

Annex 2

Preparation of copper sulphate solution

Materials:

- 1 one glass bottle with stopper or becher (600 ml capacity)
- 15 ml capacity test tubes with stoppers
- 1 funnel
- 1 spatula
- anhydrous copper sulphate
- distilled water

Copper sulphate is a light blue coloured crystal powder.

Take the container with copper sulphate and a plastic test tube with a stopper.

On the test tubes there's a scale, from 1 to 15 units. In case of powdered substances, 1 unity corresponds to 1 cm³.

With a funnel, introduce the anhydrous copper sulphate in the test tubes, up to reach 5 cm³.

Pour the content in the bottle or in the becher and add distilled water up to reach 250 ml.

Vividly and continuously mix the solution in order to let the salt completely melt.

Copper sulphate has a low solubility; for the complete dissolution of the salt is required a waiting time of at least 30 minutes. At the end of the process, the copper sulphate solution appears limpid and light blue.

For the experimental activity, pour the solutions in the test tubes as needed.

SAFETY AND DISPOSAL

Read the anhydrous copper sulphate safety sheet carefully to use it safely and dispose of it properly.

Annex 3

Preparation of the sodium hydroxide solution

Material:

- 1 one glass bottle with stopper or becher (600 ml capacity)
- 15 ml capacity test tubes with stoppers
- 1 funnel
- 1 spatula
- sodium hydroxide
- distilled water

Sodium hydroxide is in form of solid, white and odorless pellets.

Take the sodium hydroxide and a test tube with stopper.

On the tube there's a scale, from 1 to 15 units. In case of solid substances, 1 unity corresponds to 1 cm³.

With a funnel, put the pellets in the tubes up to reach 10 cm³.

Pour the content in the bottle or in the becher and add distilled water up to reach 250 ml.

Vividly and continuously mix the solution in order to let the pellet melt.

Sodium hydroxide presents a high solubility and is an exothermic substance: an increase of temperature of the solution may happen during the process.

At the end of the process, the sodium hydroxide solution appears limpid and colourless.

For the experimental activity, pour the solutions in the test tubes as needed.

SAFETY AND DISPOSAL

Read the sodium hydroxide safety sheet carefully to use it safely and dispose of it properly.

City Lab Sofia: I <3 Food – general template

I ♥ FOOD

This module was created by secondary school biology teachers together with school director, parents and end users. A check for scientific accuracy was done by a biology teacher in Bulgarian.



AT A GLANCE

Thematic Area	nutrition, food production
Format	short school course
Duration	4-5 sessions of 35-40 minutes
Type of audience	primary school children
Age group	9 years old
Number of participants	10-15, the group could be bigger if there are more facilitators to support the activity.
Prerequisites for participation	None
Number of facilitators	1-3
Overall difficulty	Topic: Beginner Preparation: Beginner Facilitation: Beginner

OVERVIEW

The sessions would be organized as games, and students will learn about healthy food, food production, food origin through fun.

OVERALL AIM

Make the students more aware about healthy diets and food production. Create favorable environment for better understanding of healthy diet.

SPECIFIC (LEARNING) OBJECTIVES

After the successful completion of this module participants are expected to be able to...

- to understand which foods are good for their health;
- which foods should be avoided or consumed rarely;
- have knowledge how basic foods are prepared;
- what are some basic rules for a healthy diet;
- understand the importance of fruits and vegetables for a healthy diet;
- Understand meaning of proper and healthy eating habits.

SUGGESTED SCENARIO FOR IMPLEMENTATION

This activity could take place at schools as a short course, additional classes or as a part of educational activities, organised by a different institution. It could take the form of a non-formal education.

TOPICS & COMPETENCES COVERED BY THE ACTIVITY

Thematic area(s)	<i>food elements; food production; healthiness of food</i>
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FOOD2030 Research & Innovation priorities

<i>Priority</i>	<i>Indicate whether main or secondary</i>	<i>Addressed through</i>
Circularity & Resource Efficiency		
Innovation & Empowerment of Communities		
Nutrition & Health	main	Food and health connection, including basic rules for healthy diet, knowledge of the different types of food.
Climate & Sustainability		

(Food) Systems thinking

The modules show the how different foods are produced and prepared how they affect our health.

Other competences

<i>Competence</i>	<i>Addressed through</i>
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	<i>E.g. Explicitly integrated within the learning goals, or integrated in materials and assignments, etc.</i>
Basic nutrition knowledge, Learning about the importance of food and how it affects our health	Participating in „Traffic lights of foods“, learning about the fruits
Have knowledge of where food comes from	Participating in „APC of foods“, learning about how fruits grow
Have a healthy food relationship: Learning to have positive attitudes around food and eating, as well as understanding that all foods can have a positive role in our diets	Participating in „Traffic lights of foods“, learning about the fruits
Potential of bringing the arts, socio-economic science and humanities creatively or trans-disciplinarily with the module?	
The module includes learning through arts and students will draw and use visual materials. A short dramatization which could be developed as a performance is developed.	

TARGET AUDIENCE	
Audience category	primary-level students
Recommended number of participants	10-15
Recommended age	9 years old
Prerequisites	There are no specific prerequisites, students should have.








OPTIONS FOR MULTI-STAKEHOLDER ENGAGEMENT

<i>Stakeholder</i>	<i>Role envisaged in the activity</i>
Teachers	Leading the activity
Demonstrators/animators	Supportive activities
A chef at the school or guest for a session	Supportive activities
A musician or older student who plays and instrument	Supportive activities

SETTING UP THE MODULE

FACILITATION/DELIVERY

The activity might be organized with one facilitator – a teacher (for example) or 2 or 3 facilitators e.g. involving older students/volunteers involved in the process of improving food literacy. Students do not need any specific background or competences.

RESOURCES		
<i>Physical materials</i>		
<i>Resource name</i>	<i>Picture</i>	<i>Number</i>
Cardboards (to be used as boards for collages)		10 -15
“Traffic light” made by colourful cardboards		3-5
Pictures of products related to milk, cereals, healthy and junk food		6-10 sets of 5-10 pictures
Adhesive tape		3-5 tapes
Painting materials		10-15
“Medals”, might be in the form of fruits/stars...		20-30
Pictures/Cards with different fruits to be used as “costumes” in a dramatization		5-15
PREPARING THE SETTING		
The activity could take place in the class room and few blocks of tables with chairs around them could be organized for each team. For the last part of the module, short dramatization, more free space is needed.		
DETAILED DESCRIPTION OF THE MODULE SCRIPT		

Step
The facilitator could choose one or several activities, which they could implement. The idea is that all sessions are game-like. Keeping this in mind the facilitator could modify or add a fun element in the session.
As a first step the students are introduced to food elements, using pictures and boards to visualise them.
After this they learn about the healthy foods and others which should be consumed rarely. The sessions include answering quizz, which could be made in two or three teams, using healthy rewards and/or medals. Another approach is organizing a short dramatization, which could be accompanied by music. If the faciliator has possibility, they could make costumes together with the students or with the help of older students.
It is advisable that each session starts with a short revision of the previos one.
A good practice would be to show the students work – boards, posters, drwaings, etc. In the school as a result of their work.

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APC of food?

Hello!

We are here as your guests with the idea to get familiar with you and to play games together. Today's game is called "APC of food".

- "A" – Do you like to eat? (Here follow their answers. We ask which their favorite foods are).

- What do you think "P" stands for in our "APC of food" game?

* We wait for their answer and if they don't give any, we proceed with giving the answer with a relevant explanation*

- "P" is the initial letter of one of the three types of nutrient substances – proteins. Do you know what proteins are and why they are so useful for us?

We wait for an answer

- Proteins are the basic material of which the bodies of all living organisms on the planet Earth are made, they are the small "bricks" of which our bodies are built too.

Can you give examples of foods rich in proteins?

Some possible answers are meat, lentil, eggs, fish. Upon getting the reply "milk", we proceed with the subject of milk products

- Milk, or rather the food products containing milk, are exactly what we are going to talk about today. Milk is the food which mammals (such as us humans) begin to feed their offspring with. Milk and the dairy products are one of the basic food groups in children's nutrition. Their daily intake is very important at the age of children's growing up when the need of calcium is very high. Calcium is a mineral that is highly essential for having healthy and strong bones. If children don't take enough calcium in childhood, they will not be able to grow up healthy and strong enough. The dairy products supply one fourth of the proteins necessary for the growth, and three fourths of the minerals calcium and phosphorus that we

need in order to have healthy bones and teeth. Milk and the dairy products are very important for the proper development and functioning of the children's bodies, because the fats they contain are responsible for the supply and the assimilation of the vitamins A and D. The lactose (or milk sugar) and vitamin D are necessary so that calcium can go to the right places in our body – in the bones and the teeth – in order to make them strong and to protect us from diseases when we have grown up. Which are your favorite dairy products?

Some possible answers are: butter, cheese, yellow cheese, yoghurt

- Do you actually know where milk comes from?

We wait for their answer and if the children don't give any, we show them the picture with the origin of milk, followed by an explanation

- After milking the animal, the milk goes to the dairy products plant where it is processed, bottled or transformed into different milk products, then it goes to the shop. After we buy it, it reaches our table and we start eating it.

After the explanation, we introduce the game

- Now you will be divided into 3 teams, and each team will receive several pictures. You have to choose from them and arrange in a "Clover of health" all pictures related to milk. In its center you place the "source" of milk and dairy products. Time for the task – 5 minutes.

*Our teams take their places next to the children and help them, observing the decisions they make. We give out one cardboard cut in the shape of clover to each one / or they stick tapes with pictures as a hanging collage. After the time is up, each team shall present its clover / tape collage and explain its arrangement. The team having included the picture with "beating of butter" shall get an additional point. The team that was the quickest to solve the task shall get respectively 3, 2 or 1 point.

- The time has come for the next letter of our game – "C". What do you think "C" stands for in our "APC of food" game?

* We wait for their answer and if they don't give any, we proceed with the explanation*

- "C" like carbohydrates. Do you know what carbohydrates are?

* We wait for their answer and if they don't give any, we proceed with the explanation*

- Carbohydrates are the basic sources of energy for our bodies. Can you tell what do we need energy for?

Possible answers: to grow up, to study, to move, to play

* If they don't give the answers, we prompt them*

- And do you know which foods are rich in carbohydrates?

Possible answers: sweets, fruits and vegetables (upon getting the reply “cereals”, we proceed with the subject of cereals, or if not, we give that answer

- Do you know that the foods most rich in carbohydrates are the cereals and the cereal plants? These are also the foods providing the group B vitamins that are so important for our health and good mood? What examples of cereal plants can you give?

Possible answers: wheat, oats

- Do you know what this symbol means (wheat ear crossed out)? This is a symbol put on foods that should not be eaten by people with a special disease. The foods containing flour of wheat grains are harmful for such people and they have to keep a very special food diet. For all the rest people the cereals are a wonderful source of fibers, energy and vitamins.

- Now we are going to test your knowledge in still another game. You have to arrange consecutively the cereal plants and the foods we make of them in “The wheat road”. You shall get 1 point for each item arranged in the right order.

We give out a large cardboard with a road drawn on it to each team. At the beginning of the road they have to stick the cereal plants, then the wheat grains and after that the pictures of the foods. After the end of the game, if the items are not arranged in the right order, we shall explain what the order should be.

Finally, we account the points and award the teams with special medals

- Now, as an award for the wonderful job you did, everyone of you shall get one little star/fruit. We hope that you had a wonderful time learning something interesting in a slightly different way.

- And for a finish, we strongly hope that you have materials for drawing, because it is time for your creativity. Now color the collages that you made today in the two games and we shall be greatly pleased to see them when we come again soon.

„Traffic lights of foods“

1. We prepare the materials – traffic lights with sticks attached to them
2. Cut out pictures of different types of foods and examples of different impacts on the environment due to human activity
 - 1) Packaged – chips, snacks, lollipops, sweets
 - 2) Meat and meat products

- 3) Fruits, vegetables, bread, rice, potatoes, milk and dairy products
- 4) Pile of plastic bottles, pictures of chimneys polluting the air; people planting a tree, picture of innovative/alternative technologies as source of energy; people cleaning the ocean, people gathering garbage in the forest, recycling

3. Game realization:

- 1) At the beginning the children show the colored pictures from the previous games. Then follows a discussion for reassertion of the learned notions from the previous time. Focus again on the importance of proteins and carbohydrates as a part of good nutrition. We ask the children how often do they eat milk products and which are the most frequently used foods containing carbohydrates at home.
- 2) As a logical continuation to the subject of frequently used foods, we introduce the new subject. We ask questions so that that we can find out whether the children have the knowledge and skills to differentiate the foods' qualities according to their nutrition value.
 - 1) Do you know which foods you should eat every day?
 - 2) Do you like to eat various meals?
 - 3) What do you have for breakfast, lunch, supper most frequently?
 - 4) Do you compose a daily, weekly menu at home?

b) We proceed with the topic of city traffic:

- Today we shall play traffic cops – what does a man with this job do? Have you watched a traffic cop in operation? (Possible answers: he/she controls street traffic/puts on traffic lights in the streets).
- When there is no traffic cop, how do you cross the street correctly? (Possible answers: we wait for the green traffic light to switch on).
- What do you do at yellow and red traffic light? (We are careful and do not cross the street).
- Do you want us to play traffic cops today? Guess what we shall be learning to regulate? (Possible answers: the food, food products, nutrient substances).

4. We give out the prepared traffic lights and pictures to the teams. We ask them to view the pictures carefully and to try and guess the principle of foods sorting.
5. We hear the suggestions of each team before starting the sticking activity. We give directions:
 - To the green light (color) you must stick the pictures of foods that you should eat every day – fruits, vegetables, carbohydrates (such as bread, rice, pulses, legumes / milk and dairy products).

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We explain that these are the foods that give us the necessary daily energy and material for building our bodies. We recall the items from the previous game.

- To the yellow light (color) you must stick the pictures of foods that you should eat several times a week, but not every day – meat, eggs, fish. We explain that these foods are more difficult to digest and our bodies assimilate them more slowly and when taken in greater quantities, they create a sensation of heaviness in the stomach. We shouldn't eat too much of them.
- To the red light (color) we sort the foods that we must eat rarely – packaged foods, candy, sweets, cakes. We explain that these products don't give our bodies any useful substances, and the great quantity of sugar in them gives us a fast energy "bomb", which is manifested in restlessness, jumpiness and overexcitement. The unwanted carbohydrates are transformed into fats that our body stores up and our weight goes up without us noticing it. Again we should stress that these foods have zero nutrition value!
- And the other team – to the green light you should stick the pictures of different activities that help the environment; to the yellow light you could stick pictures of such activities which are good for the environment, but only trying to recover the damages done by people and to the red light – the negative consequences of human activities.

6. We announce start of the game. Our teams offer help in the activities accomplishment.
7. After the set time (10 minutes) is up, we announce end of the game and proceed with a short presentation of the elaborated traffic lights. The children give their arguments as to why they have sorted out the pictures of food products in that specific way.
The team which prepares the traffic light of human activities according to their effect on the environment do the same. In this way they reassert what they have learned on that topic.
8. The evaluation is based on the correct elaboration and explanation of the activity.
9. Follows the teams awarding.
10. We say good-bye to the children and promise to come again and play games together.

Food and health. Plants and Fruits

The session begins with comments on how plants grow and then the basic rules of healthy and balanced nutrition. Then the students answer questions in an entertaining quiz.

Where do plants come from?

We show pictures of the different stages of a growing plant.

A life cycle shows how a living thing grows and changes. While plants life cycles keep going, a plant's life begins with the seed. With water, right temperature and right location, the seed grows. It becomes a seedling. Roots push down into the ground to get water and minerals. The stem reaches for the sun, and leaves begin to unfold. A bud appears. The plants then produce flowers. The flowers are then pollinated in many ways – by bees, moths, butterflies, insects, moths, bats, butterflies and even by the wind. The pollinated flower turns into fruit. The new seeds are inside the fruit. The ripe fruit drops to the ground and the cycle begins again.

Some seeds have an outer layer called a seed coat, which provides protection and food for the seed. When a seed grows, a small root begins to grow downward and a shoot grows upward. When the shoot hits the surface, the plant is called a sprout. The sprout uses water and nutrients from the soil along with sunlight and air to grow and change into a seedling.

A seedling is a small plant with few leaves. Later the seedling changes into a young adult plant.

At this stage, the plant is bigger and may have more leaves. Thin branches will develop on young adult trees. Over time, the young adult plant will grow into an adult plant.

The adult plant is now mature and has the ability to reproduce through spores or flowers. After flowers are pollinated, they get bigger and turn into fruit with seeds inside. The fruit protects the seeds and after it ripens, the seeds can start the life cycle all over again. Because there are so many threats to both seeds and seedlings, sometimes a plant will make a lot of seeds so it will survive.

Important!

All plants need plenty of water and light to grow into healthy plants! But don't over water or give too much light to plants as well!

That is how fruits and vegetables grow!

Then we ask: "Where do you get fruits and vegetables from?"

Does your mom or dad (or aunt or grandma) buy them at the grocery store?"

Give each child a chance to answer. We continue by saying: "There are a lot of places to get healthy fruits and vegetables. Have you ever picked an apple off a tree or picked strawberries off vines on the ground?"

After giving each child a chance to answer, we say: "There are a lot of places to get fruits and vegetables. We can buy them at the grocery store, at a fruit or vegetable stand, at a farmers' market, or we can pick them from a garden. Has anybody ever gone to a farmers' market?"

The group discusses what the children have shared.

The next step is to explain to the children the ten rules of healthy nutrition as the key to a long life and healthy lifestyle. The healthy nutrition determines not only the normal growth and development of the students, but also their work capacity and good results in the studies. Healthy means varied, balanced and regular nutrition.

1. Rule: Variety in the choice of food products. In order to stay healthy and fit, a person needs nutrition substances – proteins, fats, carbohydrates, vitamins, mineral salts and water.
2. Rule: Neither too much, nor too little. Food provides energy in the form of fats, carbohydrates and proteins, and it is measured in calories and joules. It is the source from which our bodies draw strength in order to think, to support the muscles in fit condition, to regulate the body temperature, to keep up the heart activity and breathing – in other words – in order to live.
3. Rule: Smaller food quantities, but more frequently. Everybody has to find the right solution for oneself – corresponding to one's work habits and free time. Don't forget: a man has to take time for feeding!
4. Rule: Enough proteins. Life is unthinkable without proteins. They are necessary for the growth, for replacement of the used-up substances that are necessary for the body, and for the normal course of the life processes.
5. Rule: Fats should be maintained within specified limits. The excessive use of fats results in accumulation of body fats. You should prefer vegetable fats to animal fats. And as always – choose variety!
6. Rule: Restrict sugar and sugar products. The excessive sugar is transformed into fats that accumulate in the body.
7. Rule: Eat fresh fruits and vegetables, as well as whole grain products every day. These products are your best guarantee that your body is supplied with enough vitamins, minerals and nutritive fibers. The more various, the healthier!
8. Rule: Correct food processing (cooking). If the food is cooked incorrectly, it not only smells and tastes worse, but it also loses a great deal of its vitamins and mineral substances.
9. Rule: Be thrifty for the salt. Remember the following rule for the salt: the less, the healthier.

10. Rule: Be physically active – get moving, engage in sports you like and maintain your fitness.

After discussion of the rules, the students answer the questions in the quiz:

Quiz:

1. Its color is pink-red, it tastes and smells divinely. Children love it in a jam and juice.
What is it?
 - a) Melon
 - b) Raspberry
 - c) Fig
2. It looks like the peach, but its taste is not the same. A lovely fruit with orange color.
 - a) Plum
 - b) Pear
 - c) Apricot
3. They usually call me southern fruit and I look like huge egg or fir-cone. Guess who I am?
 - a) Fir-cone
 - b) Pineapple
 - c) Pear
4. Water melons are my sisters, my color is yellow and I smell wonderfully, because I bathe in sun all day long!
 - a) Lemon
 - b) Melon
 - c) Banana
5. I live far away from here, in warm countries in the south. There everyone can feast on something long and yellow!
 - a) Bananas
 - b) Pears
 - c) Lemons
6. I look like little red, juicy, fragrant heart! And I am loved by everyone! My name is...
 - a) Strawberry

b) Cherry

c) Peach

7. You look at me and see a ball, but green. I sunbathe on the melon beach to grow up big and sweet.

a) Melon

b) Quince

c) Water melon

8. I have a little heart of stone, my color is dark blue, and I am sweet and tasty.

a) Olive

b) Plum

c) Cherry

9. They import us from countries far away, but we can also grow in the south of Bulgaria. They sometimes pick us yet little and green and sell us in jars of jam.

a) Olives

b) Water melons

c) Figs

10. I am the bigger and sweeter cousin of the lemon, with juice as sweet as honey.

a) Orange

b) Grapefruit

c) Tangerine

At the end of the game we sum up the points and award the winners.

Food and health. Fruits II

The children are given the text of the dramatization “The speaking fruits”. The roles are distributed among the students so that all of them are included; the part of the presenter may be divided between more children, or the groups of the different fruits may also include more students.

Dramatization

“The speaking fruits”

Presenter: One evening Vanya did not eat her dessert that consisted of a large red apple. She preferred something sweeter and softer because her front teeth were getting loose and very soon were to be replaced by new ones.

Her mom told her crossly that she didn't buy any sweets today. Vanya was displeased. She got up from the table and flung herself angrily on the bed in the children's room. As she lay face down on the pillow, she heard a sudden ringing. She peeped and saw a tiny princess sitting next to her on the bed.

V: Who are you?

F: The fairy of the fruits.

V: What do you want from me?

F: Nothing. I just want you to meet several good friends.

Presenter: Vanya became interested at once. She loved making friends, but it was the first time a fairy offered her friendship.

V: What are their names?

F: You know them, but you just keep avoiding them. In fact they are very kind and knowing them can be very healthful.

V: This is the first time I hear that a new acquaintance can be healthful.

F: You can judge for yourself.

The fairy swings the magic wand and the fruits appear on the stage:

Cherries:

We are cherries,
Dressed in red
Here we come to you
With some very tasty news:
„If you want to grow up,
Eat fruits, don't wait!”

Strawberry:

I am their pretty sister
Strawberry is my name.
I sit on the top of cakes
Over their glossy cream.

Peach, apricots:

We are friends and neighbors,
Tasty beauties dressed in velvet.
And to have rosy cheeks like ours,
Eat some peaches and some apricots.

Plums:

If you eat me with my heart of stone,
You will have a plum tree
growing in your stomach.
Every little child must read
This rule important:
Never eat the fruits with dirty hands!!!
Wash with water every fruit you eat!!!

Grapes:

When the autumn comes to us,

The old vine gets heavy
with its fruits.
It fills the grapes with honey
And the baskets fills with grapes.

Pear:

I am the sweet wild pear,
Hurry, snatch a bag,
Loose no time and pick me up.

Quince:

You can eat the whole of me
This is known since ages past.
Now you learn at once
How useful I can be!

Blueberries, raspberries, blackberries:

We are tiny blueberries, raspberries, blackberries
If you want to get sound and strong
Eat our berries, don't wait long!

Pumpkin, melon, water melon:

We are cheerful and noisy
And we tell sweet tales
Everybody loves us
And they call us pumpkin, melon, water melon!!!

Walnut:

If you want to be as smart as me,
Break my shell
And eat my heart,
Remember not to try
To break my shell
With your teeth!

The fruits sit around Vanya and every fruit draws a picture of itself.

F: One fruit is missing! Can you guess which one?

V: The apple.

F: You guessed right! I shall introduce it last because it is very important.

V: What is so important about it?!

The fairy swings the magic wand and the apple appears on the stage.

Apple:

Here I am! You should eat me every day!

V: You wish!!! /she shakes her head disapprovingly/

F: Just listen to her story.

The apple begins to tell her story:

APPLE:

The apple is a wonderful fruit – it has no fats, it has very few calories, it is poor in sodium chloride and has no cholesterol.

The pectin hairs in the apple clean like a brush the inside of our intestines and thus not only help our stomach to work well, but they also remove the harmful deposits that are inside our bodies.

F: Here is one excellent ripe apple for you, dear, eat it!

V: I can't. My teeth are loose!

F: Don't worry, you will have new ones, even better and stronger, grown in their place, but you must take care of them! My sister, the Tooth Fairy, will tell you how to do this.

The fairy goes out and the Tooth Fairy dressed in white enters the stage.

TF: Hello! I am the Tooth Fairy. In order to have healthy teeth, you must take care of them.

V: I know! I brush my teeth regularly after every meal, I eat sugar free candy and bubble gum.

TF: And do you drink milk in the morning?

V: I hate milk! And what does milk have to do with my teeth?!

TF: But you should not hate it... Now listen to the story of one cup of milk.

A cup of milk appears on the stage.

Cup:

Milk is the basic food of all newborn babies and young animals - mammals, as well as of the man. You can find almost all vitamins in milk, and it contains also calcium and phosphorus which are very important for your teeth. Milk is not a durable product, which is why man has found ways to make it more stable and resistant to spoiling. One of the ways is by curdling it, as a result of which you get yoghurt. The most popular sour milk product is the Bulgarian yoghurt. It is widely spread in the whole world and the basic bacteria from which it is prepared is *Lactobacillus Bulgaricus*. Curd is made by using other bacteria. Other countries have other popular sour milk products, such as clabber, mazzoni, kefir, kumis, and others. The lactic acid (or milk acid) that is obtained under the action of sour milk bacteria, suppresses the development of harmful microorganisms not only in milk, but in human intestines too. The sour milk products contain a great number of living sour milk bacteria. They can suppress and even stop the development of the harmful microorganisms in the intestines that may cause diseases. The nutrition value of yoghurt is greater than that of fresh milk.

There is a huge variety of cheeses manufactured around the world. For instance, in France considered as the cheese paradise, you can find about 150 kinds of cheese. In Bulgaria there are 2 basic types of cheese manufactured out of the different milks – white brined cheese and yellow cheese. The cheeses are a concentrated source of proteins and calcium. They contain 3-6 times more vitamin A compared to milks, 2 times more vitamin B2 and 2-8 times more of the folic acid vitamin. Milk sugar is almost completely decomposed and there are only traces of it in the cheese. In most yellow cheeses the contents of fats is high, which is why we recommend you to restrict their consumption. But the Bulgarian cow's white brined cheese is much more dietary – it contains about 19 g fats in 100 g.

V: I am surprised that a simple cup of milk knows so much!!!

TF: Yes! So never miss your daily cup of milk if you want to be healthy and to have strong white teeth ...

Bye-bye ...

Here goes the sound of the alarm clock.

Vanya's mother enters the room and wakes her up for school ...

V: Mom, where is my cup of milk? Please put an apple in my school backpack, and I want a pot of yoghurt for dessert tonight. BYE!!!

Presenter: Vanya went to school and she was lively and vital all day long because the milk and the fruits gave her strength.

The fruits hang their pictures on a string after which they dance merrily.

After finishing the dramatization, we review the usefulness of fruits for the health.

Nutrition

This module was created by secondary school teachers together with the school director, parents and end users, with specific support of other stakeholders.



AT A GLANCE

Thematic Area	nutrition, eating habits
Format	short school course
Duration	6 sessions of 45 minutes
Type of audience	secondary school children
Age group	12 years old
Number of participants	10 - 20
Prerequisites for participation	None
Number of facilitators	1-2
Overall difficulty	Topic: Beginner Preparation: Beginner Facilitation: Beginner

OVERVIEW

The module foresees several lessons about nutrition, diet example and traditions related to food, each ending with example tasks, which could be further developed if the students are interested. The aim is to make young people realize the importance of nutrition and healthy diet as well as prevention of nutritional diseases.

OVERALL AIM

The main aim is to make young students more aware about healthier eating habits, cultural specificities related to food.

SPECIFIC (LEARNING) OBJECTIVES

After the successful completion of this module participants are expected to be able to...

- build healthier eating habits and diet;
- creating open conscious towards healthy life style;
- have practical knowledge of calorie balance and its considering;
- have knowledge about different cultures' eating habits and their consequents as well;
- have knowledge about traditional practices related to food.

SUGGESTED SCENARIO FOR IMPLEMENTATION

This activity could take place at schools as a short course, additional classes or as a part of educational activities, summer schools. It is considered non-formal education.

TOPICS & COMPETENCES COVERED BY THE ACTIVITY

Thematic area(s)	<i>healthy food, traditional food, healthy habits related to healthier lifestyle, food and communities</i>
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FOOD2030 Research & Innovation priorities

<i>Priority</i>	<i>Indicate whether main or secondary</i>	<i>Addressed through</i>
Circularity & Resource Efficiency		
Innovation & Empowerment of Communities		
Nutrition & Health	main	Principles of healthy diet and leading healthier lifestyle
Climate & Sustainability		

Research & Innovation (R&I)

<i>Related concept</i>	<i>Addressed through</i>
secondary	New productive methods and practices of responsible research

(Food) Systems thinking

The module combines knowledge about nutrition and healthier eating habits and practical tasks through which the students would gain deep understanding of the topic.

Potential of bringing the arts, socio-economic science and humanities creatively or trans-disciplinarily with the module?

The module includes some activities as making dashboards/posters, locating a corner – specially organized for the students to eat.

TARGET AUDIENCE

Audience category	Secondary level students
Recommended number of participants	10-20
Recommended age	12 years old
Prerequisites	There are not any specific prerequisites needed, students should have general background.




OPTIONS FOR MULTI-STAKEHOLDER ENGAGEMENT

<i>Stakeholder</i>	<i>Role envisaged in the activity</i>
Teachers	Leading the activity
Expert in health and nutrition or sport	Supporting activity

SETTING UP THE MODULE

FACILITATION/DELIVERY

The activity might be organized with a facilitator or/and demonstrator. Students do not need any specific background or competences.

RESOURCES		
<i>Physical materials</i>		
<i>Resource name</i>	<i>Picture</i>	<i>Number</i>
Cardboards (to be used for posters) <i>Optional, if such specific task is chosen</i>		10 -15
Painting materials <i>Optional, if such specific task is chosen</i>		10-15 sets
Equipment for printing materials <i>Optional, if such specific task is chosen</i>		20-30 <i>Depending on the number of students, who decide to prepare journals and/or booklets; menus.</i>
Food products for healthy meal <i>Optional, if such specific task is chosen</i>		Varies depending on the meal chosen, if the students take part in such activity.
PREPARING THE SETTING		
The activity could take place in the class room and the school canteen if students prefer to be engaged in a task related to food preparation.		

DETAILED DESCRIPTION OF THE MODULE SCRIPT
<i>Step</i>
The facilitator chooses the topics that they would like to include in the module. After each session it would be useful to ask the students to work on an individual task (there are suggestions for such after the different topics). In this way students would be more involved in the activities and the content could be delivered based on students' experience.
Explanation of balanced nutrition.
Sevreal recommendations which should be followed in relation to balanced nutrition.

Theoretic formulation of the principles of a healthier lifestyle.

Students are introduced to norms for appropriate behaviour for different social groups.

Preparing healthy diet with practical examples.

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For the facilitator

Lessons objectives

After this lesson students should be able to:

- acquire knowledge and skills related to healthy eating as part of a healthy lifestyle;
- understand and realize its meaning and show a desire to observe it in its everyday life;
- to feel more responsive to their own health;
- realize that nutrition is subject to rules, compliance with which will improve the quality of their lives;
- to become acquainted with basic rules and norms for proper behavior as well as with some foreign traditions for healthy eating.
- to be aware about eating habits specificities - benefits and damages.
- to be able to build a proper attitude towards nutrition.

Modules aims at preventing and reducing the risk factors most common among students - low physical activity, unhealthy nutrition, etc. and thereby reduce the incidence of major chronic non-communicable diseases among students.

Suggestions for organizing a lesson

A technique that could be used is to intentionally structure topics to end three-fourths of the way through the time, leaving one quarter of the time to start the next module/topic. This would generate an automatic bridge between sessions.

As a start for every lesson, the facilitator could discuss the previous one in brief or comment on the materials that the students prepared. Otherwise they could directly ask several questions on what students know about the topic and discuss the answers with the group as middle schoolers usually do not share their opinions or thoughts as readily as younger students. One might give the children several minutes for brainstorming - interactive brainstorming is typically performed in group sessions, or they could give them a little time to think, then pair with the classmate/child next to them and share.

An alternative way to start a discussion is to show students an image with no explanation, and ask them to identify/explain it, and justify their answers.

Or the instructor might invite one volunteer to “take the microphone” at a time (even sitting on a different chair), then calls on the next volunteer. Each subsequent speaker must summarize the previous one’s points (or, if desired, all the speakers thus far) before adding original ideas.

Also, it is good for students to illustrate a concept or idea. In this way when comparing drawings around the room, one could clear up misconceptions as stations or displays are spread across the room, and students go around to each station individually or in groups.

Another option is to carry out questionnaires among the students and receive a feed back based on the results as a helpful tool for module evaluation.

To make the lesson more interactive the facilitator could select some students to travel the room, polling the others on a topic relevant to the course (for example how much water they drink daily, or what they have for breakfast, etc.), and then report back the results for everyone.

After the main information is presented, the facilitator could ask the students what they learned and which fact was most interesting for them, after this, children could choose word of the day or phrase to describe the lesson. The facilitator could ask true or false questions and instruct students either stand or sit to indicate their binary answers.

Additional materials: [How to Make Your Teaching More Engaging: Advice Guide, Sarah Rose Cavanagh](#)
[How Peer Instruction and Polling Have Changed My Teaching, James M. Lang](#)
[Ready-to-use teaching and learning resources which aims to raise awareness among Europeans aged 11-15 of the importance of food and farming for Europe, EC](#)

1. Discussion: Wholesome and balanced nutrition – what does it mean?

For the facilitator: [Learning About Nutrition in the Classroom: Tips for Teachers](#)

[Teaching with Discussions](#)

Wholesome nutrition is a hot topic, since the use of junk food affects greatly the energy at a person’s disposal and also one’s mood and weight. Overweight (obesity) is a confirmed problem of our time and it can cause serious diseases.

The growth, development and health of adolescents depend on nutrition. Nutrition is of great importance at school age. It is the most significant prerequisite for securing good health and harmonious physical and mental development. Good nutrition increases the body’s resistance against different diseases and some negative impacts of environment. At this age good nutrition is of vital importance also because then the

final building of the organism takes place – the physique, the individual metabolic stereotype, the intellect, the reactivity and the adaptability to life become shaped at this age. The role of good nutrition under the modern life conditions is also important with respect to acceleration – a process of premature physical and psychical development of the human organism at a pace that significantly exceeds that of previous generations. The basic task of rational nutrition at school age is to ensure a balanced nutrition corresponding to that specific age.

Quantitative insufficiency and qualitative incompleteness have equally unfavorable effects on the physical and neuropsychical development of the adolescent generation. Therefore rational nutrition is the basic means of maintaining a normal physiological condition of the body to ensure a high level of functionality and adaptability to the constantly changing conditions of the environment. The basic elements of rational nutrition are the balance of the nutrient substances in the daily menu and the correct eating regimen.

It is in the very early childhood that a child is taught to have an attitude and taste for certain foods (for example with less fats, salt and sugar), as well as to feel pleasure from the food: they can build nutrition habits that can improve the health.

1. Discussion – Balanced nutrition

Some basic recommendations about balanced nutrition are presented. They are followed by a discussion by the participants – what do they eat. It ends with an element of play – do we eat correctly based on the given examples.

Here are some basic rules of balanced nutrition:

- Nutrition that ensures the exact calories quantity depending on how much we move. This balances the consumed energy and the used up energy. Eating a wide range of foods is important because it guarantees intake of all the necessary nutrient substances.
- Eat meals that have starch carbohydrates. It is recommended that these foods should be a little more than one third of the food that we eat. The starch carbohydrates include potatoes, bread, rice, pastries and cereals.
- Choose wholegrain varieties (or eat unpeeled potatoes) whenever you can, because they contain more fibers that create a feeling of satiety for a longer time. We have often heard that carbohydrates lead to overweight, but they contain less than half the calories contained in the fats. This is one of the reasons to pay attention to how much fats you use as an addition to these foods, because often the dressings and the fats for the foods preparation contain a huge amount of calories.

- Eat lots of fruits and vegetables. It is recommended to eat at least five portions of different fruits and vegetables every day. This is easier than it sounds, as it is not difficult to replace the intermediate meals (snacks) with fruits or vegetables. A 100% fruit juice without additional sugar, a vegetable juice or smoothie can be considered as one of the 5 portions a day.
- Eat as much fish as you can. It is good to have at least two portions of fish a week, including at least one portion of fish that is rich in fats. Fish is a very good source of proteins and it contains many vitamins and minerals. Eat fish regularly.
- Everybody needs small quantities of fats in the food, but it is important to pay attention to the amount and type of fats. There are two basic types of fats: saturated and unsaturated. Too much saturated fats may increase the amount of cholesterol in the blood, which is harmful.
- The saturated fats are present in many foods such as solid cheeses, cakes, biscuits, cold cuts, cream, butter, lard, pies. Try to reduce the intake of saturated fats and choose foods containing unsaturated fats, such as vegetable oils, fish and avocado. When you eat meat, choose the one with less fats and remove the visible fats.
- The regular consumption of foods and beverages with high sugar content increases the risk of obesity and spoiling of the teeth. The sugar foods and beverages, including the alcohol drinks, usually have a high energy value and if consumed too often, they may lead to increase of weight. Avoid carbonated beverages with sugar, alcohol drinks, cereals with sugar, cakes, biscuits, sweets.
- Salt restriction.

Healthy nutrition is far from complete by the above recommendations, but they are a good start.

Also, in order to follow a healthy nutrition, we should be very careful about food quality.

So that students can grasp better the recommendations for balanced and healthy nutrition and use them in their daily life, we gave them **the following tasks**:

- 1) To compose an “ABC health book” in which to collect the most important recommendations for healthy nutrition as a condition for good health and successful studies.
- 2) The “ABC health book” could be presented to the parents, to younger students and to their schoolmates, share it with the other students at school. It may be represented as an open poster and other students and teachers could add their proposals.

- 3) To prepare balanced and healthy menu. An additional activity might be Design Challenge: The Ideal Meal - Teachers TryScience, Deliverable 6.1

2. Discussion: How to eat usefully

The basic recommendations on balanced nutrition shall be presented. They shall be followed by a discussion by the students – what do they eat. It ends with an element of play – do we eat correctly based on the given examples.

Healthy nutrition is a key to good health. In order to grow up healthy and strong, try to keep the following recommendations for healthy nutrition:

1. Eat a variety of foods. BUT take enough time for having meals in a friendly and restful atmosphere.

The nutrition is balanced when the foods we take are neither too much, nor too little, but as much as to give us the energy we need for the day. There is no such food product or group of foods that contain all nutrient substances in the necessary quantities. That is why it is good to eat varied foods. It is recommended that the foods we should take every day include foods from the following 4 groups:

- 1) Cereals (bread, rice, pasta, spaghetti, corn, oat flakes, cereal snacks) and potatoes;
- 2) Vegetables and fruits;
- 3) Milk, cheese, yellow cheese, curds;
- 4) Meat, fish, eggs, beans, lentil, nuts (walnut, almond, hazelnut, etc.).

These foods are very important for the individual's growth and health and that is why it is necessary to take at least one food of each group every day. The foods and the drinks that you have to take in smaller quantities are included in the remaining two groups:

5. Fats (butter, lard, sunflower oil, corn oil, olive oil);
6. Sugar products and sweets (candy, chocolate, wafers, pastries, cakes, baklava, syroped pastries, halva, Turkish delight, and many others), as well as beverages with sugar.

Having meals together with the family at home or with friends at school creates pleasant emotions and enjoyment. Eat without hurry – this is the time when you can enjoy both good food and company.

2. Don't miss breakfast in the morning, eat regularly

The morning breakfast is very important because after the night's sleep you need charging with energy and nutrients. Breakfast is a wonderful beginning of the day and it gives you energy for studying and sports. You can choose milk with cereals and a fruit for breakfast, or a sandwich with cheese or yellow

cheese, with ham or eggs and a cup of fresh milk or yoghurt, fruits or fresh fruit juice. Our body needs energy all the time and therefore it is important to eat regularly. Besides breakfast, don't miss the other principal meals – lunch and supper - in order to feel alive throughout the whole day. For snacks between the principal meals choose a fresh fruit or fruit juice, yoghurt with fruits, cereal or muesli bar, a sandwich with wholegrain bread, etc.

3. Eat cereal foods as an important source of energy, prefer wholegrain bread.

The cereal foods (bread, pasta, spaghetti, rice, corn, oat flakes, etc.) and the potatoes are basic plant foods for the man, they provide nutrient substances and the basic part of the energy for the day. The wholegrain foods are richer in nutrient substances – plant fibers, vitamins and many mineral substances that are useful for the health.

- Include bread, other cereal foods or potatoes in your daily menu;
- Choose more often wholegrain foods, it is recommended that at least half of the bread you eat should be wholegrain;
- Eat stewed or baked potatoes, avoid fried potatoes and chips;
- Restrict the consumption of pastries with high content of fats (batter fried in deep oil, donuts, banitza, tutmanik, milinki, etc.).

4. Eat more vegetables and fruits, possibly with each meal.

Fruits and vegetables are some of the most useful foods. They are rich in many vitamins, mineral substances, fibers and biologically active substances that are necessary for the functioning of the body, for its growth, development and resistance against diseases. You cannot put on weight from fruits and vegetables because they contain much water, have no fats and are poor in energy.

- Eat various vegetables and fruits – green, yellow, orange, red;
- Eat vegetables in salads, dishes, sandwiches;
- Choose fresh fruits instead of sweets for dessert and snacks.

5. Take milk and dairy products every day.

Yoghurt and fresh milk and the dairy products (cheese, yellow cheese, curds) are valuable foods for the children. Milk and the dairy products are the best source of easily assimilated calcium, they are also rich in proteins and vitamins that ensure the growth and the strength of the bones and the teeth. Yoghurt, the

traditional Bulgarian food, is a particularly good choice because it has a special importance for the health – it improves digestion and increases the immunity against diseases.

- Every day eat 3-4 times milk or dairy products;
- Choose yoghurt with low fats (1.5 - 2%);
- Prefer dairy products with low fats and salt content (curds with low fats, fresh cow's cheese, desalinated cow's cheese).

6. Choose meat without fat, replace meat by fish, beans and lentils more frequently.

Foods of animal origin (meat, fish, eggs) and some foods of plant origin (beans, lentil, soya, nuts) are rich in proteins and are very important for man's growth and health. Meat and fish contain easily assimilated iron – the element important for the formation of red blood cells and for the body's resistance against infections, and for improvement of the attention (focusing) and overall strength. Fish contains valuable fats useful for the function of the brain and the heart. At least one of these products should be eaten every day.

- Eat poultry meat (chicken, turkey, etc.) and red meats without fats (veal, beef, pork, lamb);
- Avoid and restrict eating sausages and cold cuts with a high content of fats and salt;
- Eat fish 1-2 times a week;
- Eat beans or lentil 1-2 times a week;
- Eat nuts (walnut, hazelnut, peanut) unsalted;
- Eat at least 5 eggs during the week (this quantity includes the eggs in different dishes and desserts).

7. Restrict the fats, especially animal fats, and avoid fried foods

Fats are necessary for the human organism, as are the other nutrient substances. They are the richest source of energy and help for the assimilation of important vitamins – A, D, E and K. However, the consumption of large quantities of fats leads to overweight and obesity. Animal fats and solid margarines are not recommended, since they contain substances which, if taken in large amount, may lead to disease of the blood vessels and the heart. Besides in butter, oil and the visible meat fats, some foods like chips, snacks, cakes, wafers, cold meat cuts, fried snacks, dressings, salads with mayonnaise, etc. contain "hidden" fats as well. In order to reduce fats consumption, it is useful to remember the following recommendations:

- Choose foods with low fats content – low-fat milk and dairy products, lean meats;
- Restrict the consumption of cold cuts, sweets and pastries, cakes, donuts, milinki, etc.;
- Restrict the consumption of products containing solid margarine – bisquits, wafers, dry cakes, etc.;
- Avoid fried foods;
- Prefer plant oils (sunflower, corn, olive oils, etc.) to animal fats (butter, lard, etc.).

8. Restrict the intake of sugar, sugar products and sweets, avoid consumption of sugar containing beverages.

Sugar gives a pleasant sensation of sweetness, it gives a fast supply of energy, which is why the foods and drinks containing sugar are commonly preferred. The frequent consumption of candy, wafers, chocolate, sweets and other sugar foods and beverages is harmful for the teeth and may lead to overweight. Honey contains useful substances and it should be preferred to sugar as a sweetener.

- Try not to sweeten the milk and tea with sugar. If you want to sweeten your food, prefer honey, but don't use it excessively;
- Avoid frequent use of beverages with sugar. Prefer tap water or mineral water;
- Prefer natural juices without added sugar to juices and nectars sweetened with sugar;
- Choose fruits for dessert instead of sweets and cakes;
- Avoid frequent intake of sugar foods and beverages between the separate meals.

9. Reduce the use of salt and consumption of salty foods

Salt contains sodium and chlorine that are important for a number of bodily functions, but the excessive use of salt and salty foods may lead to loss of calcium from the bones and to increase of blood pressure. Besides the salt added to cooked food, processed foods such as: chips, cold cuts, sausages, canned meat, canned fish, cheeses, pickles, dry soups, salty snacks, ketchup, dressings, etc., are with high content of salt. The taste preference for salty foods can be changed by a gradual decrease of salt consumption.

- Reduce the consumption of canned foods, sausages, saline fish;
- Avoid addition of salt to your food;
- Instead of salt, flavor your food with lemon juice, vinegar, plant spices.

10. Take enough water and liquids during the day. Don't use alcohol drinks.

Water is vitally necessary. Dehydration caused by insufficient intake of water and liquids leads to a decrease of mental and physical activity, attention disorder, fatigue and headache. Children are particularly sensitive to dehydration. The best thing to satisfy the thirst is common drinking water, as well as low mineralized mineral waters. Drinks such as tea, ayran and natural fruit juices without sugar, contain also useful nutrient substances.

- Drink at least 6-8 glasses of water and liquids (1.5 – 2 litres) every day, which includes water, milk, juice, tea, soups, etc.;
- Drink water regularly in small quantities throughout the whole day before you feel thirst;
- Drink more water when the ambient temperature is high or at intensive physical effort;
- Prefer tap or mineral water to beverages and juices with sugar or other sweeteners;
- Drink water and liquids with moderate temperature, avoid very cold and very hot drinks.

The organism of children and adolescents is particularly sensitive to the effect of alcohol. Alcohol injures the brain, the liver and other essential organs. Even in small quantities, alcohol may cause intoxication in children. That is why don't use alcoholic drinks.

11. Keep the hygiene rules in eating, foods preparation (cooking) and storage.

Take part in choosing the menu, shopping and cooking the food at home. This is a wonderful way to choose and prepare wholesome foods that you prefer to eat. Besides wholesome, food also should be safe. The food may get contaminated at any stage of its preparation, storage and consumption. Keeping the hygiene rules in eating and foods preparation (cooking) is an important condition for good health. How should we protect foods from contamination?

- Wash your hands before eating;
- Use individual cutlery and dishes when eating;
- Don't eat foods after their expiry date;
- Wash well the fruits and the vegetables before eating them;
- Avoid contact between raw foods and foods ready for consumption when storing them;
- Store the foods in the fridge in their packages, closed boxes and covered.

13. In order to have healthy nutrition it is important to eat fresh food and as little processed food as possible. But where does our food come from? Home production? A grocery store? A restaurant? A farmer's market? A refrigerator? All of these answers are correct, but really, all food starts out in a farm!

Farmers all across the country produce different foods and products. There are vegetable farmers, dairy farmers, wheat farmers, corn farmers, cranberry growers, apple growers, hog farmers, chicken farmers, turkey farmers, and so on. Some farmers grow more than one thing, and other farmers may only produce one thing. Part of the home production is free from harmful additives during growth.

After farmers produce their food, they must find a way to market it so that it gets to the citizens. Some farmers sell it directly to consumers from their farms. Other farmers bring their fresh foods to the farmer's market in town. Some companies buy a farmer's food so they can process it, preserve it and send it longer distances to grocery stores all over the world. And some – sell their goods online.

Farmers depend on everyone in the community in order to have a successful farm, and everyone in the community depends on farmers for food. That's why cooperation and community are so important. And the more local food you eat the fresher it is.

In this way, choosing locally produced food, you can not only have fresher food, but also help the environment – the transportation would not take as much fuel and will be for much shorter distance compared to the transportation that is needed when importing goods.

2.1. Independent work of the students – Tasks:

- 1) To elaborate a pyramid of healthy nutrition and to put it in the assigned place at school so that it is visible for the onlookers.
- 2) To prepare presentations or pictures/comic strips with the basic rules of healthy and rational nutrition and to show them to the parents and to the other students at school. Ask other students (not part of the course) to participate with their pictures or presentations.

3. Discussion: The inseparable relation between food, health and sport

The balance between sport, nutrition and healthy habits is the key to a healthy body.

Nutrition is a basic biological necessity of man. Food is necessary for the correct growth and development of the body and for the constant renewal of the substances in the cells and tissues, for increasing the immunity, for preserving the health and the work capacity, for extending the years of creativity. The nutrition needs of children and adolescents are essentially different from those of the adults. The

metabolic processes in a growing organism are more intensive, which is why the nutrients are not only necessary for covering the energy needs, but for an intensive growth and development as well.

Our nutrition pattern very often is unbalanced. We take more than enough food in volume and calorie value, which, however, is poor in proteins, vitamins and minerals. This proves a lack of established nutrition habits.

As we already discussed, cereals are an important source of energy, and wholegrain cereals should be preferred. The physiological needs of vitamins and minerals of the adolescents are higher compared to those of the other age groups, and this relates to their indispensable role as activators of many metabolic processes taking place much more intensively during this period. Nutrition should not only be varied but also regular – 4-5 times in a day. The morning breakfast is particularly important for the students, but it is often omitted, which results in lack of focus, easy fatigue and reduced immunity. Consumption of refined sugar, sugar and chocolate products should be restricted. The consumed food should be processed by healthy culinary technologies: stewing, baking and boiling. Students should reduce the consumption of fried foods: fried potatoes, chips, snacks, etc. The use of iodized salt when cooking various dishes should be restricted. Instead of using salt for food flavoring, use plant spices as: savory, mint, parsley, dill, etc.

Water is vitally necessary for the young organism. Healthy nutrition not only determines the students' healthy growth and development, but also their capacity for work and their successful studies and sports. There is a lot of stress in our everyday life. The unhealthy nutrition can be one of the reasons for the great amount of stress. The accumulated stress can have a negative effect on our health and to contribute to increase of weight.

One of the best ways to control the stress is by regular physical activity. This, combined with rational nutrition, is an efficient means of keeping one's body healthy.

We are presenting herewith several basic principles that you must keep if you aspire to health and good fitness:

1. Breakfast is the most important meal of the day.

This is the most widely known rule for healthy nutrition, but also the most neglected one by most people. We recommend to you to create the habit of taking breakfast every day before you proceed with your daily tasks and activities. Include fresh or dried fruits, yoghurt, nuts or other favorite products of yours.

2. Take at least 1.5 - 2 of water a day.

For athletes water is the number one factor and it is critically important to maintain a high level of hydration of the organism.

3. Before intensive physical training, take carbohydrates with retarded action.

Potatoes, rice and nuts are examples of such foods. Thus, you will be provided with enough energy and stable levels of glucose in the blood that you will need for the sports.

4. If you are actively engaged in sports – add meat to your menu.

Don't forget that meat contains large amounts of zinc, iron, food fats, that are responsible for the cells growth.

5. Don't miss a meal after sporting.

The most suitable foods to take after active sporting are protein bars, tuna fish salad or other foods rich in proteins.

6. Eat at least 4 times a day.

Don't forget that frequent meals speed up metabolism and balance blood sugar. Moreover, there is less possibility to feel hunger throughout the day. The small food portions are recommended and completely sufficient if you take them at least 4 times a day.

3.1. PRACTICAL ACTIVITIES:

- 1) Elaboration of a poster “We practice active sports and healthy nutrition”.

For the facilitator: [Implementing Posters in the Classroom](#)

- 2) Organizing sport games in the open. (relevant for summer schools and ski week travels)

4. Discussion: “Traditional nutrition and health”

Knowing the wisdom of our forefathers is a wealth that gives meaning to our life and brings inner peace. The students might visit the ethnographic museum in the city. The museum team could familiarize them with folk traditions in the field of nutrition and some specific cooking habits during the holidays as well. Healthy nutrition is associated with regular daily meals at approximately equal time intervals. Healthy nutrition should include moderate, but varied in contents and amount food complied with the individual needs.

Determined historically, the different cultures keep different ideas, traditions and manner of cooking, serving and eating of food. These ideas build and shape the notion of different national cuisines, as well as of culinary traditions in a wider sense.

The basic group of foods is of plant origin. Fruits and vegetables are the most valuable ones. The dishes prepared only from vegetables in the traditional Bulgarian cuisine are known as lean and vegetarian.

The second group of foods is of animal origin – a source of proteins – eggs, milk and dairy products. In Bulgarian cuisine, the inclusion of proteins from animal origin (eggs, milk, dairy products) is acceptable for a vegetarian cuisine.

The third group of foods (as nutrients) is the fats. They are divided into fats from animal origin and fats from plant origin. There are animal fats (e.g. lard; and butter – from milk origin), and plant oils (e.g. sunflower oil). Not all plant oils are food products.

Throughout the ages, Bulgarian traditions have imposed periods (fixed short or longer seasonal periods) in which meat was excluded from the meals and that custom is known as “fasting”. These customs are the result of combined rituals - heathen and orthodox religious canons. Such a diet has a healthful effect on the organism.

In terms of the daily meals, the Bulgarians have accepted three types of meals – breakfast, lunch and supper. There can be several breakfasts, the basic one is considered to be the morning breakfast (early or morning breakfast). Lunch is composed of three dishes – entrée (usually something light – soup, salad), the principal dish and the dessert which comes last (usually some sweets, fruit or sweetened product- fruit yoghurt or sweet curds). The supper does not involve serving of soup, except in the cases when it is prepared as a basic dish (usually in winter).

All the great holidays are related with cooking of specific food and gathering of the whole family around the festive table. Here are some examples:

Shrovetide

The Bulgarian holiday Shrovetide also known as the first Sunday before Lent is one of the first spring holidays and its date is not fixed. It is seven weeks before Easter. After Shrovetide, the Great Fasting starts and lasts 49 days and it ends on the greatest Christian holiday – Easter. Shrovetide has its traditional rituals. They are connected first and foremost with the food that is strictly fixed. There should banitsa (cheese pastry), boiled eggs, rice, beans, lentil, dried fruit compote on the table. In the center of the table is served halva – mostly white halva with walnuts or peanuts. The children also try to catch with their mouths a piece of halva hanging on a string without using their hands.

Enyov Day

Enyov Day coincides with summer solstice. It is believed to be the distant beginning of winter – hence the expression: “Enyo slipped on his fur-coat, so there would be snow in winter”. There are many superstitions related to this day – by that day they try to foretell what will be the remaining part of the year.

What is most important about this holiday is that it is believed to be the day when the herbs acquire their healing power and it is the best time to collect and dry the herbs with which they will cure the people for a year ahead and will also be used as food spices. Basically this is the day for collecting herbs related to people’s everyday life.

St. Jordan’s Day (Epiphany)

The third (and last) Christmas Supper is prepared in the eve of St. Jordan’s Day. Only vegetable food dishes are served on the table: beans, stewed cabbage or stuffed cabbage leaves, walnuts, bread (but not of pure wheat flour, but mixed with millet – in honor of the millet – in some regions they also serve corn bread instead of millet). On the table they also light the candle from the second Christmas Supper that did not burn down.

St. George’s Day

St. George’s Day is associated with a traditionally rich table. For the festive table the housewife prepares special ritual bread (“bogovitsa”) on which she models dough figurines of the shepherd and the sheep. Every household slaughters a young lamb in honour of St. George. Before that they place on its head a wreath of flowers that they picked in the morning, and on its left horn they light a candle and read a prayer. They usually slaughter the lamb before the front door and pour the blood in the river or over an ant-hill – for the sheep to multiply like the ants. The lamb’s skin goes as a gift to the church temple. The traditional dish on the festive table is “lamb roasted on a spit” or “lamb’s drob-sarma”. They drink wine and sing songs round the table. After the meals people get up and start to dance a horo (Bulgarian folk dance).

Cooking can be a lot of fun, especially when family and friends are involved. In this way you enjoy cultural foods, while learning on family food traditions through celebrations, cultural foods, and family recipes. At the same time, you avoid highly processed food. This keeps you healthy and you help the environment, because less food of such type is consumed, therefore produced and distributed to your city.

4.1 Practical activities:

- 1) Presentation or video clip – My favorite traditional holiday. Each student or students in small groups prepare a short presentation or clip related to their traditional holiday with special focus on food.

5. Food traditions all over the world

One way to find joy and meaning through food is enjoy cultural foods, not only from Bulgaria, but from other countries as well. In this way you could experience new and varied foods, that is how you will be open to eating and enjoy cooking new and diverse foods.

All nations around the world have their eating etiquette and use specific products most often in their menus. This is related to their geographic location, as well as to the ages-long experience of the peoples in healthy nutrition. We shall now introduce you to some of them.

Traditions around the world helping healthy nutrition

1. India: Spices and large variety of tastes.

About 40% of India's population sticks to vegetarian cuisine and prefers a menu consisting of rice, cereals and legumes, vegetables and bread. Even those who don't give up meat don't forget to eat a lot of vegetable meals.

Of course, Indian nutrition is famous for its spices added to almost all the meals. But piquant food has its advantages too. The chilly pepper, for instance, with its low calorie value and strong taste quality, increases metabolism and helps for fats burning down.

The legume plants (like chick-peas and lentils) contain little fats and more carbohydrates, which makes us feel satiated for a longer time.

According to Ayurveda (a system of care for the health originating from India), the key to satiety is the food that includes the 6 principal flavors: sweet, sour, salty, bitter, piquant, and astringent.

2. France: Eat a little of everything you like!

The secret of the elegant figures of French women is that they enjoy food in small amounts. Although their menu is rich in fats and includes butter, cheeses and red meat, the size of the portions remains very small.

Moreover, the French are well organized with respect to nutrition – they stick to three meals a day and don't eat at the other time, and they turn every meal into a social event. For them lunch is the principal meal and they find time to enjoy the food they take. This helps them to control their weight because:

- The prolonged chewing of the food gives the stomach the possibility to understand that you are satiated;
- When the basic food intake is in the middle of the day, you have enough time to actively burn down the calories swallowed through it.

You should not forget that the French prefer home cooked food and not the semi-finished products.

3. Japan: Start with a soup!

Japan is the country with the lowest percent of obesity of its people on a global scale – less than 5%. The nutrition of the Japanese is natural – it consists of fresh products as rice, vegetables, fresh fish, soya and minimum amount of meat and sugar. They consume varied products (up to 30 types daily) and stick to the saying: “A dish without color is as good as going out naked in the street”. Enriching their dishes with colors (green, yellow and red vegetables) leaves little space for unhealthy products.

Another characteristic habit of the Japanese is that they start the meals with a light soup that satiates them while containing few calories. The studies have shown that those who eat soup take in 100 calories less.

And there is one more rule kept in Japan, which sounds like this: “Leave the table when you feel 80% satiated!”. If you overeat, the stomach extends by 20%, which undermines strongly the control of appetite.

4. Greece: Enjoy the Mediterranean diet!

The Greek or Mediterranean diet has long ago won its name as one of the healthiest worldwide, being especially beneficial for the heart.

The Greeks consume lots of vegetables, fish, chicken, legumes, as well as wholegrain products. This type of nutrition is low in calories and at the same time is rich in flavors. We should not forget the olive oil which is rich in unsaturated fats and is useful for the health.

Similar to the French, our Greek neighbours turn their meal into a real event, sharing their supper with their family and friends, so that they get maximum use of the Mediterranean diet and relax and enjoy their food.

5. Iceland: Don't be stingy with fish!

A man eats about 15 kg fish a year on average. If it seems like a lot to you, compare it with the amount of fish consumed by the real fish lovers – the Islanders – which is about 90 kg a year.

According to nutritionists, a menu containing large amounts of fish helps to control one's weight in different ways:

- fish is rich in eicosapentaenoic and docosahexaenoic acids – irreplaceable fats that block the formation of fats in the body, control appetite, and activate the genes instrumental for fats burn down.

6. Brazil: Eat legumes and rice!

The Brazilian secret for a slim figure lies in the favorite traditional dish of rice and beans. It is low in fats, rich in fibers and proteins; it helps to stabilize blood sugar level and controls appetite.

The dishes of rice and beans reduce the risk of obesity by 14% as compared to the traditional western nutrition.

5.1 Tasks for independent work:

- 1) Find examples for good practices in the food systems of other countries. They may be related to environment friendly production, waste management or any other part of the food system. Discuss whether and how these examples could be implemented in your city system.

6. Discussion: Daily diet

According to all experts in fitness, dietetics and healthy lifestyle, the correct nutrition is the key to good health. It is important to note that this includes not just restrictions as to what we eat and how we cook it, but also when and what amounts we should consume. Nutrition should take place in a nice and peaceful atmosphere, in good mood and without distracting factors.

For the facilitator: The session could start with exercise and presentation on the topic: „How does my day pass“. Students could fill template 6.1. This could be done as a preliminary task at home or as a short exercise in the beginning. After everyone has the templates filled out, the following advices are discussed.

[How to use the task-based learning approach](#)

Advices:

1. Eat something every 3-4 hours. This charges the metabolism, prevents overeating and blood sugar problems.

2. Combine proteins (meat, fish, eggs, beans, nuts, dairy products) with fibers (wholegrain foods, fruits, vegetables) at every meal. When consumed together, these foods take more time to digest than common carbohydrates and you will stay satiated for a longer time.

3. Move more often and drink water regularly. This daily nutrition plan has a wide calories range: (from about 1550 to 2100). If you are physically active, you may choose the upper limit.

And last: even the perfect regimen will not be perfect if you eat the same food over and over again. In order to avoid this problem, as well as many others related to the wrong choice of the type of food and the hour of eating, an hourly schedule for a day is proposed, in which the food is distributed correctly – according to amount and type of food:

For better understanding of the advices the following example is reviewed:

Example

6:30 - 7:00 a.m.: Wake with water

Before tea or any other food, drink a glass of water with lemon juice. While sleeping, the body restrains not only the food, but the water too. Since many vitamins are water-soluble, drinking a glass of water before eating will help the body to absorb better the nutrients of the food. The acidity of the lemon will help for the rebalance of the digestive tract making it alkaline – thus the “good” bacteria in the intestines will be activated for an optimal digestion of the nutrients.

7:00 a.m.: Short gymnastics – it is perfect for activating the energy reserves of the body.

7:30 a.m.: Breakfast

Many nutritionists recommend porridge (oatmeal) for breakfast. It is true that not everybody likes it, but its usefulness is undoubted - the body digests the fibers slowly, i.e. you will not feel hungry for several hours. Add a cup of milk or a hardboiled egg for proteins. Or mix the porridge with some nuts (walnut or almond). Eat also a cup of fruits – they will provide you with the necessary vitamins, antioxidants and more fibers (for instance, a cup of orange juice, rich in vitamin C, folic acid and potassium).

9:00 a.m.: Drink a glass of water

As you know, you must drink a lot of water, but better drink small amounts of water throughout the whole day, than drink a large amount when you suddenly feel great thirst.

10:00 a.m.: Physical activity

During the sport classes or in the schoolyard during the big break

10:30 - 11:00 a.m.: A little snack

Eat every 3 or 4 hours, in order to have energy and to avoid overeating. So as to get fibers and proteins, try an apple, some yellow cheese or a handful of nuts (especially if you haven't had nuts for breakfast) or some yoghurt with small fruits.

Additional advice: Sit while you eat. Eat small bites and try to prolong the snack as much as possible (10 to 15 minutes is perfect). The more you chew, the more nutrients will be assimilated by the body.

11:30 a.m. until noon: Water and movement.

Drink a glass of water, fill it again and drink it up.

13:00 - 13:30 p.m.: Lunch

Start with salad and fish, grilled chicken, turkey meat, beans or lentils.

Additional advice: Eat a slice of wholegrain bread if you want. It is hard to find someone who doesn't like bread.

14:00 p.m.: Water and a stroll

The clean air and sunlight will vitalize and protect you.

15:30 – 16:00 p.m.: Afternoon snack

Almost everybody feels a need of some snack between lunch and the evening meal. For a mixture of fibers and proteins, eat 200 g yoghurt and a handful of some cereal snack with a high content of fibers. Or eat a banana and a spoonful of peanut or almond butter.

Additional advice: Let your appetite lead you – you may need the same type of snack every day. If you have eaten more for lunch, you may need just something small for a snack.

17:00 – 18:00 p.m.: Walk or sports

If you have missed the stroll in the morning, now is the time to compensate. It is recommended to do some intensive physical activity regularly before supper – no matter if it is going for a walk in the garden or elsewhere or training in the fitness hall.

18:30 p.m.: Supper

Start this meal with a soup – in this way you won't eat too much food. It is a good choice to take soups low in fats – e.g. thick soups with vegetables and pasta. Choose a moderate portion for the basic dish, e.g. 100-120 g baked salmon – it provides a dose of the healthful omega-3 fatty acids. Add some stewed vegetables – broccoli or spinach with half a cup of brown rice.

A variant without fish is chicken meatballs (rolled in oat flakes and spices - for more fibers and antioxidants) over a portion of spaghetti. Add half a glass of tomato juice and sprinkle with a handful of nuts.

21:30 p.m.: Time for bed

Try to sleep 8 hours a night. Scientific research shows that insufficient sleep increases the risk of different health problems and leads to lack of focus and fatigue.

In the end of the session, students reflect on what they have learned and what would be a good change in their daily regime.

Tasks for independent work:

- 1) To ask their parents, grandmothers and grandfathers fill in template 6.1 and make suggestions on how their daily regimes might be improved.
- 2) To elaborate a poster on the topic „How do we eat at home and at school“. It might include an overview of the learning group and have parts before and after what they have learned at this course. Another option is to include and interview more students in the school. The poster might be displayed at a suitable space at the school in order to be visible for everyone.

For the facilitator: [Implementing Posters in the Classroom](#)

- 3) Design Challenge: The Ideal Meal - Teachers TryScience, Deliverable 6.1 exercise

7. Food safety along the food system

For the facilitator: [Additional materials An Educator's Guide to Food Safety Material](#)
[Kitchen & Food Safety Lesson Plans](#)

A thing to keep in mind that in order to be healthy we should eat good food and we should pay attention to food safety. Please, remember that everyone plays a role in reducing foodborne bacteria:

- FARM - use good agricultural practices
- PROCESSING - monitor at critical control points
- TRANSPORTATION - use clean vehicles and maintain the cold chain
- RETAIL - follow the food code guidelines
- TABLE - always follow the 4 cs of food safety
 - ✓ Clean
 - ✓ Cook

- ✓ Combat Cross-Contamination
- ✓ Chill

As you see literary everyone along the Farm-to-Table Chain plays a major role in keeping our food safe. If a link in this chain is broken, the safety and integrity of our nation's food supply can be threatened.

There are many places on a farm that can be contaminated by harmful bacteria, so farmers have to make sure that the areas where food is handled are kept clean and at the right temperature. There are many innovations on the farm that help prevent the growth of bacteria — like special areas for washing vegetables, refrigerated storage areas for milk and eggs, and portable sanitation in fields.

Keeping food safe and in good condition as it's shipped across the country or around the world is critical. There are many steps to shipping food safely and there's science behind each step. The cold chain has to be maintained throughout the loading process, in transit, and during receiving. The food is cleaned and precooled as it comes from the field or plant. The cooling extends product life by reducing field heat, rate of ripening, loss of moisture, rate of respiration, and the spread of decay. Proper packaging is selected for the product. The shipping container is cleaned and properly loaded, making sure that the boxes are stacked tightly to lock in the cold during transit. Proper temperature control can be tracked by satellites. Refrigerated containers usually have equipment that automatically records refrigeration system functions and the air temperature inside the container. This information provides a detailed record of refrigeration system performance throughout the trip.

Food is properly stored and cooled at the warehouse.

In any restaurant or place that serves food, cleaning, cooking, combating cross-contamination and chilling are critical. Humans are one of the biggest sources of food contamination in restaurants. So, proper handwashing is critical to keep food safe. For example, contamination can occur when someone doesn't wash his or her hands and then prepares or serves food.

Supermarkets. Receiving areas are maintained at cold temperatures of 5° C or below to maintain the cold chain that started way back in the field. Storage areas and display cases are kept clean and temperature controlled. Food preparation areas are also kept clean, and are set up to avoid cross-contamination. Foods are always separated to avoid cross-contamination. Red meats, fish, and poultry will never be mixed together or mixed with fruits and vegetables.

Even with all the great technology, food can still become contaminated, so it's important for YOU to always be careful about food safety. Once you purchase food and take it home, the responsibility for food safety is literally in your hands. This means to:

- Clean — Wash hands and surfaces often. Wash hands with warm, soapy water, and cutting boards, dishes, utensils, and surfaces with hot, soapy water before and after food preparation.
- Cook — Cook foods to proper temperatures.
- Chill — Refrigerate promptly. Refrigerate or freeze foods quickly because cold temperatures keep harmful bacteria from growing and multiplying. Follow the 2-Hour Rule: Refrigerate or freeze perishables, prepared foods, and leftovers within 2 hours or less.
- Combat Cross-Contamination (Separate) — Keep raw meats, poultry, and seafood — and the juices from raw foods — away from other foods in your shopping cart, on kitchen counters, and in your refrigerator.

After all these steps along the way food is finally at your table. But its journey hasn't ended, because there are always some waste. That is why it is important to know what waste management is. Waste management means the best practice for the waste handling: collection, transportation for re-use, recycling (for recyclable materials) and recovery the organic for energy production for fertilizer, finally the useless waste that cannot be re-used, recycled or recovered should go to a sanitary landfill. If there is poor waste management, that means poor handling, collection, transportation and dumping and this will result in negative impacts on human health and environment.

That is why it is important to know that the most environmentally friendly ways to dispose of trash are to reduce, reuse, recycle and compost. These are several steps in "integrated waste management". This means that you try to reduce the amount of garbage by the first step (reduce) and with what garbage is left, you venture onto the next step (recycle), and so on, until the garbage or waste is all gone. The key is to have barely any waste left when reaching the last step.

7.1 Tasks for independent work:

1. Fill in the steps on the food system template – Template 7.1
 - 1.2 How do you think each part of the food system could be improved in your city?
2. Implement and example CommNet project: Communicating the Bioeconomy, Deliverable 6.1
3. Food and food labels: From food to meals – making choices – SAILS project, Deliverable 6.1

Tempalte 6.1

My Day

1. I get up at...
2. I have breakfast around ... a.m. and usually I eat...
3. After this I ...
4. At school I would have for snack at ...
5. My lunch typically is ...
6. By this time of the day I have drunk ... liters of water.
7. In the afternoon I eat ...
8. Most of the times I have dinner at ... and my meal consists of...
9. Before bed I ...
10. Usually I go to sleep at ...

Template 7.1



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FOOD PRODUCTION

PROCESSING

PACKAGING

LOGISTICS

DISTRIBUTION

HEALTHY PEOPLE

WASTE STREAMS

City Lab Sofia: Specific features of Food System – general template

Specific Features of the Food System

This module was created with the help of researchers in the University of Food Technologies, using materials such as European strategies and national policies. Presentations delivered at the piloting of the training were developed individually by the speakers.



Elaborated originally for the Bulgarian context (see Annexes 1 and 2), this module presents guidelines on how training of a similar nature could be conducted for and with journalists in other countries and settings.

AT A GLANCE

Thematic Area	Food quality, food control, new trends in the food system, e.g. urban farming
Format	One day training
Duration	4 sessions of approximately 1 hour, optional additional time for discussions in the end
Type of audience	Journalists, professionals in the food system
Age group	Adults (18+)
Number of participants	20 to 30
Prerequisites for participation	None
Number of facilitators	4-5
Overall difficulty	Topic: Intermediate Preparation: Intermediate Facilitation: Intermediate

OVERVIEW

The module foresees organizing training for journalists in several steps. First a survey among journalist is done in order to outline topics interesting for them as an audience. And based on them suitable speakers are invited. The training includes presentation of the project and food R&I, presentations, discussion, networking and hands-on exercises. Depending on the different context each City Lab could choose different or modify new exercise(s).

OVERALL AIM
The main aim is to make provide journalists with relevant information on topics they are interested in, communicating with the most suitable specialists, while in the same time support networking between specialists in the food system with journalists.
SPECIFIC (LEARNING) OBJECTIVES
<p>After the successful completion of this module participants are expected to be able to...</p> <ul style="list-style-type: none"> • gain knowledge on topical subjects • assess the reliability of sources of relevant information; • improve their system thinking • begin to conceptualise how their practices could improve the food system in their city • connect with specialists in the food system.
SUGGESTED SCENARIO FOR IMPLEMENTATION
This activity could take place in any conference room as it is in the form of standard training.

TOPICS & COMPETENCES COVERED BY THE ACTIVITY		
Thematic area(s)	National/local food systems In the Bulgarian case, the issues of food quality and control, double standards, urban farming, children’s eating habits, health condition of children at national level, specific foods related to it, food provided to children in state institutions, dangerous lifestyle trends, concerning food.	
FOOD2030 Research & Innovation priorities		
Priority	Indicate whether main or secondary	Addressed through
Circularity & Resource Efficiency		
Innovation & Empowerment of Communities	secondary	Giving opportunity to journalists/citizens to be better informed and more literate, making connections between them and trust worthy sources of information.

Nutrition & Health	main	Principles of food quality and control, better understanding of the “double standard” in foods, better understanding how food affect young people and what are the current trends among them.
Climate & Sustainability	secondary	Giving example how urban farming, which has a lot of traditions in Bulgaria, could actually change and add to a city food system.

(Food) Systems thinking

The module introduces system thinking, encourages the discussion of challenges from the points of view of different actors in the system (e.g. the citizens, policy makers, executive institutions, businesses, including producers) and increased awareness about connections between elements of the system. In this way the participants gain deep and systematic understanding of the topic.




Potential of bringing the arts, socio-economic science and humanities creatively or trans-disciplinarily with the module?


Discussing topical subjects of food system includes discussing socio-economic aspects – such as the factors in the society and economy which lead to the current situation, what socio-economic changes should be made, is empowering citizens enough or other actors should take active participation as well.

TARGET AUDIENCE

Audience category	Professionals/Journalists
Recommended number of participants	30
Recommended age	Adults
Prerequisites	None, though knowledge of and interest in issues concerning food systems is desirable.

OPTIONS FOR MULTI-STAKEHOLDER ENGAGEMENT	
<i>Stakeholder</i>	<i>Role envisaged in the activity</i>
Specialists/researchers/ representatives of a state authority	Leading the activity
Journalists/professionals in the food system	Audience

SETTING UP THE MODULE		
FACILITATION/DELIVERY		
Depending on the type of topics chosen and the presenters could be 3 or 4. It is advisable that one more facilitator opens the training, presents the specialists and moderates the discussions.		
RESOURCES		
<i>Physical materials</i>		
<i>Resource name</i>	<i>Picture</i>	<i>Number</i>
E.g. Sticky notes in 3 different colours		30
Flip Chart board		1
Multimedia equipment		1 set

Writing materials (pen and folders for the audience)		20-30 Depending on the number of journalists attending.
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PREPARING THE SETTING

The activity could take place in any conference room, big enough for the expected audience. The facilitator should make sure that the screen is visible from every seat in the room and all participants could hear well enough the speakers. Depending on the activities selected by each speaker (see detailed script), a flexible setting allowing group work will be necessary.

DETAILED DESCRIPTION OF THE MODULE SCRIPT

Step

Before the event

The first step is to send (short) questionnaires to various journalists and see which food system aspects are curious for them and/or need further explanation and clarification. The Coordinator could include in the survey few examples in order to direct the journalists – topics related to production of fruits and vegetables and what practices should be avoided; supplying more local food; waste management practices in the city. At the same time, organisers can use the opportunity to promote the training being organised.

Another or an additional option is to gather information on which topics are considered interesting and important, both by researchers and specialists and by journalists, through several focus groups meetings.

The next step is to enlist all recommendations, making sure that similar ones are combined into clusters and properly formulated. Having such a list prepared, the themes could be separated in sections in relation to key areas of the food system, for example:

- Production – this section might include different issues related to nitrates, heavy metals, pesticides, GMO, etc.
- Processing – in this category one might include – food preservatives, organic farming, innovative products, labelling.
- Market – themes related with unfair commercial practices, claims for healthy products, food supplements.
- Consumers – topics concerning informed choice (again labels might be discussed), packaging, resource recovery.

Alternatively, one could use a food system scheme to map which actors, sectors or dynamics are relevant for the training.

After identifying the themes of the training, organizers are encouraged to reflect at least two points of view on each issue, for example that of a researcher and of a policy maker or any other party's opinion, which your Lab finds important.

After constructing the content in such a way, the training could be organized in one or two days depending on the number of topics and further discussions with specialists might be organized as well.

When preparing the presentations, ask the speakers to reflect on the topics from the perspective of the whole food system in the city (country), why this issue is important for the system, how it relates to other aspects of the system and how it affects them.

They might also include the following points in their presentations as well, considering the target audience of the training:

- What is the country situation compared to the European practices and context?
- What would be the “news” for the journalists/professionals?

The facilitator could ask the presenters to choose one of the following exercises or propose another, which they think would work best and modify it with the help of facilitator. Also, the facilitator could present an exercise before the beginning of the sessions or during the open discussion.

During the event

In the very beginning of training or during a networking part of the event specialists, presenters, journalists and guests could take part in “speed dating”. All participants make random couples and for one-minute exchange quick information on who they are, what they are interest and what they would like to learn, after one minute all swap and form different couples answering the same questions.

It is advisable to start the training with a presentation on the systemic approach to food systems Research and Innovation and information about the FOOD2030 policy framework and the FIT4FOOD 2030 project.

If an exercise has been foreseen to run throughout the event, it could be introduced by the facilitator at this point.

Each of the training sessions animated by the speaker and the facilitator would include:

- a presentation by a speaker
- a stand-alone exercise(s) chosen by the speaker and co-developed with the facilitator or the chance to work on part of an exercise if it is ongoing throughout the whole day
- time for discussion.

Each part could be approximatively 20 minutes.

Optional exercise 1: Visioning food systems (transformation)²¹ – stand-alone exercise

This exercise aims to develop participants’ understanding of the food system and its

²¹ FIT4FOOD2030 exercises: https://fit4food2030.eu/wp-content/uploads/2019/01/FIT4FOOD2030_D1.1_Toolstraining-for-Setting-Up-a-Transformative-Network.pdf)

elements and to guide them in creating collectively a vision of the desired transformation in order to set the scene for later discussions. Several steps could be foreseen:

- how would the city's food system need to change in the next 10 years to get closer to the Food 2030 priorities;
- what steps it would take to get there;
- how media practices could support those steps;
- what could be their role in future change

An additional step: The facilitator could combine all answers (if on a sticky notes) in clusters. Working backwards from the desired media practices in support of transformation, each group could draw a map or timeline based on them.

Optional exercise 2: The food system and new media practices – throughout the day

A possibility to stimulate deeper reflection on the speakers' contributions is to invite the audience to work on conveying the content using a familiar or a less-than-usual format, e.g. storytelling via a certain platform, or collective storytelling. Possible steps include:

- A media representative with experience in the field could be invited to share their knowledge and practices, needs and challenges regarding this format at the start of the session.
- Journalists attending the event are split in groups and choose a challenge related to food and nutrition security or the food system more generally to work on.
- Throughout the day, 15-20 minutes of each training session are allocated to develop content reflecting the contribution of the speakers to the challenge selected.
- Groups present their work in a plenary session. Depending on the group and outputs, these could be published following the training.
- Ask the speakers to give feedback on the way their topic was reflected upon by the group and what difference it would make for their own (research, policy making, consuming, etc.) practices.

Optional exercise 3: Greater mutual understanding - standalone exercise

Speakers could propose to the journalists an output (produced by one of the other stakeholders represented among the speakers) which is aimed to be used by, and useful to, media representatives. An example could be a press release (N.B. if using a real example, this should be edited so that it is not obvious from which organization it originates). Working in groups, journalists improve it during the training based on their needs. The researchers and professionals in the room could join the groups for this work and present their own perspectives on the document. Mutual understanding of the different positions can be encouraged through guided questions. Based on the changes suggested and participant discussions, recommendations can be drawn up and published.

Optional exercise 5: Building connections

Ask journalists and speakers to make a map how the themes discussed by the presenters connect and what could be done as one measure, which could support several aspects of the food system. Add it to the plan. This could be a continuous process taking place throughout the whole day. The facilitator could use the systemic map prepared by the City Lab Barcelona to map these out.

Optional exercise 4: **Connections revealed** – throughout the training

Ask journalists to take notes during the training and come up with notes on the food system connections that become clear during the presentations, that they were not previously aware of, as well as questions and angles for further investigation. Ask for comments from the speakers.

After the event

It would be useful for the journalists to receive any materials related to the event as soon as possible, including maps, plans and/or summarized future measures participants agreed upon.

It would be beneficial if the facilitator gathers feedback in order to improve the content or the format of the course.

DEVELOPERS

This module was created with the help of researchers in the University of Food Technologies, using materials such as European strategies and national policies. Presentations delivered at the piloting of the training were developed individually by the speakers.

A check for scientific accuracy was done by a professor in University of Food Technologies in Bulgarian and the English language translation was checked by a professional interpreter.

ANNEXES

ANNEX 1: An overview of the training delivered in Sofia City Lab as part of the piloting

I. Event program

- 1) 10.00 – 10.15 – Registration (ongoing coffee break)
- 2) 10.15 – 10.30 - Short welcoming presentation explaining the focus and aim of the project and presenting the speakers and topics
- 3) 10.35 – 11.30 - 1st presentation - Double standards, what are the facts
- 4) 10.30 – 11.30 - 2nd presentation – Eating habits of children, the latest statistics related to food and children's health
- 5) 11.30 – 12.30 – Networking lunch
- 6) 12.30 – 13.30 - 3rd presentation – Urban farming
- 7) 13.30 – 14.30 - 4th presentation – Food quality and control
- 8) 14.30 – 15.00 Open discussion

II. Double standards, what are the facts

- 1) Political campaign
- 2) The meaning of the term – what citizens think it is and what is the definition
- 3) The three most common theses and the consumers desires
- 4) Scientific arguments
- 5) Quality function

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6) Conclusions, results and Brussels official position

III. Healthy nutrition for children

- 1) Eating patterns and nutritional status
- 2) Obesity in children
- 3) Malnutrition
- 4) Relation between diseases and food as a factor in European context
- 5) Statistical information for trends in child's nutrition in Europe with a focus on Bulgaria
- 6) Regulations in Bulgaria and support for their implementation
- 7) Related actions and activities in Bulgaria
- 8) Prevention
- 9) Reliable information and recommendations
- 10) Future steps

IV. Urban farming

- 1) Milan Urban Food Policy Pact
- 2) Definitions for urban farming
- 3) Scheme of the food system
- 4) Business models in urban farming
- 5) Pros and cons
- 6) Examples, Almere case study

V. Food control. The Bulgarian case

- 1) How is it done?
- 2) Is it effective?
- 3) Participants in the food system
- 4) Control throughout the whole system
- 5) Basic terms and definitions
- 6) Competent authorities in EU and Bulgaria
- 7) Types and organization of the official control, methodology
- 8) How does it look in practice?
- 9) Evaluation and recommendations

ANNEX 2 Contents of the information pack prepared as a result of consultations with Bulgarian journalists and researchers

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Beeswax food wrap

This module was created by the employees of Science Centre AHHAA: Kristel Schreiner with help from Pille Randjärv, Elisabeth Parman and Sander Kask. Members of City Lab Tartu were consulted in the development process. Checks for scientific accuracy and English language translation were done by Üllar Kivila.



AT A GLANCE

Thematic Area	Food packaging, food waste,
Format	Hands-on workshop
Duration	45-60 minutes
Type of audience	From primary school to high school
Age group	12-18
Number of participants	10-20
Prerequisites for participation	None
Number of facilitators	1
Overall difficulty	<p>Topic: beginner</p> <p>Preparation: beginner</p> <p>Facilitation: intermediate</p> <p>Handling a large number of kids and hot tools (oven and oven trays) in the room requires lots of attention.</p>

OVERVIEW

Children will make their own piece of beeswax food wrap, which sticks like plastic food wrap does, but is reusable. They will also learn and discuss about different food and general packaging methods and materials, why do we package it and how to prevent unnecessary packaging.

OVERALL AIM

Allow children to see how unnecessary food packaging is bad for our environment, a waste of material and give them a tactile example of how they themselves can make a difference.

SPECIFIC (LEARNING) OBJECTIVES

After the successful completion of this module participants are expected to be able to...

- Understand the extent of producing waste and how much of it is one-time packaging.
- Identify moments when packaging can be avoided.
- Know more about where different materials come from and their properties (plastic and beeswax for example).
- Repeat some simple kitchen cooking techniques that they might not have tried before.
- Make beeswax food wrap.
- Understand why we use food packaging and why plastic wrap is so successful in achieving this goal.

SUGGESTED SCENARIO FOR IMPLEMENTATION

This workshop is created as a science centre / science museum 1 hour workshop that requires participants to be present for the whole duration, from start to finish. Trained facilitators can carry out the workshop multiple times in one day, with different participants.

With the necessary kitchen equipment at hand (an oven), Beeswax Food Wrap workshop could also be facilitated, for example, in a classroom, as part of a science festival or some other science seminar, as a fun hands-on workshop to further engage and energize the participants.

The workshop is considered non-formal education. Connections with the school curriculum can be found and the workshop could be used to exemplify an environmental topic.

TOPICS & COMPETENCES COVERED BY THE ACTIVITY

Thematic area(s)	Food packaging, food waste, the environmental footprint of food systems, food preservation
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FOOD2030 Research & Innovation priorities

<i>Priority</i>	<i>Indicate whether main or secondary</i>	<i>Addressed through</i>
Circularity & Resource Efficiency	main	Presenting, evaluating and discussing different (and bad) methods of packaging. Making a reusable alternative to plastic wrap.
Innovation & Empowerment of Communities		
Nutrition & Health	secondary	Explanation on what happens with food when it is exposed to air and other elements.

Climate & Sustainability	secondary	Making a reusable alternative to plastic wrap.
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Responsible Research and Innovation (RRI)

<i>Related concept</i>	<i>Addressed through</i>
Innovation with and for society	Explanation and presentation of different innovative (and less innovative) materials and methods connected to food packaging and their sustainability.

Research & Innovation (R&I)

<i>Related concept</i>	<i>Addressed through</i>
Research about different packaging materials and how they affect food	Presentation of food preserving methods and their impact.

(Food) Systems thinking

The workshop focuses on an important component of the food system: packaging; and interlinks this component with production, transport, waste management, retail and consumer habits. This facilitates circular economy thinking.

Other competences

<i>Competence</i>	<i>Addressed through</i>
Using kitchen tools	Measuring and applying beeswax, heating beeswax to the right temperature, taking care with hot surfaces and items.

Potential of bringing the arts, socio-economic science and humanities creatively or trans-disciplinarily with the module?

Cutting out and designing (with non-toxic markers) your own reusable beeswax wrap is a form of creative expression.

TARGET AUDIENCE

Audience category	Children and youngster from primary school to high school.
Recommended number of participants	10-20
Recommended age	12-18

	Younger children will need help, because they need to work quickly with hot wax coming from a hot oven, which can be dangerous.
Prerequisites	No prerequisites required.

OPTIONS FOR MULTI-STAKEHOLDER ENGAGEMENT










<i>Stakeholder</i>	<i>Role envisaged in the activity</i>
Shops and markets selling unpackaged food	This workshop could be carried out at an event at or near food shops or markets (often specializing in organic food) that sell unpackaged food, to draw attention to their more sustainable practices and waste management. This would work best during events that target the public. Regular shops are transitioning towards these practices as well (e.g. the ban on small plastic bags), so this workshop could be attractive for them as well.
Waste management, food preservation and materials experts	Scientists or specialists could be brought to the workshop to share their insights on packaging materials and methods and what happens with the waste.

SETTING UP THE MODULE

FACILITATION/DELIVERY

One facilitator is sufficient. It helps if the facilitator has a generally good grasp of different scientific topics and already understands the concepts of over packaging and sustainable packaging, but reading through the extra-information in the facilitation script should be enough to successfully carry out the workshop.

RESOURCES		
<i>Physical materials</i>		
<i>Resource name</i>	<i>Picture</i>	<i>Number</i>
Thin cotton cloth (recycled is the best)		1.5 m ²
Beeswax pellets		0.5 kg
Baking mats (reusable silicone mats are the best, cooking paper works also)		3
Kitchen scales		5
Small bowls		10
Sharp scissors		5
Ruler (at least 25 cm)		5
Pencil		5

Silicone spatula		5
Oven (can be fixed in the room or portable)		1
Oven trays		3
Drying rack		1
Clothes line (a substitute for a drying rack, to be tied between two chairs)		1
Floor cover underneath the drying rack or clothes line (for example a large plastic waste bag, meant to be reused)		1
Printed large pictures of topics and items mentioned in the workshop (such as wax plates being produced by bees, oceanic plastic pollution, growing cotton etc.)		10
Store-bought examples of over packaged products		3
Non-toxic fabric markers		10

Oven mitt		1-2
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Useful links, videos, articles

<http://www.foodsafety.gov/educators/competencies/general/microbiology/mic6.html>

<https://www.weforum.org/agenda/2019/01/most-plastic-packaging-is-unrecycled-that-has-to-change/>

<https://www.dw.com/cda/en/plastic-waste-and-the-recycling-myth/a-45746469>

<https://www.un.org/sustainabledevelopment/blog/2017/04/feature-uns-mission-to-keep-plastics-out-of-oceans-and-marine-life/>

<https://ourworldindata.org/plastic-pollution>

https://en.wikipedia.org/wiki/Plastic_pollution

<https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/beeswax>

<https://superbee.me/beeswax/>

<https://www.beeswaxcandleco.com/wax-removal-tips/>

<https://en.m.wikipedia.org/wiki/Beeswax>

https://www.boredpanda.com/unnecessary-wasteful-packaging/?utm_source=google&utm_medium=organic&utm_campaign=organic

<https://www.youtube.com/watch?v=RS7IzU2VJIQ>

How plastic was seen as a wonder material:

<https://youtu.be/IesIsKMjB4Y?t=356>

Examples of novel materials to be used instead of plastic:

<https://www.cbc.ca/news/canada/montreal/mcgill-researchers-use-lobster-shells-to-make-biodegradable-plastic-1.4920820>

<https://www.lifegate.com/people/lifestyle/muskin-leather-mushrooms>

<https://biotrem.pl/en/>

PREPARING THE SETTING

Set up the room so that participants sit in tables of 4 each, set up chairs accordingly.

It is best if the room has a fixed oven, but if it doesn't then a portable oven has to be set up beforehand.

Set up the drying rack or tie a clothesline between chairs (multiple lines for bigger groups). Put the floor cover underneath the drying area, to protect the floor from potentially dripping beeswax. You will also need put a table near the drying rack, to minimize the length dripping pieces of cloth have to travel. Put spatulas on that table.

Since you will have multiple table groups, it is best if you have the cloth already cut into at least one piece per table. Also, dividing beeswax into smaller containers for each table is useful, but this can be done during the workshop.

It is best to keep the materials participants need during the workshop at a large table at the front of the room.

DETAILED SCRIPT FOR IMPLEMENTATION

Step

2 min

Introduction to the workshop, setting the agenda.

Tell participants that in this workshop participants will take a look at packaging, will get to know more about the concept of overpackaging, about different packaging materials and make their own piece of sustainable packaging – beeswax food wrap, that can be reused many times, unlike the single use plastic food wrap.

10 min

To have participants share their own ideas about food packaging, start with the following questions:

What is the point of food packaging? For example, for store-bought products.
What kind of food is not packaged?

Use the extra information to further explain key ideas behind packaging, as participants touch upon them:

Packaging protects food products (and other products) from going to waste and lets us store or use them for a longer time. Packaging depends on the product, but generally its principles are:

- **Lock nutrients** and ingredients in one place (for example, moisture and aroma compounds could easily leave an unsealed product);
- Control contact with **air** (e.g. meat would rot faster in contact with oxygen, because it enhances microbial growth);
- Regulate **moisture** (keep it in or keep it out);
- Block **organisms** from reaching the product and spoiling the product;
- Block **light** from affecting the food – photodeterioration, which causes chemical reactions in vitamins, pigments, amino acids and fats (for example, storing milk in transparent

bottles under bright supermarket lighting results in a distinct flavor change and loss of vitamins);

- Preserve the **shape** of brittle food items (e.g. chips and cookies);

Furthermore, packaging gives us **information** about the product, its nutrients, usage and safe storage methods and duration. Packaging can also be used to boost the attractiveness of a product (**marketing**).

Show participants store-bought or otherwise acquired real examples of overpackaging one by one and ask:

What is wrong with this example?

What is the reason behind this packaging?

What could be done differently in this example?

What are the downsides of food packaging?

What happens with packages after they are used?

Use the extra information to explain further:

In Estonia, there is an average of **311 kg of unrecycled waste generated each year by each person**. 30% of its mass and 60% of its volume is packaging waste. All of the packaging waste created by the small Estonian nation in one year takes up the space of a three-story building, two football fields in size. In the European Union, Estonia is among the top three plastic packaging waste producers, behind Ireland and Luxembourg (2016).

Waste thrown in the **general bin will not get recycled**. Instead it is put in a landfill or incinerated. These methods can be used for **generating energy** (by utilizing the landfill gas methane, created by microorganisms, or heat generated by incineration), but it is better to have the packaging materials recycled and thus reused (for example, bottles) or downcycled (made into flower pots, fleece cloth, packaging paper etc.).

29 European countries have established a system of **recyclable packaging bins**, where companies pay a fee to finance the collection, sorting and recovery of packaging waste. But of course consumers are the ones paying for this service, as a part of the product price. Recycling has its controversies, such as consumers fail to recycle correctly, packages with mixed materials might still not get recycled, humans still have to sort through the recycled waste and for this waste is sometimes shipped overseas etc.

Packaging is the dominant use of plastics in the world, **accounting to 42% of the plastic use** (second is construction with 19%). In 2016, the global population of 7 billion created more than 300 million tons of plastic in one year, while in 1950s the number was about 1.5 million tons. Much of it **ends up in the oceans**, also as microplastics. Reports show that if this trend would continue, by 2050 our oceans will contain more plastic than fish by weight.

Sustainable packaging, **minimizing single-use plastics** and avoiding unnecessary packaging in the first place is key here. An example is to use beeswax food wrap instead of plastic wrap or a single-use plastic bag.

5 min

Give the groups (or have them come to you and receive the following items):

- one scale each
- groups share of beeswax in a bowl (~100 g)
- measuring bowl
- groups share of cloth
- scissors
- pencils
- fabric markers

With a sample of beeswax on their tables, have the participants touch and smell pellets of beeswax, while you explain what it is.

Beeswax is an **antibacterial, waterproof, malleable** substance that young bees secrete on the bottom of their bodies. Bees eat honey in order to create beeswax, then scrape the beeswax platelets from the bottoms of their bodies, chew them up and build their hives using it. Beeswax has a melting point of 60-65°C and its autoignition temperature is 204°C.

Beeswax is **non-toxic** and safe if ingested, although it wouldn't provide you any nutrients, because our bodies cannot break it down. Beeswax is in fact so stable, that thousands of years old beeswax discovered in pyramids is still the same as beeswax produced today.

10 min

Instruct participants to measure and cut themselves 25 cm x 25 cm pieces of cloth, that they can design using fabric markers. They must add at least a minimal element of design, such as their name, in order to identify their wrap later.

Meanwhile, turn the oven on at 100 degrees Celsius, it will heat for about 8 minutes. Put the baking mats on the oven trays outside of the oven.

10 min

Give the oven trays to groups and instruct the group to measure 20 grams of beeswax per each person. Then they will need to fold their cloth in two, lay it on the tray and sandwich the beeswax between the two layers of their cloth. One group's 4 pieces of cloth should fit all on one tray. Then put the tray in the oven (or let the children do it) for 3-4 minutes. Task the children with measuring time.

As ovens don't have space for many trays, and usually there aren't many trays either, groups will use the trays and get oven-time taking turns.

2 min

Explain the next part, so it goes more smoothly and quickly: once the tray comes out of the oven, it will be placed on a table near the drying rack. Participants must take care with the hot tray and spread their beeswax on their cloth using the spatulas very quickly. The beeswax hardens very rapidly at room temperature within a couple of minutes.

15 min

After 4 minutes have passed (verify visually that the wax is totally molten) invite the corresponding table-group to the table that is set up near the drying rack. Take the tray out using

oven mitts. (The tray is actually not very hot, but it is a precaution.) Place the tray on that table and have them quickly spread the beeswax into the try parts of their cloth.

Then quickly separate the two layers of the folded cloth and hang the pieces on the drying rack. Older participants can hang the cloth by themselves.

Repeat this with each group.

2 min

After a couple of minutes of drying, participants can take their cloth. Allow people to test their food wrap on the bowls that were used in the workshop. Ask them:

What can you use this wrap for?

2 min

Thank the participants for taking part, the workshop is now over. You can let the participants leave now.

Collect the used materials and equipment (you can have participants help you with this), wash anything that became dirty.

Food and Vacuum

This module was created by the employees of Science Centre AHHA: Kristel Schreiner with help from Pille Randjärv, Elisabeth Parman and Sander Kask. Members of City Lab Tartu were consulted in the development process. Checks for scientific accuracy and English language translation were done by Üllar Kivila.



AT A GLANCE

Thematic Area	Food packaging, food preservation
Format	Hands-on workshop
Duration	45-60 minutes
Type of audience	From primary school to high school
Age group	10-18
Number of participants	10-20
Prerequisites for participation	None
Number of facilitators	1
Overall difficulty	Topic: beginner Preparation: beginner Facilitation: beginner

OVERVIEW

Children will make their own vacuum chamber to exemplify vacuum packaging and freeze drying – two methods of food preservation.

OVERALL AIM

Participants will explore phenomena of vacuum first hand. This shows how science and research are an integral part of our food system, and the method of how food will be preserved more and more in the future – freeze drying.

SPECIFIC (LEARNING) OBJECTIVES

After the successful completion of this module participants are expected to be able to...

- Understand better how food is stored and what are the chemical and physical principles behind these methods.

- Make a vacuum chamber.

SUGGESTED SCENARIO FOR IMPLEMENTATION

This workshop is created as a science centre / science museum one-hour workshop that requires participants to be present for the whole duration, from start to finish. Trained facilitators can carry out the workshop multiple times in one day, with different participants.

Food and Vacuum workshop could also easily be facilitated, for example, in a classroom, as part of a science festival or some other science seminar, as a fun hands-on workshop to further engage and energize the participants.

The workshop is considered non-formal education. Connections with the school curriculum can be found and the workshop could be used to exemplify food and physics topics.

TOPICS & COMPETENCES COVERED BY THE ACTIVITY

Thematic area(s)	Food packaging, food preservation
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FOOD2030 Research & Innovation priorities

<i>Priority</i>	<i>Indicate whether main or secondary</i>	<i>Addressed through</i>
Circularity & Resource Efficiency	main	Presentation and explanation of different food packaging methods, and trying them out.
Innovation & Empowerment of Communities	secondary	Explaining the science behind innovative food preservation methods.
Nutrition & Health	secondary	Discussion on why do we even need to preserve and package food – to keep it from becoming harmful to us.
Climate & Sustainability		

Responsible Research and Innovation (RRI)

<i>Related concept</i>	<i>Addressed through</i>
Innovation with and for society	Explanation and presentation of different innovative (and less innovative) methods of food preservation and how science, entrepreneurs and consumers can work together here.

Research & Innovation (R&I)	
<i>Related concept</i>	<i>Addressed through</i>
Science behind the chemistry and physics of food preservation	Presenting the principles of food preservation.
(Food) Systems thinking	
The workshop focuses on a component of the food system: food preservation; and interlinks this component with production, packaging, transport, waste management, retail and consumer habits. This facilitates circular economy thinking.	
Other competences	
<i>Competence</i>	<i>Addressed through</i>
Understanding schematic instructions, finding solutions accordingly	Participants have to make their own vacuum chamber, following a scheme, that doesn't list all of the steps required to produce the outcome, but they have to find the solutions on their own (or as a table-group).
Handcraft, tinkering	The activity involves measuring, cutting, gluing, fitting components together.
Potential of bringing the arts, socio-economic science and humanities creatively or trans-disciplinarily with the module?	
Building the vacuum chamber is partly a design process, but currently the creativity here is quite limited.	

TARGET AUDIENCE	
Audience category	Children and youngster from primary school to high school.
Recommended number of participants	10-20
Recommended age	7-18
Prerequisites	No prerequisites required. However, mixed-age groups can be tricky, because different ages need different explanations in order to understand vacuum. If one would go over it too quickly, young children will not understand vacuum and the experiments will not be interesting.





OPTIONS FOR MULTI-STAKEHOLDER ENGAGEMENT








<i>Stakeholder</i>	<i>Role envisaged in the activity</i>
Nutrition and food preservation experts	Scientists or specialists could be brought to the workshop to share their insights on food preservation methods.
Physics educators	Teachers, educators, tutors etc. can use this activity to tie together physics topics and food topics. Vacuum chamber is useful to observe space-vacuum related phenomena as well.

SETTING UP THE MODULE

FACILITATION/DELIVERY

One facilitator is enough. Basic general background knowledge about physics and chemistry helps.

RESOURCES		
<i>Physical materials</i>		
<i>Resource name</i>	<i>Picture</i>	<i>Number</i>
Glass jars		20
Lids with 5 mm holes drilled into them		20
Pieces of transparent hose (40 cm each) (5 mm diameter) Link		20
Plastic syringe (5 mm diameter for the opening) Link		20
Small aquarium one-way valves (5 mm connection diameter) Link		40
T-connectors for hoses (5 mm connection diameter) Link		20
Ruler		5

Scissors		5
Tape		5
Adhesive putty		3 packs
Small balloons (water balloons work well)		10
Pack of freeze-dried products (such as strawberries)		1
A pack of marshmallows		1
Schematic for making a vacuum jar	See Annex 1	5
Mini grip bags		10
Useful links, videos, articles		
https://www.sciencedirect.com/topics/food-science/food-preservation		

<http://ecoursesonline.iasri.res.in/mod/page/view.php?id=1706>

<https://www.sciencedirect.com/topics/food-science/active-packaging>

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5868547/>

<https://www.foodqualityandsafety.com/article/containing-food-waste-food-storage/?singlepage=1>

<https://www.unenvironment.org/regions/north-america/regional-initiatives/minimizing-food-waste>

<http://www.fao.org/food-loss-and-food-waste/en/>

<http://www.euro.who.int/en/health-topics/disease-prevention/food-safety/news/news/2015/12/more-than-23-million-people-in-the-who-european-region-fall-ill-from-unsafe-food-every-year/presentation-the-global-burden-of-foodborne-diseases-results-for-action>

<http://www.euro.who.int/en/health-topics/disease-prevention/food-safety/news/news/2015/12/more-than-23-million-people-in-the-who-european-region-fall-ill-from-unsafe-food-every-year>

<https://foodinsight.org/the-benefits-of-preservatives-in-our-food/>

<https://www.triplepundit.com/story/2015/preservatives-good-bad-and-essential/57276>

<https://www.thekitchennyc.com/the-history-behind-the-modern-vacuum-sealer/>

https://en.wikipedia.org/wiki/Vacuum_packing

https://en.wikipedia.org/wiki/Modified_atmosphere

<https://www.newfoodmagazine.com/article/36664/vacuum-packaging-food-waste/>

<https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/vacuum-packaging>

<https://www.greenbiz.com/article/reducing-food-waste-could-dramatically-cut-ghg-emissions>

http://www.fao.org/fileadmin/templates/nr/sustainability_pathways/docs/FWF_and_climate_change.pdf

<https://en.wikipedia.org/wiki/Freeze-drying>

<http://www.madehow.com/Volume-2/Freeze-Dried-Food.html>

<https://harvestright.com/blog/2017/how-to-store-freeze-dried-food/>

<https://harvestright.com/>

PREPARING THE SETTING

Set the room so that all participants can be divided into groups of 4. Each group has their own table and chairs.

It is best to keep the materials participants need during the workshop at a large table at the front of the room.

DETAILED SCRIPT GUIDELINES

Step

1 min

Introduction and setting the agenda. Tell the people that in this workshop all of the participants will make their own vacuum pump, test it out and learn how it connects with food preservation.

10 min

Start with asking participants questions and let them express different opinions about:

How is food preserved?

How long can different food be preserved?

Why do we need to preserve food?

How would it be possible to store and preserve food for as short time as possible? What would be the benefits? What would be negative about it?

What are the causes of food deterioration? (i.e. the things you need to protect food from when preserving it.)

If possible, write down on the whiteboard (as people name the causes), what are the causes of food deterioration (and add the missing ones):

- Growth and activities of **microorganisms**, mainly bacteria, yeasts and moulds (this can lead to contamination or production of toxic compounds in food, which is dangerous for humans);
- **Temperature**, both heat and cold (low temperatures are used to slow down biological and chemical deterioration of food);
- **Moisture** and dryness (water is a good breeding ground for microbes);
- **Air** and in particular **oxygen** (oxygen helps microorganisms grow and facilitates chemical breakdown of nutrients, such as lipids);
- **Light** (photodeterioration, which causes chemical reactions in vitamins, pigments, amino acids and fats);
- **Time** (deterioration can generally be slowed down, but not stopped);
- Activities of **natural food enzymes** (for example peeled apples becoming brown quickly);

- Insects, **parasites** and rodents;

Use the extra information to add key facts to the answers participants give:

United Nations estimates that **one third of the food produced globally is lost** or wasted, either thrown away after a meal or the food gets bad and inedible during transport or preservation. Also, 23 million people in Europe annually fall ill from eating **contaminated food**. In United States that number is 48 million, one in six people, every year. World Health Organization notes that malnourished people are more vulnerable to foodborne diseases and households suffering from famine rarely discard contaminated food.

It is evident that although **sourcing our fresh food locally** is the best way to minimize our ecological footprint (less packaging, transport, cooling etc.), preserving food correctly while it reaches the hungry millions is very important. Packaging and different food preservation methods help here.

Use of **preservative ingredients** helps fight off microbes, but preservatives have their own effects on health, taste and other properties of food. For example sugar and salt are known natural preservatives often added to food as well (jams and beef jerky), but they are not healthy in their own right. However, modern packaging and other methods can alleviate the need of using any preservatives and food processing.

Intelligent packaging (IP) helps to monitor the safety of food. A simple widespread example of IP is the use of barcodes to identify food and its properties. A more futuristic example is the use of **time-temperature indicators** or oxygen indicators in packaging. Time-temperature indicators show how long food has been stored and how long it has been in favorable or unfavorable conditions. The active ingredients in the indicators change color slowly in cold or frozen conditions, and more rapidly in warmer conditions, indicating (more precisely than best-before dates) if the food is safe to eat or not. These solutions have found commercial use in USA, Japan and Australia, but Europe is lagging behind because of strict regulations of food-contact materials that can't keep up with technological innovations.

Vacuum packaging – pumping out the air prior to sealing the food in plastic – helps to preserve food 3-5 times longer, because air and oxygen is removed from the product, which inhibits the growth of microorganisms and inhibits oxidation processes. It also locks components of food (aroma components, nutrients) in one place, prevents contamination, preserves the level of moisture, reduces packaging volume and fixes food in a certain position (good for displaying food in a retail store).

Examples of how long food can be preserved without and with vacuum packaging:

- Bread – 2 days in room temperature, 8 days vacuum packaged in room temperature;
- Coffee, nuts, pasta – 120 days in dry conditions in room temperature, 360 days vacuum packaged in room temperature;
- Raw meat – 2-3 days in a refrigerator, 6-9 days vacuum packaged in a refrigerator.

Modified Atmosphere Packaging (MAP) is a similar popular technique, where air is also evacuated from the package, but is then replaced with another air mixture, usually lacking in oxygen and containing high levels of CO₂ or inert nitrogen. The effects are basically the same as vacuum packaging, but the resulting package is larger.

The history of vacuum packaging goes back to World War II, when allied soldiers used evacuated latex bags were used to help preserve frozen food. Commercial use started in 1940s and plastic packaging became preferred.

The plastic used in vacuum packaging can be used only once. This is the controversial and **wasteful** aspect of this method, but it does prevent food loss. Developing world experiences food loss because of inadequate preservation and packaging techniques (before the food arrives at the market), while developed world does not have this problem, instead uneaten food is thrown away at supermarkets and at homes. **It is debatable, which is more harmful for the environment:** the production and waste management of single use plastics used in vacuum packaging or the production and waste management of un-vacuum-packaged food that is lost.

Greenhouse gas (GHG) footprint produced by food waste is calculated by adding up the footprints of all the steps in the production process of wasted food – growing, producing fertilizers, transport, refrigeration etc. Wasted food also usually ends up in landfills, where it produces a potent GHG methane. This adds up to **4.4 billion tons** of CO₂ equivalent GHG emissions annually in the world, caused by food waste. If food waste were a country, it would rank third in GHG emissions, behind China and USA. Food waste has almost the same GHG footprint as global road transportation.

As food is wasted in the final stages of the food cycle in the developed world (as opposed to production, storage and transportation in the developing world), **developed world is accountable** for a larger part of the GHG emissions of food waste, because more energy and resources are used up by the time our food is wasted.

2 min

Give each table (or have them come over and pick up) a schematic for building a vacuum pump, tape, half a pack of adhesive putty, scissors, ruler, and for each person:

- a jar
- a lid
- a syringe
- 40 cm hose
- a T-connector
- 2 one-way valves

15 min

Instruct everybody to make their own vacuum chamber by reading the schematic and using their available tools. Have group members help each other and walk around and help them, as necessary.

The common mistake that people might make is putting valves on the wrong way. Adhesive putty and tape are necessary to seal the hole in the jar lid.

10 min

When participants are nearing completion, hand two balloons per group. Instruct them to blow the balloons a little and close them (water balloons have a suitably limited size) and see what happens.

Let them try to explain (and fill in the blanks): **Why the balloon increases in size when air is pumped out of the vacuum chamber?**

Vacuum is the absence of air and other materials inside a space. Air pressure is absent inside a perfect vacuum, however the vacuum in our chamber is not perfect, thus some air molecules and low air pressure remains.

Air balloon (and also marshmallows and for example shaving foam) has air trapped inside an elastic container. The large pressure inside the balloon gives a filled balloon its shape and size (by inducing more force upon the elastic material), but **atmospheric pressure still acts upon the balloon, limiting its size**. If we lower the pressure (inside our vacuum chamber) our balloon can take a larger form, because the pressure inside the balloon is not counteracted by the atmospheric pressure.

5 min

Hand participants marshmallows to try out in their vacuum pumps as well.

Hand each table a couple of mini grip bags and have them try to seal something of their own choice inside the bag, using the vacuum pump. It is a two-person job. They will have to remove the hose from the jar lid, but they will have to remove it in a next step anyway.

10 min

Coming back to freeze drying, explain how vacuum pumps are used for freeze drying. It is time to bring out the freeze-dried products and have participants taste them.

Ask participants, **how this fruit tastes like and how does it differ from fresh fruit?**

Freeze drying is a food preservation method that consists of the following steps:

- 1) Freeze all the water content inside the food;
- 2) Place the food in (near-)vacuum;
- 3) Heat the food (can be up to 38 °C);
- 4) Ice sublimates directly into water vapor, collect the vapor by letting it condense on a cold surface;
- 5) (For best possible storing conditions, break the vacuum with an inert gas and package your product.)

This method results in food that will have **empty space where ice crystals used to be**, thus

maintains its form and can be easily rehydrated. The nutritional content, flavors and smells generally **remain unchanged**, unlike canning or regular dehydration. Freeze dried products can be stored in **room temperature** and they are **very light**, as they are missing all of their original water content (for example, 90% of the mass of fruits can be water). The dehydration also prevents the growth of **microbes**.

Hermetically sealed freeze dried products can be stored **up to 25 years**. A simple container in room temperature, like a cookie jar, can safely store such products for a couple of months. Contact with air (and more precisely water vapor inside the air) will gradually rehydrate freeze dried food.

Because of its light weight and ease of storage, freeze dried food is **great for astronauts, military combatants, campers** and to stock **bomb shelters**. But all of freeze drying benefits are useful for regular food preservation as well and could see use in a wider extent in the future.

The main drawback currently is the **cost of freeze drying**, as it is a technologically difficult process. Home freeze dryers are available for 2000-3000 euros, but commercial freeze drying is done in special rooms and complexes. Nevertheless, proponents of freeze drying imagine that large supermarkets could all use freeze drying rooms, to prevent food loss by applying it on products nearing the end of their shelf life, effectively stopping the spoiling process.

2 min

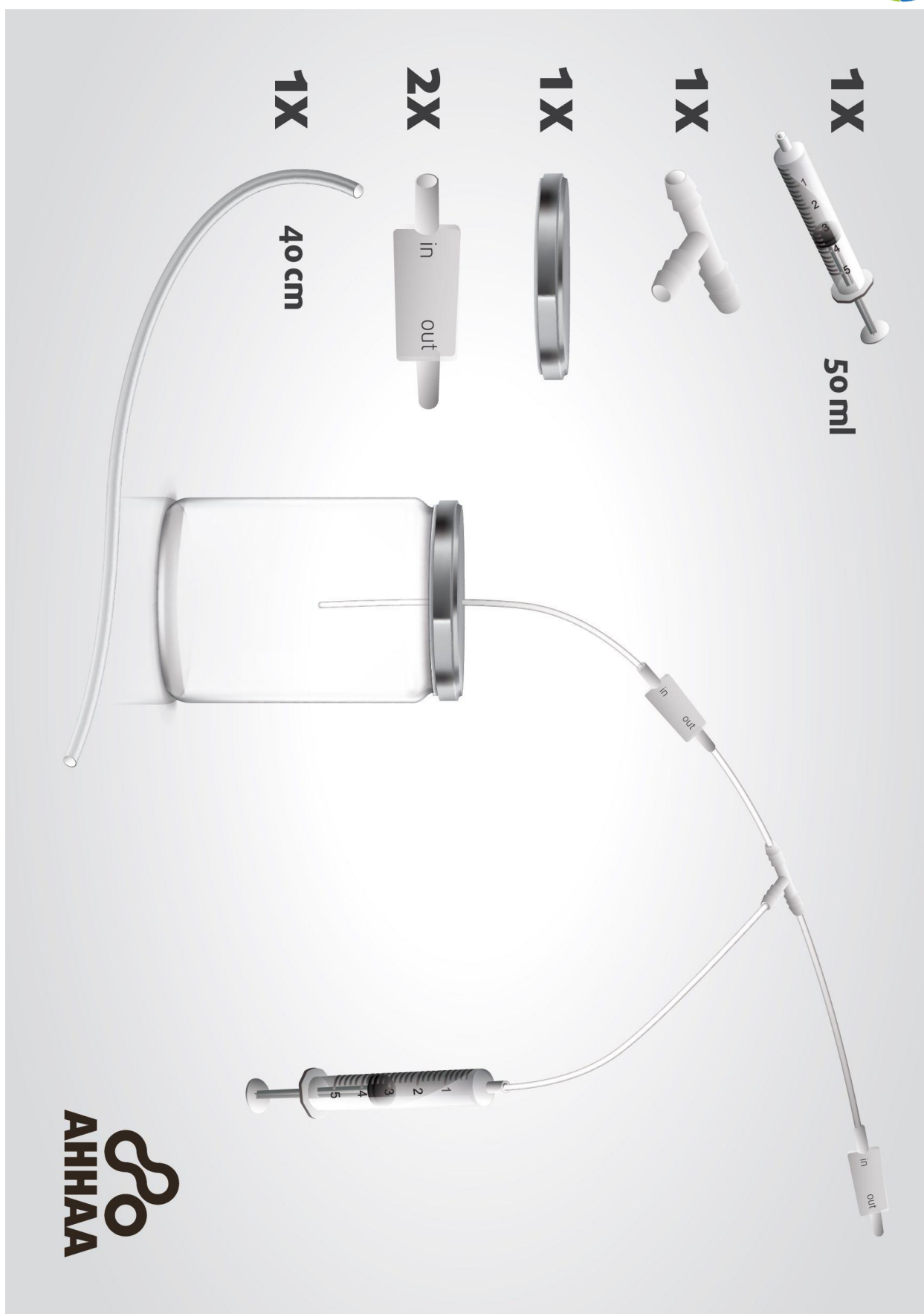
Thank the participants for attending! Let them keep their vacuum pump systems, if they desire, but the jars with lids will stay in the facilitator's possession, for future workshops.

Encourage participants to continue experimenting with their vacuum pump at home, by repurposing an old jar and making a hole in the lid (possibly with parents' help). Shaving cream gives out excellent results in a vacuum chamber as well.

Remove the adhesive materials from the vacuum pumps and take them apart to reuse in future workshops.

ANNEXES

ANNEX 1: Schematic for making a DIY vacuum chamber



City Lab Tartu: Food and Vacuum – extra – Activity Guide and Teacher Guide

TASK

Build a vacuum chamber to explore the effect of pressure changes.

VACUUM CHAMBER

The maximum length of a straw you can use to suck water from a well 3'4" at. Beyond that the vacuum in our mouth will not be enough. Theoretically, it is possible to pump water up to 10.3 m high using a vacuum, before the water column pressure overpowers the air pressure and even a full vacuum would not get further.

Mold and bacteria cannot reproduce in an oxygen-deprived environment, therefore vacuum packaging is a good option to preserve food. By placing frozen food in a special type of vacuum chamber, it is possible to transform ice crystals in food directly into gas. The result is water-free freeze-dried food, which has the original taste and texture. Since freeze-dried food can be stored for decades, it can also help prevent food waste and be used more widely in the future.

IDEAS

How does the placement of air valves affect air movement?
What can you do to prevent air leaks and air moving back to the jar?
What can you do to make your jar as airtight as possible?

BUILDING

Build a vacuum chamber and test the device with a small inflated balloon.

TRY AGAIN

How can you remove the air from the syringe without disconnecting it?

DISCUSSION

Why does the volume of foam, balloons and marshmallows increase while pumping air out of the jar?

SUMMARY

Describe the effect of air pressure changes on shaving foam, marshmallows and sound. Did the decreased pressure effect food preservation?

EKSPERIMENT I

Explore, how does the change of pressure affect shaving foam, marshmallows and sound.

EKSPERIMENT II

During two weeks, observe, what happens to food placed in the vacuum chamber. Try this experiment for example with a piece of bread, fruit or a biscuit. As a control experiment observe the same food in regular air conditions.

DISCUSSION

Are there any similarities between our lungs and the balloon placed in the vacuum chamber?

DISCUSSION

Why does the volume of foam, balloons and marshmallows increase while pumping air out of the jar?

When pressure increases, for example while diving, dissolution of nitrogen and other gases in the blood improves. As pressure decreases, the solubility of gas is reduced and gas builds up in bubbles. If the pressure declines rapidly, lungs cannot remove bubbles fast enough and the diver gets decompression sickness.

Very low atmospheric pressures can make saliva in the mouth boil, but not blood or other body liquids (as sometimes shown in sci-fi movies), because cells and body's internal environment can maintain the required pressure.

Pressure is the force applied perpendicular to a surface divided by its area.

$$P = \frac{F}{S}$$

P = pressure, F = force, S = AREA.

A pressure gauge is used to measure pressure in liquids and gases.

Atmospheric pressure at sea level is: 1 atm (atmosphere) = 101325 Pa (Pascal) = 1,013 bar = 760 mmHg (millimetres of mercury).

Atmospheric pressure at sea level varies between 870 - 1085 mbar. Pressure decreases by half for every 5.54 km of height.

Sound cannot travel through a vacuum, because there is no air or other molecules to transfer sound vibrations.

Air valve (in/out) allows air to move only in one direction.

This material was developed using co-funding by European Union's Horizon 2020 programme under grant agreement No 774088. Authors: Kristel Schreiner, Kõle Randjärv, Sander Kask, Ülar Kivila, Heian Järvpõld, Elisabeth Parman, Andres Kuura.

VACUUM CHAMBER

Task

Draw a sketch of your vacuum chamber design and modify it later if necessary.

Observation

What are the factors affecting the reliability and quality of a device? How can the device be improved?

Table

Observe the effect of pressure changes on different objects. Write the results in a table below.

Object	Brief description of the test result, estimated measurement results
Shaving foam	
Marshmallow	
Slightly inflated balloon	
Buzzer	

Discussion

What indicates that there is not a vacuum in the device, only a reduced pressure instead?

Vacuum packaging and shelf life

Based on your previous knowledge, explain whether you think the food is better preserved in the air or in the vacuum chamber you built.

Observation

During 2 weeks, on 8 different days, observe two sets of food, first one placed in the vacuum chamber and the second one under normal air conditions. Write down your observations.

Day	Normal air (control test)	Inside the vacuum chamber
Day ...		
Day ...		
Day ...		
Day ...		
Day ...		
Day ...		
Day ...		

Discussion

Were the results expected? How can you explain the results?

Observation

You took a bottle of water with you on a mountain trip, cranked all of the water at an altitude of 3000 meters and put a closed bottle back in the bag. What happens to the closed empty water bottle 60 m above the sea level and why?

Could a similar change occur even if the altitude would not change? ☐ Yes ☐ No

KEYWORDS FOR ONLINE SEARCH

Pressure, vacuum, pressure gauge, mold, vacuum packaging, barometer, manometer, phase diagram, freeze drying, mmHg to Pa, smart packaging, modified atmosphere packaging

Vacuum Chamber



Duration

45 min

+ 2 weeks observation



Related topics



What you need (for each group)

- 0,5 l Jar
 - 40 cm Silicone tube
 - 2 pcs Air valve
 - 1pc 50 ml Syringe
 - T-connector
 - Insulating tape or adhesive pads
 - Scissors
 - Marshmallow
 - Balloon
 - Buzzer and a suitable battery
 - Shaving foam (or similar) (1 can per class)
 - Piece of fruit or other food
 - Ruler
- Optional:**
- Small disposable plastic cups for foam
 - Freeze- dried berries/ fruits for tasting
 - Rubber gloves
 - Pressure gauge



Instructions

The task of the participants is to build a vacuum pump (one per each group).

There are several ways to build a working vacuum pump. One of them is shown on the additional page of this teacher guide. If the participants do not have any ideas how to start, they can be directed towards that solution.

The vacuum chamber can also be built simply by attaching the syringe to the lid of the jar using a silicone tube, but it does not allow all of the air to be removed from the jar. This would require a system that, on the one hand would remove air from the jar, but on the other hand, wouldn't let it go back to the system. A suitable tool for that purpose is a T-connector which has three branches. Air valves should be attached so that one of them prevents the air from going back into jar and the other allows the air to leave the system (diagram on the additional page). A well-sealed jar gives the best results. Insulating tape or adhesive pads are good for sealing.

The pressure gauge helps to determine the change in pressure. Place it in the jar while testing. It is more convenient to put shaving foam in a cup before you put it in the jar. The volume of materials filled with gas increases when the pressure in the jar is reduced as the gas inside them begins to expand. Sounds become quieter as air pressure decreases. No sound is transmitted in a full vacuum.

The devices built by our participants do not reach a full vacuum because the system will have some leaks and the pump itself is not powerful enough. The presence of air is indicated by the balloon not retaining its size (swells and pulls back), the sound of the buzzer and also the jar remaining intact. Vacuum chambers that are used in science laboratories are made of materials that withstand high pressure and temperature changes.

By looking at the water status diagram (figure 1), you can discuss with participants if their vacuum chamber could be improved so that it could also be used for freeze-drying.



Explanation

Pressure gauge is used to measure the pressure while pumping tires, barometer is a device that measures atmospheric pressure, meteorologists use the unit millibars in weather forecasts.

As liquids and gases are not structured as solid bodies, the pressure that is exerted on them is carried equally in every direction.

Breathing is possible due to pressure changes in our lungs. During inhaling, the diaphragm contracts, the thoracic cavity expands and the lungs expand. **Negative pressure** created in the lungs allows air from outside to enter the trachea and flow into lungs. As we exhale, the diaphragm relaxes, reduces space in the chest and pushes air out of the lungs.

A vacuum is a state when there is no substance (including air and other gases) in a space. An approximate vacuum fills the whole universe. Due to the lack of pressure in a vacuum, there is no resistance to moving bodies.

Astronauts wear pressurized suits in outer space. An unprotected living being can withstand a vacuum environment without losing consciousness for about 15 to 20 seconds, assuming they have exhaled deeply. The widely popular belief that the human body will explode in a vacuum is not true because the skin and cell walls are strong enough to prevent the bodily fluids from boiling and tissues from swelling. Studies and animal experiments have shown that even an unconscious human can endure vacuum for one minute without any damage to the body or the brain.

Freeze-drying technology was developed by NASA scientists to make bringing food into space easier. Freeze-dried food is first frozen, then it is placed in a vacuum chamber that has a heated bottom. The aim is to reach the pressure and temperature at which ice sublimates (goes directly from solid to gaseous state; see figure 1). The extracted water vapor is caught on pipes that are cooled down to -80°C .

This method allows preserves up to 98% of the nutritional value and the food tastes and smells as it did before. All food can be freeze-dried: berries, vegetables, fruits, mushrooms, herbs, meat, seafood etc. Although the volume of the food stays the same, 70 to 90 percent of its weight is lost. Depending on packaging, the shelf-life of freeze-dried food can be up to 25 years. Freeze-dried food is considered raw food because the process takes place at temperatures below 40°C . Freeze-drying is a great solution to prevent food from spoiling in grocery stores, although the best way to prevent food wasting is to consume locally produced food, because a considerable amount of food spoils during transportation.

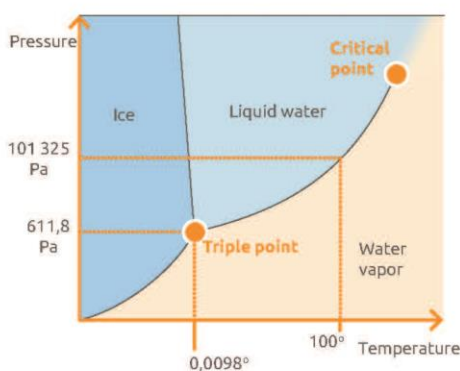


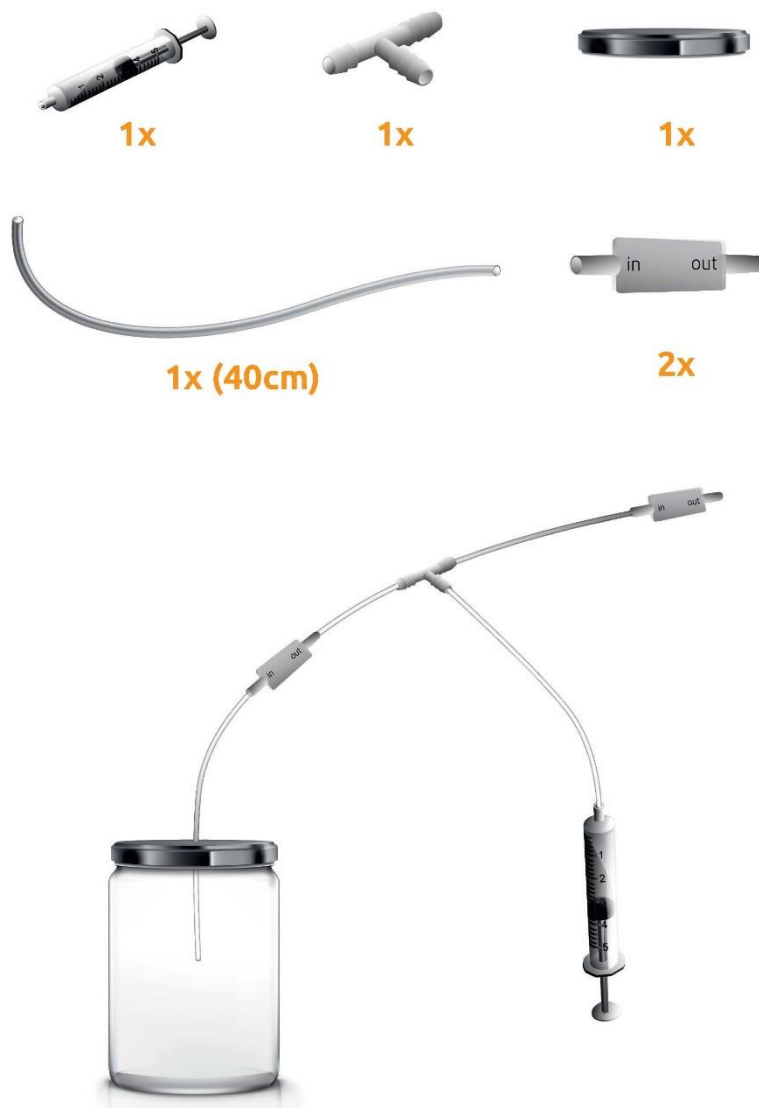
Figure 1. Water phase diagram

Freeze-dried food should be kept at a constant temperature, be protected from sunlight and the package should also keep moisture away. Package however does not always guarantee food freshness, because even packaged food can get spoiled when kept under wrong conditions. Therefore, scientists are working on "smart labels" that react to even small temperature or chemical compound changes. If any difference occurs, smart label changes its color.



Keywords for online search:

Pressure, vacuum, pressure gauge, mold, vacuum packaging, barometer, vacuum meter, phase diagram, freeze-drying, mmHg to Pa, smart packaging



This material was developed using co-funding by European Union's Horizon 2020 programme under grant agreement No 774088.



Taste Alternative Protein!

This module was created by the employees of Science Centre AHHAA: Kristel Schreiner with help from Pille Randjärv, Elisabeth Parman and Sander Kask. Members of City Lab Tartu were consulted in the development process. Checks for scientific accuracy and English language translation were done by Üllar Kivila.



AT A GLANCE

Thematic Area	Sustainable (and healthy) food and nutrition
Format	Hands-on workshop
Duration	75 minutes
Type of audience	From primary school to high school
Age group	7-18
Number of participants	Maximum 20 (divided into groups of 4), no lower limit
Prerequisites for participation	None (however, basic understanding of nutritional components helps)
Number of facilitators	1
Overall difficulty	<p>Topic: beginner</p> <p>Preparation: beginner</p> <p>Facilitation: intermediate</p> <p>Handling a large number of kids and hot stoves in the room requires lots of attention.</p>

OVERVIEW

Children will make their own seitan patties from wheat flour, which is a fun tactile activity. This culminates with the final tasting of their own product and tasting of protein-rich insects. Also, discussion about nutrition -> protein -> meat and its alternatives will be instigated among the participants.

The environmental impact and low sustainability of producing meat will be presented to the participants as well.

OVERALL AIM

The goal of this workshop is to have children think and express ideas and experience new possibilities about food, and more precisely, the protein content in their food.

Within the setting of current information overload, it is easy to develop conflicting, polarizing and misinformed views about what we eat or should eat. Children should know what are the motivators behind different meatless (or less meaty) diets, what is the scientific consensus about diverse nutrition, and get an experiential introduction into food (protein) sources that they might not have thought fondly of before – to broaden their horizons, to better understand our changing world and to become more fit for the future.

However, it is essential for this workshop not to feel like top-down propaganda. This is why inter-participant discussion is used to get different ideas and viewpoints on the table. Scientific information will focus on the scientific consensus and not dwell on ethical questions of slaughtering animals.

SPECIFIC (LEARNING) OBJECTIVES

After the successful completion of this module participants are expected to be able to...

- Know why do we need protein in our food and what are the different options of getting it.
- Know about the environmental footprint of production of different protein sources.
- Articulate opinions about and analyze their own preferred source of protein.
- Cook a vegetarian “alternative meat” meal, widening their perspective on such possibilities.

SUGGESTED SCENARIO FOR IMPLEMENTATION

This workshop can be facilitated in many different settings. It is created as a science centre / science museum 1 hour workshop, that requires participants to be present for the whole duration, from start to finish. Trained facilitators can carry out the workshop multiple times in one day, with different participants.

With the necessary cooking equipment at hand, Taste Alternative Protein! workshop could also be facilitated, for example, in a classroom, as part of a science festival or some other science seminar, as a fun hands-on workshop to further engage and energize the participants.

The workshop is considered non-formal education, but implementing it with the right students at the right time, it could be connected with school curriculum as well.

TOPICS & COMPETENCES COVERED BY THE ACTIVITY

Thematic area(s)

Nutrition, health, taste. Also climate and the food system and alternative systems surrounding production of meat and other protein-rich food.

FOOD2030 Research & Innovation priorities		
Priority	Indicate whether main or secondary	Addressed through
Circularity & Resource Efficiency		
Innovation & Empowerment of Communities		
Nutrition & Health	Main	Presenting, making, testing and discussing different protein sources.
Climate & Sustainability	Secondary	Presenting and discussing information about the climate footprint of meat production.
Responsible Research and Innovation (RRI)		
Related concept	Addressed through	
Balance and connection between consumption habits, food culture, health suggestions, food industry and research necessary to support/dispute different views and to offer attractive alternatives.	Open discussion of different viewpoints.	
Research & Innovation (R&I)		
Related concept	Addressed through	
Research about nutritional needs and how different diets cover them, and different innovative food examples of the future.	Answers to questions about how plant-based diets can be nutritionally sound. Presenting future (and current) venues of food research and innovation, with the option to taste one of them – insects.	
(Food) Systems thinking		
Presentation of information and discussion on how our food affects the natural environment of the world, and what pressures our cultural and dietary preferences lay on the world (growing population, sustainable nutrition, land, energy and water needs required to grow animals and crops etc.). The actual eating cooking and eating process, health, climate footprint and the relevant scientific analysis behind them all are interlinked in this workshop.		
Other competences		
Competence	Addressed through	

Cooking competence	The assignment of making seitan patties.
Articulation of personal viewpoints	Asking questions from participants about different diets, what they know and how they feel about them, forming a discussion that gets as many different views on the table as possible.
Potential of bringing the arts, socio-economic science and humanities creatively or trans-disciplinarily with the module?	
Some of the information and discussion revolves around socio-economic aspects of protein-rich food. Choosing the shapes for their seitan patties and choosing the flavoring is a creative process.	

TARGET AUDIENCE

Audience category	Children and youngster from primary school to high school.
Recommended number of participants	15-20
Recommended age	7-18
Prerequisites	No prerequisites required, prior knowledge of nutritional components in food can help.

OPTIONS FOR MULTI-STAKEHOLDER ENGAGEMENT

<i>Stakeholder</i>	<i>Role envisaged in the activity</i>
Restaurant manager	This workshop could be carried out at a restaurant/cafeteria specializing in vegetarian food, as a one-off special event. Restaurants already have the necessary equipment and the infrastructure to clean everything efficiently after the workshop.
Cooking teachers, nutritionists, dietary experts	These specialists can be brought to the workshop to share their insights on what participants are currently doing, and help facilitate discussion or answer questions of the participants.





SETTING UP THE MODULE

FACILITATION/DELIVERY

One facilitator is sufficient. Facilitator should have a generally good grasp of different scientific topics, but most importantly, good grasp of the topic of nutrition. For a person that has a generally wide perspective on scientific topics and open mind, reading through the extra-information in the facilitation script should be enough to successfully carry out the workshop.

RESOURCES		
<i>Physical materials</i>		
<i>Resource name</i>	<i>Picture</i>	<i>Number</i>
Big photos exemplifying protein-rich foods, such as beef, chicken, pork, eggs, milk-products, beans, lentils, insects, fish, nuts etc.		10
Large infographic showing protein content in food		5
Large bowls		5
Pots		5 (can be shared, so 2 large pots might be enough)
Pans		5 (can be shared, so 2 large pans might be enough)
Sieves		5
Stoves		5 (can be shared, so 2 might be enough)
Spatulas		5 (can be shared, so 2 might be enough)

Measuring cups		5
Tap water		25 liters
Electric kettle (optional, but makes boiling water quicker)		1
Wheat flour		1 kg
Seasoning, spices, salt		5 different resealable packets is enough for variety
Soy sauce		1 small bottle
Dried edible insects		1 small pack
Paper towels to wipe hands, or preferably running water and fabric towels		1 pack of paper towels

Plates		5
Forks		20
Cutlery knife		5 (can be shared, so 1 could be enough)
Cooking oil		1 bottle (small bottle is enough)

Useful links, videos, articles

Online search keywords: protein, essential amino acids, vegetarian source of protein, seitan, insect protein, gluten intolerance etc.

Highly recommended short videos by Kurzgesagt:

<https://youtu.be/NxvQPzrg2Wg>

<https://youtu.be/8PmM6SUn7Es>

<https://www.healthline.com/nutrition/meat-good-or-bad#section12>

<https://www.youtube.com/watch?v=2pPwwU1N9hM>

<https://www.sciencedirect.com/science/article/pii/S0960982213004181>

https://www.sciencedaily.com/releases/2018/12/181206114729.htm?utm_medium=cpc&utm_campaign=ScienceDaily_TMD_1&utm_source=TMD

<https://www.vegansociety.com/go-vegan/definition-veganism>

<https://nypost.com/2016/08/04/selfish-vegans-are-ruining-the-environment/>

<http://www.fao.org/news/story/en/item/197623/icode/>

<https://www.healthline.com/nutrition/how-much-protein-per-day>

<https://www.medicalnewstoday.com/articles/321474.php>

<https://www.ahajournals.org/doi/pdf/10.1161/01.CIR.0000018905.97677.1F>

<https://www.vegansociety.com/resources/nutrition-and-health/nutrients>

<https://www.forbes.com/sites/quora/2016/12/23/how-humans-evolved-to-be-natural-omnivores/#4ed55acb7af5>

<https://www.health.harvard.edu/staying-healthy/the-hidden-dangers-of-protein-powders>

https://waterfootprint.org/media/downloads/Hoekstra-2012-Water-Meat-Dairy_1.pdf

https://en.wikipedia.org/wiki/Environmental_impact_of_meat_production

https://en.wikipedia.org/wiki/Feed_conversion_ratio

<https://en.wikipedia.org/wiki/Entomophagy>

<https://en.wikipedia.org/wiki/Protein>

https://en.wikipedia.org/wiki/Gluten-related_disorders

<https://www.health.harvard.edu/blog/going-gluten-free-just-because-heres-what-you-need-to-know-201302205916>

Soots, A. (2018). Health from Food. (Tervis toidust, in Estonian.)

PREPARING THE SETTING

The room should have as many tables as there will be groups making seitan patties together. If there are 20 people, then there should be 5 tables. 4 chairs around each table. Participants will mostly work by these tables.

If the stove in the room is fixed in a location, then this location will be used for boiling and frying, with participants moving around a bit when they get to those parts. Otherwise table-top stoves can be put on the tables as well. They can be put later on in the workshop or before the start. Extension cords are probably necessary for tabletop stoves, but these should be hidden as much as possible, because spilling water on extension cords can pose a danger!

It could be useful to keep all of the stoves in one location, to minimize the use of extension cords and potential confusion, that rises when everybody is doing everything everywhere. It is best to keep the materials participants need during the workshop at a large table at the front of the room.

DETAILED SCRIPT FOR IMPLEMENTATION

Step

5 min

Before starting the workshop, have people wash their hands. Guide early arrivers already to go wash their hands.

Welcome and introduction, dividing into groups of 4 if they are not already. Tell the participants that in this workshop they are going to learn what's up with these alternative meatless foods popping up these days, and make and taste some of them.

10 min

Quick round of questions on who eats or does not eat meat and why. Try to get answers from each table and add extra information to the discussion. Segway from talk on protein source into the next activity – cooking an alternative protein source.

Questions to ask participants (and extra information):

Raise your hand who over here eats meat?

Raise your hand who doesn't eat meat?

5% of the world population are vegetarians and less than 1% are vegans. This differs by country, for example 30% of Indians are vegetarian, often for religious reasons.

How do you call people who don't eat meat?

Vegetarians don't eat meat, chicken or fish, but they can eat eggs and dairy products. Vegans don't eat any of those. There are numerous different versions of these diets, for example:

Lacto vegetarianism (includes dairy products but not eggs)

Ovo vegetarianism (includes eggs)

Raw veganism (food is not cooked past 48°C)

Some vegans don't eat honey, because it hurts insects, but some do.

Do you know any people who don't eat meat?

Why don't these people eat meat?

Empathy for animals is the most reported reason – vegetarians **don't want animals to be killed** for their food. If regular vegetarians are happy with milking cows and collecting eggs from chickens, then vegans don't tolerate that either. The definition of veganism is "a way of living that seeks to exclude all forms of exploitation of animals for food, clothing or any other purpose."

Animals that are grown not only for consumption, but also for their milk and eggs, are often living in **very difficult conditions**, regarding space, sunlight, nutrition, diseases and abundant antibiotics to combat them etc.

However, this ethical question does not fall within the scope of this workshop, as it is difficult or impossible to translate personal moral views into scientific facts. Participants can, of course, express their views on this topic and you can ask others if they agree or disagree, and why, but the focus should remain on nutrition, health and environment.

Health benefits – vegetarians who also eat eggs and milk-products, are consistently shown to have **less cardiovascular diseases**, diabetes and obesity, a lower blood lipid count, lower blood pressure and **longer lifetime**.

These benefits come from the facts that plant food usually has **lower energy content** (less obesity), lots of fiber (helps regulate the digestive system) and is a less processed food (more

vitamins and antioxidants). But it should be noted, that “junk food vegetarians” (and vegans) also exist, who might eat, for example, large amounts of greasy fries. The quality of vegetarian food still matters.

Environmental reasons – Growing animals for food leaves a very large global environmental footprint. At any moment there are the following amounts of animals being grown for food: **23 billion chicken, 1.5 billion cows, a billion pigs and a billion sheep**. 83% of farmland is used to feed animals, as food crops or grazing lands. That is 26% of Earth’s total land area. Thus meat and dairy production accounts for 27% of global fresh water consumption. **18-58% of the greenhouse gases** created by humans are a product of the meat industry (depending on the calculation method and inclusion of deforestation, food loss, transportation etc.)

These numbers are high, because animals **don’t convert their food into muscle that efficiently**, much of their nutrition is used in their bodies to keep the animals alive. **Feed conversion ratio (FCR)** is used to measure how well animals convert the food they eat into the desired output (flesh, milk or eggs). A FCR of 7 means that 7 kg of animal feed are used to create 1 kg of flesh. The FCR numbers for different animals are:

Cow: 7

Pig: 4

Chicken: 2

Fish: 1

Crickets: 1

Note that these results vary wildly according to different sources. The FCR for cows could be as high as 25 kg of feed per kg of meat, and the freshwater footprint of a kg of beef could be as high as 15000 liters.

Different estimations show that our planet could support billions of more people if we simply ate the plants that we feed to animals. However, not all land that is used to feed animals (such as grazing land) can be used to efficiently grow edible plants for humans. Thus **a totally vegan world would not be the most environmentally sustainable**, instead growing animals for food in moderation would be the most sustainable way.

Why do other people eat meat?

Because it is considered **tasty and nutritious**. Meat is an excellent source of **protein, vitamin B12**, iron and also other vitamins and minerals. Proteins are essential building blocks of the body and they take part in all bodily functions. A **deficiency of protein leads to lowered muscle mass, stunted growth and development**, weaker immune system and impaired nervous system, among other things. Overconsumption of protein burdens our livers, but is mostly not harmful (unless overconsumption happens for extended periods).

But **meat is also rich in fat and salts**, which we shouldn’t eat so much of, and diets rich in meat have been linked with cardiovascular disease and cancer, according to many studies.

Early humans evolved to be drawn towards food that is **sweet, fatty and salty**, because such ingredients gave us necessary energy and minerals that were otherwise scarce. Other omnivores lick salty rocks when their bodies need minerals as well, but humans rely on sweating to release excess heat, so we have an even higher need for salty minerals.

At the modern times of abundance, however, it is **easy to eat too much of the things we like**, such as sweet, fatty and salty things. Couple that with the excessive environmental footprint of growing meat, and the fact that we can get our necessary protein from other sources, like vegetarians do and as participants are going to learn in this workshop, choosing to eat less meat should be logical.

Throwing garbage on the ground or in the nature is comfortable, yet we don't do it (at least we shouldn't!). Leaving electric lights on and music playing when we leave home is convenient, but we don't do it either. The same mindset should be adopted when considering our consumption of meat.

Cutting back on our unsustainable meat consumption and replacing it with alternative protein is one of the **goals of European Food 2030 strategy** and Fit4Food2030 project.

2 min

Instruct teams to come and take necessary items, and then return to their seat, and explain what each item is for.

At first, teams will need to take:

- A large bowl – for mixing the dough together;
- Flour and water – the basic ingredients of our experiment;
- A measuring cup – to measure the ingredients;
- A sieve – for washing the starch out of the dough;

7 min

Instruct teams to measure flour (1.5 cups) and water (0.5 cups) and to make the dough – mix the ingredients slowly and knead the dough thoroughly. Tell them to choose who does what, and how, and mention that there will be other important steps as well. Then let them work.

10 min

When the dough is ready, let it sit for 5-10 minutes. This is discussion time. Go deeper with the questions:

How often do participants eat meat?

The average Estonian eats about 50% more meat than is recommended – 78.5 kg per year (half of it is pork). That is equivalent to the meat content of 5 McDonalds cheeseburgers every day. In the past 5 years, Estonian meat consumption has risen by 15% and it is 10 kg more per year than the European average.

Estonian National Health Institute recommends to eat about 100g of meat per day. This recommendation includes fish and eggs. Fish is the most recommended out of these, followed by chicken and eggs. It is also noted that you don't have to eat these types of protein-rich foods every day, but in that case you should replace them with legumes and grain.

It is recommended to eat at least 0.8 grams of protein per kilogram of body weight. For an 80 kg adult that is 64 grams of protein. If you are training or growing, then you need more. But eating more than 1.6 g or 2.2 g of protein per kg of bodyweight doesn't add any more benefits.

Have they tried other sources of protein? How do they like their taste?

Introduce different sources of protein with images and protein-content chart. Ask:

Is something surprising in the protein chart?

If participants have not mentioned lack of certain essential nutrients in vegetarian food, then ask them about this:

Is it true that plant-based food lacks some of the key building blocks (nutrients) our bodies need?

What have you heard about this?

The protein that is so vital to our bodies, is made up of amino acids. Our bodies can create and recombine many amino acids, but there are the types that need to be obtained with food – our bodies cannot synthesize them. These are called **essential amino acids**.

It is a longstanding belief that only animal protein gives us all the essential amino acids, but this is not true. Meat has all of the essential amino acids and plants often miss some of them indeed, but **a mix of legumes and grains gives humans all of the different amino acids they need**.

However vitamin **B12 needs to be added** by food supplements or fortified food, because plant-based food doesn't have it. Deficiency of B12 leads to anemia and damage to the nervous system.

Plant-based diets can have low numbers of some other key nutrients, such as **vitamin D, calcium, iron** and some others (and some that are not researched so well yet, such as cholesterol and carnitine). Deficiencies of these ingredients can lead to serious health problems, but these deficiencies also rise among meat-eaters. **Eating diverse is key** for both plant-based and meat-based diets. Furthermore, lack of these nutrients affect our bodies differently. Some people, for example in case of low iron in their diet, will then absorb iron better. The best way to determine what your body needs, is to undertake a metabolic analysis (by giving a sample of blood or urine etc.).

Estonian health specialists **don't recommend a totally vegan diet**. Vegetarian diet, however, includes milk products and eggs and thus leads to more balanced nutritional intake. A balanced and **healthy vegan diet is certainly possible with conscious planning and perhaps food supplements, but it is safer to be an omnivore**.

Humans are **omnivores**, which is evident from the fact that our bodies don't create all of the nutrients we need. Cows, for example, create their vitamin B12 using bacteria in their gut. But being an intelligent omnivore in the modern era means that we can choose what we eat – a vegan diet is possible, so is a meat-only diet, but both of those need some added supplements.

A counterargument for meat-only diet is that carnivorous humans would need **vitamin C supplements**. Most animals create their own vitamin C, but humans, apes and monkeys, for example, cannot. Not to mention that carnivores would have to eat organs too, not only meat

tissue, to get a wider spectrum of nutritional intake. Thus we were evolved to eat both plants and animals.

5 min

During the discussion once you get to insects, offer participants to taste them. (This can also be done at a later part, when the seitan patties are boiling.) Ask participants:

How do you like the taste, texture etc.?

What does the taste resemble?

Insects are seen as a possible future food source, rich in protein and other nutrients. They need a lot **less resources** (feed, area, water, energy) to grow compared to animals and reach their full size in a matter of **weeks**. Insects are then freeze-dried or ground to make flour, which will be used to make different types of food.

In fact, only Europeans and North-Americans don't eat insects, but different kinds of worms, beetles, crickets, grasshoppers, cockroaches etc. have been eaten elsewhere in the world for thousands of years. The Food and Agriculture Organization of the United Nations lists around **2000 species of edible insects** and estimates that there are **2 billion insect consumers worldwide**. Insect farms have been set up in Europe and in the United States, in an effort to introduce this type of food here as well.

But even westerners eat bugs already, without knowing it. Chocolate, coffee and wheat grain contains **parts of insects**, with the largest amount actually in beer hops that are used to make beer – 25000 bugs per 100 grams. (But these insects are aphids that measure only a maximum of a couple of mm.)

10 min

When the dough is ready, instruct participants to wash the starch out of the dough. Tell them what will remain – stringy protein named gluten, that is supposed to have a texture similar to meat.

In the background, put the electric kettle on, to make boiling water in the next step faster. Fill the electric kettle to its limit and boil it.

Gluten is the stringy and sticky protein in wheat flour. It is **insoluble**, which means that other parts of wheat flour (mostly soluble starch – a carbohydrate used for energy) can be washed away, leaving only gluten behind. Different flours have different gluten content. Corn and buckwheat flour have none, but wheat flour can have 9%-80% gluten. When flour is made into dough, then the amount of gluten determines its baking properties – low gluten is good for crumbly cakes, but high gluten makes elastic bread.

Gluten, which as a dish also goes by the Japanese name **seitan**, is cooked before eating. The first time this ingredient is documented comes from the **6th century China** where Buddhist practitioners ate it as a substitute for meat. It is still popular in Asia, similar to soy-based tofu.

As gluten/seitan is a protein, the dish consists of almost **only protein** and water. It is a good protein source, but it is **not a complete protein** (it lacks other essential amino acids). You cannot survive eating seitan alone, but you should eat a variety of food anyway.

Not all people can eat gluten, however, because they have **gluten intolerance**. This includes the well-researched **coeliac disease**, which affects the small intestine and gradually makes absorbing nutrients more difficult, as a reaction to ingesting gluten. However more and more people self-diagnose gluten intolerance and report that they feel better if they cut gluten from their diet.

Estonian nutritional recommendations **suggest to not completely cut out food groups** from of your diet, such as wheat. This would raise the risk of having a deficiency of key nutrients. More research is required to understand completely whether it is gluten that can cause harm or some other factors, such as high consumption of wheat-based products.

Specialists are currently divided between **two opposing sides**:

Some say that gluten is **harmless**, the self-reported cases are *nocebo* (the negative opposite of *placebo*), you shouldn't follow trends based on little research and instead save money by not buying expensive gluten-free products;

Others believe that if the components of gluten are not digested completely, they will **form toxic substances**, and that even though bread has been eaten for thousands of years, modern wheat is genetically different (because of selective breeding) and can have abnormal side effects.

5 min

Once the flour is washed, instruct participants to start boiling the seitan patty. It will boil for about 5 minutes, until the patty rises to the top.

Boiling can be done at their tables or at the designated stove-area. Boiling needs to be overseen from time to time, but other than that it is hands-off.

5 min

Once the seitan patty has risen to the top, instruct teams to put their patty on their plate and add seasoning to it. Participants can experiment how they like – choose as much or as little flavoring as they want, different kinds, and also cut their patty into pieces, or not. Tip – they require quite a lot of seasoning. Marinating would be ideal, but quickly sprinkling spices, salt and/or soy sauce works good enough.

5 min

Instruct teams to fry their seasoned patty for a short while, from each side, to make it brown and crunchy.

10 min

Once the seitan patty is fried, let the participants put it on their shared plate, cut it (or let them cut it) and let them taste it! Encourage participants to share and test the results of other groups. Ask questions:

How does your seitan taste like?

How is the texture?

Is it similar to meat or not?

Should it be similar to meat or not?

Encourage participants to share and test the results of other groups.

1 min

Once finished, thank the participants for participating, let them leave the workshop and clean up after them. You can also ask participants help you clean.

ANNEXES

ANNEX 1: Table of food items and their protein content.

Protein content in finished foods

Source: Food composition database (tka.nutridata.ee/en)

**Foodstuffs
(ready to eat)
protein per 100g**

1. Beef	31g
2. Chicken fillet	29g
3. Peanuts	27g
4. Pork	24g
5. Salmon fillet	23g
6. Sunflower seeds	23g
7. Peanut butter	23g
8. Seitan	22g
9. Shrimps	21g
10. Grasshoppers	20g
11. Curd cheese	17g
12. Egg	13g
13. Beans	9g
14. Lentils	8g
15. Tofu	8g
16. Bread	7g
17. Milk	3g
18. Pasta	3g
19. Mushrooms	3g
20. Cauliflower	2g
21. Tomato	1g



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AHHAA



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City Lab Tartu: Taste Alternative Protein! – extra – Activity Guide and Teacher Guide

SEITAN - MEATLESS PATTY

Estonians eat on average 215 g of meat per person daily, which is more than twice the recommended maximum of 100 g. Long-term over-consumption of fat, protein and salt burdens our liver, kidneys and heart. In Asia people also eat for example seitan instead of meat. Nuts, legumes and insects are also excellent sources of protein. Lowering our meat consumption would lower our environmental footprint, as at least a fifth of all human-emitted greenhouse gases comes from livestock production.

TASK

Find out, how seitan is affected by:

- kneading duration;
- the time the dough ball rests;
- number of washes;
- boiling duration.

PLANNING

Remember to change only one variable in order to get reliable results. Decide which team will do the control experiment.

How many seitan patties should each team prepare?

Are there any other variables that can affect the properties of seitan?

CONTROL EXPERIMENT

1 MAKING THE DOUGH BALL
For one seitan patty mix 75 ml flour and 25 ml water. Knead until the dough doesn't stick to hands anymore. Let the ball rest for 15 minutes. Wash the ball with cold water until the rinsed water is more or less transparent. 1 wash = 1 l water. Dough ball can crumble during washing. Press the pieces back into a ball.

2 IDENTIFYING STARCH
Put 50 ml of the final rinsing water into a glass. Add 5 drops of iodine solution. Compare your solution with the other teams and order the glasses by their starch content.

3 POST-PROCESSING
Form the resulting spongy mass into patties (thinner patties are easier to fry) and boil them for 3 extra minutes after rising to the surface. Make sure that the patties can move freely in the boiling water. Season with soy sauce and/or spices and finally fry them in a bit of oil until they are golden brown.

EXPERIMENT

Do the experiment by changing one variable and keeping the other variables as they are. Use 50 ml of the final rinsing water to identify starch content. Write down how long did you knead and how long did you let the dough rest, how many times you washed and how long did you boil.

RESULTS

Sort the fried patties according to the variable that you studied. Cut the patties so that everybody could taste different ones. Evaluate the results according to: taste, texture, similarity to a meat product.

A diet that eliminates entire food groups should still include as diverse foods as possible. Vegans should pay extra attention to vitamin B12 that our bodies don't produce on their own.

CONCLUSION

How are the properties of seitan affected by:

- kneading duration;
- the time the dough ball rests;
- number of washes;
- boiling duration;
- seasoning.

ADDITIONAL INFORMATION

Seitan is a meat substitute made out of gluten, a wheat protein. Starch must be removed from the flour in order to make seitan.

100 grams of seitan has the same total amount of protein as 100 g of fish.

Flour type numbers indicate the remaining bran content. A larger number indicates a larger bran content and darker flour. For example type 495 flour is suitable for baking sponge cake and type 512 flour, which is high on nutrient and low on energy contents, is good for whole wheat bread.

A - Gliadin

B - Glutenin

↓ mixing + kneading

C - Gluten (gliadin+glutenin)

Proteins unravel, gluten network is formed.

Wheat has the most gluten, rye and barley have less and oat has the least.

Write down how long did you knead the dough, let the dough rest, how many times you washed and how long did you boil.

83% of agricultural land is used to grow food for animals, which is 25% of the surface area of Earth.

Estonian agronomist Mikael Pii proved in the 20th century that you can grow sufficient quality wheat in Estonia by breeding his own varieties.

Seitan is not suitable for gluten intolerants. Some burners are hot. Hands are covered with microbes. Water dropped in hot oil makes it splash around. A balanced diet is required to get all of the essential amino acids and other nutrients.

SEITAN - MEATLESS PATTY

What kind of variables will most likely make seitan denser?

☐ Longer kneading ☐ Letting the dough rest longer ☐ More thorough washing ☐ Longer boiling

Are there any other variables that can affect the properties of seitan?

Fill the table with planned and actual durations for each step.

Variable	Kneading (min)		Washing (min)		Resting (min)		Boiling (min)	
	Planned	Actual	Planned	Actual	Planned	Actual	Planned	Actual
Control test					15		5	
Test/Team 1								
Test/Team 2								
Test/Team 3								
Test/Team 4								

Mark the cell that has the variable that your team is going to study.

Write down the results of the taste test. Think about how will you evaluate the results. What kind of scale will you use? What are the outermost values of the scale?

Quality	Taste	Texture	Similarity to meat
Control test			
Test/Team 1			
Test/Team 2			
Test/Team 3			
Test/Team 4			

Best tasting seitan was Seitan most similar to meat was

The softest seitan was The toughest seitan was

The most was

Connect the pairs

<p>If you boil seitan longer...</p> <p>If you knead seitan less...</p> <p>If the dough rests longer...</p> <p>If you wash the dough less...</p>	<ul style="list-style-type: none"> • ... your seitan will be denser. • ... your seitan will be softer. • ... your seitan will be softer. • ... your seitan will be denser.
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How to promote the formation of gluten?

How much protein does your final seitan contain, if you presume that you didn't wash out any of the proteins? (look at the package for more info)

Why is protein-rich flour more suitable for making airy bread and why can you find gluten in many bread products?

It is recommended to get 10-20% of your daily energy intake through proteins. How many grams of protein should you eat, if your daily energy requirement is 2000 kcal? (1 g of protein is approximately 4 kcal)

Choose the right amount of diverse protein sources for a three day menu.

Day 1	Day 2	Day 3

Which health problems are linked to eating too much meat? Which are linked to eating only plants?

KEYWORDS FOR ONLINE SEARCH

Celiac disease, gluten, seitan, biomolecules, plant-based protein, edible insects, WHO (World Health Organisation), FAO (Food and Agriculture Organization)



Seitan - Meatless Patty



Duration

90 min



Related topics

BIOMOLECULES PROTEIN SOURCES

COOKING NUTRITION

GREENHOUSE GASES AGRICULTURE

THERMAL FOOD PROCESSING

GENETIC
PREDISPOSITION
TO DISEASE GRAIN FOODS



What you need (for each group)

- 300 g Wheat flour (durum flour, if possible)
- 1-3 packs Spices (low sodium, if possible)
- 30 ml Iodine solution (enough for whole class)
- 1-2 tk Measuring cup (100-200 ml) or spoon for measuring 150 and 50 ml
- 2 pcs Small bowl (for seasoning boiled seitan)
- Small bottle of soy sauce
- Bowl (2-3l)
- Large measuring cup (1l)
- Oil for frying
- Kitchen burner
- Boiling pot
- Frying pan
- Spatula
- Plates, forks, knives for serving



Instructions

The goal is to show that every meal doesn't need to include animal protein and that there are different protein sources available. The task of the participants is to find out how is seitan affected by:

- kneading duration;
- the time the dough ball rests;
- number of washes;
- boiling duration.

Since there are 5 different experiments (including the control group) it is good to divide participants into 5 teams - one team performs the control test and 4 teams study the effect of a variable. There could also be more teams with some teams experimenting with new or combined variables. In order to better divide seitan patties for evaluation, each team could make as many patties as there are teams, e.g. 5 patties for 5 teams. Note that the recipe on the Activity Card is meant for one seitan patty. The patties can later be cut into smaller pieces, one for each team member.

Thinner seitan patties cook better and faster. People with celiac disease (or other forms of wheat allergies) should not eat seitan, of course.



Figure 1. The more starch there is in the solution, the darker it will become through reactions with iodine compounds.

To see if seitan contains starch or not, drop 5 drops of iodine solution into a small sample of the final dough-washing water. Order the test solutions by their starch content.

Lighter color indicates lower amount of starch in seitan.



Explanation

Seitan consists of the protein gluten (Latin for “glue”) which is a mixture of other wheat proteins. The formation of a gluten network is **promoted by**:

- **Kneading** (proteins that form gluten have a higher chance of positioning next to each other)
- **Resting** (dough has to rest, because network formation takes time)

The formation of gluten is **hindered by** additives in the dough, such as **starch** (or milk or oil). These will stop gliadin and glutenin (proteins) from making bonds.

It is sufficient to boil seitan for 5 minutes (after it has risen to the water surface). Longer boiling duration will make seitan denser.

Protein/gluten content is an important characteristic of flour. The properties of gluten will determine the properties of the dough made from that flour. Gluten swells up in contact with liquids and, with the help of gases emitted during rising and baking of dough, forms a strong and porous wireframe. These proteins also give baked goods their rigid form and dense crust.

Dough made of flour with a lower protein content rises less. Protein-rich flour (over 12%) is used to bake fluffy bread and pizza. Shortcrust pastry and sponge cakes use flour with a lower protein content (5-9%). A medium protein content (~10%) is suitable for most home-baked pastry.

In addition to protein content in food, the amino acid content of those proteins is also important. Our bodies are unable to construct some of the necessary amino acids and we must get them from food. These can be easily obtained from meat, but also from plants, if your menu is varied. Vegans should also take supplements or foods fortified with vitamin B12, which is important for our nervous system. Vitamin D, calcium and iron should also be noted, as they are more readily available in animal-based food, however these deficiencies plague omnivores as well, whose menu is very one-sided.

Starch is an organic substance that acts as the glucose reserve of plants¹. Adding iodine into starch solution makes the starch molecules twist around iodine ions which forms a dark blue compound (Figure 2).



Figure 2. Starch molecule chain twists around iodine ions, which changes the color of the solution.

Insects (e.g. fly larvae, crickets and mealworms) are a sustainable alternative to usual animal protein. Their production doesn't require large land areas, but instead needs the right humidity and temperature (in the range of 22-30 °C).

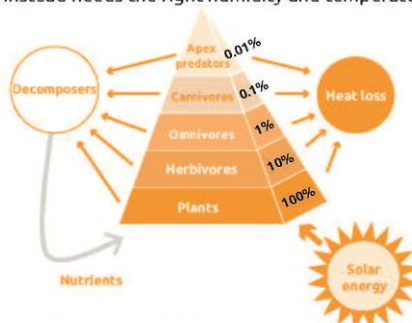


Figure 3. Ecological pyramid

Unlike regular livestock, insects reach their maximum weight within a few weeks. Once ready for consumption, insects are either freeze dried or ground into insect flour. One product, such as a patty, an energy bar or a pack of pasta, could require hundreds or even thousands of insects. Their nutritional value is high, 400-500 kcal per 100g.

If you don't count Europeans or North-Americans, humans have actually always eaten bugs. In fact, we have insects in our Western diets even now, for example in chocolate, coffee and grains. The largest amount of insects (tiny aphids) is in the hops that go straight into beer production.

The agricultural land that is used to grow animal feed could be used to directly produce food for humans. Raising animals requires additional drinking water, releases methane and could pollute the soil and water. Every level of the ecological pyramid captures about 10% of the energy available in the previous level (Figure 3.), the rest is dissipated as heat.



Keywords for online search:

Celiac disease, gluten, seitan, biomolecules, plant-based protein, edible insects, WHO (World Health Organisation), FAO (Food and Agriculture Organization)

Protein content in finished foods

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10. Grasshoppers	20g		
11. Curd cheese	17g		
12. Egg	13g		
13. Beans	9g		
14. Lentils	8g		
15. Tofu	8g		
16. Bread	7g		
17. Milk	3g		
18. Pasta	3g		
19. Mushrooms	3g		
20. Cauliflower	2g		
21. Tomato	1g		

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