FOOD DESIGNED FOR SPACE

(1) Have you ever had a desire to eat toothpaste from the tube? Imagine squeezing the contents of the tube directly into your mouth and instead of tasting mint toothpaste you taste chocolate sauce. This is what Yuri Gagarin, a Russian cosmonaut, tasted in April 1961 when he became the first human to travel into outer space. He ate one tube of chocolate sauce and two tubes of meat sauce. Until Gagarin, scientists were unsure if food could be swallowed in space with little to no gravity. It turns out that the process of peristalsis, which is the involuntary wave-like contractions of the esophagus, pushes food from the throat to the stomach even when gravity is unavailable to aid in the transport.

(2) As you can imagine, food in a tube was not very delicious and soon new space foods were designed. Designing space food is tricky because it has to meet specific requirements for space. It has to be nutritious for the astronauts, take up very little space, be easy to clean up, produce very little waste and be easy to eat without leaving crumbs behind. Another vital requirement is that the food has to last a long time without spoiling at room temperature since most ships lack refrigeration capabilities. There are various types of foods typically used for space missions.

(3) One of the most important types is the *rehydratable food*. Most food is up to 90% water so dehydrating food is a great way to save space. Dehydrated foods have the water removed from them, leaving only the solid components behind. The food can be easily returned to its original state by adding hot water to rehydrate it. Space crafts are not built with a lot of room so designing foods that save space is essential. Dehydrating the food also kills microorganisms which require moisture to grow; this allows food to have a longer shelf-life. These foods include cereals with powered milk and sugar, soups and stir fried vegetables.

(4) *Rehydratable beverages* are a type of space food. Powdered fruit drinks and instant coffee or tea with powered milk and sweetener are put into pouches and then vacuum sealed. The pouches have a spout where water is added to rehydrate the beverage and then a straw is inserted for drinking from the pouch.

ISS Space Food on a Tray, credit: NASA

(5) Even astronauts miss their sodas so eventually some were allowed on board ships, however, fizzy drinks with carbonation proved to be problematic. Microgravity conditions caused "wet burps" that resulted in a bit of vomiting for some astronauts. Though sodas are still allowed, they are not the best type of space beverage and are kept to a minimum.

(6) There's another type of space food called *immediate moisture foods*. These foods do not require added water or reheating in order to eat them. These foods contain a bit of water, but not enough to cause quick spoilage at room temperature. Examples include dried fruits and beef jerky. *Natural form foods* have even less water content and these include nuts, cookies and granola bars.

(7) Food can also be heated or exposed to ionizing radiation to prevent spoilage. *Thermostabilized food* can be eaten without rehydration, but before it is packed it is heated to destroy any microorganisms or enzymes that could cause food spoilage. An example of a thermostabilized food is tuna salad. *Irradiated meat* is exposed to ionizing radiation to kill microorganisms. On Earth, this method of sterilizing food is only allowed at very low levels of radiation. Due to the special requirements of space food, NASA has been given special permission from the FDA (Food and Drug Administration) to irradiate their meat at much higher levels. Irradiated precooked meat includes beefsteak, sliced turkey and breakfast sausage.

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(8) *Fresh foods* like fruits and vegetables only last for the first two days of a space mission. Bread is not permitted due to crumbs but *extended shelf-life bread products* have been designed like tortillas, waffles and rolls. *Condiments* like salt is dissolved in water and pepper oil is used instead of flakes. Ketchup, mayonnaise and hot sauce is also available.

(9) Not only does the food have to be carefully designed, so does the equipment used to eat the food. All the food is sealed in containers or pouches that are kept secure on trays by Velcro fasteners or straps. Scissors are used to cut open pouches and moist towelettes are used to clean hands at the end of meals.

(10) You might not think that an astronaut should care that much about food, but good tasting food is important to everyone. The crew of the Gemini III mission snuck aboard a corned beef sandwich for their commander who loved eating them. The astronauts were reprimanded for this act by NASA when it was discovered. The challenges of making tasty food is made more difficult because microgravity causes fluid to build up in the upper body, causing permanently stuffed up noses and preventing a good sense of smell. When food can't be smelled properly, it also loses taste. It is essential that food taste good so that astronauts don't lose the motivation to eat, especially on long space missions.

Article Questions

1) Why is it possible to eat and swallow food in space even if there is very little gravity?

2) Why is a straw needed to drink beverages?

3) Describe three methods used to decrease the chances that microorganisms will spoil the food.

4) Why is salt dissolved in water and pepper oil used instead of regular salt and pepper?

5) When it comes to sitting down for a meal, what challenges do you think an astronaut might face that we don't? Provide solutions to these challenges.

6) Why does food not taste as delicious in space as it would on Earth?