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Exploring the role of amino acid

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I. INTRODUCTION

Proteins are large biomolecules and macromolecules that comprise one or more long chains of amino acids. Proteins perform many functions within organisms, including catalyzing metabolic reactions, DNA replication, responding to stimuli, providing structure to cells and organisms, and transporting molecules from one location to another. Proteins differ from one another primarily in their sequence of amino acids.A protein molecule is huge compared with molecules of sugar or salt and consists of many amino acids joined together to form long chains, much as beads are arranged on a string. About 20 different amino acids occur naturally in proteins. Proteins of similar function have similar amino acid composition and sequence.

Types of amino acids

Essential Amino Acids:-Amino acids which cannot be synthesized or produced by the body and are required from food supplements are called essential amino acids. There are 9 essential amino acids that include histidine, isoleucine, leucine, lysine, methionine, ph enylalanine, threonine, tryptophan, and valine.

Non-Essential Amino Acids:-Amino acids which are produced or synthesized by our bodies and are not taken up as food supplements are called nonessential amino acids. There are 20 total amino acids common in all life forms and the nonessential amino acids out of these include arginine, alanine, aspartic acid, asparagine, cysteine, glutamine, glutamic acid, proline, glycine, serine and tyrosine. Without these amino acids, our body will find it hard to make up proteins it needs which are required for the repair, growth and maintenance of cells.

Conditional Amino Acids: Some of the amino acids which are usually not essential but in times of illness and stress, may become essential are called conditional amino acids. These may be required in conditions such as prematurity in infants. The six conditional amino acids include cysteine, arginine, tyrosine, glutamine, ornithine, glycine, serine, and proline.

1.Histidine is an essential amino acid that plays a role in many bodily functions, including:

- **Protein biosynthesis**: Histidine is used to create proteins
- **Tissue repair**: Histidine helps repair damaged tissues
- **Blood cell production**: Histidine helps produce blood cells
- **Nerve cell protection**: Histidine helps protect nerve cells
- **Histamine production**: Histidine is used by the body to produce histamine
- **Proton buffering**: Histidine helps buffer protons
- **Metal ion chelation**: Histidine helps chelate metal ions
- **Reactive oxygen and nitrogen species scavenging**: Histidine helps scavenge reactive oxygen and nitrogen species

Histidine is found in many protein-rich foods, including: meat, fish, eggs, soy, whole grains, beans, and nuts.

2.Isoleucine is the oxygen-carrying pigment inside of red blood cells and helps to make hemoglobin. It is also helpful in glucose transportation, growth,immunity, and fatty acid metabolism. Isoleucine is known to help speed the healing of injured muscles and support muscle development.

3.Leucine is one of the 3 essential branched-chain amino acids. These amino acids can be used by skeletal muscle to give energy during exercise. Eating foods that have complete protein gives enough of these amino acids.

4.Lysine is an essential amino acidinvolved in growth, tissue repair, collagen production, and other important bodily functions. It's concentrated in foods like meat, fish, eggs, and beans and can also be taken as a dietary supplement.

Due to its importance in several biological processes, a lack of lysine can lead to several disease states including defective connective

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tissues, impaired fatty acid metabolism, anaemia, and systemic protein-energy deficiency.

5.Methionine is an essential amino acid found in high quantities in average American diet such as nuts, beef, lamb, cheese, turkey, pork, fish, shellfish, soy, eggs, dairy, and beans. Foods with a particularly high percentage include eggs (31 mg/g protein), cod (30 mg/g), and chicken (28 mg/g). Intermediate content is in beef (26 mg/g), pork (26 mg/g), milk (25 mg/g), and rice (24 mg/g).

6. Phenylalanine is an essential amino acid. It is found in high-protein foods. It may improve memory and learning ability. It may enhance mood and alertness.

Found in breast milk, meat, poultry, fish, cottage cheese, lentils, peanuts, and sesame seeds.Phenylalanine is thought to mediate or exacerbate hepatic encephalopathy, and an impaired liver may not be able to cope with the ammoniagenic properties of the amino acid constituents, or adequately metabolize

Phenylalanine is a naturally-occurring amino acid that makes up part of the molecule aspartame, a non-caloric sweetener used in diet drinks, like Diet Coke, and sold under the trade names Nutra sweet.

Phenylalanine is an amino acid naturally found in protein-rich foods such as milk and eggs. It's often added to sweeteners like aspartame, which is used in diet sodas. It's not a health risk, unless you can't metabolize it--a hereditary condition that affects only one in 15,000 people.

7.Threonine can maintain your hair's health, strength and shine. This amino acid minimizes excessive hair shedding and breakage and its anti-static properties can tame frizzy, dry hair. Threonine moisturizes and nourishes your hair by keeping the scalp well-hydrated.

8.The body uses tryptophan to help make melatonin and serotonin. Melatonin helps regulate the sleep-wake cycle, and serotonin is thought to help regulate appetite, sleep, mood, and pain. The liver can also use tryptophan to produce niacin (vitamin B3), which is needed for energy metabolism and DNA production.pineapple, bananas, kiwi fruit, plums, and tomatoes contain high amounts of tryptophan. Moderate amounts can be found in avocados, dates, grapefruit, cantaloupe, and more. Eat a variety of fruits and vegetables every day to get the best health benefits.

9.Valine is an essential amino acid that's used to make proteins and energy in the body.

- **Sources**

Valine is found in protein-rich foods like meat, fish, soy, and dairy, as well as some nuts, vegetables, and whole grains. Most people can get enough valine from a balanced diet, but a healthcare provider may recommend supplements in some cases.

- **Function**

The body uses branched-chain amino acids like valine to help produce energy.

Functions of proteins- It includes antibody formation, contractile proteins, enzymes, hormonal proteins, structural proteins, storage proteins, and transport proteins.Antibodies: Antibodies are specialized proteins that defend the body against antigens or foreign invaders. Their ability to travel through the bloodstream enables them to be utilized by the immune system to identify and defend against bacteria, viruses, and other foreign intruders in blood. One way antibodies counteract antigens is by immobilizing them so that they can be destroyed by white blood cells.

Contractile Proteins: Contractile proteins are responsible for muscle contraction and movement.Enzymes: All enzymes identified thus far are proteins.

Enzymes, which are the catalysts of all metabolic reactions, enable an organism to build up the chemical substances necessary for life—proteins, nucleic acids, carbohydrates, and lipids—to convert them into other substances, and to degrade them.Life without enzymes is not possible

Hormonal Proteins: Hormonal proteins are messenger proteins that help coordinate certain bodily functions.eg:

Cortisol is a steroid hormone (hormones which have a steroid nucleus that can pass through a cell membrane without a receptor) which is produced in the adrenal cortex of the kidney. It is a stress hormone.

The most common example of a structural protein is collagen which is found in the bones, cells and skin.

Structural proteins are also found in cells. They are used to provide an internal structure to the cell (the cytoskeleton) and are sometimes involved in cell movement. Structural proteins are especially important in larger cells.

Storage Proteins: Storage proteins reserve amino acids for the body until ready for use. Examples of storage proteins include

Ferritin a storage protein that stores iron.

Transport Proteins: Transport proteins are carrier proteins that move molecules from one place to another in the body.

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The respiratory protein hemoglobin acts as oxygen carrier in the blood, transporting oxygen from the lungs to body organs and tissues.

Daily requirement

MALES	Recommended daily protein intake (for average age weight)	Specific intake recommended per kg of body weight
14-18y	65g	0.99 g/kg*
19-70	64g	0.84g/kg
70 and above	81g	1.07g/kg

FEMALES	Recommended daily protein intake (for average age weight)	Specific intake recommended per kg of body weight
14-18	45g	0.77g/kg
19-70	46g	0.75g/kg
70+	57g	1.07g/kg
Pregnant (18-50y)	60g	1.00g/kg
Lactating (18-50y)	67	1.10g/kg

How much protein do you need in diabetes?

It depends on your age, sex, health, and physical activity. On average, people with diabetes eat about the same amount of protein as the general public, which is 15-20% of their daily calories (typically 1-1.5 grams of protein per kilogram of body weight per day). The American Diabetes Association (ADA) does not recommend a specific amount of protein, but if you currently get less than 15-20% of your calories from protein, this is a good range to aim for. If you eat 2,000 calories per day, then about 300-400 of those calories would come from **protein, which is about 75-100 grams of protein.**

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Will eating too much protein damage kidneys?

The truth is, if kidney function is proper then it is not necessary to restrict protein. Keeping glucose levels and blood pressure within target range is the best way to prevent kidney damage.

What about people with diabetes and kidney disease?

In the early days of diabetes care, people with diabetes and chronic kidney disease were advised to follow a low protein diet. We now know reducing protein intake in individuals with mild kidney disease does not change kidney disease progression. In fact, a low-protein diet may lead to malnutrition.

Causes of deficiency

Malnutrition and undereating. Hypoproteinemia can relate directly to a person's diet, especially if a person does not eat enough protein or avoids certain food groups. ...
Liver disorders. The liver plays a key role in processing proteins in the body. ...
Kidney problems. ...
Celiac disease. ...
Inflammatory bowel disease.

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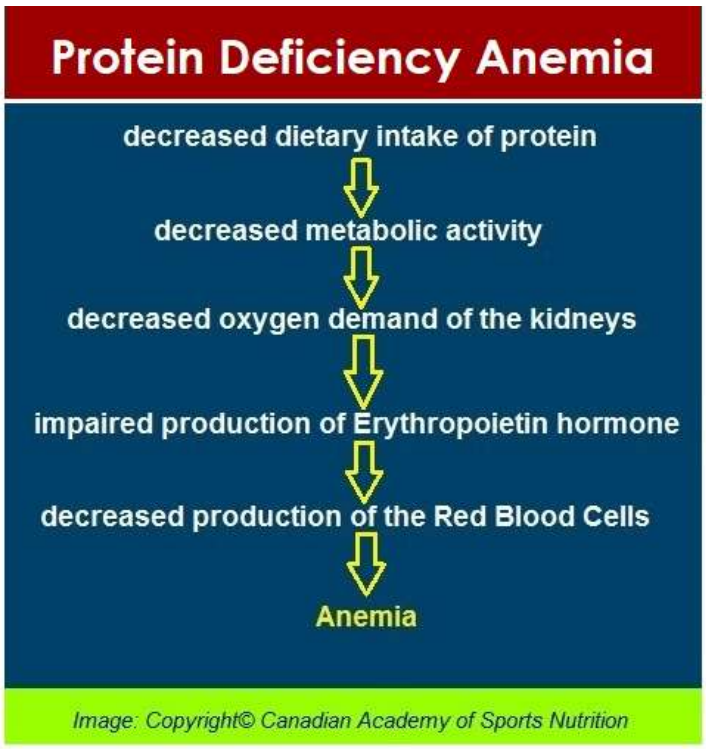

Effects of protein supplements

Composition of High-Protein Bars without Chocolate Coating

Ingredient	Percentage Content in Final Product (% *w/w*)
Protein ingredient (WPC, SPI, PAP, RPC, WHP, ALP, SUP, HMP or PMP)	38.18
Glucose syrup	31.82
Rapeseed oil	13.64
Maltodextrin	5.45
Water	5.45
Barley malt extract	3.64
Soy lecithin	0.91
Vanilla flavor (aroma)	0.91

Composition of High-Protein Bars with Chocolate Coating

Ingredient	Percentage Content in Final Product (% *w/w*)
Protein ingredient (WPC, SPI, PAP, RPC, WHP, ALP, SUP, HMP or PMP)	30.2
Glucose syrup	25.0
Rapeseed oil	10.8
Maltodextrin	4.3
Water	4.3
Barley malt extract	2.9

Many protein bars also contain high amounts of added sugar and use unhealthy sweeteners like high fructose corn syrup, which adds excess fructose to your diet and can increase your risk of fatty liver, obesity, and diabetes when consumed in high amounts.

1. Gain Weight: One of the unexpected side effects of eating protein bars is the potential for weight gain. Although protein is essential for muscle growth and repair, excessive consumption can contribute to an increased caloric intake. Many protein bars are fortified with additional ingredients such as sugars, fats, and carbohydrates to enhance their taste and texture. These additives can significantly increase the caloric content of the bars, making it easy to exceed daily calorie limits without even realizing it .

2. Develop Metabolic Disorders: Regularly indulging in protein bars can lead to the development of metabolic disorders. Certain protein bars contain artificial sweeteners like

sucralose and aspartame, which have been linked to metabolic disruptions and an increased risk of metabolic syndrome (Mashed, 2023)2. Metabolic disorders, including insulin resistance and dyslipidemia

3. May contain unnatural ingredients: Protein bars often contain a myriad of ingredients, some of which may be unnatural or heavily processed. Protein bars usually contain artificial additives, preservatives, and flavourings. This is to improve taste and extend shelf life. These additives can potentially have adverse effects on health, including allergic reactions, gastrointestinal disturbances, and increased inflammation in the body .

4. Not Cost-Effective Option: Another side effect of relying on protein bars as a regular snack option is the financial burden they can impose. Protein bars tend to be more expensive than whole food sources of protein. Over time, the cost of consuming protein bars regularly can accumulate, potentially straining one's budget. It is important to consider more cost-effective alternatives, such as natural sources of protein like lean meats, eggs, or legumes .

5. Digestive Issues: Certain protein bars may contain high amounts of fibre or sugar alcohols (like sorbitol or maltitol) to boost their nutritional profile. These ingredients can cause digestive issues such as bloating, gas, or diarrhea.

6.Whey protein consumption can hamper the regular functioning of your kidneys by increasing the plasma urea content, urinary calcium excretion, and urinary volume. This overburdens the kidneys and can lead to kidney stones.

II. CONCLUSION

Protein is an important part of a healthy diet. Proteins are made up of chemical 'building blocks' called amino acids. Your body uses amino acids to build and repair muscles and bones and to make hormones and enzymes.

Amino acids are molecules used by all living things to make proteins. Your body needs 20 different amino acids to function correctly. Nine of these amino acids are called essential amino acids. Essential amino acids must be consumed by food.

Animal-based foods (meat, poultry, fish, eggs, and dairy foods) tend to be good sources of complete protein, while plant-based foods (fruits, vegetables, grains, nuts, and seeds) often lack one or more essential amino acid.

The recommended dietary allowance to prevent deficiency for an average sedentary adult is 0.8 grams per kilogram of body weight.

Protein helps repair and build your body's tissues. It drives metabolic reactions, maintains pH and fluid balance, and keeps the immune system strong. It also transports and stores nutrients and can act as an energy source.

Protein deficiency can lead to malnutrition, such as kwashiorkor and marasmus, which can be life threatening. Protein deficiency can arise if a person has a health condition, including: an eating disorder, such as anorexia nervosa. certain genetic conditions.

Intake of proteins supplements can also cause acne, increased bowel movements, bloating, and even nausea. Other side effects include flatulence and diarrhea. If taken in excess quantities, protein supplements can cause you to gain weight.