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Flour - The Integral Part of Balance Diet-Exploratory Study on Cereals Products

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ABSTRACT

This paper shows that many foods made with flour are not healthy, but that is not entirely to be blamed on the flour itself. And it is not necessarily the number of carbohydrates those foods have that make the food unhealthy. Whole grains contain an abundance of healthy vitamins and minerals to support the health of your body.

Keyword-- Gluten, Bran, Cereals, Triticum, Pastry Flour, Bran, Germ

I. INTRODUCTION

Cereals are named after ceres, the roman goddess of agriculture, and comprise edible grains such as wheat oats, corn and foods prepared from such grains.

Characteristics

- They are starchy carbohydrates which are essential for human consumption.
- They come from cultivated grasses. The cereal grasses we harvest are the valuable grains which are actually the fruit of the plant.

Division

Cereals can basically be divided into two:

i) Grains (that are used directly for consumption) ii) Cereal Products (processed products from cereals)

GRAINS:- Barley, Buckwheat, Corn/Maize, Millet, Oats, Rice, Rye, Wheat.

CEREAL PRODUCTS:- Cornmeal, Cracked Wheat, Sago, Semolina, Tapioca, Bran (Wheat germ)

Barley – It is native of Mesopotamia where it was milled to make bread. It is usually used to make bread flour. The husked, polished berry is pearl barley which is used to make soups.

Buckwheat – It is probably native of china. Its seeds are roasted and made into flour which is used to make pancakes and noodles.

Corn/Maize - It is native of Mexico. It has been cultivated for thousands of years, both as a vegetable as well as a source of meal. The dried grains when grounds are known as cornmeal, used as a thickening agent. Used for making corn flakes, a breakfast cereal.

Millet - It is native of Asia. High protein content but is inferior for baking. Millet flour is used for flat breads and griddle cakes. The grains can be mixed with vegetables and pulses to make soups and stews.

Oats - It is Native to central Europe. They are Scottish staple and are milled to varying degrees of fineness. Cooked with water oats become porridge. It is the hardest amongst all cereals.

Rice - It is native to India and Indo-China. Countless varieties include: i) Glutinous ii) Converted (parboiled to remove surface starch) iii) Arborio: Italian. iv) Kome: Japan v) Carolina: America vi) Basmati: Pakistan vii) Brown rice with the bran

Rye - It is important cereal crop in Europe, after wheat where it is milled to make bread flour. In Germany rye flour is used to make dark pumpernickel bread. Because of its gluten deficiency, rye flour is usually mixed with wheat flour in bread recipes.

Wheat - It is native of Mesopotamia and grown extensively in Europe. They are basically of two varieties, bread wheat mainly used for bread flour and hard wheat used to make pasta and semolina.

CEREAL PRODUCTS (Cracked Wheat) - It is obtained by boiling and drying the grains and finally grinding them. This is prominent staple food throughout the Middle East to make Tabbouleh salad. It is pounded to a paste with lamb to make Lebanese Kibbi.

Cornmeal/Polenta - It is finely milled grain. Cornstarch is the paste of starch extracted from the meal. A polenta is deficient in gluten, so when mixed with wheat flour and baking powder it acts as the raising agent.
Sago - It is the dried, starchy granules obtained from the sago and other palm trees growing in the Far East. It is used as an invalid food, in milk puddings.
Semolina - It is particles of the endosperm of the hard durum wheat used to make puddings.
Tapioca - It is Pellets (grains) or flour made from the root of a tropical plant called cassava. They form the basis of nursery milk puddings, and is also used in soups and stews as a thickening agent
Bran - It is bran of cereals helps to provide the roughage in the diet and can be added to white flours. Is rich in proteins and is used as a thickening agent for stews and soups.
Flour comes from the word 'Flower' that means best part of the meal, i.e. portion of grain left after milling and screening out the large particles of grain. A single grain consists of three layers, bran, germ, and endosperm. There are many varieties of wheat and they are classified according to their planting schedule and endosperm composition. Flour is obtained when grain and pulses are milled. Milling can be of various degrees to give a particular stricter to the product and the usage of each milled product will be different from other. Wheat is the among the most extensively cultivated cereal crops in the world, it is a member of grass family and botanical name is triticum. Commercially wheat is classified into three sections. 1. Triticum vulgare, used for making baker's flour. 2. Triticum durum, used for making pastas. 3. Triticum compactum. Used for making low-gluten flour.

II. RESEARCH METHODOLOGY

This study is done using extensive literature review and further study is undertaken in experiential manner by collecting data directly from various food and tourism books and journals.

Wheat is milled to produce flour. The main factor to be considered when choosing a flour for baked goods is the protein content. This protein is called gluten and is responsible for giving elasticity to the dough. Always store the flour at 10-16 c. White flour can be store till 4-6 month. Brown and whole meal flours contain more fiber than white flour. There are many varieties of flour on the market today. Flour is the powdery substance created when a dry grain is powdered. This is referred to as the milling process. The most common varieties of flour are made from wheat although any grain can be made into flour, including rice, oats, corn or barley. The Components of Flour: In addition to the type of grain used, flour also varies depending on what part of the grain is retained during the milling process. This may include the endosperm, bran or germ.

- **Endosperm**: This is the starchy center of the grain, which contains carbohydrates, protein and a small amount of oil. Most simple white flours contain only this portion of the grain.
- **Bran**: The outer husk of the grain, known as bran, adds texture, color and fiber to flour. Bran gives whole grain flours their characteristic brown color and rough texture.
- **Germ**: The germ is the reproductive epicenter of the grain and is a concentrated source of nutrients. Flour that retains the germ during the milling process will contain more vitamins, minerals and fiber.
- **Gluten** is a protein found naturally in the endosperm of wheat. It gives structure, strength, elasticity and a characteristic chewy texture to baked goods.

Milling of wheat

The grains are passed through fitted cylindrical rollers having blades which are adjacent to each other. Before milling, grain is passed through two steps – cleaning and conditioning. Conditioning is done to increase the moisture content of the grain. Milling is the process of separating endosperm from bran and germ and grinding the endosperm, a)It is passed through grooved rollers. b) Then through reduction rollers. Grading of wheat:- according to size, quality and shape the wheat grains are graded in to 1st grade, 2nd grade and 3rd grade. Cleaning:- cleaning is done to remove any unwanted material from the whole wheat yield.
(i) After grading wheat is put into cylinders and air is passed from the bottom of the cylinder so that light material fly up and are collected in to waste bags, kept at the top of the cylinder.
(ii) Heaver weeds, stones and any other grain are removed by passing them in to disc separators, which have holes in the center and collects the wheat only
(iii) Grains are passed through rotators which rotate wheat and water together. by this process wheat is floated on top leaving behind the heavy materials at the base of the rotators.
Bleaching & Ageing: - After milling, the flour is bleached and aged. Bleaching is done to whiten the flour and is done with chlorine gas. This improves the quality of the flour. Ageing is done using chemicals to accelerate and control flour improvement. It affects bonding characteristics of gluten protein in such a way that they form stronger and more elastic dough. The different substances present in flour including protein are starch, lipids, sugar, and enzymes.

Tempering

Tempering given to wheat before milling to allow the bran to be completely removed without losing much of the endosperm. Wheat is held in tempering tanks containing water held at a specific temperature of 80 F.

good milling can be achieved when the grains have moisture between 16% to 17%.

Enrichment

The refined flour is enriched with vitamins and minerals, then packed and dispatched to the consumers.

Flour are used for the following purposes in baking:-

A) It's a structure builder of product.
B) It absorbs more water and gives much better yield.
C) Its gives good texture, volume of finished product.
D) Eating quality(taste) depends on quality of flour.
E) Forms the foundation of all bread, pastries and cookies.
F) Gluten, a protein present in flour plays an important role in the formation of dough.
G) Feeds the yeast and makes it grow and rise with the aid of carbon-di-oxide with in the dough, giving it right structure.
H) The protein of interest is gluten forming protein.
I) Gluten is made up of two insoluble proteins called gliadin and glutenin. When wheat flour is mixed with water, gluten forms. Gluten gives the dough gas-retaining ability.
J) Gluten imparts elasticity to the dough.

Common Flour Varieties: - All-Purpose: All-purpose flour is made from the endosperm of wheat. This flour is often bleached to give it a clean, white appearance and enriched to include nutrients that are lost due to the removal of the germ and bran. All-purpose flour has a medium balance of starch and protein so that it can be used in a wide variety of products without being too heavy or too delicate.

Unbleached: Unbleached flour is similar in composition to all-purpose flour but has not been chemically bleached. Unbleached flour can be used successfully in as many recipes as all-purpose flour. Unbleached flour is a good choice for those who are concerned with flavor purity or exposure to chemicals.

Bread Flour: Bread flour contains a higher ratio of protein to carbohydrates than all-purpose, which produces stronger dough. The strong gluten matrix provides structure to rising dough and gives the end product a nice, chewy texture.

Cake Flour: Cake flour contains less protein than all-purpose and is milled to a finer texture. These two factors combined create a softer and more delicate crumb. Cake flour is often bleached to improve its appearance.

Pastry Flour: Pastry flour has a medium protein content and is between all-purpose and cake flour in texture. The fine texture produces flakey pastry crust while the slightly lower protein content prevents pastries from being too dense or chewy. In addition to pastries, this flour is also great for making cookies, biscuits and quick breads.

Self-Rising: Medium strength flour has chemical agents blended with it. On being made into dough, the chemical agents react producing carbon dioxide and make the dough expand and become porous. Self-rising flour is mainly used to make biscuits and other quick breads. It is comprised of all-purpose flour, salt and a chemical leavening agent such as baking powder. Self-rising flour should never be used to make yeast breads.

Whole Wheat: Whole wheat flour is made by grinding the entire grain (endosperm, bran and germ). This flour contains more nutrients and fiber than all-purpose making it popular among health conscious individuals. Because bran can interfere with the formation of a gluten matrix in dough, whole wheat flour often produces a heavier, denser bread than all-purpose or bread flours.

Whole-meal flour: Flour, which by law must contain 100% whole-wheat grain, is called whole-meal flour. It is light brown in color. Stone brown whole-meal flour is usually considered as quality whole-meal because of the developed flavor due to heat generation during milling.

Wheat-meal flour: Similar in appearance to whole-meal, it contains more than 85% of the grain, the very coarse bran particles being removed during milling. Like whole-meal, the granularity of the bran affects the general color and appearance of the flour. Most brown flours available are wheat-meal.

Germ Meal Flour: All germ meal contains a higher percentage of germ than is usually found in the flour, this germ having been cooked with salt and then mixed with flour. The addition of a higher percentage of germ makes the meal more nutritious and full of flavor.

Malted Meal Flour: This is usually made of whole-meal and white flour plus soya and malt flour. Sugar and salt are added to the meal before it is sold.

Weak Flour: Milled mainly from English & Australian wheat it is low in protein content [about 8%].

Medium Flour: Milled from a mixture of wheat that produces flour with an average protein content [about 10%].

Strong Flour: Milled from Canadian and American wheat, this grade is high in protein [about 17%].

Straight Run Flour: It is general-purpose flour and does not have any patent grade. It contains all the white flour extracted from a particular grist.

High Ratio Flour: Also called special cake flour, this is milled from high-grade wheat that has an extraction rate of less than 50%. It has low gluten content but is of high quality. The flour is milled more finely than usual and is heavily chlorinated. Besides increasing absorption properties, chlorination brings about oxidation improving the gluten quality and bleaches the flour, increasing whiteness.

High Protein Flour: The small particles of endosperm, being less than 15 microns in size, contain a much higher percentage of protein. Because of its small particle size, it is not satisfactory on its own for bread making.

Grades of Flour:- Although white flour is of three types – weak, medium, and strong, there are grades of quality within each. These are based on the proportion of flour

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extracted from the wheat and the amount of bran and germ in the flour. The two main grades are

1) **Patent Grade**: It is the finest grade and comes from the first, second and third break-rollers. A typical patent would be 25% to 40% extraction. The remaining percentage is further processed to make a lower grade of flour. Patent grade is used for bread and cake manufacturing.
2) **Baker's Grade**: It is the main grade of white flour with 70% to 72% extraction i.e. nearly all the endosperm is removed from the grain. It is not as refined as patent grade and therefore cheaper.

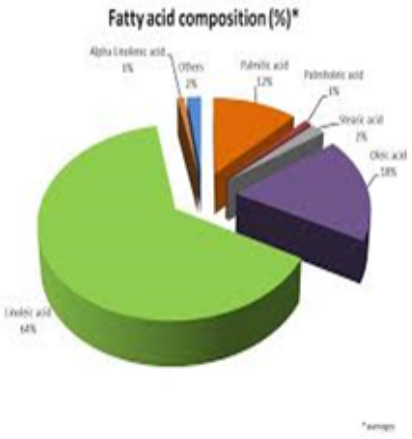
Other Flours: Rye flour does not develop gluten. The breads are heavy and hard. Rye blend is a mix of rye flour and hard wheat flour. Corn meal, buckwheat flour, soy flour, potato flour, oat flour, and barley flour are mostly used in combination with wheat flour because they do not develop gluten. Stone Ground: Stone ground flour is the same as whole wheat flour but is milled to a coarser texture. Stone ground flour is valued for its characteristic rough texture and rustic look.

Semolina: Semolina is flour made from a specific variety of wheat known as Durum. Durum wheat has exceptionally high protein content, giving it a very dense, chewy texture. For this reason, semolina is most often used to make pasta.

Rice Flour: This flour is made from milling grains of rice and can be found in both white (endosperm only) and brown (whole grain) varieties. Rice flour is lighter in texture than wheat flours and is a popular choice among those who are intolerant to gluten.

Masa Harina: is flour made from milling corn that has been treated with an alkaline solution, usually containing lime. The lime helps loosen the corn's husk prior to milling and improves the nutritional content of the flour. Masa harina is used to make tortillas, tamales and other dishes popular in Central America.

Types of flour and their protein content



Flour	Protein Content
Whole wheat flour	13.3%
Semolina	12.3%
Straight hard flour	11.8%
All purpose flour	10.5%
Straight soft flour	9.7%
Cake flour	7.5%

Source:-google.com

Gluten: Gluten is a substance made up of two proteins named gliadin and glutenin present in flour. Gluten gives the strength to the dough in order to hold the gases during baking and the gliadin gives the elasticity or the elasticity nature to to the dough. For gluten to develop the proteins must first absorb water. As the dough/batter is kneaded/mixed, gluten forms long, elastic strands and as dough/batter is leavened these strands capture the gases in tiny pockets or cells and we say that the product rises. When the product is baked, like all other proteins, gluten coagulates or solidifies and gives structure to the product. The selection of flour [strong or weak], shortening used, amount of liquids and mixing methods help a baker to control gluten.

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- **Physical structure of wheat**

• Bran	>15%
• Endosperm	>83%
• Germ	>2%

- **Composition of flour**

• 1)STARCH	>70%
• 2)PROTEIN (gluten)	>13%
• 3)MOISTURE	>13%
• 4)FAT	>1.0%
• 5)MINERALS(ash)	>0.5%
• 6)SUGAR	>2.5%

Grading of wheat: According to size, quality and shape the wheat grains are graded in to 1st grade, 2nd grade and 3rd grade.

Cleaning: - cleaning is done to remove any unwanted material from the whole wheat yield.

(i) After grading wheat is put into cylinders and air is passed from the bottom of the cylinder so that light material fly up and are collected in to waste bags, kept at the top of the cylinder.

(ii) Heaver weeds, stones and any other grain are removed by passing them in to disc separators, which have holes in the center and collects the wheat only

(iii) Grains are passed through rotators which rotate wheat and water together. by this process wheat is floated on top leaving behind the heavy materials at the base of the rotators.

Tempering: Tempering given to wheat before milling to allow the bran to be completely removed without losing much of the endosperm. Wheat is held in tempering tanks containing water held at a specific temperature of 80 F. good milling can be achieved when the grains have moisture between 16% to 17%.

Milling: Grains are passed through fitted cylindrical rollers having blades which are adjacent to each other.

Enrichment:- Refined flour is enriched with vitamins and minerals, then packed and dispatched to the consumers.

Wheat contains a large amount of gluten. Gluten is elastic, sticky tough substance formed, from the insoluble proteins of wheat flour during dough development. It is the gluten which always expansion of air cells within the dough as it warms. This is essential to a leavened product . Consequently, wheat makes batter bread then other grains. The only other grains which contains appreciable amount of gluten is rye.

Wheat milling process: Wheat is an annual grass of the genus TRITICUM and its grown in most countries in the world. Depending on the soil, climatic conditions, quality of seed and farming techniques, wheat varies widely in its properties.

Wheat is generally classified according to the colour and hardness of grain. Hard wheat yield flour that is high in good quality protein. Such flour have high water absorption power (WAP), good mixing and fermentation tolerance and good gas retention power, and are excellent for bread making. Soft wheat have lower amount of proteins and absorb less water. Such flour are good for cakes, soft dough biscuit and cookies but are unsuitable for bread making.

Physical structure of wheat :- Bran 15% Endosperm 83% Germ 2%

Classes of wheat: Very hard wheat (Durum wheat) Generally high in gluten-producing proteins. Used for

making macaroni, other pasta, semolina and flour which are into Indian flat bread.

Hard wheat: *Includes hard winter wheat and hard spring wheat's, which contain more gluten-producing proteins than soft wheat. Used for making* chapatti, parathas bread, bread roll, French loaf, brown bread.

Soft wheat: Low in gluten-producing proteins. Usually milled into cake and pastry flour.(cake, cookies, pastry). The flour flat shape of the spiced cake best be achieved using flour with week gluten (protein content 8 to10%).

Ray flour has good absorption qualities and is capable of binding to a dough.ray flour rich in enzymes. poor sponginess and reduce the growth during baking.

Durum wheat: As compared to normal wheat, durum wheat is known for good taste, pleasant aroma, and high nutritional value. Its protein content and gluten strength is comparatively higher than regular wheat which makes it easy to cook and great to taste.

Functions of starch: Damaged starch absorbs water in the dough, becoming fully hydrated. Undamaged starch becomes fully hydrated during starch gelatinization which occurs at 140-180f (60-82c)degrees. This is when the structure of bread "SETS". Enzymes convert damaged or gelatinized starches into sugar.

Function of protein: Gluten is made up of two proteins: gliadin and glutenin. When wheat flour is mixed with water, gluten forms. Gluten gives the dough gas-retaining ability. Gluten imparts elasticity to the dough.

TYPES OF FLOURS

CAKE FLOUR— This is selected soft wheat flour which is very finely milled. Cake flour contains more starch and less gluten than a hard wheat bread flour. It makes possible to produce a cake with a lighter smoother texture.

ALL PURPOSE— This is a mixture or blend of hard and soft wheat flour. This type of flour is usually used in home baking.

BREAD FLOUR— It is made from hard wheat and has a high gluten content.

PASTRY FLOUR— It is made from soft wheat but is not as finely milled as cake flour.

WHOLE WHEAT FLOUR— As the name indicates, this flour contains all the ingredients of the cleaned whole wheat grain.

Defining flour quality

PECKER'S TEST— Hold a fist full of flour in the palm and close the palm. If it forms lumps, the flour is having high moisture. It should not taste bitter.

***GLUTEN TEST*—**Make dough with two samples of flour. Then wash the dough separately under cold running water. The jelly like substance left behind is the gluten. Now compare which sample contains more gluten.

WATER ABSORPTION TEST— To find out the amount of water absorbed in making dough, take two samples of flour and make dough. If the amount of water absorbed is 50%- 55% of the weight of flour, it is a good variety of flour.

BAKING TEST— The final texture and appearance of a baked product with two samples of flour are compared and the quality of flour is judged.

Rich dough: Rich dough contains 41.25% enriching ingredients in comparison to the lean dough which contains 0% enriching ingredients.

There are many different formulas for bread, yeast raised products, cake and icing. Some of these formulas contain few or no enriching ingredients. These are termed lean dough, lean cake etc. other formulas have a high percentage of these enriching ingredients. Egg, butter, cream, sugar, fat etc. These are termed rich dough.

Lean dough: Dough made from water salt, flour, yeast is a lean dough. A dough made with flour, yeast, milk, cream, butter, egg, sugar salt is a rich dough, contain a number of enriching ingredient.

III. SECONDARY DATA

Secondary data is collected from various sources like textbooks on human resource, journals and publications, Articles and research papers of other researches in the relevant field of study.

IV. CONCLUSION AND RECOMMENDATION

It is true that many foods made with flour are not healthy, but that is not entirely to be blamed on the flour itself. And it is not necessarily the number of carbohydrates those foods have that make the food unhealthy. Whole grains contain an abundance of healthy vitamins and minerals to support the health of your body. But, in order to create white flour, wheat goes through heavy processing that removes all six of the outer layers of the seed's bran. Whole wheat flour is also rich in vitamins B-1, B-3, and B-5, along with riboflavin and folate. (**It is** distinct forms of which are known as **folic** acid, folacin, and vitamin B9, is one of the B vitamins. The recommended daily intake of **folate** is 400 micrograms from foods or dietary supplements. **Folate** in the form of **folic** acid is used to treat anemia caused by **folic** acid deficiency.) Whole wheat also has more iron, calcium, protein, and other nutrients than white flour. When you are eating a low-calorie diet plan, it's important that the calories you're consuming are loaded with as many nutrients as possible.

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