D Family and Household, D3 Food Preparation and Nutrition

Food Production Principles and Food Processing in a Household

Author: Milan Kraitr, Jan Hrdlička

Recommended year	*7th grade and more of primary school*
Time framework	*1 – 3 lessons*
Thematic block	*Principles of food production and food processing in household*
Objectives and development of competencies	*Pupils will work according to the given procedures* *They will acquire some ways of food preparation in household* *Pupils will formulate statements about the changes which follow the food preparation procedure*
Interdisciplinary (cross-curricular) relations	*Chemistry – mixtures, emulsions, separation of the solid and liquid phase – filtration, test the starch presence by iodine solution, the polymer* *Information technology – searching for additional sources of information* *Biology - yeast*

Theoretical Introduction

Food is basic and essential need of humans. People use **food** from various organic sources, especially plant and animal origin. Their chemical composition and physical properties are really diverse.

These days, a significant part of food gets to consumers from shops. Some food may be consumed with no processing in their raw condition (fruit, some vegetables), on the other hand most of the food need preparation prior their consumption. Many of them are produced industrially and the consumer receives them like products after complex and complicated processes which change their chemical composition, physical properties and nutritional value (digestibility and so on). There are used adjuvants in the food industry and also in a human body – the enzymes which can be produced either by microorganisms or by the human organism. A part of industrial food products is consumed with none or just small modifications (warming up etc.). The **shelf life** of food is significant: therefor some products are cured in a form of **preservation**.

Home food preparation uses except the industrial products or semi-finished products also untreated **natural foodstuff** (potatoes, vegetables, fishes, eggs, etc.) or slightly modified ("fresh food" like meat). In modern households, it is quite common to also find more or less preserved products with the long shelf life, including frozen meals, which nutritional value is close to the value of fresh food. Also "ready meals" are today available in shops, prepared in the same way like at home.

The actual **meal preparation at home** ("cooking") has got its analogical principles like the food industrial processes. It is a complicated complex of physical and chemical changes of raw materials which use a relatively simple and available device and procedures (e.g. heat process). The result of "cooking" is usually the improvement of food characters like digestibility and taste.

The proposed **tasks for pupils** are suitable from the seventh grade. They do not require any deeper knowledge of chemistry or other subjects, nor special equipment. It is enough to have ordinary available device and foodstuff. The tasks can be carried out in an ordinary classroom, a heat source is necessary for a part of the tasks (electrical or gas stove).

Methodical part for teachers

Objectives: through the individual tasks, to show individual processes which are used for food preparation and their impact on final features

Basic food ingredients

There are three **basic** groups of **nutrients**: **sugars (saccharides or carbohydrates), proteins** and **fats (lipids)**.

Sugars are the immediate source of energy, fats are partially the storage source and proteins serve like a material to construct and regenerate the organism. All the basic nutrients are essential for human organism and should be served in a balanced ratio. Apart from these, there are many other substances, e.g. minerals and vitamins.

Sugars (Saccharides, Carbohydrates) are the most common nutrient and their origin is mostly from plants. Simple sugars are in human nutrition less often (i.e. in fruit), their small molecules do not divide further to other sugars. Carbohydrates compounded from more units of simple sugars are more significant. (Sugar beet sucrose is a disaccharide compounded from two simple sugars. Carbohydrates with more sugar units in molecule are called **polysaccharides,** they are usually not water-soluble.) In human organism, the most significant is non-fibrous polysaccharide **starch** (base of flour and corps), it is a polymer of glucose sugar. The most common natural polysaccharide is fibrous polymer of glucose cellulose with its molecule weight bigger than starch. Cellulose is the basic building material of all plants and humans cannot digest it. However, it works like **fibre** in nutrition, which improves the function of the digestive track.

Proteins are substances with big molecules too, these are polymers of so called amino acids. They are built from tens of various amino acids and represent a very diverse group of natural substances. Proteins are mainly of animal origin. They can be found in meat structure, milk, eggs etc. Several of proteins are water-soluble.

Fats are derived from so called fatty acids whose chains include units or tens of carbon atoms. They are available in different volumes in plant and animal food materials. Apart from the adipose tissue (the body fat where it reaches almost +100%) and certain plants, where they form the majority of the content, man can get them together with saccharides or proteins like some % from dry materials (a significant part of food stuff is usually consisted from water).

Tasks

We have chosen some simple and from materially available tasks for each group of basic nutrients to show **model procedures and demonstrate the principles** of food production and food preparation at home. Some of the tasks are ready in few minutes, other ones take 1 – 2 lessons, most can be carried out by pupils like homework. Each of the experiments demonstrates an important food feature or a food processing principle. Pupils evaluate the products of the individual experiments sensory, i.e. panel tasting.

Carbohydrates

Bread making is demonstrated in a multi-phase process. Use so called leaven (mixture of flour, sugar and yeast) to make dough. Mix the dough with flour and water and let it **rise**, mixing it occasionally, (there is alcoholic fermentation when bubbles of carbon dioxide are formed: the dough is gaining volume). If you do the experiment like frontal with pupils, make small doses of the ingredients and prepare flat breads on a pan or in a small pot. (If you do not use a dish with Teflon layer, put some fat first.) During the teaching demonstration or home preparation, choose “bread” shaped in thick flat breads (cakes) with dimensions according to the pan. When you flip quickly, the thin layer gets baked on both sides. The crust is a sign that it is well done. Dextrin is produced of starch during this process called **hydrolysis**. It is partially degraded (depolymerized) starch – glucose polymers with a smaller molecule. The “bread model” shows also brown spots like brown crust of bread baked in the oven (bread is baked there with no turning and the crust is made from the top part of the loaf too). There are many other processes happening e.g. protein modifications (so called denaturation – see further) and reactions between proteins and saccharides which give the bread crust colour, taste and smell. Taste the product from the experiment, which takes about one hour.

An experiment of **dry roux** preparation is a model of dextrin production (“water-soluble starch”) and it is undemanding from the point of time. It is an excellent preparation for thickening and seasoning meals. **Dextrin hydrolysis** runs by careful roasting of flour or starch. It is enough to work with a spoon of flour and it is necessary to stir it (e.g. with a wooden stick). The prepared roux differs from the raw material with its modified colour, taste and smell too.

You can follow the similar process with potato starch too. There you can prove also the level of dextrin hydrolysis, e.i. the level of decrease of a starch molecule (depending on the temperature and time of roasting), through a simple experiment with iodine solution which changes its colour (degraded starch gets deep blue, dextrin violet, the colour is temporary on the contrary of the original colour of starch).

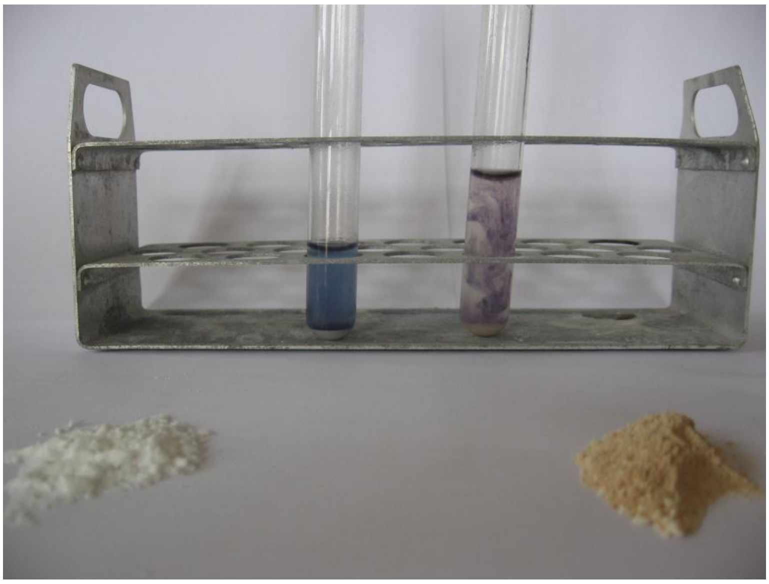

Fig 1 Comparison of the colour changes of starch (on the left) and dextrin (on the right). In the test tubes, there are the results of the experiment with iodine solution.

Even less time is necessary to demonstrate **sugar caramelizing** (a model of caramel production into the sweets and so called **caramel couleurs** to give the food brown colour). The caramelization needs careful warming of crystal sugar up to the heat of about 200°C (it is sufficient to heat just a small amount of sugar in a spoon). The complicated processes start running due to partial sugar degradation. The product is brown, smells delicious and you can taste its caramel flavour after it gets cold.

Alcoholic fermentation of sugar solution is a simplified model of gaining alcoholic drinks. At the same time, you can demonstrate a model of one type of **preservation.**

Let some sugar melt in warm water and divide the solution into halves. Add a bit of yeast in one of the halves, mix it and put the solution into a vial (preferably with a fermentation lock). Soon there will appear bubbles of carbon dioxide which is a product of alcohol fermentation. Add bensoic acid to the other part of the sugar solution (or use borax, which is more available). It is a usual preserving agent and serves to eliminate the microorganisms which grow when the food is turning bad. At the moment, we are not watching the preservation process of sugar solution, but we analyse the process of inhibition (preventing the reaction) of useful productive yeasts from yeast (leaven). Mix it, add some yeast like in the previous case. As the preserving agent inhibits, there will be no yeast process.

Proteins

Curd cheese is formed basically from milk protein - casein; if you use full-cream milk like a raw material then there is much fat in the curd cheese too. The production principle involves precipitation of soluble proteins from milk by acidification. We usually use fermentation with lactic bacilli in industrial processes, but we can substitute it with acidification (e.g. vinegar. Crud cheese fermentates immediately. Separate it from whey by filtration, wash it with water and taste it.

Fig 2 Tools for crud cheese making and the finished product

Gluten plays a significant role in some kind of flours. It is often mentioned in connection with wheat, barley and rye. Those are proteins with feature of “sticking or gluing” dough, because they hold together very well after getting baked. This is crucial feature when we compare another, glutenfree flours. Gluten intolerance may cause a disease called coeliac disease after its consumption. Lately, 1% of European population has been diagnosed with coeliac disease.

Protein denaturation is a process where protein structure and physical features are changing. The simpliest demonstration of denaturation is **egg cooking**, when the state of egg yolk and white changes when it gets boiled The time of boiling determines whether the egg is cooked mushy (precipitated white only) or hard (precipitated white and yolk).

Another way to demonstrate denaturation is **meat preparation**. Make **soup** by boiling meat (which is made from protein water-soluble fibres) – broth, to which will pass among others soluble products of partial degradation of meat proteins (part of them makes during boiling foam on the level of soup) and also the soluble portion of meat, water-non-soluble share of fat gets into the solution too. **Meat** changes its structure and colour as a result of complicated chemical changes, running at the boiling, it gets flavour and easily digestible for people.

You can **make** some **vegetables** together with meat (celery or other suitable soup veggies) and watch its structure changes (significant softening) and soaking its flavour into the broth. Celery boiling also demonstrates the production of canned vegetables and fruit.

Fats

A simple and quick experiment is **clarified butter**. It demonstrates that butter contents 18% of water (it is actually water emulsion in fat). Put a piece of butter on a spoon and heat up **carefully**. Melted butter contains water (spitting). After a while of heating, the water is practically evaporated and the content on the spoon solidifies when you get it off the flame. The product is yellow dewatered fat. The yellow shadow points out the degradation of fat (which also demonstrates the processes of oil changes during frying etc.). In the spoon next to the yellow clarified butter, there will remain brown flakes (cracklings) which are formed from non-fat additives in butter (milk sugar proteins), or a separated drop of water.

Butter clarification used to be the way to prolong the product life as it has far less tendency to turn rancid than fresh butter.

Water in food

Water is important item in all foodstuff and the main item for some fresh food (fruit, vegetables, milk, meat). Dewatering process from fresh food (**drying**) makes it impossible for microbes to survive and therefore this is the easiest way of **preservation**. We usually use it for drying mushrooms, fruit, fishes etc. You can get some of dried products in the market e.g. **legume**.

However, dried food is inedible and it is necessary to hydrate it prior consuming. The dried material **swells** in water and it gets soften. Especially for pulses is necessary to soak it in water. Apart from swelling there are some toxics leach out, which reduce the digestibility of pulses.

Lentils preparation requires soaking for a day. Pour off water (lentil leach is toxic) before further preparation. Keep boiling the lentils for at least half an hour.

Another task demonstrating water content in food is presented in the above mentioned process of **butter clarification.**

Preservation

Preservation is a way how to prevent or limit food degradation by the effect of microorganisms, fungi or moulds. It appears in various forms, e.g. by **heat effect** (bottling, milk or beer pasteurisation) or various **chemical substances**. Those are chosen to be toxic for lower organisms, but you have to watch out the volume contained in food to keep food safety for human digestion and not to change the flavour. High concentration of preserving agents are used in the model experiment to demonstrate their ability to prevent food degradation.

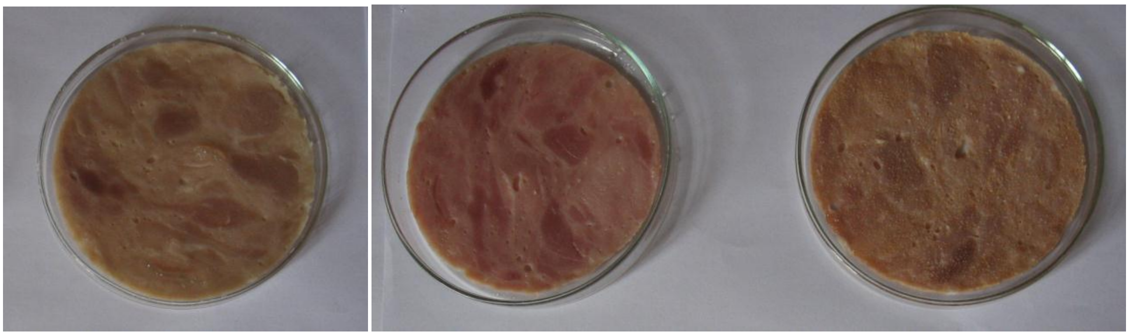

Fig. 3 The effect of preservants on salami, (from the left): sodium benzoate, cooking salt and a control sample.

Table 1 **Task overview** – lesson implementation, equipment requests

Task no.	Recommended year	Time framework	Teaching place	Tools
1	7th and more	90 min	an ordinary room with a stove	wheat flour, half pack of yeast (about 20g), a bowl (for about 1L), a spoon, a little bowl, a teaspoon, salt, sugar, warm water, a chopping board, a pan, if needed a bit of oil
2	7th and more	10 min	an ordinary classroom with a stove or a spirit burner	a tablespoon or small metal cup, a cooker, soft wheat flour, toothpick or a piece of skewer for mixing
3	8th, 9th and more	10 min	an ordinary classroom with a stove or a spirit burner	a tablespoon or small metal cup, a cooker, potato starch, a toothpick or a piece of skewer for mixing, several test tubes, iodine tincture, water
4	7th and more	10 min	an ordinary classroom	a table spoon or small metal cup, heat protection (cloth, potholder, glove), a cooker, crystal sugar, a toothpick or a piece of skewer for mixing, a glass, water
5	7th and more	60 min	an ordinary classroom	3 pcs PET bottles of 0,5 l, fermentation locks, a tablespoon, a teaspoon, lime water, preserving agent (benzoic acid or borax), sugar, yeast, water, water bath heated to the temperature about 35°C
6	7th and more	15 min	an ordinary classroom	milk, vinegar, a glass for precipitation (volume 250 – 300 cm^3), a spoon for mixing, a tea strainer (diameter about 10-12 cm) and water for washing
7	7th and more	30 min	an ordinary classroom with a stove	soft wheat flour and soft corn flour, a tablespoon, 2 bowls, transparent kitchen foil, water, 2 glasses (volume 250 – 350 $cm^{3)}$
8	7th and more	15 min	an ordinary classroom with a stove	2 eggs, a pot for boiling water, a spoon, water, a cooker
9	7th and more	45 min	an ordinary classroom with a stove	about 10 – 15 dkg chicken meat, a small pot, water, salt, carrot or celery as desired
10	7th and more	15 min	an ordinary classroom with a stove or a spirit burner	a tablespoon or small metal cup, heat protection (cloth, potholder, glove), a cooker, butter, a toothpick or a piece of skewer for mixing

11	7th and more	45 min	an ordinary classroom with a stove	about 10 – 15 dkg of lentils soaked in water for 24 hours, a cooker, a small pot, water, a spoon for mixing, 3 bowls
12	7th and more	10 min	an ordinary classroom	3 slices of soft salami (ham salami, junior or gothaj type), 3 bowls, food foil, benzoic acid (or sodium benzoate), cooking salt, protective gloves

Notes for teachers

The individual tasks are constructed for pupils from the 7th grade on, except the **task no.3** which is suitable for higher grades (8th, preferably 9th grade). They have some knowledge from the Chemistry and they know about polymer existence and should be able to carry out a simple demonstration of the described process – fission of polymer into smaller particles. At the same time, they are able to make the experiment with iodine solution. The solution is available in the form of so called “iodine tincture” at pharmacy/drugstore or the Chemistry teacher can prepare it by himself.

All the tasks are designed so that they are achievable with minimal equipment, preferably with ordinary cooking utensils. Thanks to that, the tasks may be implemented at home too. In case of the **task no. 5**, the fermentation locks are not necessary, you can substitute them by a smaller suitable hose (e.g. the hose used by fishkeepers for aeration) leading into a glass with lime water. The lime water needs to be prepared in advance. (Add 2-3 teaspoons of slaked lime into 1 litre of distilled water and leave it still with occasional stirring for about a week. Filter the clear liquid from the white sediment. It contains a fraction of dissolved slaked lime.) If you add carbon dioxide (which is formed by fermentation) into such a solution then the liquid becomes turbid due to the limestone precipitation.

If you do not have the possibility to use a fermentation lock with lime water you can monitor the development of carbon dioxide bubbles in solution and you can estimate the fermentation intensity according to the amount of bubbles. However, you cannot prove the formation of carbon dioxide during the fermentation process, you can just inform about it.

For the **task no. 1**, you can make a comparison when you use the same dough but do not add yeasts. Unleavened bread is quite hard and taste different, because the fermentation causes among others starch fission.

For the **task no. 11, it** is necessary to soak lentils in water in advance to continue with its boiling on the demonstrating day. The **task no. 12** needs a week break between its preparation and results evaluation.

Part of the tasks includes heating on a cooker or similar heat source. It is important to keep health safety. First, there is danger of getting burnt by the source flame and secondly by the heated metal spoon, because metal is good heat conductor and the spoon can burn the fingers. Working with lime water performs another risk. It is appropriate that the teacher manipulates with the solution, as it can irritate skin.

Used literature and references

[1] Kadlec P., Melzoch K., Voldřich M., a kol.: Co byste měli vědět o výrobě potravin? : technologie potravin, Ostrava, Key Publishing, 2009. ISBN 978-80-7418-051-4

[2] Hejda S.: Kapitoly o výživě, Praha, Avicenum, 1985.

[3] Hampl B., a kol.: Přehled potravinářského a kvasného průmyslu, Praha, SNTL, 1962.

Attachments

Learning text for pupils

The basic food components are carbohydrates, proteins and fats. Some food is produced industrially and in edible form comes to the shops, other is consumed in its raw state (e.g. fruit, vegetables). However, most of raw foodstuff (vegetables, meat) or semi-products (flour) are in our households processed in various ways. E.g. heat processing (baking, cooking) is a common way of meal preparation.

The following tasks are selected models of easily feasible production processes and home food preparation. Some of them demonstrate the procedures which are essential in industrial food production (curd cheese making, alcoholic fermentation of sugar, which is the base for beer, wine or alcohol production, bread making, dextrin production). Other tasks demonstrate simple preparation of food or food products in households (making egg, lentils, cooking meat, clarifying butter, preparing dry roux, sugar caramelization, comparison of flour types from the point of gluten content) or they are focused on food preservation.

Practical tasks

Task no. 1 Prepare dough and make bread (flat breads)

Tools and ingredients: wheat flour, half pack of yeast (about 20g), a bowl (for about 1l), a spoon, a small bowl, a teaspoon, salt, sugar, warm water, a chopping board, a pan, if needed a bit of oil

The procedure has three parts: sourdough preparation, dough raising and baking

Sourdough preparation

1) Put 2 tablespoons of flour into the small bowl, add half teaspoon of sugar and a pinch of salt. Mix it.
2) Add mashed yeast, carefully pour warm water and keep stirring. The leaven should not get too liquid.
3) Watch the leaven reaction. When the fermentation finishes, start making dough.

Dough preparation and rising

1) Mix about 100g of flour with a half teaspoon of salt in a bowl.

2) Add the leaven and add warm water bit by bit during you keep stirring. The dough should be so dense to keep its shape, not too liquid.
3) Leave it raising for about 30 – 45 minutes.
4) Place the dough on a board covered with flour. Shape it flat and leave it still for about 10 – 15 minutes.

Baking

1) Put the prepared bread on a heated pan and roast it slowly from both of the sides until its skin gets brown. If you do not own a pan with stick-less coating, it is necessary to powder the flat breads with flour from all sides before baking or roast it with a bit of oil to prevent its burning.
2) Describe the effects and reactions, which occurred during "bread making". Taste the finished product to evaluate it.

Task no.2 Make dry roux

Tools and ingredients: a tablespoon or small metal cup, a cooker, soft wheat flour, toothpick or a piece of skewer for mixing

1) Put a teaspoon or two of flour into a tablespoon or small metal cup.
2) Hold the spoon in cloth or use a glove to avoid burning and start heating it slowly. Keep stirring softly by a toothpick during while heating it up.
3) Stop heating every minute and watch the modifications of colour, flavour and sometimes even taste.

Task no. 3 Gain dextrin by heat degradation of starch

Tools and ingredients: a tablespoon or small metal cup, a cooker, potato starch, a toothpick or a piece of skewer for mixing, several test tubes, iodine tincture

1) Put a teaspoon or two of starch into a tablespoon or a small cup. Hold the spoon in cloth or use a glove to avoid burning and start heating it slowly. Keep stirring softly by a toothpick during while heating it up.
2) Stop heating after about five minutes and put some roasted starch into a test tube.

3) Place a bit of original starch into the second test tube. Pour both of the tubes with several spoons of water, mix it and add a drop of iodine solution.
4) Compare the colouring inside the test tubes one to another and evaluate it.

Task no 4 Sugar caramelization

Tools and ingredients: a tablespoon or a small metal cup, a cooker, crystal sugar, a toothpick or a piece of skewer for mixing, glasses, water.

1) Put a teaspoon or two of crystal sugar on a tablespoon or into a small cup.
2) Hold the spoon in cloth or use a glove to avoid burning and start heating it slowly. Keep stirring softly by a toothpick during while heating it up.
3) Monitor sugar melting and colour changes regularly.
4) When it gets brown, leave it to cool. Then evaluate the resulting colour and smell. Let some caramel melt in water and evaluate how it colour water.

Task no. 5 – Fermentation of sugar solution

Tools and ingredients: 3 pcs PET bottles of 0,5 l, fermentation locks, a tablespoon, a teaspoon, lime water, preserving agent (benzoic acid or borax), sugar, yeast, water, water bath heated to the temperature about 35°C .

1) Fill each bottle with 2 table spoons of sugar, 2 dcl of water. Keep mixing until the sugar melts.
2) Put lime water into a fermentation lock.
3) Add a teaspoon of yeast into each bottle and mix it.
4) Add a half spoon of preservant in one of the bottles and mix it.
5) Close all bottles with fermentation locks.
6) Take one of the bottles with no perservant and place it into heated bath, one leave still standing as well as the bottle with added preserving agent.
7) Watch the currently running reactions and note down any changes.
8) Evaluate the effect of temperature and preservant to the leaven production.

Task no. 6 Curd cheese making

Tools and ingredients: milk, vinegar, a glass for precipitation (volume 250 – 300 cm^3), a spoon for mixing, a tea strainer (diameter about 10-12 cm) and water for washing.

1) Pour about 1 – 2 dcl of milk into a glass.
2) Keep mixing and add about 0,5 dcl of vinegar.
3) Leave the precipitated cheese substance and leave it for about 10 minutes still.
4) Pour the ready mixture through a teaspoon screen and wash it with water.
5) Keep stirring curd cheese so that the high water floats away.
6) Stir the curd cheese by a tablespoon to drain water as much as possible. With regards to softness of particles, a part of solid share leaves too.
7) Tip over the prepared cheese cake and if needed taste it too.

Task no. 7 Isolation of gluten from flour

Tools and ingredients: soft wheat flour and soft corn flour, a teaspoon, two bowls, transparent kitchen foil, water, 2 glasses (volume 250 – 350 $cm^{3)}$.

1) Put 2 – 3 teaspoons of flour into each bowl, corn into the first one, wheat into the other one. The following steps are equal for both flours.
2) Add water bit by bit, drop by drop and shape flour into dough.
3) Make a ball from the dough, cover the bowl with a piece of kitchen foil and leave it 10-15 minutes.
4) Take the ball out of the bowl, sink it into a glass with water and there rub it between your fingers. Watch the different reaction of both flours.

Task no. 8 Egg boiling

Tools and ingredients: 2 eggs, a pot for boiling water, a spoon, water, a cooker

1) Boil water and insert 2 eggs into it.
2) Take out one egg by spoon after three minutes and cool it with cold water.
3) After ten minutes boiling, cool down the second egg too.

4) Peel the eggs, cut them longwise and compare their look.

Task no. 9 Meat cooking

Tools and ingredients: about 10 – 15 dkg chicken meat, a small pot, water, salt, carrot or celery as desired

1) Check the look, colour and structure of raw chicken meat, if you want check the peeled vegetables too.
2) Place it into a pot with about 1 litre of water, add a teaspoon of salt and let it boil.
3) Keep boiling it slowly and watch the colour change of meat and vegetables, notice the foam forming.
4) After about 15, quit boiling and let it cooling. Take the meat and vegetables out from the broth and compare its look, colour and structure once more.

Task no. 10 Butter clarification

Tools and ingredients: a tablespoon or small metal cup, a cooker, butter, a toothpick or a piece of skewer for mixing

1) Put some butter about wallnut size on a spoon.
2) Hold the spoon in cloth or use a glove to avoid burning and start heating it slowly. It is necessary to heat up really slowly to avoid foaming and splitting of hot butter. Keep stirring slowly during melting.
3) When all butter is melted into liquid, take out the spoon and leave it cooling.
4) When it gets cold, scratch carefully off the solidified fatty layer. There should be a small paddle of water on the bottom of spoon.

Task no. 11 Lentils making

Tools and ingredients: about 10 – 15 dkg of lentils soaked in water for 24 hours, a cooker, a small pot, water, a spoon for mixing, 3 bowls

1) Drain lentil water

2) Take a small part of swollen lentils apart for later comparison and place the rest into a pot. Add water to have all lentils soaked.
3) Bring lentils to boil and cook slowly for about 20 – 30 minutes, stir it from time to time.
4) Divide the lentils into the three bowls, one with original dry lentils, then swollen lentil and last boiled lentil. See and compare the character and flavour of the samples.

Task no. 12 Preservation

Tools and ingredients: 3 slices of soft salami (ham salami, junior or gothaj type), 3 bowls, food foil, benzoic acid (or sodium benzoate), cooking salt, protective gloves

1) Wrap up two slices of salami in preserving agent, place them into a bowl and cover with kitchen foil. Leave one slice without any preparation to have a control check, put it to a bowl and cover with foil too. Do the preservation in latex gloves.
2) Leave all the bowls free standing in a room for about a week, keep it away from direct sunshine.
3) A week later, check the looking and maybe smell of individual samples. The control sample would probably smell bad, be careful when you smell it. Evaluate the effect of each type of preservation.