Odessa National Academy of Food Technologies

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STATE OF THE ART IN BREAD PRODUCTION

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This review on the State of art in bread production has been written in the framework of the BaSeFood FP7 project. General information on bread is given with a special emphasis at rye bread, as containing most useful nutrients and bioactive compounds. Other kinds of bread are also reviewed. Bread market and its peculiarities across different countries are analysed and the technology of bread production is shortly described. The review is useful for bread manufacturers, as well as for scientists and students in the field of bread properties and production.

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CONTENT

Introduction

By definition [1], the state of the art is the highest level of development of something at a particular time. The present state-of-the-art in production of bread is an overview covering the main aspects of bread properties and its production. The main accent is made at bioactives, especially on their importance in health claims, as well as their modification during processing of grain (milling and flour production) and the followed bread baking. Namely these two unit operations (milling and baking) are critical for retention of bioactives during the bread production that will be addressed while performing studies in the frameworks of BaSeFood project's description of work. More attention in this review is paid to rye bread than to wheat one, because of its traditionality and popularity not only in Ukrainian and Russian cuisines, but also in cuisines of some other European countries.

Bread belongs to those foods that form the basis of all civilizations' diets due to its nutritive value, its low price, and the simplicity of using its primary ingredient, the cereals, for culinary purposes [2,3]. Since prehistoric times, bread has been a staple food in man's diet. Probably, the first breads were made with acorn or beechnut flour. It is known that Egyptians prepared bread and it is thought that they discovered fermentation casually.

Bread is rich in complex carbohydrates (starch being the major component), it has a high content of plant proteins, and hardly contains fat. It is a good source of B vitamins and minerals such as

phosphorus, potassium, and magnesium. Due to these nutritional properties, it comes as no surprise that nutrition experts define bread as an essential part of the food pyramid's base, as it should also constitute the base of the diet (in countries where bread is a staple source of carbohydrates), the way it has been for the majority of cultures over the course of human history.

Many false beliefs exist around nutrition and food habits and in the case of bread (and other staple carbohydrate food sources), the popular myth is that it should be one of the principal components to eliminate or restrict when being on a weight loss diet. This false belief according to which carbohydrates make you fat and lack nutritional importance has caused bread consumption to fall far behind the World Health Organization (WHO) recommendations to eat bread several times a day [4]. A number of European countries recommend a daily bread intake of about 250 g, which corresponds to 4-8 slices depending on national food habits (World Health Organization, 2003).

Wheat provides carbohydrate which is the key source of energy. Some people still believe bread is fattening which may be linked to the low-carb fad created by the Atkins diet, but there is absolutely no scientific evidence to support this theory. One slice (35g) of wholemeal bread contains just 76 calories.

Taking into account its nutritional value, bread should constitute a vital part of the diet, ideally being present in all meals from breakfast to dinner. Not consuming bread habitually contributes to an unbalanced calorie intake because the amount of calories coming from foods high in fat or protein would increase, thus deviating from the recommendations for a balanced diet, where 50-55% of total calories should come from carbohydrates, 10-15% from proteins and 30-35% from fat. Therefore, bread should be a regular part of everybody's diet. Only people that suffer from coeliac disease or gluten intolerance need to substitute it by other varieties, which are free of gluten.

In a balanced diet, at least 50% of total calories of diet should come from carbohydrates, which are needed to provide a body with energy to function and develop correctly [5].

Bread contains on average 50-60 g of carbohydrates, mainly as starch (a part of which is resistant starch, which is a type of carbohydrate of slow absorption). Starch is the main component in the wheat grain, accounting for two thirds of it. Other polysaccharides

such as cellulose, hemicellulose, lignin and pentosans are also present but in lower amounts. Bread also contains dextrins, maltose and glucose, which are starch breakdown products.

Fibre in cereals is concentrated in the bran, which is removed to obtain white flour for the production of white bread (the most consumed bread in developed countries). Consequently, the fibre content is much higher in whole grain breads than in white breads, approximately from 2 to 6 times higher. Although fibre is not a nutrient, its consumption is necessary because it has numerous benefits for health.

Bread provides water-soluble vitamins of the B group, which our body has little capacity to store, as well as numerous minerals that our organism needs to function properly.

Specifically, bread contains vitamin B1 or thiamine, vitamin B2 or riboflavin, vitamin B3 or niacin, vitamin B6 or pyridoxine and vitamin B9 or folic acid. With respect to minerals, it contains large amounts of phosphorus, magnesium, calcium and potassium, and in lesser quantities others such as sodium, iron, or iodine.

Both vitamins and minerals are concentrated in the bran and in the germ, parts that are removed during the milling. In consequence, white bread has a much lower content of vitamins and minerals than whole grain bread. This is another reason, together with the higher content of fibre, why it is recommended to increase the consumption of whole grain bread.

Bread is one of the oldest prepared foods, dating back to the Neolithic era, and is referred to colloquially as the "Staff of life". Fresh bread is prized for its taste, aroma, quality and texture. Retaining its freshness is important to keep it appetizing.

CHAPTER I
GENERAL INFORMATION ON BREAD

1.1 Bread in the BaSeFood project

The BaSeFood project provides for execution of works related to traditional bread and improvement of its nutrition value due to optimisation of the production process and improved retention of key bioactive components. To perform this, yield and retention factors of