unique context of space tourism service to so-called space tourists and is specific to the challenges of space exploration and limited in extent.
2. *Basis:* The right to food is established on the broader foundation of international human rights encompassing fundamental insight. At the same time, the space right to food is emanated from the prior framework taking into account the distinct characteristics and prerequisites associated with food proportionally to the space assignments. This recognition is required to discourse the unique challenges and considerations involved in supplying bearable sustenance of space tourism.
3. *Acquisition:* The right to food arises from birth, while the space right to food is acquired and has nothing to do with the moment of birth but is related to the

physiological needs in means of Maslow's hierarchy of needs actual in space as well.

4. *Irrevocability:* The right to food is irrevocable, whereas the space right to food is contingent upon the completion of service-level agreements with the food provider party throughout the duration of the space journey. Once these agreements expire or are completed, the food guarantees cease to be executed.
5. *Status:* The space right to food is only possible upon participation in space tourism given to such a person-specific status of a participant in a space flight respectively. The general right to food does not require any status irrespective, and everyone enjoys the freedom of this right without prejudice.
6. *Duration:* The right to food always exists due to an enduring entitlement, whereas the space right to food ceases to be effective when the space mission is completed and/or when the legal arrangement with the food service provider is terminated and comes to an end.
7. *Choice:* A person has the freedom to choose what and when to eat with the right to food, while the space right to food is restricted to a strict schedule and a specific diet developed for space flight. It means the right to food annuities individuals the freedom to choose their meals and eating schedule according to their preferences. Contrariwise, the space right to food is subject to severe schedules and exhaustive diets organized for space travel and could be modified to a predetermined regimen.
8. *Territory:* The right to food is often practically realized with the link to the place of residence and a respective minimum living wage, while the space right to food is limited in realization due to a specific outer space environment.
9. *Enforcement:* The right to food is enforced by national and international regulation measures, while the space right to food is subject to specific distinct happiness-alike enforcement measures tailored to deliver the best expectations with dining options and culinary juice during space travel.
10. *Policy:* Policy formulation is a political process and does not proceed based on available scientific evidence alone (Ashley, 2018: 80). The space right to food is subject to space tourism policy governance, and the right to food is subject to worldwide policies.
11. *Protection:* The space right to food is protected by specific legal instruments related to space missions and the lack of a strong cure, while the right to food is protected by human rights law with immediate remedies and redress.
12. *(State) Intervention:* A person may receive resources or free food from state authorities for social and economic reasons under the right to food. However, this is not eligible with the space right to food since the food is a cost that shall be covered together with the potential service fees. The space right to food operates under a dissimilar context with foreseen financial support to equip nutrition.

Consequently, the state of the results is the need to regulate the tailored right and allocate it to a specific group to confirm space tourists' legitimate interests because the right to food is not just about guarantees in minimum calorie or protein requirements, but it is also access to all necessary nutritional items vital for a healthy and wholesome life to meet their Maslow's hierarchy of needs and to cater individual requirements in terms of happy end of space travel.

Research discussion toward implementation specifics

Developing appropriate legislation to regulate space food is a critical first step for any private space flight program. International law plays a crucial role in addressing micronutrient deficiencies, particularly in fortified foods. International regulations can help ensure that the space tourism industry supplies adequately fortified meals that meet an individual's dietary needs based on supplementary factors such as age, health, occupation, and sex. Thus, the human endocrine system plays a crucial role in providing space tourists with essential services such as prepared meals under the legal protection affected by the unique conditions of space flight. The effects of space travel on human hormones, such as epinephrine and cortisol, can lead to modifications in metabolic processes that impact glucose, fatty acids, and glycogen content (Popova & Grigoriev, 1994). Previous missions have shown an increase in catabolic hormones and prolonged metabolic stress responses, influenced by various factors such as energy intake, exercise, and gender (Stein & Wade, 2001). Fluid balance is also affected by hormones like catecholamines and renin-aldosterone, leading to sodium retention without fluid retention (Drummer et al., 2000). However, given that space tourism is open to the public, it is crucial to consider the modernity of technology and the potential health risks for non-astronauts' self-sustainability. Although those tourists are undergoing a medical and physical examination, they may not have the same tolerance for certain food and substances under the influence of gravity. As the multiple causes of undernutrition are "structural," so they need redress in a "structural" way (Ashley, 2018: 83). Therefore, lawmakers should prioritize the protection of tourists' health by implementing reliable test processes to identify endocrine disruptors and manage them appropriately based on reliable experimental results in cooperation with medical institutions.

Space food presents unique challenges in servicing balanced nutrition for human beings in zero-gravity environments while ensuring that the food is legally safe and could be on sale and consumed. Maintaining equicaloric intake during private space flight involves addressing factors such as vitamin requirements, physiological changes in taste and satiety, scheduling issues related to meal preparation and consumption, food quality, regulatory standards, and availability (Smith & Zwart, 2008). In addition, many space food scientists believe in sustainable and convivial space habitation that requires a readiness for a supply of food that does not have to be transported from Earth (Häuplik-Meusburger, 2015). This means that different living conditions and occupations, such as space stations on Moon, Mars, and beyond require specific dietary needs and rations. Given these challenges, there is a growing legal concern about public space health to ensure that standards are tailored to the unique requirements of space food and are not simply an extension of existing food policies.

The article spotlights the efforts of the United Nations Office for Outer Space Affairs (UNOOSA) in developing international safety standards for space food. However, there are concerns about the applicability of current International Food Standards (IFS) in outer space due to modernized changes and enforcement issues, as Samuel Godefroy noted in his research (Godefroy, 2016) suggesting IFS should be a guide for standardizing food products globally and highlights the special role of the Codex Alimentarius Commission in food security. The author agrees with Godefroy's opinion and implies that IFS could be spread in inventing and modifying the law on space food for long-distance space travel. However, given the unique circumstances of space tourism, the author proposes that specific standards for space food should be developed, implemented, and enforced through international space food standards

(ISFS). Such standards would ensure the right to food in space and guarantee the safety and standardization of food for space tourists with limited supplies calculated for the duration of the trip and for individual dietary needs. To prevent possible negative consequences caused by poor-quality products, ISFS should assess the specifics of space travel and the preparation and consumption of space food defined within IFS with respect to the need for daily replenishment of necessary minerals and supplies. Such standards would promote consumers' healthcare and decrease obstacles.

Consequently, the following back-and-forth is accentuated. Firstly, the demand for nutritional space food for non-astronauts and nutrition is crucial in individual microgravity acclimatization as any technological arrangement of the spacecraft. Secondly, there are significant differences in diet and health requirements taken on Earth and space due to the unique conditions of human spaceflight. Defining nutrient and diet requirements for extended periods in microgravity is necessary to address these unknowns. Given the legal complexities, thirdly, environmental factors such as space radiation, space shuttle, and spacesuit pressure can affect the nutritional status of space food supplements. Fourthly, more extended missions to the Moon and Mars, with their low gravity, can further compound the situation and increase the risk of nutritional deficiencies. Finally, modified ration intake may be necessary to neutralize or alleviate the adverse effects of spaceflight on the human body. As such, future goals for nutritional resistance should be established to improve space food's persuasiveness and guarantee well-being. Therefore, ISFS must be developed to address the need for specific nutrient and diet requirements, environmental impacts, and mission duration.

With the increasing service of technological substitutes for food, human rights supporters must pay attention to the machine-made nature of these food products designed for non-astronauts, as opposed to natural food sources. To establish the need for specific standards for space food, it is crucial to underline the specialized advancements in space food production, such as 3D printing technology (Khot et al., 2017). It is consequential to remark that such refinements in space food display bring potential concessions and hazards. Indeed, the production of space food in 3D allows for the creation of customized and nutrient-rich meals that meet specific dietary requirements. However, there are potential health risks associated with the continuous consumption of 3D-printed space food. Similarly, as technology advances, it is compulsory to evaluate the ethical implications of relying on machine-made food rather than natural food sources.

In order to address the unique characteristics of space gravity, the author recommends that standard categories for space tech food products be included as a significant part of the ISFS. As the origin of cosmic food is often through technology rather than natural inputs, it is important not to overlook the presence of critical nutrients like calcium. It is essential to adopt appropriate laws that regulate standards for technically derived space food to prevent oversight. Calcium and its effects on skeleton metabolism should be of particular interest to lawmakers since as the research has shown, space flight causes increased bone absorption and effectively unchanged bone formation, resulting in the loss of calcium and bone mineral (Sibonga, 2013). Also, the technical side of the released 3D print space food shall operate under the protection of the patent, and the product label acts as a distinctive category falling under the protection of trademark law, which in turn allows space tourists to identify the space object as a source (Bulgakova, 2020b). This, in turn, alters the endocrine regulation of calcium metabolism, making it crucial to ensure that space food meets diverse nutritional needs. Furthermore, several biological components are crucial for maintaining healthy bones together with calcium such as vitamin D. After consuming a meal with calcium, the digestive tract absorbs and sends it into the bloodstream. However, during spaceflight, calcium absorption from the intestines decreases, even if astronauts or non-astronaut crew members take calcium supplements, which leads to bone loss (Smith et al., 2012). Furthermore, sodium intake is also a concern during spaceflight, which is why space diets contain more than the usual sodium amount. However, increased sodium consumption can result in elevated calcium excretion in urine and an increased risk of developing kidney stones. To address bone health in spaceflight, it is essential to establish optimal dietary standards and guidelines that must be enforced. Therefore, this article emphasizes the importance of meeting the specific calcium and sodium needs during spaceflight and the significant losses of these elements, which necessitate the development of optimal dietary standards for space food that account for biodiversity and genetic resources. To establish these standards, experts should study the regularity of bone harm during spaceflight and develop international legal standards for space food testing that mitigate bone loss. At the same time, another issue that requires further research and legal regulation is the cardiovascular health of space travelers and their adaptation to nutrition during space flight (Zhang, 2013). For example, although Omega-3 fatty acids have been shown to profit cardiovascular health on Earth, this benefit has yet to be analyzed in space. An effort to grow Omega-3 fatty acids in astronauts' diets through the consumption of caustic fish may have potential benefits on other body systems, such as bone and muscle health (Rizos et al., 2012).

International organizations play a crucial role in developing international norms and rules for space food to ensure no gaps or potential negative impacts of products and consumption on the human endocrine environment. In the realm of product testing for endocrine system effects, including those resulting from space activity, it is crucial to focus on the Organization for Economic Cooperation and Development (OECD) activities. The OECD has published the Revised Guidance (2018) on Standardized Test Guidelines for Evaluating Chemicals for Endocrine Disruption, which is of paramount importance. This document applies to the development and testing of space food, as it features a universally accepted meta-methodology that applies to various food-related fields. It addresses the impact of food products in toxic environments, which is also relevant to the space environment. The document proposes about fifteen possible forms of toxicity that should be employed when examining the impact of space on a person's endocrine system while consuming food. Furthermore, the Convention on Biological Diversity is proposed as a crucial international document for addressing the issue at hand. According to the convention, biological diversity encompasses the variability among living organisms from all sources, including terrestrial, marine, and other aquatic ecosystems, as well as the ecological complexes of which they are a part (Article 1). It defines genetic resources as a material of plant, animal, microbial, or other origins containing heredity units (Article 2). However, when it comes to food, neither its diversity nor its resource content can be adequately captured by these definitions. While biodiversity is essential for all biological systems, the relationship between genetic resources and bone health is more systematic and significant than its correlation with other bodily systems. Therefore, there is a need for a more nuanced approach to regulatey the diversity and resource content of food in space.

To ensure the well-being of space travelers, it is important to enrich their diets with essential nutrients. The General Principles for the Addition of Essential Nutrients to Foods Codex (Codex Alimentarius Commission, 1987) define fortification as the addition of necessary nutritional components to food items, regardless of whether they are customarily found in the food, to prevent or correct nutrient deficiencies. Food fortification is already being used to address deficiencies in vitamins A, D, and E, as well as calcium, iron, phosphorus, and vitamins A, B, C, and D worldwide (Mozaffarian et al., 2018). However, any fortification added to space food should maintain its nutritional characteristics and quality without substantially altering its flavor, assimilation of nutrients, or reducing its safety with at least twenty-two mineral elements required for human well-being (Samoraj et al., 2018). It is important to continue exploring additional ways to enrich diets to maintain health and well-being during space missions.

The examples provided illustrate the need for a thorough examination of the legal implications and gaps, especially in cases where negative consequences may occur. Additionally, a comprehensive approach to food data should cover a broad definition of food accessibility to ensure space tourists are informed about the food they consume. The availability of space food is also an essential factor to consider, with the need to maintain the immune system of individuals who have flown into space. Changes in diet during space flight can lead to a violation of nutritional balance and negatively affect the immune system. To address this, a system of providing a vitamin complex is proposed, including the preferred vitamin complex in a menu. Therefore, the implementation challenges of the space right to food & guarantees are required to maintain space travelers' immune systems and ensure food components availability and safe consumption.

Conclusions

As space technology advances, it raises important legal questions regarding the rights and guarantees of individuals – space travelers. One significant challenge is ensuring that adequate food standards are provided for private space flights, taking into account the unique physiological needs of each person in a zero-gravity environment. To address these challenges, it is necessary to establish a specific set of rights for non-astronauts under international human rights law, with a particular focus on addressing gaps in food regulation. Designing food systems for space missions is a complex task that involves the cultivation, care, harvesting, and processing of food. This is because microgravity can affect individual nutrition-related characteristics, such as the skeletal and circulatory systems.

The space tourist leads not only to meet basic needs to satisfy hunger, but also there are happiness-relating needs to have visually appealing food which is easy to prepare and store, tasty, capable of retaining its quality over time and recyclable donating to sustainability in the space domain. Besides, current nutritional requirements for private space missions are based on limited research with links to trained astronauts, thus, further assessment is to ensure the health and happy-alike well-being of space travelers. To achieve this, international legislators should collaborate with medical and space institutions to thoroughly analyze the specific requirements of space food. This will provide verified data to inform the development of future space travel. It is necessary to establish explicit standards and regulations for space food tailored to each space tourist's nutritional needs and preferences, considering the limited access to food during the trip and the potential risks associated with the consumption. To bridge the gap in international regulation, the discipline of international law should work in conjunction with other relevant disciplines to address the specific challenges of space food and develop comprehensive policies. Medical evaluations, biochemical assessments, and dietary considerations should be incorporated into the legal implementation of space food regulations and assessments of countermeasure measures.

Although there is experience with space tourism, international law requires confidence evaluation in the human organism's ability to readapt to the space environment during private space flight. For instance, the research has shown, the effects of prolonged journeys have led physicians to conclude that regulation is necessary to mitigate the adverse physical and psychological impacts of the space environment on space tourists. This is essential for non-astronauts to safely enjoy private space flights. One of the most significant global challenges facing space nutrition is mineral deficiencies, which is a surmountable subject to the discourse of potential radiation through daily micronutrient intake. The theoretical doctrine also argues that space food must have modifications in diversity and mineral content, considering the specifics of natural origin and technical requirements. This will secure that all space tourists can safely enjoy their journey while also protecting their statement of the body. Unlike professional astronauts, space tourists are not experienced in space exploration, and their well-being is at the center of legal concern for this new industry service. To confirm the success of private space flight exploration, the recognition space menu for human-manned commercial space flights is crucial. Future research needs to critically analyze and establish guidelines for essential areas of nutrition and international food law science together with a productive legal system for international regulation of space rights, particularly the space right to food and guarantees. This directs the collaboration of various disciplines, including and not limited to physiology, horticulture, psychology, advanced medical technology, diagnostic testing, food science, and biochemistry.

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