

Part I

Introduction

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Introduction: Oat Nutrition, Health, and the Potential Threat of a Declining Production on Consumption

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1.1 A landmark health claim

The landmark approval of a health claim for oats in 1997 by the United States Food and Drug Administration (FDA) marked the first food specific health claim. The FDA had concluded that an intake of at least 3 g β -glucan from oats as part of a diet low in saturated fats could help reduce the risk of heart disease (Chapter 17). Of importance is that the oat health claim signifies for the first time recognition by a public health agency that dietary intervention could be beneficial in disease prevention, and that certain foods or food components, when consumed as part of a healthy diet, may reduce the risk of certain diseases. It is, therefore, not surprising that the first food-related health claim was approved for reducing the risk of cardiovascular disease (CVD), the leading cause of death in the United States and many western countries, including Canada (Health Canada, 2010). Often under communicated is that CVD is the leading cause of death among women in the United States (Roger *et al.*, 2012). The FDA approval of a health claim elevated the role of diet in overall health, adding emphasis to disease prevention in addition to treatment. For example, many of the risk factors

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associated with CVD are preventable by dietary interventions, including high blood pressure, high total serum cholesterol, low-density lipoprotein-cholesterol (LDL-C) and very low density lipoprotein-cholesterol, and high blood glucose associated with type 2 diabetes, and obesity.

1.2 The growing interest in oats and health

The oat health claim that underwent extensive scientific review for approval by the FDA sparked great interest in the scientific community. For the first time, health practitioners (dietitians, nutritionists, and physicians) had the option to recommend that a specific food be incorporated into a diet for an adjunct intervention in the management and prevention of disease.

The unique chemistry and nutritional composition of oats suggest that the benefits of oats may not be confined to just a cholesterol-lowering effect but, as demonstrated by further research, that they may also have other favorable health benefits. As of 2010, ischemic heart disease (number 1 ranking) and stroke (number 3 ranking) were two of the top 12 world health problems that could be favorably affected by oat consumption (Cohen, 2012; Lim *et al.*, 2012). Important risk factors recently highlighted by the Global Burden of Disease Study that could be affected by oats include high blood pressure, high body mass index, and high fasting blood glucose levels (Cohen, 2012; Lim *et al.*, 2012), as well as an elevated LDL-C level as noted by the American Heart Association (Roger *et al.*, 2012).

The oat health claim has sparked interest in developing a better understanding of oats, from breeding for the best oat cultivar, processing, nutrition research on oats and health, as well as public health education and policy. It has become clear that the challenges to improving the quality of oats are not just yield but rather a combination of three possible dependent traits—yield, groat percentage, and β -glucan level (Chapter 2).

Recent advances in research have focused on oat chemistry and nutrition with the goal of demonstrating the mode of action of oats on lipid and glucose metabolism. Of interest is the form of β -glucan in oats, which differs from other whole grain soluble fibers. In oats, the majority of the soluble fibers are β -glucan, accounting for 3–6% of whole groat weight. Although β -glucan also exists in barley and wheat, the β -glucan in oats differ in many physicochemical properties, such as solubility, gelation, and molecular weight, all of which affect physiological functions in the gastrointestinal tract, for example, bile acid binding, colonic viscosity accumulation, and fermentation. These differences in β -glucan structure may explain the reduction in cholesterol and postprandial blood glucose levels with oat consumption (Chapter 5)

The health benefits of oats can be attributed largely to their unique chemistry and nutrient profile. Recent efforts have focused on isolating, identifying, and characterizing the bioactive constituents unique to oats. Compared to other whole grains such as corn, wheat, and rice, oat nutrition profiles are uniquely “complete” across many constituents, ranging from nutrients to phytochemicals and bioactive compounds. Nutritionally, oats provide many essential nutrients.

On a 100 g basis, oats are a significant source of dietary fiber, soluble fiber mostly as β -glucan, thiamin, folate, iron, magnesium, copper, and zinc. Additionally, oats are an excellent source of potassium and are low in sodium, with a Na:K ratio less than one (Chapter 4).

Avenanthramides are phytonutrients in oats known to have anti-inflammatory and antioxidative activity, and may be involved in some of the health effects unique to oats. Avenanthramides are emerging as an interesting class of chemicals that may be beneficial for skin health, including treatment for atopic dermatitis, contact dermatitis, pruritic dermatoses, sunburn, drug eruptions, and other conditions. Colloidal oatmeal has also been used to relieve skin irritation and itching, and for cleansing and moisturizing. The flavonoids in oats may also protect against ultraviolet A radiation.

More recently, research has focused on the impact of oat intake on other health outcomes beyond the lipid lowering effect, such as blood pressure, body mass index and weight, glucose metabolism and type 2 diabetes, as well as caloric regulation and satiety. These studies are ongoing and the data are still preliminary. A consistent finding is that oat β -glucan lowers serum cholesterol, and although the magnitude of cholesterol lowering varies, it correlates to the amount of β -glucan consumed.

1.3 Declining production poses threats to the growth of oat intake

Although oat and health research have advanced significantly, a very different picture is emerging on the global scene with respect to oat production and consumption. Since the approval of the health claim for oats in 1997, there has been a steep growth in the demand for hot breakfast cereals and oats sales have soared. This positive trend developed in North America was also observed in eastern and western Europe over the same period. On the other hand, world production of oats has declined and is at a record low rate. In 2011, world oat production lagged behind wheat, corn, and barley, dropping to its lowest level since 1960, from 6.8 to 0.8% of the world's crop production. In the United States, oats are fading from a commodity to a specialty crop. The worldwide drop in production may be attributed to several factors, including more land devoted to growing more profitable crops for foods, feeds, biofuels, and vegetable oils; low amounts of funding for research, little innovation in production techniques; and a weak demand for oats as a feed source (Strychar, 2011). Today, oats are considered an orphan crop, receiving little research investment from either government or industry.

If the trend of decreased oat production continues, oats will become so expensive that affordable and widely accessible oat products for the public may be limited. Reversing this trend will require programs that involve both public and private collaborations to assure an adequate level of research investment for advancing the understanding and securing the accessibility of this important crop.

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