



Chapter-5

Flour

5.0 Unit Overview & Description

- ❖ Overview
- ❖ Knowledge and skill outcomes
- ❖ Resource Materials
- ❖ Duration
- ❖ Learning Outcomes
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5.1 Introduction to Wheat Flour

5.2 Composition of Wheat Flour

5.3 Types of Flour

5.4 Grades of Wheat Flour

5.5 Water Absorption Power

5.6 Gluten

5.0 UNIT OVERVIEW & DESCRIPTION:

Overview:

This unit will provide the students information about the composition of wheat flour. It will make them familiarize with the types & grades of flour. It will also provide them information about the water absorption power and gluten.

Knowledge and skill outcomes:

- i) Know the composition of wheat flour.
- ii) Know the types and grades of flour.
- iii) Understand the water absorption power and the role of gluten.

Resource Materials:

- ❖ Gisslin, W. *Professional baking*. New York : John Wiley & Sons, c1985.
- ❖ Sultan, W. J. *Elementary baking*. New York: McGraw-Hill, c1969.
- ❖ Sultan, W.J. *Practical baking. 5th edition*. New York : Van Nostrand Reinhold, c1990

Duration: Total Hours 20

Learning Outcomes:

5.1 Introduction to Wheat	General Overview
5.2 Composition of Wheat Flour	❖ Learn the composition of Wheat Flour ❖ Understand its Composition
5.3 Types of Flour	❖ Know the types of Flour ❖ Learn their Importance
5.4 Grades of Wheat Flour	❖ List down the grades of Wheat Flour
5.5 Water Absorption Power	❖ Learn the power of Water Absorption Power of Wheat
5.6 Gluten	❖ Understand the role of Gluten ❖ Learn its Importance

Assessment Plan: (For the Teachers)

Unit-5	Topic	Assessment Method	Time Plan	Remarks
5.2	Composition of Wheat Flour	Exercise: Question & Answer		
5.3	Types of Flour	Exercise: Question & Answer		
5.4	Grades of Wheat Flour	Exercise: Question & Answer		
5.5	Water Absorption Power	Exercise: Question & Answer Group Discussion		
5.6	Gluten	Exercise: Question & Answer		



5.1 INTRODUCTION TO WHEAT FLOUR

WHEAT is the backbone of most yeast breads. A wheat berry (the actual seed that is clustered on the stalk) is an edible power package. Within just one wheat berry is the near perfect balance of nutrients that so efficiently sustained our ancestors. Upto 19 percent of the grain is protein and the rest being nutritionally valuable complex carbohydrates.



There are three main parts of the grain: The Bran, The Germ, and The Endosperm.

The bran is the thin shiny outer covering of the berry. It consists mainly of cellulose, an indigestible fiber that is good for our digestive system.

The wheat germ is the embryo of the berry. It is rich in protein and oil. Since this oil can turn rancid very easily it is important that the germ is refrigerated or for that matter any flour that contains the wheat germ such as whole-wheat flour.

The endosperm nourishes the berry and makes up the bulk of the grain. When the entire berry is ground, including the bran, the germ, and endosperm, the result is whole-wheat flour. When the bran and the wheat germ are removed the endosperm that remains is ground to make white flour.

Wheat has two growing seasons. The wheat that is planted in spring produces a hard red berry. Since this wheat has a long growing period it develops strength and is quite hearty. It is actually called hard red spring wheat even though it is harvested in early fall. The grain is very high in protein -from 12-14 percent.

Wheat planted in winter and harvested in spring produces a softer berry with a lower protein content-10-11 percent. This grain is called soft red winter wheat.

Whole-wheat berries are available in stores and are usually added into bread dough's to add extra protein, fiber and a strong wheaty flavour to the loaf as well as a substantially delicious chew to the crumb. They are usually softened by soaking overnight in water.

Cracked wheat is exactly what the name suggests: the whole berry coarsely cracked. It can be added into the dough or sprinkled on the crust. It gives the loaf a final rustic look, a



delectable habit forming chew, and an extra nutty flavour. (Don't get this mixed up with bulgur, which is cracked wheat that has been par cooked by steam, dried and packaged.)

As a food crop essential to the making of bread, pastry, and pasta, wheat products are eaten by many people at every meal. Wheat products are valued for their taste and for their nutritional benefit.

Wheat is one of the oldest cereal crops. It was cultivated as long as 9,000 years ago in the Euphrates Valley of the Middle East. Egyptian pharaohs were buried with an ancient variety of wheat to help nourish them on their voyage into the afterlife.

Wheat was also harvested by the ancient Greeks and Romans. It spread from its place of origin into Central Europe and into China, where it has been grown for perhaps 5,000 years. Wheat was brought to North America after the discovery of the New World, but corn remained the major crop of the early settlers. After winter-hardy varieties of wheat were brought to the Great Plains in the 1800s, acreage grew rapidly.

In 1990 more than 595 million metric tons of wheat were produced. The world's largest producer in that year was the Soviet Union, with an estimated annual yield of about 108 million metric tons. Other leading producers were China, the United States, India, Turkey, France, Canada, Germany, Australia, Pakistan, the United Kingdom, Argentina, and Poland. Wheat is a major crop throughout the United States, except in Alaska, Hawaii, and the New England states.

Wheat is easily handled and stored. The wheat berry is small and has high food value. Stored wheat is a highly concentrated form of food. Five bushels of wheat, when processed, will produce more than a barrel of flour. Wheat keeps so well that it can be shipped around the world or stored for years.

Wheat is called a grain. A grain is a member of the grass family Gramineae that yields a starchy seed suitable for food. Other grains are barley, corn, millet, oats, rice, and sorghum.

The Many Kinds of Wheat

There are two basic types of wheat: winter and spring. Winter wheat is seeded in the fall, grows slowly during the winter months, accelerates in growth as spring arrives, and is ready for harvest in early summer. Where winters are harsh, spring wheat is planted in





the spring and harvested in late summer. It can also be sown in the fall where winters are very mild.

There are winter and spring varieties of both hard and soft wheat. Hard wheats are rich in gluten and make fine bread flour. Soft wheats are generally grown in areas with high levels of rainfall. They tend to be rich in starch and low in gluten. Soft wheats lack stickiness for bread making but are used in pastries and are often mixed with bread wheats. White wheat is usually soft winter wheat.

Classification

More than 30 subspecies of wheat (*Triticum*) are known. Some are cultivated, and some still grow wild. A wheat species is classified according to the number and makeup of chromosomes and the structure of the head (spike or ear) of the plant. Chromosomes are the carriers of genetic information in the plant cell. The primitive and early cultivated wheats, such as einkorn (*T. monococcum*), had only 14 chromosomes. They are called diploids. Later types, such as durum (*T. durum*), emmer (*T. dicoccon*), and Polish wheats (*T. polonicum*), have 28 chromosomes and are called tetraploid wheat. The hexaploid wheats spelt (*T. spelta*), club (*T. compactum*), and most of the common bread wheats (*T. aestivum*) have 42 chromosomes. Most commercial wheats are either common wheat, used to make bread and flour, durum wheat, a hard wheat used for stock feed and to make pasta such as spaghetti and macaroni, or club wheat, a softer type, low in protein, used for pastry flour.

The Wheat Plant

Wheat is an annual plant made up of roots, a stem, leaves, and the head, which is also called a SPIKE. The roots can grow about 3 to 6 feet (90 to 180 centimeters) deep. The hollow stem has about six segments joined by nodes, each with an attached leaf. Wheat leaves may be short and wide or narrow and long. They are made up of a sheath, which surrounds the stem, and the leaf blade, which lies out flat so it can gather light. Each leaf is on the opposite side of the stem from the leaf above or below it. Some wheat varieties grow only 2 to 3 feet (61 to 91 centimeters) tall, while others may grow 5 feet (152 centimeters) tall. The shorter varieties are a more suitable food crop.

The head or spike is the part of the plant where the grain forms. The head is usually made



up of a zigzag central axis along which are alternating spikelets each containing several flowers. The flowers are enclosed by protective structures called glumes. In some bearded varieties of wheat, the glumes have a long, slender bristle called an awn.

Fertilization begins about two days after the spike emerges from the sheath of the flag leaf. As the flowers open up, the anthers shed pollen that sticks to the stamen and germinates to grow into the ovary and fertilize the egg cell. Wheat is self-pollinating, which means that it is fertilized by its own pollen. The grain starts to grow after fertilization. The time needed for the grain to grow and mature depends on such factors as temperature and rainfall. In much of the United States, this takes about one month.

The Wheat Kernel

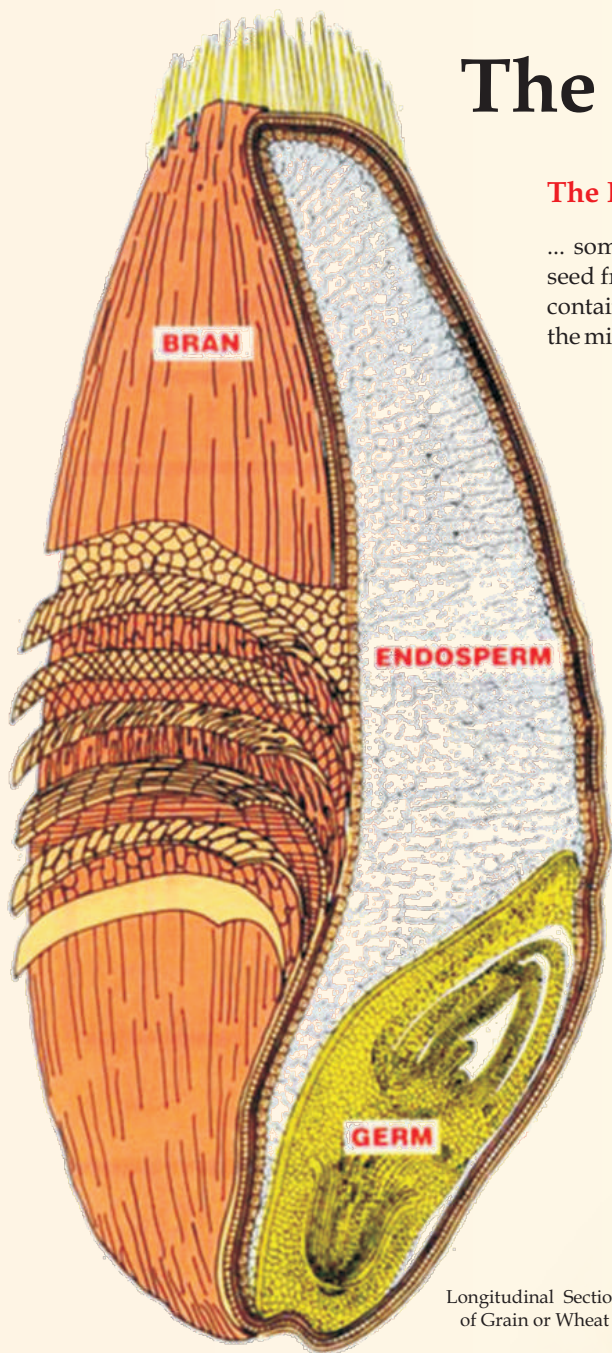
The wheat kernel consists of a tiny plant called the embryo, or germ, which makes up about 3 percent of the weight of the kernel, the starchy endosperm, and the protective seed coat, or bran. The endosperm makes up about 83 percent of the weight of the kernel and is the food supply for the seedling when a seed germinates. When wheat is milled into flour, the bran and germ are removed. Flour is produced by grinding or rolling the endosperm into powder.

Hard wheat used to make bread has 12 to 15 percent protein, while soft wheat has only 7 to 11 percent protein. This extra protein in hard wheat makes bread dough sticky, so that it rises better during baking. The rest of the wheat kernel is 2 percent fat, 2 percent mineral, 65 to 70 percent carbohydrate, 3 percent fiber, and 13 percent water. Wheat grain also contains some vitamin E and several B vitamins, especially niacin. Since the bran contains more protein and vitamins than does the starchy endosperm, whole wheat flour is more nutritious than white flour. In addition to being one of the oldest grains grown, wheat is the world's most widely grown cereal. It is believed to have been milled into meal 9,000 years ago. In modern times wheat is used to produce meal, breakfast cereals, and flour for bakery products. It can be cultivated in a wide range of soils but thrives in temperate climates. There are essentially two kinds of wheat. Hard wheat is grown mainly in the United States and Canada, and soft wheat is raised mainly in Europe and Australia. The hard wheat is better for bread making, the soft wheat for cakes and biscuits. There are also differences between the varieties of wheat planted in the spring and those in winter. Spring wheats grow quickly and are harvested in late spring or early





summer, whereas winter wheats are planted in late autumn and are not harvested until spring or early summer wheats grow quickly and are harvested in late spring or early summer, whereas winter wheats are planted in late autumn and are not harvested until spring or early summer.



The Kernel of Wheat

The Kernel of Wheat

... sometimes called the wheat berry, the kernel is the seed from which the wheat plant grows. Each tiny seed contains three distinct parts that are separated during the milling process to produce flour.

Endosperm

... about 83 percent of the kernel weight and the source of white flour. The endosperm contains the greatest share of protein, carbohydrates and iron, as well as the major B-vitamins, such as riboflavin, niacin and thiamine. It is also a source of soluble fiber.

Bran

... about 14 percent of the kernel weight. Bran is included in whole wheat flour and can also be bought separately. The bran contains a small amount of protein, large quantities of the three major B-vitamins, trace minerals and dietary fiber - primarily insoluble.

Germ

... about 2 percent of the kernel weight. The germ is the embryo or sprouting section of the seed, often separated from flour in milling because the fat content (10 percent) limits flour's shelf-life. The germ contains minimal quantities of high quality protein and a greater share of B-complex vitamins and trace minerals. Wheat germ can be purchased separately and is part of whole wheat flour.

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Longitudinal Section
of Grain or Wheat



5.2 COMPOSITION OF WHEAT FLOUR

Refined flour is a hard wheat flour with about 12 percent protein. It is used for yeast raised bread because the dough it produces has more gluten than dough made with other flours. Sufficient gluten produces a light loaf with good volume. Slices hold together, rather than crumble. Wheat flour contains the nutritious germ and bran as well as the endosperm of the wheat kernel. Bran particles cut through the gluten during mixing and kneading of bread dough, resulting in a smaller, heavier loaf.

Composition of flour will be depending upon the types of wheat used in grist. A typical analysis is given below:

Starch	71.5 to 74.5%
Moisture	13.5 to 14.0%
Protein (gluten forming)	7.0 to 10.0%
Protein (soluble)	1.0%
Sugar	2.0%
Fat	1.0%
Ash (mineral salts)	0.5%

Starch

Starch consists of microscopic granules or cells. Although starch is not soluble in water, it absorbs moisture through its cells and hence the necessity of protecting flour from too humid atmosphere.

When starch is heated about 140 deg F. with about six times of its weight of water, starch cell swells and cell bursts. Starch becomes soluble in water and in concentrated form will form a gel.

This process is known as gelatinization. This quality of starch is made use of in making fruit pies where fruits are kept in suspension in starch gel, degree of gelatinization influences the water holding capacity of starch cells. Completely gelatinized starch will hold more water for long time than partially gelatinized starch. For complete gelatinization of starch, there should be sufficient water available and it should be heated to 140 deg F.



During the cooling process starch cells give away some of its water, which is partially held by gluten framework and partially evaporated. When such bread is heated, starch cells again absorb available water and become swollen. This is why a state bread becomes softer when heated.

During the process of milling about 6% of starch cells are crushed and damaged due to impact of rolls. Such starch is also known as soluble starch. The enzyme Beta-amylase present in the flour acts on soluble starch and converts it to maltose sugar. Enzymes also get activated with the rise in temperature and convert more starch into maltose sugar. Thus the need of yeast for more food is fulfilled and due to increased gas production, bread acquires desired volume. However, the presence of excessive damaged starch cells will cause production of undesirable amounts of maltose sugar, only a part of which will be needed by yeast.

Alpha amylase is another enzyme of amylolytic group which is found in flour. This enzyme partly breaks down the sound starch cells to form dextrins which, in limited amount, give sheen to bread, improving its eye appeal.

This activity of alpha and beta amylase is known as diastatic activity. When flour lacks in diastatic action, it can be supplemented by using diastatic malt in the formula. If flour has excessive diastatic activity as in this case of flours made from sprouted wheat it may be useful to take the following precautions in order to reduce to some extent the harmful effects of excessive diastatic activity.

1. Use plenty of yeast for vigorous fermentation of dough.
2. Keep the doughs cool as high temperatures will promote the amylase activity.
3. Use emulsifiers liberally to prevent stickiness in the crumb.
4. Keep strict control on fermentation and prevent the doughs from becoming acidic.
5. Bake the bread thoroughly so that it has even golden brown colour all around.
6. Slice the bread when it is thoroughly cooled.

Moisture

The next important constituent of flour is moisture. A level of 13-14% moisture content in flour is ideal from bakers point of view. If moisture in flour is higher, the baker will be



getting less solid material and more of water for his money. Higher moisture will warm up the flour during storage and will induce insect infestation, reducing its storage life. If the moisture content of flour is high, it will reduce the water absorption power of the flour, resulting in less yield.

Protein

Maida contains soluble and insoluble proteins. Soluble proteins are useful in providing nourishment to yeast for its growth and reproduction during fermentation process. Two insoluble proteins gliadin and glutenin form a rubbery material when water is added to flour and it is mixed. This rubbery material is known as "gluten" and is responsible for formation of structure of baked products. High structured products like bread will require stronger quality of gluten while lower structured products like cakes, cookies do not require strong gluten.

Glutenin gives strength to the dough in order to enable it to hold gases during baking operation and gliadin gives elastic or stretching properties to dough. The quantity and quality of these two proteins present in the flour determine the quality of the flour which is termed as strong, weak or medium. These terms should not be confused with hard or soft because these terms specify the type of wheat from which the flour is milled.

It does not require any elaborate equipment to estimate the quantity of gluten. Just an accurate weighing scale, a small bowl, a plastic spatula or a spoon, a small measuring cylinder and a wire sieve.

Ash Content

Ash content of flour is indicative of the degree of its purity with respect to bran fragments. Higher ash content means that the flour contains too much of bran fragments. Apart from darkening the colour of flour, the bran fragments can also have a cutting action on gluten fibres. Such flour will not retain gas during different stages of processing and the product thus made will have a low volume and poor texture. The protease enzyme present in the "Aleuron Cells" will also weaken the flour.

On a small glass plate place a small heap of flour and with another similar glass plate press the flour to smoothen the upper surface. Gently cut out rough sides, and form a neat wedge. Now dip this wedge gently in slanting position in a bowl of water so that the



surface of flour is moistened. Now observe the moistened surface minutely. Colour of bran fragments will be more pronounced in wet condition.

Sugar

Small quantity of sugar which is naturally found in flour is of sucrose or maltose type. Even if sugar is not added to bread formula, it should be possible to make bread as the sugar naturally occurring in flour will provide sufficient food to yeast to produce carbon dioxide gas. Apart from providing food for yeast, sugar has other functions to perform i.e. retaining moisture in bread, imparting golden brown colour to crust, improving taste and flavor of bread etc. these beneficial effects cannot be achieved with the limited amount of sugar naturally occurring in flour. Hence, the necessity for using additional sugar in bread formula.

Exercise

Activity:-

1. Write the components of flour along with their percentages?
2. Define the following?
 - a) Gelatinisation
 - b) Gluten

5.3 TYPES OF FLOUR

Wheat flour is consumed in larger quantities worldwide than any other cereal flour. This is because of its extensive availability wheat can be grown under widely varying climatic conditions and to its almost universal acceptance as a staple food item (see Wheat). Wheat flour contains a unique protein called gluten. When wheat flour is mixed with water, the gluten forms an elastic dough. When the dough is baked in a hot oven, it expands to several times its original volume. Flours made from soft wheats containing less than 12 percent of gluten protein are used to make





tender products such as cakes and crackers. Flours made from hard wheats containing more than 12 percent protein are used for bread and roll production. The miller can supply the baker with a wide range of wheat flour types, each custom milled to the baker's specifications

Rye flour contains a small amount of gluten protein and may be used by itself to produce dark rye breads. It is often blended with wheat flour to produce finer textured, light rye breads. The distinctive flavor of rye flour makes it a common inclusion in such items as snack foods and prepackaged toast.

Rye has always been grown amid wheat, being a more heartier and insistent plant-like a weed. At one time the European farmers tried to remove it from cultivated wheat crops but they had to give up, because the rye persisted growing at a faster rate than they could remove it. So they simply started harvesting it with the wheat, and started calling it rye flour. Nowadays rye is grown separately and one can get 100 percent rye without the adulterating wheat.

Rye contains very little gluten so rye breads are often created by a high proportion of gluten strong wheat flour to assure a well-risen loaf. Breads that are completely rye will not rise much, but they will have a real hearty intriguing flavour. Be warned that dough's with rye flour behaves differently from wheat dough's; it will be very tacky and will rise at leisured not more flour if these dough's appear sticky, or you will get a heavy, sodden loaf.

Rye berries are dark brown whole grains. Although each grain delivers about 7 percent protein but virtually no gluten, the fragrant benefit of adding rye to breads is remarkable. One can even add the soaked softened whole grain and the cracked rye berries to breads for extra nutrition, distinct toasted aroma, and subtle bite in flavour.



Some mills grind the whole rye berry, bran and all into a very coarse meal, which is often called pumpernickel rye flour. (Pumpernickel bread does not come from the pumpernickel grain. The name derives from a German, Herr Pumpernickel, who popularized this dark, hearty bread many years ago.)



Corn flour and **Corn meal** are used in the production of crusty corn breads and muffins. Corn has no gluten but does have a distinctive flavor and a pleasant yellow color that is desirable in many products.

CORN is native to the Americas. According to the archeologists the Aztecs grew sacred forests of these yellow grain. The kernel just like the wheat berry is full of complex carbohydrates. Cornmeal comes in a variety of different colours. Mostly one finds the yellow cornmeal, though one even gets the white variety as well as the blue cornmeal. The yellow and the blue are the most flavourful, but you may have to add a little more fat to the blue variety. Cornmeal adds a rich sweet taste to the crumb and gives a rugged look to the crust.



Corn flour



Corn meal

Oat flour and **Oat meal** are used primarily in breakfast foods and granola-type products. Oat flour is the most nutritionally complete of all flours. Oats the grain is called Groat, and it is packed with B vitamins, vitamin E, minerals, and iron, a great deal of soluble fiber and a fair amount of fiber. One can use the familiar rolled oats, which is often cooked into oatmeal, on top of some bread for the classic country appearance.





Barley flour can be found in baby foods and malted milks. In some countries large quantities of barley flour are used for bread making.

Sorghum and millet flours are popular in India, Central America, and Ethiopia. They are utilized in the making of flat bread, tortillas, and pancakes.

Rice has long been the staple food of Asia. It is normally eaten as a whole grain, so rice mills remove either the hull to produce brown rice or both the hull and the bran coat for the production of white rice. A small percentage of rice is converted to flour and is used in baby foods and sauces.



Buck wheat is not a true cereal grain, but buckwheat flour



provides a distinctively flavored pancake and breakfast food ingredient. Buck wheat is actually a grass like herb, related to sorrel, and has a slightly sour flavour. Buckwheat flour has an attractive tan colour speckled with dark brown. Substitute not more than 20 percent of buckwheat for regular wheat in the recipe. If you add more the taste will be too overpowering and too strong.

Whole Wheat Flours are made from 100 percent whole-wheat berries creating a heady light brown flour. The flour feels gritty when rubbed between your fingers, and the bran is visible in flecks. During fermentation these bran flecks help the dough rise as they trap the carbon dioxide.



Bleached and Unbleached Flour: Unbleached flour is ground wheat flour with the bran sifted out, but with all the germ remaining. As the sifted flour is stored and aged it naturally starts bleaching and lightens in colour. It was found that the aged bleached flour was easier to manipulate into the dough's, so commercial bakeries began to demand the whitened flour. To accommodate this need without the lengthy aging period, chemical methods of bleaching were developed.

Semolina Flour is granular flour made from Durum, which is a variety of hard wheat, with the bran and germ removed. The term Semolina refers to the texture, which is



similar to finely ground cornmeal. Many believe that semolina flour makes the best pasta. Semolina Flour is used in making pasta and Italian puddings. It is made from durum wheat, the hardest type of wheat grown. The flour is highest in gluten. When other grains, such as rice or corn, are similarly ground, they are referred to as "Semolina" with the grain's name added, i.e., "Corn Semolina" or "Rice Semolina." There are difference grades:

- 1) Semolina flour is finely ground endosperm of durum wheat.
- 2) Semolina meal is a coarsely ground cereal like farina.
- 3) Wheaten is ground whole-grain wheat.
- 4) Durum flour is finely ground semolina and is grown almost exclusively in North Dakota.

Organic Flours are flours that are grown in fields that are fertilized by naturally occurring substances-composted materials, aged animal manure, and green manure. The soil as a result becomes more loose and this allows the roots to grow deeper, and the plant structure is strong. When the grain is harvested and cleaned it is stored without the use of fumigants or synthetic agents. The result is a full bodied wholesome taste, like a tomato or a carrot grown in your own garden.

Commercial fields are on the other hand treated with pesticides, to fight bugs, herbicides to combat weeds, fungicides to combat fungi and other synthetic fertilizers. The young crop is sprayed repeatedly during the growing season and sprayed again after it is harvested and stored. The flour is rather flat tasting and characterless in flavour.

Food Value

Foods containing cereal flours have contributed to human nutritional needs for thousands of years. In the United States they contribute up to 28 percent of the energy, 18 percent of the proteins, and 46 percent of the carbohydrates in the average diet. In some European and North African nations, they provide as much as 75 percent of the energy and 90 percent of the proteins in the average diet.

In the United States wheat flour, corn meal, and macaroni are enriched with vitamin B1, vitamin B2, niacin, and iron. Vitamin D and calcium are added to flours for use in areas where flour is a primary nutritional source. Cereal flours are generally low in fats.

Exercise

Activity:-

- Q1) Visit a nearby flour mill and identify the products and categorize them.
- Q2) List the different types of flour.

5.4 GRADES OF WHEAT FLOUR

Bleached and Unbleached flour: Flour that is bleached naturally as it ages is labeled "unbleached," while chemically treated flour is labeled "bleached." Bleached flour has less protein than unbleached. Bleached is best for pie crusts, cookies, quick breads, pancakes and waffles. Use unbleached flour for yeast breads, Danish pastry, puff pastry, strudel, Yorkshire pudding, eclairs, cream puffs and popovers.



Bread Flour is white flour made from hard, high-protein wheat. It has more gluten strength and protein content than all-purpose flour. It is unbleached and sometimes conditioned with ascorbic acid, which increases volume and creates better texture. Bread flour has 12% to 14% protein (gluten). This is the best choice for yeast products.

Cake Flour is a fine-textured, soft-wheat flour with a high starch content. It has the lowest protein content of any wheat flour, 8% to 10% protein (gluten). It is chlorinated (a bleaching process which leaves the flour slightly acidic, sets a cake faster and distributes fat more evenly through the batter to improve texture. When you're making baked goods with a high ratio of sugar to flour, this flour will be better able to hold its rise and will be less liable to collapse. This flour is excellent for baking fine-textured cakes with greater volume and is used in some quick breads, muffins and cookies. If you cannot find cake flour, substitute bleached all-purpose flour, but subtract 2 tablespoons of flour for each cup used in the recipe (if using volume measuring).

Pastry Flour also is made with soft wheat and falls somewhere between all-purpose and cake flour in terms of protein content and baking properties. Pastry flour (also known as cookie flour) has a protein (gluten) of 9% to 10%. Use pastry flour for making biscuits,



pie crusts, brownies, cookies and quick breads. Pastry flour makes a tender but crumbly pastry. Do not use it for yeast breads. Pastry flour (both whole-wheat and regular) is not readily available at supermarkets, but you can find it at specialty stores and online. You can try to mimic it by using a 2-to-1 ratio of all-purpose flour to cake flour.

Exercise

Fill in the blanks:

1. The percentage of gluten in bread flour is _____.
2. The percentage of gluten in cake flour is _____.
3. The percentage of gluten in pastry flour _____.

5.5 WATER ABSORPTION POWER

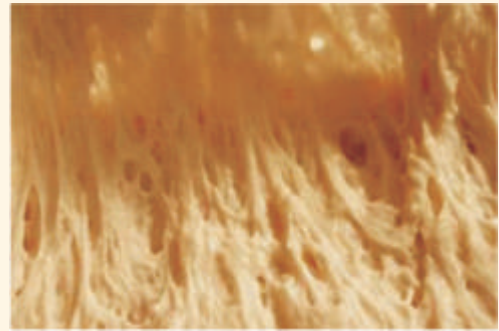
The most important characteristic of flour is its protein content, because the protein content determines how much gluten can be developed. The protein content depends primarily on the type of wheat used and its growing conditions. To make high protein flour, you must start with high protein wheat.

The milling process affects the protein content of a grade flour. Remember that the outer portion of the endosperm is higher in protein than the inner portion. Thus, a flour made from just the inner portion of a high protein grain will still be a high protein flour, but it will be lower in protein than a flour made from the entire endosperm or from just the outer portions. The protein content of flours available to professional bakers is always indicated. It may range from about 8% for cake flours to 12% to 13% for bread flour to 14% and up for high gluten flour.

Absorption refers to the amount of water a flour can take up and hold dough consistency or stiffness. It is expressed as a percentage of the weight of flour. Thus, if the absorption ratio of a certain grade of flour is described as 60%, this means 60 lb water combined with 100 lb flour would yield a dough of standard consistency. The absorption ratio of water is a function of the protein content. The higher the protein content of the flour, the more water it can absorb. This is an important consideration for the baker. She will have to adjust the water in her bread formulas if she starts using flour of a different protein content.

5.6 GLUTEN

While the endosperm contains mainly starch, it also contains the proteins glutenin and gliadin. When these two proteins are moistened they form together a super protein called GLUTEN. Gluten provides the muscle for a yeast dough, a highly valued baking quality. When the dough is kneaded the gluten develops, forming thin flexible web like strands in the dough. The muscular strands stretch and expand, trapping carbon dioxide as the dough rises during fermentation.



Dough's with well developed webs of gluten, will rise well , producing high expansive breads with good flavour. Wheat is the only grain which provides this proportion of gluten, therefore it is an essential ingredient in making traditional bread.

Exercise

- Q1) What is gluten?
- Q2) Discuss the role of gluten in dough?