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Manminder Pal Singh
 Division of Post-Harvest
 Management, Sher-e-Kashmir
 University of Agricultural Sciences
 and Technology, Chatha, Jammu &
 Kashmir, India

Monica Reshi
 Division of Post-Harvest
 Management, Sher-e-Kashmir
 University of Agricultural Sciences
 and Technology, Chatha, Jammu &
 Kashmir, India

Neeraj Gupta
 Division of Post-Harvest
 Management, Sher-e-Kashmir
 University of Agricultural Sciences
 and Technology, Chatha, Jammu &
 Kashmir, India

Neeraj Sharma
 Division of Post-Harvest
 Management, Sher-e-Kashmir
 University of Agricultural Sciences
 and Technology, Chatha, Jammu &
 Kashmir, India

Gyan Singh Jankawat
 Division of Post-Harvest
 Management, Sher-e-Kashmir
 University of Agricultural Sciences
 and Technology, Chatha, Jammu &
 Kashmir, India

Jesreen Chauhan
 Division of Post-Harvest
 Management, Sher-e-Kashmir
 University of Agricultural Sciences
 and Technology, Chatha, Jammu &
 Kashmir, India

Barsha Sambyal
 Division of Post-Harvest
 Management, Sher-e-Kashmir
 University of Agricultural Sciences
 and Technology, Chatha, Jammu &
 Kashmir, India

Corresponding Author:
Monica Reshi
 Division of Post-Harvest
 Management, Sher-e-Kashmir
 University of Agricultural Sciences
 and Technology, Chatha, Jammu &
 Kashmir, India

Superfoods: A fact or a myth

**Manminder Pal Singh, Monica Reshi, Neeraj Gupta, Neeraj Sharma,
 Gyan Singh Jankawat, Jesreen Chauhan and Barsha Sambyal**

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Abstract

The food and nutrition industry has made notable progress in introducing a new category of food called "superfoods." These foods offer numerous health benefits that include disease prevention, immune system boosting, and providing essential macro and micronutrients in sufficient amounts. The concept of superfoods is gaining popularity due to increased health awareness among consumers. However, despite their exceptional health benefits, superfoods are still not well understood. Superfoods are typically made up of fruits, vegetables, grains, and other foods. This review provides information on the nutritional makeup of some significant superfoods and their potential to prevent chronic diseases. It can help consumers effectively integrate superfoods into their diet. Dietary supplements are products that people consume to provide additional nutrients for good health, in addition to their regular diet. These supplements contain dietary ingredients such as vitamins, minerals, amino acids, herbs, and botanicals, and are intended to be ingested as pills, capsules, tablets, or liquids. They are clearly labelled as dietary supplements. Many people use dietary supplements to improve and maintain their general health, while women specifically take supplements to support bone health and prevent osteoporosis.

Keywords: Superfoods, immune system, fruits, nutrients, health benefits, micro-nutrients, macronutrients, supplement, botanicals, osteoporosis

Introduction

In recent years, studies have shown that food and its components can have a significant impact on human health. Super Grains like oats and quinoa are rich in fiber, which is essential for healthy digestion. Fiber helps regulate bowel movements, ensuring that your digestive system works efficiently. Oats are particularly beneficial as they can help lower cholesterol levels and reduce the risk of heart problems such as clogged arteries, cardiovascular diseases, heart attacks, and strokes. It's worth noting that these grains are also gluten-free.

Turmeric is a spice that adds flavor, nutrition, and a vibrant orange hue to food. It's a close relative of ginger and is derived from the root of an Asian plant. Turmeric has been used in cooking for centuries and contains an active natural compound called curcumin. Curcumin has potent antioxidant and anti-inflammatory properties. It has many biological activities that are still not fully understood. Turmeric is also rich in phytonutrients that can help protect the body by neutralizing free radicals and shielding cells from damage caused by pollution and sunlight.

Eggs are loaded with essential nutrients that are beneficial for our health. Both egg white and yolk contain protein, but the yolk has a higher concentration of other essential nutrients. One large egg weighing 50 grams has approximately 6.5 grams of protein, 5 grams of fat, 0.5 grams of carbohydrates, and 70 calories. Due to this macronutrient profile, eggs are an excellent food for those following keto or low-carb diets. Additionally, eggs are rich in vitamins and minerals, such as vitamin B12, selenium, and iron. Recent studies have revealed that food and its components can have a significant impact on human health. As a result, people's perceptions of food have changed dramatically over the years. Nowadays, in addition to fulfilling the basic needs such as hunger and nutrition, an increasing number of individuals consider food as a means of improving their health and well-being by preventing nutrition-related illnesses and enhancing mental and physical conditions.

This belief is not new and is supported by the famous quote from Hippocrates, "Let food be thy medicine and medicine be thy food."

Foods that can improve overall body conditions, reduce the occurrence of certain diseases, and be used to treat various illnesses are known as "functional foods". Functional foods have the potential to reduce healthcare costs for ageing populations and have commercial applications in the food industry. In Western countries, the term "superfoods" is commonly used to refer to functional foods. Superfoods are considered a rich source of various macro- and micronutrients. According to the Oxford English Dictionary, superfood is defined as "food that is particularly nutritious or beneficial for human health and well-being." As a result, consumers' perceptions of food have changed dramatically. In addition to satisfying basic needs such as hunger and nutrition, an increasing number of people believe that food can enhance their health and well-being by preventing nutrition-related illnesses and improving mental and physical conditions. This idea has a long history and is supported by Hippocrates' famous quote, "Let food be thy medicine and medicine be thy food." "Functional foods" are those that can treat a variety of ailments, prevent the onset of certain diseases, and enhance general bodily health." Functional foods have the potential to reduce the cost of healthcare for ageing populations and have commercial applications in the food industry. "Superfoods" are the most commonly used term for functional foods in Western countries (Wsssolfe, D, 2009) [16]. Superfoods are considered to be a rich source of various macro- and micro-nutrients. The Oxford English Dictionary defines superfood as "food that is particularly nutritious or beneficial to human health and well-being."

Berries: Strawberries and blueberries are a fantastic source of essential vitamins and minerals, including vitamin C and K, potassium, manganese, and magnesium. They are low in calories, but high in fiber, antioxidants, and polyphenols. According to the USDA, one cup of strawberries contains 3 grams of fiber and 12 grams of carbohydrates. The leaves of strawberries can also be consumed either raw or cooked, and they are a good source of ellagic acid, vitamin C, and cyanidin, which is an anti-cancer compound (Agius *et al.*, 2003) [1].

Green leafy vegetables: Leafy green vegetables, such as kale, spinach, Swiss chard, and bok choy, are very nutritious and offer a variety of health benefits. They are rich in essential vitamins, minerals, and fiber which are good for the overall health of the body. Eating different types of greens can help you improve your brain function, lower the risk of heart disease, cancer, and high blood pressure. Leafy greens also contain powerful antioxidants like lecithin and zeaxanthin, which are good for the eyes. They are also a rich source of quercetin, a compound known for its anti-inflammatory properties. (Rahman, 2006) [11]

Eating fish and marine food is a great way to ensure that you get high-quality protein, along with various vitamins and minerals that your body needs. Fatty fish are often considered the best choice for health benefits since they contain more fat-based nutrients, such as vitamin D, which many people tend to lack. Additionally, fatty fish are rich in omega-3 fatty acids, which are crucial for optimal body and

brain function and have been linked to a reduced risk of various diseases. To fulfill your omega-3 requirements, it's recommended that you consume fatty fish at least once or twice a week. For vegans, omega-3 supplements made from microalgae are available to meet their needs (Hannah, 2015) [10].

Super Grains "Oats and quinoa are high in fiber, making them great for digestion. Fiber helps regulate bowel movements, keeping the digestive system running smoothly and efficiently. Additionally, oats can help lower cholesterol levels, as high amounts of bad cholesterol (LDL) can lead to heart problems such as clogged arteries, cardiovascular disease, heart attacks, and strokes. It's worth noting that these grains are also gluten-free." (González Martín *et al.*, 2014) [8]. Turmeric is a deeply colored spice that adds flavor, nutrition, and a vibrant orange hue to food. It's a close relative of ginger and is derived from the root of an Asian plant. Turmeric has been used in cooking for centuries and contains an active natural compound called curcumin, which has potent antioxidant and anti-inflammatory properties. According to Brown, curcumin has many biological activities, some of which are still not fully understood. Turmeric is also rich in phytonutrients that can help protect the body by neutralizing free radicals and shielding cells from damage caused by pollution and sunlight (Rao *et al.*, 1995) [12].

Eggs are packed with essential nutrients that are beneficial for our health. Both egg white and yolk contain protein, but the yolk has a higher concentration of other essential nutrients. One large egg weighing 50 grams has approximately 6.5 grams of protein, 5 grams of fat, 0.5 grams of carbohydrates, and 70 calories. Due to this macronutrient profile, eggs are an excellent food for those following keto or low-carb diets. Additionally, eggs are rich in vitamins and minerals, such as vitamin B12, selenium, and iron.

Dietary supplements

These are sold with a Supplement Facts label that lists the active ingredients, their amount per serving (dose), and other ingredients such as fillers, binders, and flavourings. While the manufacturer suggests the serving size, it is always recommended to consult your healthcare provider to determine the appropriate amount for you. It is important to seek your healthcare provider's approval before taking dietary supplements to treat a health condition or in combination with prescribed medicines. If you have an upcoming surgical procedure, make sure to talk with your healthcare provider about any supplements you are taking. It is a common misconception that natural supplements are always safe. Some all-natural botanical products, such as comfrey and kava, have been found to harm the liver. The safety of a dietary supplement depends on various factors such as its chemical composition, how it works in the body, how it was prepared, and how much you take (Ferraro *et al.*, 2016) [7]. From the beginning of human civilization, the people's diet mostly comprises of plant foods and kinds of seafood that could be easily gathered. Hunter-gatherers later contributed meat products by big game. This was the diet of most humans until about 10,000 BC, at which time the development of agriculture and animal husbandry provided more meat and grains for the whole family.



Fig 1: The image displays a variety of dietary supplements in pill form, juxtaposing natural plant elements with commercial supplement bottles in the background

At that point in time, not much had been discovered about the functions that vitamins, minerals, proteins, carbs, and fats play in human nutrition. People from all across the continents of the globe developed nutritious meals that largely used locally produced ingredients to maintain their health. They selected a range of foodstuff and methods for cooking by experimentation, leading to in physical strength, sound health, and fertility. The common wisdom of native cultures knew which foods and herbs had special properties for energy, nutrition and extra health benefits for children, pregnant women and elders. Native cultures have been supplementing their diets to make up for deficiencies for centuries. For instance, Native Americans knew that drinking tea made from pine bark and needles, which contains high concentrations of ascorbic acid, could cure scurvy. Traditional herbal medicine served as the basis for modern pharmaceuticals derived from plants, like morphine and aspirin, which are used for contemporary botanical dietary supplements. Herbal and botanical medicines have maintained their appeal because they were among the first natural remedies made from plant roots, leaves or bark. According to estimates published by the CDC, as part of the National Health and Nutrition Examination Survey 3 Dietary Supplements, 20% of adults use a supplement containing at least one botanical ingredient. Nutritional

supplements generally offer several advantages, such as high content of nutrients in small volumes, special nutrient compositions, lack of undesirable accompanying substances such as fats, cholesterol and purines, and complete coverage of specialized sporting needs. However, these formulations should be treated as a supplement to a basic healthy diet and not as a replacement. Users of dietary supplements often increase the dosage or frequency, which can make doses less and less effective. Consequently, the human organism is forced to work harder to eliminate the extra amounts of supplements taken in.

Multivitamins and minerals

Vitamins and minerals are crucial nutrients that your body needs to function properly, grow and maintain good health. They perform a variety of functions, affecting everything from your nerves and bones to your ability to clot blood. A well-balanced diet that includes plenty of vegetables, fruits, and whole grains should provide you with all the necessary vitamins and minerals. However, in certain cases, taking individual supplements can be beneficial. For example, vitamin C is great for maintaining healthy skin, vitamin D is essential for strengthening bones and teeth, and vitamin K is necessary for proper blood clotting (Zhao *et al.*, 2016) [17].

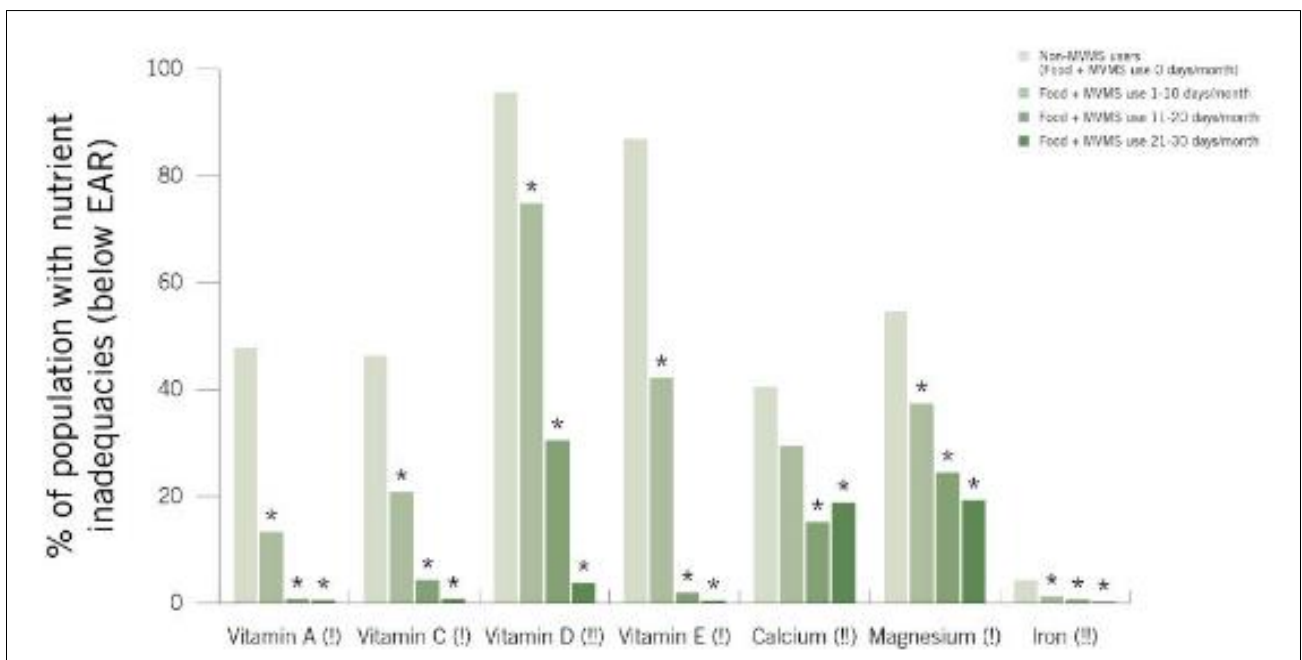


Fig 2: The graph shows the decreasing percentage of nutrient inadequacy in the population with increased use of food and nutrient supplements for vitamins and minerals like A, C, D, E, calcium, magnesium, and iron

Fish Oil and Omega-3 Fatty Acids as Supplements

Omega-3 fatty acids are a type of essential fatty acid that is crucial for maintaining optimal health. They are called essential because our body cannot produce them naturally, which means we need to obtain them through our diet. These fatty acids are primarily found in cold-water fish, such as salmon, sardines, and mackerel. They are also present in certain plant-based sources like chia seeds, flaxseeds, and walnuts.

Research has shown that people who consume a diet rich in polyunsaturated omega-3 fatty acids have a lower risk of developing certain chronic diseases. A study conducted on the traditional diet of Greenlanders showed that they consume a diet rich in omega-3 fatty acids, which contributed to a lower incidence of ischemic heart disease and diabetes. The diet includes a high intake of fish and marine mammals, such as seal and whale meat (Spector and Kim 2015) [13].

Nowadays, fish oils, krill oil, or a mixture of docosahexaenoic and eicosapentaenoic acids (DHA and EPA) purified from fish oils have become popular dietary

supplements. These supplements provide a concentrated source of omega-3 fatty acids, making it easier for people to meet their daily requirements. Studies have shown that these fatty acids have anti-inflammatory properties, which can help reduce inflammation in the body and improve heart health. Furthermore, omega-3 fatty acids have electrical stabilizing effects on ion channels in cardiac myocytes, which can help prevent arrhythmias. They have also been linked to anti-cancer and cardio-protective effects. However, the therapeutic benefits of omega-3 fatty acids on cardiovascular diseases are still controversial due to different findings from various clinical trials. It is worth noting that fish oil and omega-3 fatty acids are well-tolerated, even at doses of 1000-2000 mg/day, and there is little evidence of toxicity. However, consuming fish liver oils that also contain vitamin A and multivitamin supplements at the same time could result in hypervitaminosis A. Therefore, it is essential to consult a healthcare professional before starting any supplement regimen.

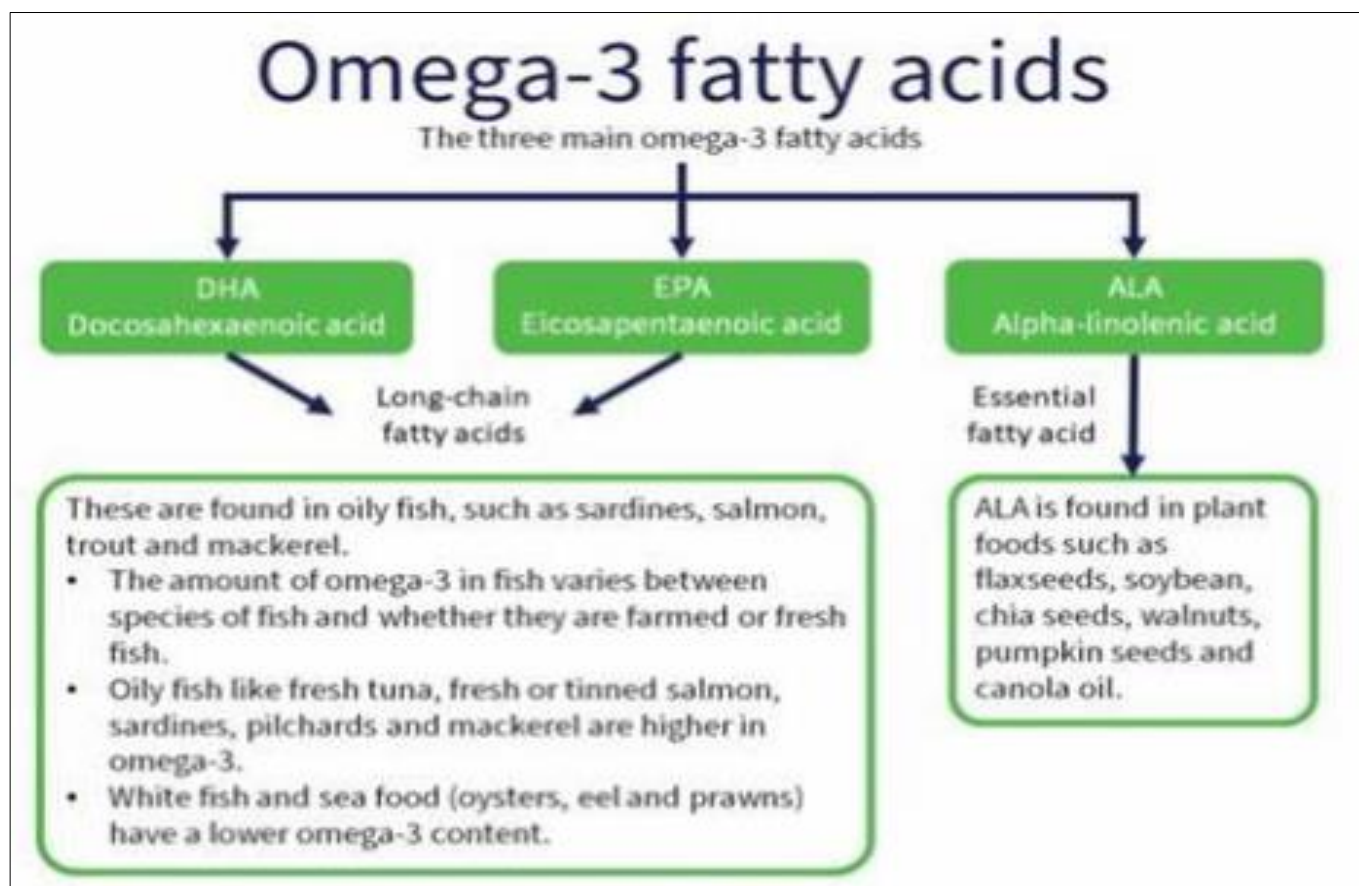


Fig 3: The image outlines the main types of omega-3 fatty acids—DHA, EPA, and ALA—found in various foods, including oily fish and plant sources like flaxseeds and walnuts

Amino Acids

Amino acids are organic biomolecules that perform essential biological and chemical functions throughout our body. They play a crucial role in building and repairing tissues, forming and operating enzymes, transporting molecules, and aiding in food digestion. Leucine, for example, helps in muscle recovery, while proline and glycine aid in digestion. Pepsin is an example of an enzyme (Combs *et al.*, 2001) [5]. Generally, the polypeptide chains are linear. However, branching points in the chains may be produced by

interchain disulphide bridges. The covalent disulphide bonds between different polypeptide chains in the same protein (interchain) or portions of the same polypeptide chain (intrachain) are also part of the primary structure. Rarely, instead of the alpha COOH group, the gamma carboxyl group of glutamic acid may enter into peptide bond formation, e.g. Glutathione (gamma-glutamyl-cysteinyl-glycine). The term pseudopeptide is used to denote such a peptide bond formed by carboxyl group, other than that present in alpha position. Very rarely, protein may be in a

circular form, e.g. Gramicidin. Purification of enzymes and other proteins usually start with precipitating them from solution. The stability of proteins in solution will depend mainly on the charge and hydration. Polar groups of the proteins (-NH₂, COOH, OH groups) tend to attract water molecules around them to produce a shell of hydration. Any factor, which neutralizes the charge or removes water of hydration will therefore cause the precipitation of proteins. The following procedures are used for protein precipitation:

Protein supplements (casein, whey, collagen)

Various supplements contain a high percentage of protein concentration. Proteins can be classified based on their structure, enzymes, receptor action, and functions. Protein can be derived from various sources such as milk, meat, egg, soy, wheat, etc. Milk contains two types of protein: casein and whey protein. Whey protein is more soluble and has a higher quality rating than casein. It has the highest biological value (BV) of any protein source and is highly bioavailable. Casein makes up 80% of the protein found in milk. It is considered a slow-acting protein type because it takes longer to digest than whey or soy protein. This slower digestion rate creates a feeling of fullness, making it a great option for a meal before bedtime. Whey protein is a high-quality protein powder derived from cow's milk. Milk has two types of protein: casein (about 80%) and whey protein (about 20%). Whey protein contains less than 1% of various proteins, including β-lactoglobulin (β-LG), α-lactalbumin (α-LA), bovine serum albumin (BSA), immunoglobulins, protease peptone, as well as several minor proteins like lactoferrin, lactollin glycoproteins, lactoperoxidase and transferrin. Whey proteins are the proteins that remain soluble at pH 4.6 and 20 °C after the removal of caseins from milk. There are two primary types of whey protein sources available: acid whey is produced by the generation or direct addition of acid and results in the precipitation of caseins, while sweet whey comes from rennet coagulated cheese when caseins are removed (Tunick *et al.*, 2008) [15].

Whey Protein

Whey protein is a high-quality protein powder from cow's milk. Milk has two proteins: casein. (Approximately 80%) and whey protein (approximately 20%) [Figure 1a-b]. [5, 6] Whey contains less than 1%

proteins comprising mainly β-lactoglobulin (β-LG), α-lactalbumin (α-LA), bovine serum albumin (BSA), immunoglobulins and protease peptone, as well as several minor proteins including lactoferrin, lactollin,

Protein powders and infant formula are supplements that are used to provide additional nutrition to individuals

Protein powders are widely used by athletes and bodybuilders to facilitate muscle growth and repair. These powders consist of dairy proteins like casein and whey, and vegetable proteins like soy protein isolate (SPI), which is also used in infant formulas. While dairy proteins are generally safe, excessive consumption may lead to ketosis in individuals with cow's milk protein allergies. SPI, on the other hand, has been a subject of debate regarding its safety due to its weakly estrogenic compounds, such as genistein and daidzein. These compounds are among the 100 phytochemicals that remain bound to the protein isolate and can become potentially estrogenic after SPI consumption (Badger *et al.*, 2009) [2]. This is a concern for soy formula-fed infants, children, men, and postmenopausal women taking soy protein supplements, as it may result in reproductive toxicity, infertility, demasculinization, and increased promotion of oestrogen-responsive cancers like breast and endometrial cancer. Studies on the safety of SPI have shown inconsistent results, with some animal studies suggesting estrogenicity, and others showing no effects on sex organ weights, serum sex steroids concentrations, or fertility. For instance, in animal studies, marmoset monkeys fed soy infant formula had suppressed serum testosterone concentrations, while in adult female ovariectomized mice, feeding SPI increased the growth of human breast cancer cell xenografts, consistent with an estrogenic effect. Similarly, lifetime feeding studies in rats fed with SPI as the sole protein source in soy formulas revealed that it had no effects on sex organ weights, serum sex steroids concentrations, or fertility. Therefore, further research is necessary to determine the safety of consuming SPI for humans, especially for those with cow's milk protein allergies, infants, children, and postmenopausal women. It is crucial to take precautionary measures and consult a healthcare professional before consuming any dietary supplement (Fang *et al.*, 2004) [6].

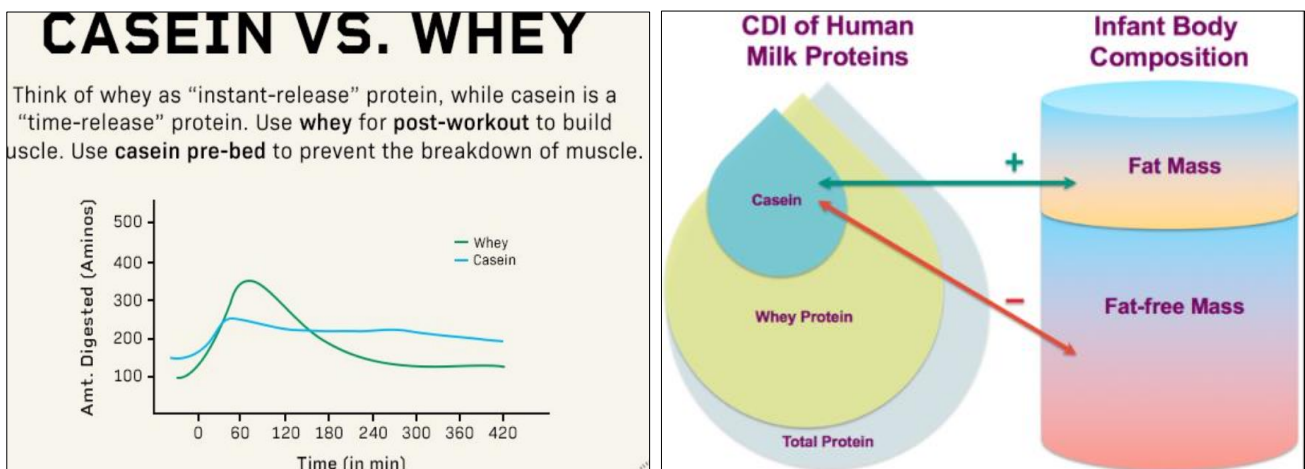


Fig 4: The image depicts a graph comparing the digestion rates of casein and whey proteins, suggesting whey for post-workout and casein for slow release to prevent muscle breakdown overnight and the composition of human milk proteins, primarily casein and whey, with the fat and fat-free mass in infant body composition.

Conclusion

Superfoods are generally plant-based foods which are nutritionally rich and offer maximum nutritional benefits for minimal calories. Future research must focus more on human intervention studies to scientifically support the benefits of superfoods. The legal food authorities should outline a general definition for superfoods, which will certainly lead to a better knowledge of superfoods.

The market for dietary supplements taken to improve the health or well-being of the customer is enormous if these supplements are consumed with proper guidance and under an umbrella of knowledge it would a cause ton of benefits.

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