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# Exploring the Nutritional Benefits of Oats and Innovative Processing Techniques for Enhanced Value-Added Food Products

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Oats (*Avena sativa L.*) are highly valued for their nutritional composition, high dietary fibre level, and phytochemical content. Oats are thought to provide a number of health benefits, including anti-cancer and hypocholesterolaemia qualities. Recently, it has also been determined that oats are a suitable component of a celiac patient's diet. Oat-based food products, such as breads, biscuits, and cookies, as well as probiotic drinks, breakfast cereals, flakes, and baby food, are becoming more and more popular due to their high nutritional content. Studying oats and their products could help fight a number of ailments that are known to humans. An overview of the nutritional and health advantages of oats as whole grains and their value-added products is given in this study. Its purpose is to shed light on how oats are processed and how it affects their useful qualities. The manuscript examines the diverse applications of oats and their fractions in clinical and industrial settings, as well as in the creation of food products with added value.

## Introduction

Globally, cereal grains provide food for a sizable population. They make up a sizable portion of the customers' regular diet. In terms of consumption, the three most popular grains are wheat, rice, and maize. You can eat these grains whole or in fractionated form. In the developing world, oats continue to be a significant cereal crop. The most widely grown variety is *Avena sativa L.*, which is generally referred to as common covered white oat. Compared to wheat or maize, oats require less N-Sodium, Phosphorus, and K-Potassium in their cultivation. Oats grow best in chilly, damp climates because they require more moisture than all other cereals combined, with the exception of rice, to generate a given unit of dry matter. The United States of America, Canada, and Russia are the main American and European nations where oats are farmed. It is primarily used as animal feed, while some humans also consume it as food. Because of the growing interest in oats as a healthy food for humans, the usage of oats as animal feed has been rapidly declining.

The health benefits of dietary fibres including β-glucan, functional protein, lipid and carbohydrate components, and phytochemicals found in oat grains have led to a rise in oat consumption in the human diet. A wide variety of phenolic compounds are also found in oats, such as ether and ester linked glycerides ester linked alkyl conjugates anthranilic acids, and avenanthramides. These substances have strong antioxidant properties. on the bran portion of the oat grain, these antioxidants are primarily found on the outer layer of the kernel. Researchers from all over the world have been drawn to oats because of their nutritional qualities, which has led to the food industry's increased interest in utilising oats as a food ingredient in a variety of food items including baby feeds.

## Consumption of oat as whole grain cereal

Because whole grains have so many health advantages, eating them has become more and more popular. This has created a lot of new options to eat tasty cereal grains. "The intact ground, cracked or flaked caryopsis, whose principal anatomical components, the starchy endosperm, germ, and bran, are present in substantially the same relative proportion as they exist in the intact caryopsis," is how the American Association of Cereals Chemists International defined whole grains. Both soluble and insoluble fractions of whole grain oat are rich in important nutrients, including proteins, carbohydrates, unsaturated fatty acids, and dietary fibre. Micronutrients found in oats include vitamin E, folates, zinc, iron, carotenoids, copper, manganese, sulfur-containing amino acids, phytic acid, lignins, lignane, and alkyl resorcinols. Oats have the benefit of being more commonly consumed as a whole grain cereal than its processed counterparts, despite the fact that wheat and rice are consumed in far larger quantities globally than oats. The eating of whole grain cereals is becoming more widely recognised because of their preventive effects.

## Nutritional components of oats

oat flour Nearly 60% of oat grains are made up of starch. It is mostly an endosperm component. The

physicochemical characteristics of oat starch and other cereal starches are found to differ significantly. Variations in the physicochemical characteristics of several oat cultivars are also noted. These variations are most likely caused by variations in the strength of the interactions between and among the starch chains in the crystalline and amorphous portions of the native granules, as well as by the length of the chains in the oat starch amylose and amylopectin fractions. Unusual characteristics of oat starch include tiny granule size, well-developed granule surface, and high lipid content. Given how oat starches differ from those of other cereals investigated the properties of oat starches. They found that oat starches had higher swelling factors, lower amylose leaching, higher peak viscosity and set back, higher susceptibility to acid hydrolysis, higher resistance to α-amylase action, and high free-thaw stability. Oat starches also showed coleaching of a branched starch component and amylose during the pasting process.

Based on the rate of digestion, starch has been divided into three fractions: resistant starch (RS), slowly digestible starch (SDS), and quickly digested starch (RDS). In order to keep blood glucose levels balanced and promote human health, starch digestion must occur slowly.

SDS is one of the most significant fractions since it reduces the glycemic response and enhances the food's nutritional value. Functional fibre has been identified as resistant starch. It is thought to play a significant part in the physiology of the digestive system. Just like fructo-oligosaccharides, it evades digestion and gives colonic bacteria fermentable carbohydrates to consume. They also have other advantages, such as helping the colon produce healthy metabolites like short chain fatty acids. In addition to its medicinal properties, resistant starch has superior look, texture, and mouthfeel compared to traditional fibres. Although resistant starch is often lost during processing, it can be found naturally in cereal grains, cooked starch, and starch-containing foods.

Protein from oats is seen as a promising low-cost, high-nutrient source of protein. Oats have a high protein level of 11–15% and a distinct protein makeup. Based on their solubility, cereal proteins are divided into four categories: water soluble albumins, salt water soluble globulins, soluble in diluted alcohol solution prolamins, and soluble in acids or bases glutelins. When compared to other cereal grains, oat protein has different structural characteristics as well as a different distribution of the protein fraction.

**Processing of oats**

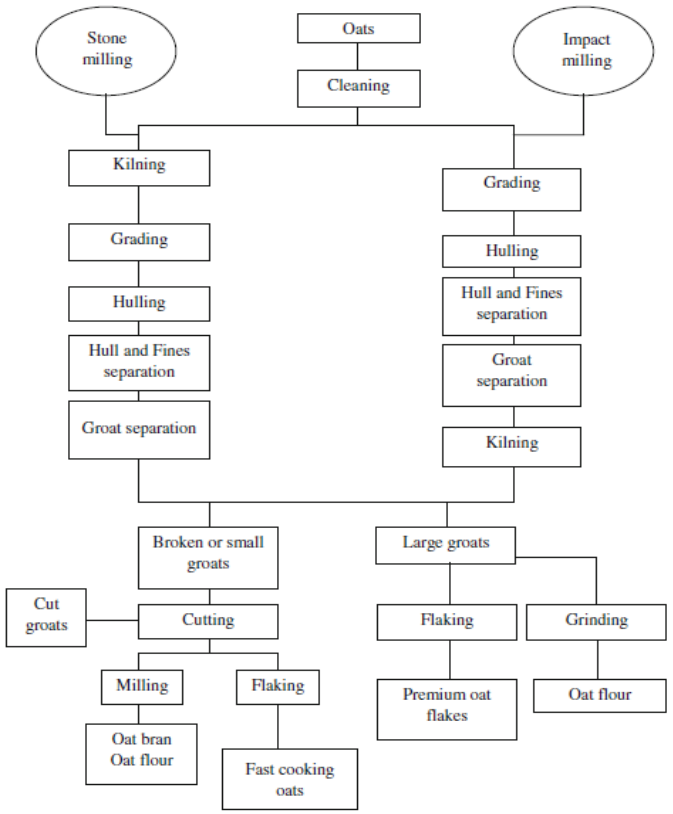
Grinding The oats are dehulled and the groats are then sorted and decontaminated before being processed into goods. The purpose of oat milling is to obtain high-quality flavour and appearance. Cleaning, grading, hulling, "hull, fine and groat separation," and kilning are the milling processes. Groat length and thickness are used to grade oats. Either impact hulling or stone hulling techniques are used to dehull the kernels. But impact hulling is employed more frequently than stone hulling.

Pearling The initial purpose of pearling technique, also known as debranning and pre-processing, was to polish wheat and rice. increased flour yield by combining pearling with wheat milling. indicated that significant microbial decontamination of wheat grains could result from pearling. Oat pearling has only received a little amount of research. These investigations show that oat pearling has a great potential for trichome elimination, which is found to be strongly correlated with the amount of aluminium in oats. Because of their softness and increased lipid content, which lessen kernel breaking, oats may be easier to apply industrially and manage pearling than wheat. The process of pearling oats makes it easier to separate the β-glucan-rich fractions from the pericarp, aleurone, and sub aleurone layers.

Heating up Oats are typically heat-processed using kiln drying and steam stabilisation; more recently, superheated steam processing and microwave heating have been employed. oats treated at high temperatures with hulls may taste harsh and rancid. oat processing, including heat treatment and milling before or after roasting, and lipid content have the most effects on taste composition. The Maillard reaction is frequently linked to heat treatment, which is a factor in the production of oat taste.

**Value added oat-based products**

Oat-based products have become more in demand in recent years as people have become more aware of their many nutritional advantages. Consumer health consciousness has increased emphasis on eating a high-fiber diet. A great source of dietary fibre is oats. Thus, encouraging its use in oat-based functional food products including granola bars, porridge, oatmeal, muesli, granola milk, oat milk, oat rim, oat-based probiotic drink, oat-based morning cereals, flakes, and baby food. Ice creams can be stabilised using oat β-glucan. Antioxidants included in oats can help stabilise meat and dairy products that are susceptible to fat oxidation while being stored. Because of their viscous and emulsifying qualities, oat




proteins have been employed in culinary products, such as heat-resistant chocolates. It has been shown that adding oats enhances the overall quality of the food. Pound cake produced with 25% (w/w) oat fibre had better texture qualities than the standard recipe. Table 3 lists the many applications of oats in industry, medicine, and gastronomy.

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