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Legumes

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Legumes

Abstract
Legumes have been part of the human diet for thousands of years. With their multiple health benefits, they deserve a central role in contemporary cuisine as well. The seed-bearing pod of legumes makes them distinguishable from other plant families. The oilseeds, such as soybeans and peanuts, are categorized separately from the grain legumes or beans, such as pinto, kidney, lima, cowpeas, fava, chickpeas (garbanzo beans), lentils, and dry peas. Scientific research linking grain legume consumption to positive health, nutrition, and longevity outcomes continues to emerge.

Disciplines
Food Chemistry | Food Processing | Food Science | Human and Clinical Nutrition | Molecular, Genetic, and Biochemical Nutrition | Plant Sciences

Comments
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autosomal-dominant characteristic and is likely the result of selective evolutionary advantage in regions where dairying developed several thousand years ago. Under poor nutritional conditions, a lactase-persistence individual would be able to consume dairy products, deriving greater nutritional benefit. The regulation of the lactase gene has been studied extensively. Most evidence supports reduced levels of lactase mRNA and transcriptional regulation.

Dietary Management for Lactose Intolerance

The most common recommendation of the medical community to lactose-intolerant persons is to avoid dairy foods. However, it is difficult for lactose maldigesters to consume adequate amounts of calcium if dairy products are eliminated from the diet. Individuals who report lactose intolerance also report low calcium intake. A more nutritionally sound approach to managing lactose intolerance is to follow a few simple principles based on the physiology of lactose digestion. First, drink no more than a cup of milk at a time, and drink it with a meal. There is a close relationship between the dose of lactose consumed and the development of symptoms. Small doses (up to the amount of lactose found in a cup of milk) typically do not cause symptoms, whereas higher doses produce symptoms in most lactose-intolerant persons. By drinking milk with a meal, the rate of transit of lactose through the intestine is slowed, thus improving digestion. The fat content of milk and added components such as chocolate may also influence the GI transit of lactose and symptoms.

Yogurts (with live cultures) are well tolerated by lactose-intolerant individuals because they contain significant microbial-derived lactase activity that has been shown to assist intestinal lactase activity in digesting lactose in vivo in the intestinal tract. Further, the semisolid nature of yogurt may slow its transit. During fermentation, the activity of the microbial lactase enzyme increases dramatically, and this enzyme has been shown to be active in the small intestine. Kefir apparently is also well tolerated by lactose-intolerant individuals, although there has been less research on kefir. Kefir has a wider variety of microorganisms, but apparently, they act much like yogurt bacteria. Acidophilus milks typically do not contain large numbers of bacteria and are not likely to improve lactose tolerance. However, there is some evidence that long-term consumption of acidophilus and other "friendly" bacteria such as bifidus may promote colonic lactose fermentation and, hence, lactose tolerance.

A common approach to managing lactose intolerance in the United States is to eat low-lactose or lactose-free milks and/or use pills, capsules, or drops to assist in lactose digestion. This strategy works well but has a financial cost that is typically unnecessary if lactose is consumed in small amounts (not more than a cup) with meals or in the form of yogurt.

A final and perhaps most useful strategy to manage lactose intolerance is counterintuitive. The regular, daily consumption of milk in modest quantities adapts the colon bacteria to efficiently assist in digestion, thus limiting symptoms of intolerance. The goal is to induce and maintain microbial lactase activity in the colon. From a practical perspective, ½ to 1 cup of milk consumed twice a day with meals for 1 week to 10 days will typically improve lactose digestion and tolerance substantially.

Dennis Savaiano

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Legumes

Legumes have been part of the human diet for thousands of years. With their multiple health benefits, they deserve a central role in contemporary cuisine as well. The seed-bearing pod of

legumes makes them distinguishable from other plant families. The *oilseeds*, such as soybeans and peanuts, are categorized separately from the *grain legumes* or beans, such as pinto, kidney, lima, cowpeas, fava, chickpeas (garbanzo beans), lentils, and dry peas. Scientific research linking grain legume consumption to positive health, nutrition, and longevity outcomes continues to emerge.

Health Benefits

Legumes are often cited for their ability to reduce the risk of heart disease, relieve constipation, improve gastrointestinal integrity, and stabilize blood sugar. Many dietary recommendation frameworks such as the *Dietary Guidelines for Americans, 2010*; MyPlate; DASH (Dietary Approaches to Stop Hypertension); American Heart Association; and American Cancer Society promote beans. The *Dietary Guidelines for Americans, 2010* continues to emphasize subgroups of nutrient-dense fruits and vegetables, such as dark green vegetables, orange and red vegetables, legumes (including dry beans), and starchy vegetables. In fact, the 2000-cal eating plan calls for 1½ cups of cooked dry beans per week.

For long-term health, legumes are good to excellent sources of protein, fiber, folate, potassium, magnesium, iron, copper, and manganese; they are also a cholesterol- and fat-free food. A Mediterranean-style diet, high in plant foods such as legumes, lowers the risk of heart disease and some cancers. A cross-cultural study of elderly adults in Japan, Sweden, Greece, and Australia revealed that of all the dietary factors analyzed, legume consumption had the most consistent and statistically significant association with reduced mortality risk. Every 20-g increase in the daily intake of legumes produced a 7% to 8% reduction in the risk of death. Even after controlling for age, gender, and smoking, the link to beans was still significant. No other food or food group—olive oil, fish, or other fruits and vegetables—appeared to affect survival.

Promoting Cardiovascular Health

Since the 1980s, researchers have known that diets supplemented with dry beans lower serum cholesterol and low-density lipoprotein (LDL) cholesterol, similar to the cholesterol-lowering effect of oat bran. Using the standard recommendation of half a cup per day, chickpeas, pinto beans, and vegetarian baked beans have effectively reduced total and LDL blood cholesterol by 4% to 8% depending on the study. Several components of beans decrease cardiovascular disease: soluble fiber, phytosterols, magnesium, potassium, copper, and folate. The soluble fiber in beans (about 6–9 g per half-cup of cooked beans) helps lower blood cholesterol by binding bile acids and preventing cholesterol reabsorption.

Controlling Blood Sugar

Beans may reduce the risk of developing type 2 diabetes as well as improve diabetes control. Over the years, several dietary-intervention studies have shown that increasing dietary intake of legumes, including beans, as well as whole-grain foods and other vegetables, positively affects blood glucose management and insulin sensitivity. For example, in one study, the glycemic responses to 5 kinds of beans were tested and compared with the glycemic response to bread. While the glycemic responses to different beans varied, all were significantly lower than the response to bread. Beans may also help in slowing digestion, thus prolonging the feeling of fullness and reducing hunger, in part due to their effect on hormonal responses to a meal.

Reducing Cancer Risk

Beans contain health-promoting oligosaccharides (short-chain sugar polymers) as well as another functional carbohydrate, resistant starch. A strong correlation exists between high intake of resistant starch, present in beans, and lowered risk for colorectal cancer. Food starches are classified as either glycemic or resistant. Glycemic starches break down into glucose and then are absorbed into the bloodstream. Resistant starches, however, cannot be broken down by enzymes in the body, and because they are not absorbed, they pass to the large intestine for fermentation by intestinal bacteria. Similar to the actions of dietary fiber, resistant starch helps decrease intestinal transit time and increase fecal bulk.

Flatulence

Some people believe that beans cause significant gas and bloating. Yet the same bean components

that cause gas—oligosaccharides and fiber—are also responsible for some of beans' health-promoting properties, including stimulating healthy gut flora. Recent research provides new insights into humans' ability to adapt to bean consumption with reduced flatulence occurring over time. Consumers may be needlessly concerned about increased flatulence and should be counseled that any increase will be transitory with continued legume consumption. In other words, eating more beans—and more often—may be better when it comes to enjoying beans and avoiding their side effects.

Donna M. Winham

See also Cardiovascular Disease Prevention and Public Health Initiatives; Diabetes, Diet and Nutrition in Prevention and Management of; Fiber in Food

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Life Course: Concepts

Life course refers to human development from birth to death. It is a term used predominantly by sociologists. *Life span* has been the term used predominately by psychologists. The life course/life span paradigm focuses on the examination of the relationship between individual development over a lifetime under changing historical, cultural, and social contexts. The life course/life span approach emerged in the 1960s and 1970s.

Key principles of a life span developmental approach include the following:

Development is lifelong: Each period of the life span is influenced by what happened before and will affect what is to come. Each period has its own unique characteristics and value; none is more or less important than the other.

Development depends on history and context: Each person develops within a specific set of circumstances or conditions, defined by time and place. Human beings influence, and are influenced by, their historical and social context. They not only respond to their physical and social environments but also interact with and change them.

Development is multidimensional and multidirectional: Development throughout life involves a balance of growth and decline. As people gain in one area, they may lose in another, and at varying rates. Development can result in both increases and decreases, at varying rates, within the same person, age period, or category of behavior. Development can affect multiple capacities or aspects of a person. Different dimensions of development can be changing at the same time.

Development is pliable, or plastic: Plasticity means modifiability of performance. It is possible to improve functioning throughout the life span, though there are limits on how much a person can improve at any age.

The *life course* refers to an age-graded sequence of events and social roles that is embedded in social structures and history. In discussing how individuals develop, researchers look at influences that affect many or most people and also at those that affect people differently: gender, race, ethnicity, culture, socioeconomic status (social class, education, occupation, and income), lifestyles, family constellations, and the presence or absence of physical or mental disabilities.

The life course evolves over both broad and short expanses of time. A broad expanse of time would be the trajectory of work and family. A short time span would be represented by a transition between statuses, such as changing from one job to another. Transitions between statuses and social roles vary in timing. These transitions can be early or late in terms of social norms and the activities of cohort members.

Some researchers distinguish between normative and nonnormative influences on development. An event is normative when it occurs in a similar way for most people in a given group. Normative age-graded influences are very similar for people in a given age-group. They include biological events (e.g., menopause or loss of physical strength) and cultural events (e.g., retirement). Normative history-graded influences are common to a particular cohort: a group of people who share a similar experience—in this case, growing up at the same time, such as individuals born right after World War II.

Nonnormative life events are unusual events that have a major impact on an individual. They are either typical events that occur at an atypical time of life, such as becoming a father at age 60 or having a severe illness experience at an early age, or atypical events, such as being in an airplane crash or winning a lottery. These events are unique to the individual and may have a major influence on his or her development.

Another key concept in life course/life span approaches is a focus on individual differences. This refers to the degree of variation within a particular age-group.

Earlier discussions of the life span consisted of sequential life stages or sets of life tasks. Today, we recognize that processes of development and aging can only be fully understood by taking a lifelong approach to development and aging. Longitudinal studies of age changes that follow 1 cohort give such a perspective; however, data collected from one longitudinal study may not generalize to other cohorts. Life stages may emerge differently in different cohorts in timing and duration. Another important insight from life course/life span research methodology is that in certain cases cross-sectional studies of age differences provide important information on different age-groups at one point in time. However, such age differences do not tell us about how future age-groups will perform in the future. An important part of this discussion is whether future cohorts of older adults will have higher levels of health and fewer disabilities later in life. This may mean that people will be able to live longer independently. However, recent data on the obesity of up-and-coming cohorts may mean that some members of future cohorts may have higher levels of disease and disability.

Another important insight is that prenatal, infant, and child care can lead to major issues in later life. Individuals who may have not had quality preventive care early in life may manifest differential health and longevity in later life. The understanding of such health disparities and their consequences is important to our understanding of health and illness across the life span.

In summary, life span development and aging is a lifelong process involving transitions from birth to death. Regardless of the term used, the dynamic of a changing individual in a changing world from birth to death is an important aspect of this approach or perspective.

Harvey L. Sterns

See also Lifestyle Medicine: History and Overview

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Lifestyle Management of Type 2 Diabetes

Diabetes is a disease that can occur at any age throughout the life span. Current research and clinical data indicate that diabetes affects approximately 300 million persons worldwide and 23.6 million persons in the United States. As with the management of any health condition, patients and family members and/or their caregivers need to understand the disease state of diabetes and how it affects one's overall health. This entry discusses the role of lifestyle behaviors in the causes, prevention, and management of diabetes.

The Connection Between Obesity and Diabetes

Approximately 1.7 billion adults worldwide are overweight and 250 million to 312 million are obese. Some estimates put the incidence of obesity in the United States between 72 million and 92 million persons. As obesity (specifically visceral fat) increases, the prevalence of type 2 diabetes also increases. As many as 90% of individuals with type 2 diabetes are overweight or obese. Trends for each disorder are remarkably similar. Obese persons with type 2 diabetes are at substantially higher risk for poor health outcomes related to the following conditions: hypertension, cardiovascular disease, dyslipidemia, nephropathy, and visual disturbances such as glaucoma and blindness. The complications of obesity and diabetes also contribute to shortened life expectancies.

In addition, some populations in the United States suffer greater health disparities due to their overweight/obese status. Ethnic populations at increased risk include African American women, certain Native American subgroups (Zuni, Pima), and Hispanics of all ages.

In January 2000, the U.S. government released its report—*Healthy People 2010*—which set forth the nation's disease prevention and health promotion agenda. This document included 26 focus areas and objectives for specific populations related to the reduction of type 2 diabetes, reducing deaths due to cardiovascular disease (in persons with diabetes), and increasing healthful nutrition, physical activity/fitness, and access to quality health services. One of the major objectives of *Healthy People 2010* was to improve the health, fitness, and quality of life of all Americans through the adoption and maintenance of regular physical activity. This was a new component of the survey's tracking systems. However, it is clear that the U.S. population did not meet these public health objectives for diabetes and obesity by 2010 and that meeting them in the future will not be easy. This may be due in part to the complex nature of the factors that influence health status and the fact that health promotion and disease prevention have never received the same research funding or attention as disease/illness management.

It is hypothesized that type 2 diabetes is preventable through weight loss and active lifestyle interventions such as exercise and consumption of a well-balanced diet. At least 4 clinical trials have addressed the impact of lifestyle activities such as diet, exercise, and medicines individually or in combination with one another in the prevention of type 2 diabetes. These studies reveal that there is a 42% to 63% reduction of diabetes with lifestyle intervention.

Definitions of Prediabetes, Diabetes, and Obesity

Obesity and type 2 diabetes mellitus are common conditions in Western societies, where consumption of high-calorie food and sedentary lifestyles are the norm. The combination of these conditions is often referred to as "diabetsity." Some authorities speculate that the historical movement of an agricultural/hunter-gatherer system to one of urbanization and industrialization has led to the problem of "diabetsity."

The definitions that follow will facilitate understanding of what each disease is and how it is diagnosed.

Prediabetes

Type 2 diabetes is often preceded by a condition called *prediabetes*, which is defined as an elevated blood glucose level that is higher than normal but not quite high enough for a diagnosis of diabetes. Estimates from the Centers for Disease Control and Prevention indicate that 57 million persons in