Unit 2

CEREALS AND PULSES

Cereals form the staple food of the human race. In their natural form (as in whole grain), cereals are a rich source of carbohydrates, protein, vitamins and minerals. Pulses are the dried seeds of the leguminous plants. They are non perishables, i.e., they do not get spoilt easily if proper storage conditions are followed.

GLLFRL

The word Cereal is derived from an ancient Greek word '*Cerealia*', a major festival celebrating *Ceres* the Roman Goddess of harvest and agriculture.

In this lesson, the students will be able to:

- Learn about different cereals and millets available in the market.
- Know the nutritive value of cereals and millets available in the market.
- Understand the importance of using a combination of cereals in the diet.
- Understand the nutritional importance of pulses and legumes.
- Promote and practice germination of pulses to enhance the nutrient content of the diet.

Cereals and pulses

A cereal is any grass cultivated for the edible components of its grain (botanically, a type of fruit called a caryopsis), composed of the endosperm, germ and bran. The ease with which grains can be produced and stored together with the relatively low cost and nutritional contribution has resulted in widespread use of cereal foods. They are the staple foods in the diets of most population groups. Millets are hardy plants capable of growing in areas where there is low rainfall and poor irrigation facilities.

2.1. Structure of cereal grains

All grains have the same basic structure. The seedcoat consists of an epidermis (outer layer) and several inner layers. Just underneath the seedcoat is the aleurone layer, which contains oils, and other nutrients like minerals, proteins and vitamins. The seedcoat and aleurone make up the outer layer called the bran, which represents about 13 percent of the grain. The aleurone layer surrounds the endosperm, which is the largest part of the grain (usually about 85 percent). The endosperm consists of storage cells containing starch granules embedded in a matrix of protein. The germ is the sprouting section of the grain. In wheat, it comprises only about 2 percent of the seed, but contains 65 percent of the B group vitamins and 33% of oil.

2.2. Nutritive value of cereals

Cereals are the main source of energy, contributing 70-80 percent of our

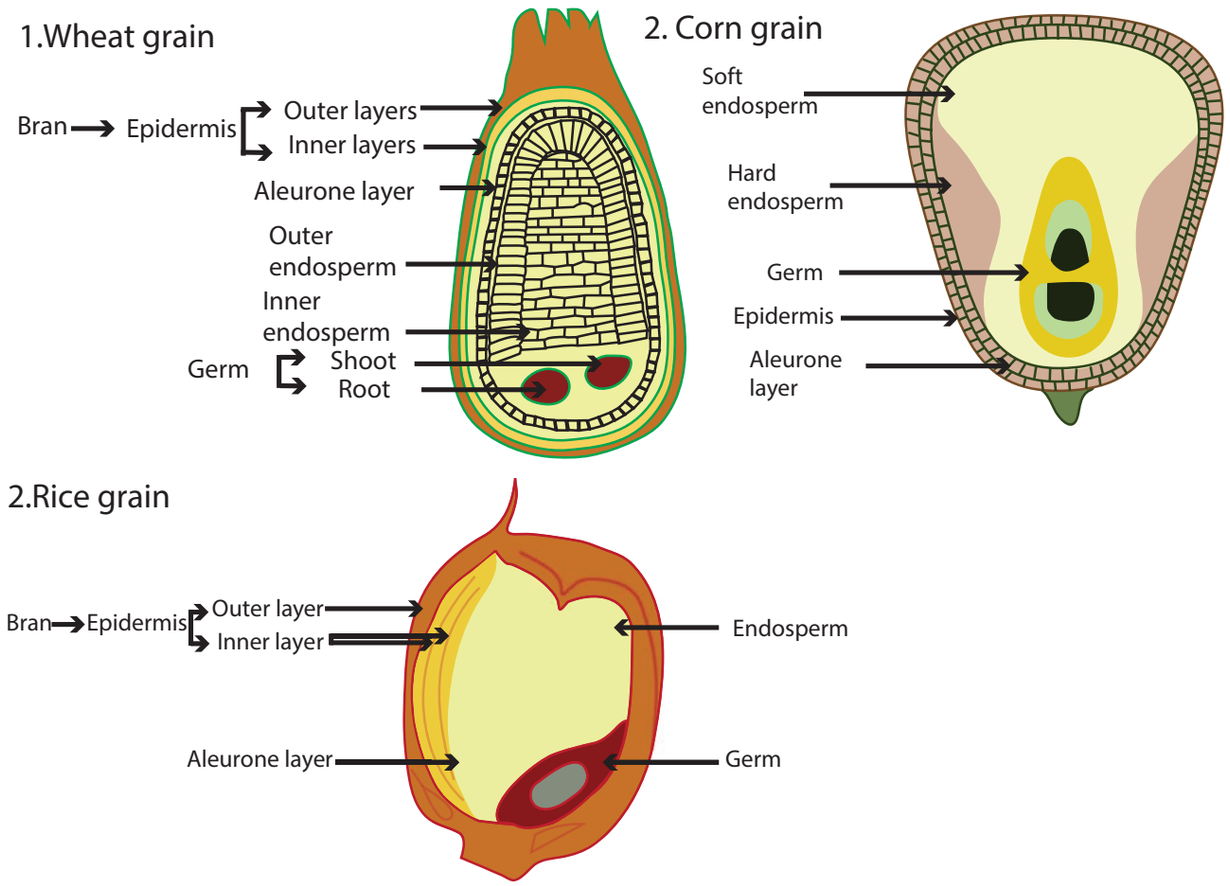

Fig 2.1: Structure of cereal grains

ACTIVITY - 1

Identify and know the nutritive value of different cereals and millets available in the market.

energy requirement. Eighty percent of dry matter of cereals is carbohydrates. The two form of carbohydrates present are insoluble fibre (cellulose) and soluble carbohydrate. Cereals contain 6-12 percent protein, which are deficient in lysine. Among cereals, protein is of better quality than others. Fats are present to the extent of 1-2 percent in wheat and rice and 3 percent in maize. Cereals are poor source of calcium and iron, except ragi, which is a good source of calcium and iron. Whole grain cereals are important source of B vitamins in the diet.

2.3. Specific cereals and millets

Common cereals and millets are

2.3.1. Rice

The major carbohydrate of rice is starch which is 72-75 percent. Protein content of rice is 7 percent.

GLVBT9

Fig 2.2: Rice

Types of rice

The different types of rice are:

Fig 2.3: Types of rice

- **Long-Grain Rice:** These grains of rice are about 4-5 times longer than their width, and don't tend to clump together when cooked.
- **Medium-Grain Rice:** About 2-3 times longer than their width, these types of rice can be chewy and tender, and often clump together.
- **Short-Grain Rice:** Often mistaken for medium-grain rice, this variety is slightly longer than its width, and clumps together easily.
- **Parboiled Rice:** This is a type of rice prepared in a unique way; rather than removing the outer hull to cook brown rice, the outer shell is left on while this rice is steamed and dried. Then the outer shell is taken off for a less clumpy and more nutrient-dense variety of rice.
- **Polished rice:** Polished rice is rice that has been milled, which effectively strips away much of the protein and vitamin content. Traditional white rice is considered has polished rice and therefore less nutrient-dense than other varieties.
- **Brown rice:** Brown rice is rice in which the inner husk is not removed meaning that it hasn't been milled and thus provides a much higher content of fiber and nutrients. It is unpolished whole grain which contains 100 percent bran, germ and endosperm constituents. Brown rice is nutritionally superior to hand pounded rice, under milled and polished rice because it has higher amounts of protein, dietary fibre, vitamins and minerals.
- **Black rice:** It has a very high concentration of anthocyanins, which gives it the black color. It is high in nutrients and relatively rare, this rice variety is slowly becoming popular in our Indian cuisine.
- **Basmati rice:** Traditionally grown, found and used in India, for making biriyanis and pulaos. Basmati rice is a long-grain variety with a very delicate texture.
- **Sticky Rice:** This is a rice variety primarily grown in Asia, also known as glutinous rice.
- **Red rice:** Red rice is similar to black rice in that it is colored due to its unique anthocyanin content. This provides the red color to the husk, which can either be partially or fully removed before preparing this type of rice.

Different rice products

- **Rice flour:** Rice starch granules are quite small and are embedded in a protein matrix. It is used in puddings, ice creams and custard powder.
- **Rice bran:** Bran includes several sublayers within the pericarp and the aleurone layer. Bran is a good source of antioxidants. Oil is taken from rice bran.
- **Broken rice:** It is mainly used in making upma.
- **Parched rice products:** This includes parched rice, puffed rice and flaked

rice. They are easily digestible and hence good for children and old people. It adds variety in the diet. Rice flakes are a good source of iron.

2.3.2. Wheat

Wheat grains are ovoid in shape rounded in both ends. Wheat proteins are rich in glutamic acid and low in tryptophan. Whole wheat is a good source of thiamin, riboflavin, niacin, folic acid, calcium, phosphorus, zinc, copper and iron. Wheat is also a good source of fibre. Wheat is consumed mostly in the form of flour obtained by milling the grain while a small quantity is converted into breakfast foods such as wheat flakes and puffed wheat.

Wheat is milled to produce flour which is used to make a variety of products including bread across the world. Wheat contains a protein called gluten which is necessary for the basic structure in forming the dough system for bread, rolls and other baked goods. Many of the foods we consume on a daily basis such as bread, cookies, cakes, pies, pastries, cereals, crackers, pasta, flour tortillas and noodles are all made from wheat flour.

Fig 2.4: Wheat

Products of wheat

Whole wheat flour: It contains the finely ground bran, germ and endosperm of the whole kernel. It is used in making chapathis, puris, whole wheat bread, etc.

DO YOU KNOW...?

Some interesting Facts about wheat

- Malted wheat is used in health drinks and in alcoholic drinks after distillation.
- Wheat is used for cattle, poultry, and other livestock feed.
- Young wheatgrass is becoming increasingly popular as a nutritional supplement offering vitamin A, B-complex, C, E, and K.
- Some strains of wheat are grown to produce starch in South Asia used in textile manufacturing.
- In many countries, rural houses still use wheat straw to thatch their houses as well as mattresses and pillows.
- Wheat is also being used for plastics manufacturing and aquaculture feed purposes for both fish and shrimp.

Wheat bran: Wheat Bran is a concentrated source of insoluble fibre and provides health benefits.

Wheat germ: It is a great source of vegetable protein, along with fiber and healthy fats. It is also a good source of vitamin E, magnesium, thiamine, folate, potassium and phosphorus.

Wheat rava: Broken wheat or wheat rava is used in the making of upma, Bisi bela bath, pongal, etc.

Wheat flakes: They are used as breakfast cereals. They are packed with dietary fibre and most varieties are fortified with numerous essential vitamins and minerals.

Maida: It is also known as refined flour. The bran and germ are separated in making white flour or maida. Maida bakes uniformly into a loaf of greater volume and it is more bland in taste and more easily digested. The more the refinement, the lesser the nutritional quality.

Semolina: It is coarsely ground endosperm and its chemical composition is similar to that of white flour.

Macaroni products: These products are also called pasta. These products include macaroni, spaghetti, vermicelli and noodles.

Fig 2.5: Macaroni

2.3.3.Oats

Oats are whole grains. Neither the bran nor germ is removed in different forms of oats and hence all forms like oat meal, oat flakes and oat bran are nutritious. In oats there are significant amounts of beta glucans, soluble fibre which reduces serum cholesterol.

2.3.4.Barley

Barley malt is used in bakery, processed foods and, in vinegar and syrup making.

2.3.5. Millets

The major millet crops of India are:

- **Pearl Millet / Bajra /Kambu:** India is the largest producer of Pearl millet. This millet is an excellent source of phosphorus which is essential for the structure of body cells. It has the same quantity of protein as wheat.
- **Finger Millet / Nachani / Kezhvaragu:** It is also known as finger millet, ragi and red millet. It is well known in Southern India. This millet is rich in protein. The major proteins of ragi are prolamins and glutelins and they appear to be adequate in all essential amino acids. Ragi is rich in minerals especially calcium with good source of iron. The malted ragi flour can be used along with germinated green gram flour to formulate a high calorie-dense weaning food having excellent nutritional qualities. Ragi flour can be used with milk beverages.
- **Foxtail Millet /Kangni / Thinai:** Foxtail millets are rich in iron and pest-free. Foxtail acts as anti pest

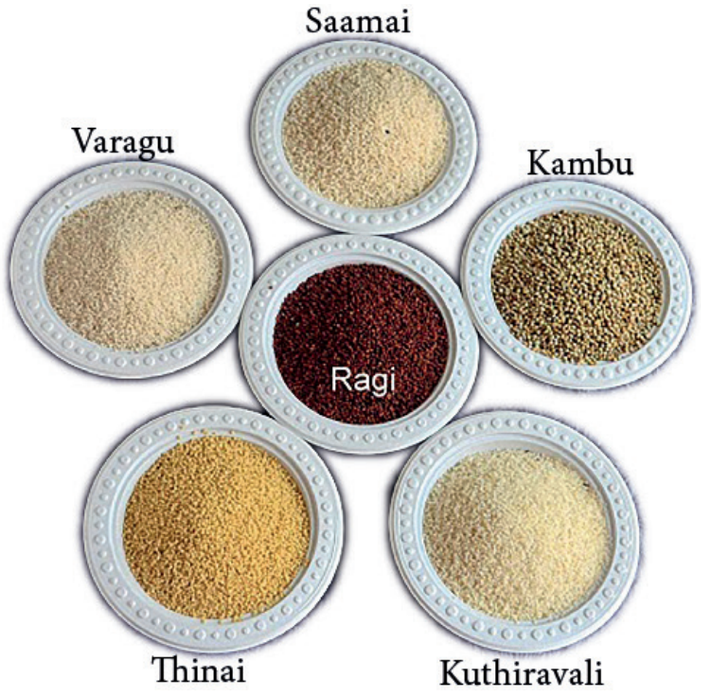

Fig 2.6: Types of Millets

agents which helps to store the delicate pulses like green gram.

- **Kodo millet/Kodra/Varagu:** Kodo millet contains high amount of polyphenols which acts as an antioxidants. It is rich in fiber and low on fat.
- **Little Millet / Kutki / Saamai:** The seeds are smaller in comparison to other millet such as foxtail millet. Little millet has high amount of iron content and fiber like Kodo.
- **Barnyard Millet / Jhangora / Kuthiravali:** Barnyard millets are good source of fiber, phosphorous as well as calcium.
- **Sorghum /Jowar /Cholam:** Sorghum is mostly cultivated due to its high fodder value. Sorghum is rich in nutrients with high amount of protein, unsaturated fats, fiber and minerals such as phosphorus, calcium, potassium and iron.

2.3.5a. Health benefits of millets

The various health benefits of millets are:

1. **Healthy heart:** Millets are rich in magnesium which helps to lower the blood pressure and also decreases the chances of strokes, heart attacks and atherosclerosis.
2. **Balance cholesterol level:** The high amount of fiber found in Millet helps to lower the cholesterol.
3. **Prevent diabetes:** It helps to reduce the risk of Type 2 diabetes as it possesses an adequate amount of magnesium.
4. **Assist digestion:** Since millets are rich in fibre, it helps to enhance the gastrointestinal health and eradicate the ailments such as excess gas, constipation, cramping and bloating.

Fig 2.7: Sweets and savouries - Millets

5. **Prevent cancer:** Research shows that fibre is the simplest way to prevent the outbreak of breast cancer in women. Since millets are rich in fiber, it can prevent occurance of breast cancer.
6. **Detoxification:** Millet contains antioxidants, which help to neutralize the free radicals that can lead to cancer and also clears up the toxins from the liver and kidney.
7. **Respiratory health:** Research shows that Millet helps to improve the respiratory health and also prevent asthma.

2.4. How can millets be used in the daily diet?

- One of the most common ways to eat millets is as breakfast cereal or porridge.
- Replace rice or wheat with millets in preparations such as:
  - ❖Sambar rice
  - ❖Curd rice
  - ❖Upma
  - ❖Kozhukattai
  - ❖Pongal
  - ❖Idli
  - ❖Dosai
  - ❖Adai

DO YOU KNOW...?

Colours of unpolished millets

- Varagu is dark brown
- Thinai is dark yellow
- Saamai and kudiravaali are light grey
- Panivaragu is creamy yellow
- Kambu has a greenish tinge.

- Snacks such as murukku, thattai and seedai and sweets such as ladoo can be made from ragi.
- Thinai is best suited for making adhirasam. It can also be used to make halwa, ven pongal, sweet pongal or curd rice.
- For pulav or biriyani, go for parboiled samai, kudthiravali or varagu.

2.5. Processing of cereals

1. Primary processing of cereals

The main purpose of primary processing of whole cereal grains is to separate the outer layers of the grain from the inner section. When the grain is milled to produce white flour, the germ and the bran are discarded. The milling process grinds and pounds the grains. The process used for milling each grain type is slightly different.

After milling of the grain, the products can be described in the following ways:

- **Wholegrain or wholemeal** products means the whole of the grain has been used that is the bran germ and endosperm. Because the oil component in the germ can go rancid after a time, wholemeal products can develop off flavours.
- **Refined** products refer to products made only from the endosperm (starch). The bran and germ are removed. Refined products have a longer shelf life but are nutritionally poor because they contain mostly carbohydrate.
- **Enriched** products have vitamins and minerals added, usually to give them similar nutritive properties to wholemeal products, but without the fibre content.
- **Flour** is the powdered form of the grain after grinding or milling.
- **Meal** is a more coarsely ground product than flour.
- ***Instant or quick-cook*** products have been cooked, or partially cooked, then dehydrated. When reconstituted they require very little preparation time. Examples include instant porridge, quick-cook rice and instant Asian style noodles.

2. Secondary processing of cereals

Secondary processing of cereals results in a variety of products. The main products are as follows:

- Breakfast cereal production may involve other processes such as rolling and baking to make flakes. Eg. Wheat flakes.
- Bread and other bakery items such as savoury crispbreads, sweet biscuits, cakes and pastries require the additional processes of sifting, mixing, kneading, proving and baking. Some breads and cakes are leavened with raising agents such as yeast and baking powder.
- Extruded snack foods — commercially produced using a dough or batter that is extruded and cooked into novelty shapes. Eg. macaroni.
- Pasta is formed from flour-based dough and formed into shapes by hand or machine.

- Noodles and dumplings are manufactured from flour-based doughs and shaped, then simmered or poached in liquid.

2.5.1. Milling

Cereal processing is complex. The principal procedure is milling, i.e., the grinding of the grain so that it can be easily cooked and rendered into attractive foodstuff. The steps involved in the process of milling are:

- Rice is passed through two stone rubber discs rotating at different speeds and by shearing action on the grain, the hull is pulled away.
- This is then milled in a machine called pearlor to remove coarse outer layers of bran and germ by the process of rubbing, resulting in unpolished milled rice.
- Unpolished rice is liable to develop rancidity and so it is next polished in a brush machine which removes the aleurone layer and yields polished rice.
- Sometimes the polished rice is further treated in a device known as trumbol to give a coating of sugar and talc to produce a brighter shine on the rice.

The percentage of losses of different nutrients during milling are: Protein 15 percent, Fat 82 percent, Thiamine 85 percent, Riboflavin 70 percent and Pyridoxine 50 percent. The degree of milling determines the amount of nutrients removed.

2.5.2. Parboiling

Parboiling is a process in which rice has been partially boiled in the husk. This makes rice easier to process by hand, boost its nutritional profile and change its texture.

1. Conventional process: This consists of the following steps:

- Steeping paddy in cold for 2 or 3 days in large cement tanks.
- Steaming of the soaked paddy for 5-10 minutes
- Drying in the sun.

2. Hot soaking process: This consists of the following steps:

- Soaking of paddy in water at 65-70° C for 3-4 hours.
- Draining of water and steaming of soaked paddy in the same vessel for 5-10 minutes
- Drying of the paddy in the sun or in mechanical driers.

Advantages of parboiling

- Dehusking of parboiled rice is easy.
- Milled parboiled rice has greater resistance to insects and fungus.
- Loss of nutrients due to the removal of husk and bran in milling are decreased.
- Loss of water soluble nutrients due to washing of rice is less in parboiled rice compared to raw rice.
- Parboiling improves digestability.

2.5.3. Malting of cereals

Malting is a controlled germination process, which activates the enzymes of the resting grain resulting in the conversion of cereal proteins and other macromolecules.

Generally barley is used in the production of malt. Other grains used in the preparation of malt includes wheat, jowar and ragi.

The process of malting of cereal grains consists of the following steps:

1. Selection of grain and cleaning.

2. Steeping in cold water for 36 hours with 2 to 3 changes in water.

3. Germination: The grains are spread on wire mesh trays and kept for 3 days. Water is sprinkled over each of these trays.

4. Kilning: The germinated grains are dried at slow rate on kilns.

Amylase rich food (ARF) is germinated cereal flours which are extremely rich in the enzyme alpha-amylase. ARF are excellent weaning foods because they reduce the bulk of weaning foods and are energy dense. Malt is used in commercial proprietary foods, breakfast cereals, malted milk confectionaries, infant foods, bakery products and in brewing.

2.6. Cereal cookery

2.6.1. Gelatinisation

Starch granules do not dissolve readily in cold water but they will form a temporary suspension with the starch tending to settle out as soon as the mixture is allowed to stand. When heated with water, the grains absorb water and swell. This process is called as gelatinisation.

2.6.2. Gluten formation

Although all cereals are more or less similar in protein content, the unique presence of glutelin and gliadin in the wheat makes it suitable for certain recipes. Glutenin or glutelin is the protein which gives toughness and rubberiness to gluten. Gliadin gives elasticity. Due to its elastic properties, the dough can be rolled to prepare chapathi or poori.

Fig 2.8: Gluten formation (Chapathi and Poori)

2.6.3. Dextrinisation

Dry heat also brings changes to starch granules through a process known as dextrinisation. If a starch product is subjected to dry heat, carbohydrate compounds called dextrins are formed. When these are dissolved in water they have a sweet taste. Colour and flavor changes also occur. Extensive dextrinisation reduces the thickening power of starches. Eg. Toasted bread.

2.7. Fermented cereal products

The term fermentation refers to the breakdown of carbohydrates into simpler substances. The advantages of fermentation are:

- Flavour and texture of the product are improved.
- Vitamin B and C content is increased.
- The product is easily digestible.
- Acid by- products formed during fermentation inhibits the growth of harmful microorganisms.
- It provides variety in the diet.

Some of the fermented cereal products are:

- Idli
- Dosai
- Dhokla
- Appam
- Bread

Fig 2.9: Fermented cereal products (Idly and Dosai)

Some fascinating facts about cereals

- The first cereal grains were domesticated by early primitive humans, about 8,000 years ago.
- The cereal industry uses 816 million pounds of sugar per year in the making of bread, biscuits and pastries.

2.8. Role of cereals in cookery

Role of cereals in cookery

1. Cereals are used as thickening agent, eg. corn flour in custard, corn flour in white sauce and macaroni in soups.
2. Cereals are used as coating agent, eg. maida paste in cutlets or bread crumbs in cutlets.
3. Cereals are used in sweet preparations, eg. rice payasam and wheat halwa.
4. Malted cereals are used in the preparation of beverages and weaning mixes.
5. Cereal products like corn flakes and rice flakes are used as ready to use foods.
6. Fermented foods made from cereals are used as breakfast foods or snacks, eg. idli, dhokla.

2.9 Health benefits of cereals

- **Source of Energy:** Cereals are the major energy provider in the diet.
- **High Mineral Content:** Ragi, millets, jowar, and bajra have high amounts of minerals and fiber.
- **Prevent Cancer:** Whole wheat products reduce the chances of breast cancer.
- **Prevent Constipation:** Cereals have both insoluble and soluble fibers like cellulose, pectin, and hemicellulose. This prevents constipation.

- **Maintain Blood Sugar Level:** The fiber content in cereals decreases the speed of glucose secretion from the food, thereby maintaining sugar levels in the blood.
- **Provide Protein:** Cereals usually have 6-12% protein.
- **Source of Vitamins:** Cereals are a good source of vitamins B.

2.10 Pulses

Pulses are edible fruits or seeds of pod bearing plants. Pulses are the edible seeds of plants in the legume family. Pulses grow in pods and come in a variety of shapes, sizes and colors. Different varieties of pulses are grown around the globe. The major pulses or dhals which find important place in Indian diet are red gram dhal, Bengal gram dhal, black gram dhal and green gram dhal. Some pulses like Bengal gram, green gram, rajmah, soya bean dry peas are used as whole grams. A legume is a plant or its fruit or seed. Well known legumes include chickpeas, channa and soyabean.

ACTIVITY - 2

List any five recipes that can be made out of:
(a) Rice (b) Wheat (c) Ragi (d) Semolina (e) Millets and their preparation.

The word pulse originates directly from the Latin *puls* meaning "thick gruel or porridge".

2.10. 1 Nutritive value of pulses

Pulses give 340 calories per 100 grams which is almost similar to cereal calorie value. Pulses contain 55 to 60 percent starch. In a vegetarian diet, pulses are important sources of protein. They give about 20-25 percent protein that is double the amount of protein compared to cereals. The proteins present in pulses are not of good quality as they are deficient in aminoacids. Pulses contain 1.5 percent fats. They contain calcium, magnesium, zinc, iron, potassium

Pulses

and phosphorus. They are excellent sources of B complex vitamins particularly, thiamine, folic acid and pantothenic acid. Like cereals, they do not contain any vitamin A or vitamin C, but germinated pulses contain vitamin C.

Pulses are considered as super food because they are:

- Good source of protein
- Rich in minerals and B vitamins
- Low in fat
- Gluten free
- Source of dietary fibre

2.10.2 Germination

Whole pulses are soaked overnight, water should be drained away and the seeds should be tied in a loosely woven cloth and hung. Water should be sprinkled twice or thrice in a day. In a day or two, germination takes place.

Fig 2.10: Germination

DO YOU KNOW...?

Pulses have been essential part of our diet for centuries. Agricultural production of pulses dates back to 7000-8000 BC.

ACTIVITY - 3

Germinate pulses and prepare any two products from them.

Advantages of germination

- Nutritive value is improved during sprouting. During sprouting, minerals like calcium, zinc and iron are released from bound form. Vitamin C is synthesized during germination.
- Sprouting decreases cooking time.
- Thickening power of starch is reduced due to conversion of starch to sugars.
- Germination improves taste and texture.
- Germinated pulses add variety to the diet.

2.10.3 Toxic constituents in pulses

Some pulses contain chemical constituents that have toxic properties.

1. **Trypsin inhibitors:** They are present in red gram, Bengal gram, cowpea, double bean, soyabean and dry peas. Trypsin inhibitors are proteins that inhibit the activity of trypsin in the gut and interfere with digestibility of dietary proteins and reduce their utilisation.
2. **Lathyrogens:** Lathyrism is a nervous disease that cripples man. It is known to result from an excessive consumption of the pulse kesari dhal (Lathyrissativus). The symptoms of lathyrism are muscular rigidity, weakness and paralysis of the leg muscle.

3. **Haemagglutinins:** These are proteins in nature and they occur widely in leguminous seeds. Haemagglutinins reduce the food intake resulting in poor growth.
4. **Saponins:** These are present in soyabeans. Saponins cause nausea and vomiting. These toxins can be eliminated by soaking prior to cooking.
5. **Goitrogens:** These substances interfere with iodine uptake by thyroid gland. They are present in soyabean and groundnuts. Excessive intake of these foods may lead to precipitation of goitre.
6. **Tannins:** They have high amount of seed coat in most legumes. Tannins bind with iron irreversibly and interfere with iron absorption. Tannins also bind proteins and reduce their availability.

These toxic constituents can be removed during processing and cooking.

2.10.4. Forms of pulses

Pulses are used in different forms such as:

- Whole legumes
- Decuticled split legumes with and without skin
- Germinated or fermented pulses
- Flour of pulses and
- Parched pulses like Bengal gram and peas.

DO YOU KNOW...?

In December 2013, the United Nations General Assembly (UN) voted unanimously to declare 2016 the International Year of Pulses (IYP). Throughout 2016 the Global Pulse Confederation (GPC) celebrated, raise awareness and promote consumption of pulses at events around the globe.

2.10.5. Soyabean

Soyabean with its high protein contents is considered as a substitute for meat protein which is expensive. Soyabean has 42 grams of protein per 100 grams of the product.

Soyabean can be processed to obtain the following products:

1. **Soya flour:** Soya flour is used in combination with wheat flour in preparation of chapathis. It can also be incorporated in the batter used in the preparation of bajji, vadai and pakoda.

Fig 2.11: Soya

2. **Soya milk:** The milk is prepared by grinding soaked beans with water. It is then passed through a mill in a stream of water. The emulsion that is obtained is filtered and transferred to a boiler and mixed with vitaminised margarine to which sugar, salt, calcium and malt are added. The mixture is cooked for 20 minutes, emulsified and then dried.
3. **Tofu:** It can be used like paneer in various preparations.
4. **Textured vegetable protein (TVP):** It is prepared using defatted soya flour from which most of the oil and carbohydrates are removed. It is quick to cook with a protein content compared to certain meats.
5. **Soya protein isolates:** Soya protein isolates are protein granules, isolated by processing. It is fortified with vitamins and minerals and used as a complementary food.
6. **Soya Grits:** Soya grits are made from lightly toasted soya beans that have been ground into coarse pieces. The toasting brings out their pleasant, nutty flavor.

DO YOU KNOW...?

Other uses of pulses

- **Part of the vital web of biodiversity.**
- **Foster sustainable agriculture and soil protection.**
- **Unexpected ally against climate change.**

2.10.6 Role of pulses in cookery

Role of pulses in cookery

1. Pulses are rich in proteins and B - vitamins and improve the quality of cereal proteins.
2. Pulses give satiety due to high protein and fibre content.
3. Pulses improve flavor and consistency of dhal sambhar and rasam.
4. They contribute to fermentation in Idli and Dosa batter.
5. They are used in snacks like sundal, bajji, etc.
6. They are used in salads, eg. sprouted gram.
7. They are used in desserts like dhal payasam and sweets like mysorepak and ladoos.
8. They are used as thickening agents, eg. Bengal gram flour in gravies.
9. Roasted pulses are used in chutneys and chutney powders.
10. They are used as seasonings and curries.

2.10.7 Health benefits of pulses

- **Good for Your Heart:** Pulses are high in fiber and potassium which is useful in lowering blood pressure and reducing the risk of heart diseases.

- **Lower Risk of Diabetes:** Pulses are a low-glycemic index food. Including pulses in the diet can make it easier to manage the blood sugar levels.
- **High in Protein:** Pulses also make a healthy and inexpensive source of protein.
- **Good Source of Folate:** Pulses also are a good source of folic acid, a B vitamin needed to produce and maintain new cells.
- **Pulses can help maintain and lose weight:** The fibre in pulses increase the satiety value and helps in reducing and maintaining weight.

Summary

- A cereal is any grass cultivated for the edible components of its grain (botanically, a type of fruit called a caryopsis), composed of the endosperm, germ and bran.
- Cereals are the main source of energy, contributing 70-80 percent of the requirement.
- Cereals contain 6-12 percent protein, which are deficient in lysine.
- Cereals are used in food preparation and processing in a variety of ways. The whole grain can be used in porridge, soups, salads and main dishes.
- Secondary processing of cereals results in a variety of products like bread, flakes, pasta, etc.
- Pulses are the edible seeds of plants in the legume family.
- Pulses give 340 calories per 100 grams which is almost similar to cereal calorie value.
- Soyabean with its high protein contents is considered as a substitute for meat protein which is expensive. Soyabean has 42 grams of protein per 100 grams of the product.

Glossary

Terms	Meaning
ARF	Amylase Rich Food. Amylase Rich Food is germinated cereal flours which are extremely rich in the enzyme alpha amylase. They are excellent weaning foods because they reduce the bulk of the weaning foods and are energy dense.
Bran	It is the hard outer layer of the cereal grain which is rich in fibre.
Dextrinisation	It is the process involving the browning of starch foods when subjected to dry heat. The starch is broken down to dextrins.
Distillation	It is the action of purifying a liquid by a process of heating and cooling.
Gelatinisation	It is the process of breaking down the intermolecular bonds of starch molecules in the presence of water and heat, allowing the hydrogen bonding sites to engage more water.

Germination	It is the process by which an organism grows from a seed or a similar structure. The most common example of germination is the sprouting of the seedling from a seed of an angiosperm or gymnosperm.
Gluten	It is a composite of storage proteins termed as prolanins and glutelins and stored together with starch in the endosperm of various cereal grains. It is found in wheat, barley, rye, oats, etc.
Kilns	It is a furnace or oven for baking or drying something.
Macaroni products	They are the class of food each of which is prepared by drying formed units of dough made from semolina, durum flour or any combination of two.
Malting	It is a controlled germination process which activates the enzymes of the resting grains resulting in the conversion of cereal proteins and other macromolecules. Generally Barley is used in the production of malt.

Questions

Part A:

Choose the correct answer (1 mark)

1. _____ is the outer layer of the kernel.

   (a) Bran

   (b) endosperm

   (c) germ

   (d) Epidermis

2. Cereals are deficient in amino acid _____.

   (a) lysine (b) methionine

   (c) cysteine (d) germ

3. Parboiling reduces the loss of vitamin _____.

   (a) A (b) B (c) C (d) D

4. The process of removing bran and germ is called as _____.

   (a) milling (b) parboiling

   (c) malting (d) boiling

5. If a starch product is subject to dry heat, it is called as

   (a) gelatinisation

   (b) gluten formation

   (c) dextrinisation

   (d) gluten

6. Pulses give _____ calories per 100 grams.

   (a) 340 (b) 250 (c) 175 (d) 179

7. Soyabean contains about _____ percent proteins.

   (a) 22 (b)32 (c) 42 (d) 52

8. Pulse protein is deficient in _____ aminoacids.

   (a) Arginine

   (b) methionine

   (c) lysine

   (d) germination

9. Germination increases the vitamin _____ content of pulses.

   (a) A (b) D (c) C (d) V

10. _____ is prepared using defatted soya flour from which most of the oil and carbohydrates are removed.

(a) Tofu (b) TVP

(c) Soya milk (d) Milk

Part B:

Write short asnwer (2 marks)

1. List any two products of wheat.
2. List any two rice products.
3. What are the nutrients present in ragi?
4. What is bran?
5. What are the uses of malted foods?
6. What is fermentation?
7. What is dextrinisation?
8. Write a note on ragi.
9. List the food products that can be made with ragi.
10. List any two millets available.
11. Write on TVP.
12. Write on the uses of soya flour.
13. What is germination?
14. Write on soya protein isolate.
15. What is Tofu?

Part C:

Answer in brief (3 marks)

1. Draw the structure of rice and name its parts.
2. Explain the nutritive value of cereals.
3. How is milling done?
4. Write on the steps in parboiling.
5. Explain the malting process.
6. What are the advantages of fermentation?
7. List the different fermented cereal products.
8. Explain gelatinisation.
9. How can millets be incorporated in the diet?
10. Discuss the nutrient content of pulses.
11. Write on the different forms of pulses.
12. What are the advantages of germination?

Part D:

Answer in detailed (5 marks)

1. Explain parboiling. What are its advantages?
2. Draw and explain the structure of wheat grain.
3. Explain the role of cereals in cookery.
4. What is fermentation? What are the cereal products prepared by fermentation?
5. Explain on the different rice products.
6. Explain the different wheat products.
7. Write on gluten formation.
8. What are the benefits of using millets?
9. How cereals are used in Indian cookery?
10. Explain the health benefits of cereals.
11. Write on the toxic constituents in pulses.
12. Write on the different soya products.
13. Discuss the role of pulses in cookery.
14. How pulses are used in Indian cookery?
15. What are the health benefits of pulses?