Amino Acid And Fatty Acid Analysis Of Avocado (*Persea Americana*) Powder

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Abstract:
Avocado (*Persea americana*) is a well-known food ingredient with a variety of health benefits. Avocado powder is derived from dried and ground avocados. This article focuses on the amino acid and fatty acid composition of avocado powder, highlighting its potential health benefits and applications in food science. The lipid extract of the sample was analyzed using gas chromatography-mass spectrometry (GC-MS) and characterized by the presence of saturated, monounsaturated, and polyunsaturated fatty acids, with the following percentages: lysine, leucine, valine, linoleic acid, glutamic acid, and aspartic acid. The presence of 1.2 and 1.5 grams of valine per 100 grams of the avocado powder contributes to muscle health and metabolic regulation. The high concentration of olic acid in avocado powder adds to its overall nutritional profile, supporting various bodily functions ranging from muscle repair and immune response to energy metabolism and cognitive health. This makes avocado powder an attractive ingredient for dietary supplements, protein-rich foods, and functional food products aimed at promoting overall health and well-being.

Keywords: *Avocado, amino acids, fatty acids, human health, functional foods*

Introduction:

Avocado (*Persea americana*) has a long history of cultivation, dating back to ancient Mesoamerican civilizations such as the Aztecs and Mayans (Galindo-Tovar, 2007), who valued it for its nutritional benefits and believed it possessed aphrodisiac properties. The fruit was introduced to Europe and other parts of the world by Spanish explorers in the 16th century and has since spread to many tropical and subtropical regions (Galán Saúco and Cubero, 2010). Avocado, a nutrient-dense fruit, is widely recognized for its rich content of healthy fats and amino acids. The growing popularity of avocado powder, derived from dried and ground avocados, has spurred interest in its nutritional profile. This article delves into the amino acid and fatty acid composition of avocado powder, highlighting its potential health benefits and applications in food science.

Methodology:

Sample Preparation

Fresh avocados were sourced from local markets, peeled, and the seeds removed. The pulp was sliced, dried at 60°C until completely dehydrated, and then ground into a fine powder.

Amino Acid Analysis

Amino acid composition was determined using high-performance liquid chromatography (HPLC) following acid hydrolysis of the sample. The amino acids were quantified and expressed in grams per 100 grams (g/100g) of the sample (Qabaha, 2010).

Fatty Acid Analysis

Fatty acid methyl esters (FAMEs) were prepared from the lipid extract of the sample and analyzed using gas chromatography-mass spectrometry (GC-MS). The fatty acid content was expressed as a percentage of total fatty acids (Prato and Biandolino, 2012)

Table: 2 Amino Acid Composition of Avocado (*Persea americana*) Powder

Amino Acid Type	Amino Acid	Concentration (g/100g)
Essential Amino Acids		
	Lysine	1.2
	Leucine	1.5
	Valine	1.1
Non-Essential Amino Acids		
	Glutamic Acid	2.3
	Aspartic Acid	1.9

This table summarizes the essential and non-essential amino acid composition of avocado powder, showing the concentration of each amino acid in grams per 100 grams of the sample.

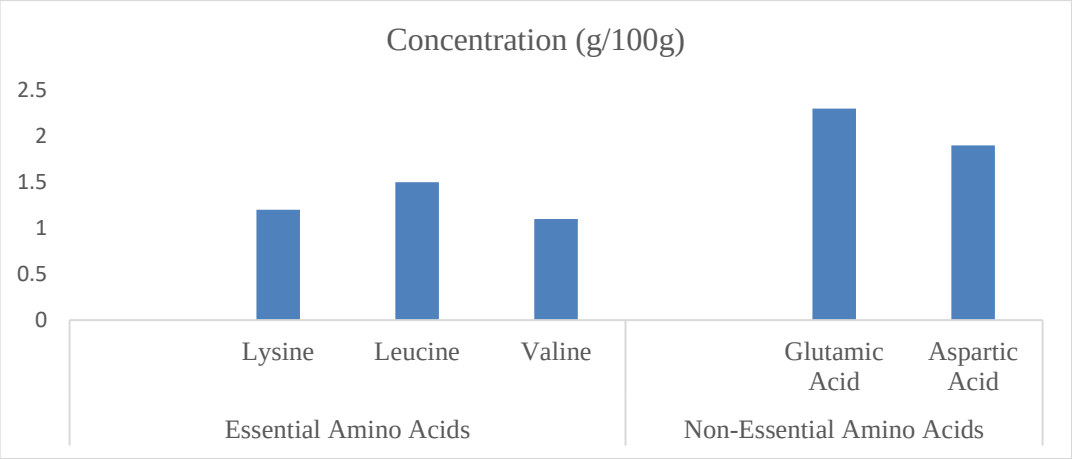

Figure: 1 Amino Acid Composition of Avocado (Persea americana) Powder

Fatty Acid Composition

The fatty acid composition of avocado powder was characterized by the presence of saturated, monounsaturated, and polyunsaturated fatty acids, with the following percentages:

Table: Fatty Acid Composition of Avocado (*Persea americana*) Powder

Fatty Acid Type	Fatty Acid	Percentage (%)
Saturated Fatty Acids (SFA)		
	Palmitic Acid	10.3
Monounsaturated Fatty Acids (MUFA)		
	Oleic Acid	65.2
Polyunsaturated Fatty Acids (PUFA)		
	Linoleic Acid	15.6
	Alpha-Linolenic Acid	2.8

This table summarizes the fatty acid composition of avocado powder, highlighting the percentage of saturated, monounsaturated, and polyunsaturated fatty acids present in the sample.

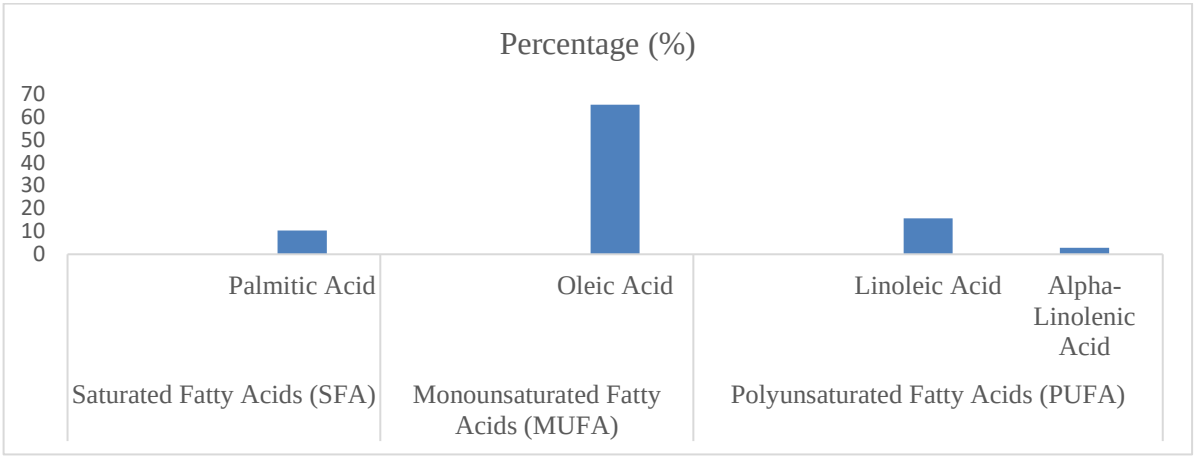

Figure: 2 Fatty Acid Composition of Avocado (Persea americana) Powder

Discussion:

Essential Amino Acids

1. **Lysine (1.2 g/100g)**: Lysine is vital for protein synthesis, hormone and enzyme production, and calcium absorption. It plays a crucial role in immune function and collagen formation, making it essential for tissue repair and growth. The presence of 1.2 grams of lysine per 100 grams of avocado powder highlights its importance as a valuable source of this amino acid in the diet.
2. **Leucine (1.5 g/100g)**: Leucine is a branched-chain amino acid (BCAA) that is critical for muscle protein synthesis and repair. It also helps regulate blood sugar levels and supports the production of growth hormones. With 1.5 grams per 100 grams, avocado powder is a significant source of leucine, contributing to muscle health and metabolic regulation.
3. **Valine (1.1 g/100g)**: Valine, another BCAA, is essential for muscle growth, tissue repair, and energy production. It also plays a role in maintaining mental vigor and emotional calm. The 1.1 grams of valine per 100 grams of avocado powder can support physical and mental performance, particularly for athletes and active individuals.

Non-Essential Amino Acids

1. **Glutamic Acid (2.3 g/100g)**: Glutamic acid is a key player in cellular metabolism and neurotransmission. It serves as a precursor for the synthesis of glutamine, an amino acid important for immune function and intestinal health. The high concentration of glutamic acid (2.3 grams per 100 grams) in avocado powder underscores its potential to support cognitive function and overall metabolic processes.
2. **Aspartic Acid (1.9 g/100g)**: Aspartic acid is involved in the urea cycle, which helps remove excess ammonia from the body. It also contributes to energy production and the synthesis of other amino acids. With 1.9 grams per 100 grams, avocado powder provides a substantial amount of aspartic acid, aiding in energy metabolism and detoxification processes.

Nutritional Implications

The presence of both essential and non-essential amino acids in significant quantities makes avocado powder a well-rounded source of protein. Essential amino acids like lysine, leucine, and valine are crucial for muscle maintenance, repair, and overall metabolic health. Non-essential amino acids such as glutamic acid and aspartic acid further enhance the nutritional value of avocado powder by supporting metabolic functions and cognitive health.

Including avocado powder in the diet can thus contribute to a balanced intake of amino acids, supporting various bodily functions ranging from muscle repair and immune response to energy metabolism and cognitive health. This makes it an attractive ingredient for dietary supplements, protein-rich foods, and functional food products aimed at promoting overall health and well-being.

Saturated Fatty Acids (SFA)

1. **Palmitic Acid (10.3%)**: Palmitic acid is the primary saturated fatty acid in avocado powder, constituting 10.3% of the total fatty acid content. While excessive intake of saturated fatty acids is generally associated with increased risk of cardiovascular disease, palmitic acid in moderation is essential for certain bodily functions, including the maintenance of cellular structure and function. The moderate level of palmitic acid in avocado powder suggests it can be part of a balanced diet without significantly impacting heart health negatively.

Monounsaturated Fatty Acids (MUFA)

1. **Oleic Acid (65.2%)**: Oleic acid is the dominant fatty acid in avocado powder, making up 65.2% of its total fatty acid content. This monounsaturated fatty acid is known for its heart health benefits, including reducing bad cholesterol (LDL) levels and potentially increasing good cholesterol (HDL) levels. Oleic acid also has anti-inflammatory properties and may help in preventing chronic diseases such as heart disease and diabetes (Sales-Campos et al., 2013). The high concentration of oleic acid underscores the nutritional value of avocado powder as a heart-healthy food ingredient.

Polyunsaturated Fatty Acids (PUFA)

1. **Linoleic Acid (15.6%)**: Linoleic acid, a type of omega-6 fatty acid, accounts for 15.6% of the total fatty acids in avocado powder. It plays a crucial role in cell function and is essential for maintaining the structural integrity of cell membranes (Magtanong et al., 2006). Linoleic acid also contributes to skin health and has anti-inflammatory properties. However, it is important to maintain a balance between omega-6 and omega-3 fatty acids to prevent excessive inflammation. The presence of linoleic acid in avocado powder adds to its overall nutritional profile, supporting various bodily functions.
2. **Alpha-Linolenic Acid (2.8%)**: Alpha-linolenic acid (ALA) is an omega-3 fatty acid that constitutes 2.8% of the fatty acids in avocado powder. ALA is known for its anti-inflammatory benefits and its role in heart health, cognitive function, and overall cellular health (Das, 2008). Although the percentage of ALA is lower compared to other fatty acids, its presence is significant, contributing to the beneficial omega-3 intake and helping to balance the omega-6 to omega-3 ratio.

Nutritional Implications

The fatty acid composition of avocado powder highlights its potential as a functional food ingredient with multiple health benefits (Ferreira et al., 2020). The high content of monounsaturated fats, primarily oleic acid, supports cardiovascular health by managing cholesterol levels and reducing inflammation. The presence of polyunsaturated fats, including both

omega-6 (linoleic acid) and omega-3 (alpha-linolenic acid) fatty acids, further enhances its anti-inflammatory properties and supports overall cellular health (Ros and Mataix, 2006.

The moderate level of saturated fats, mainly palmitic acid, ensures that the fatty acid profile remains balanced, making avocado powder a heart-healthy option when consumed as part of a balanced diet (Astrup et al., 2020). This composition is particularly beneficial for individuals looking to improve their lipid profile and reduce the risk of chronic diseases.

Conclusion

The amino acid profile of avocado powder demonstrates its potential as a nutritious and functional food ingredient. Its rich content of essential and non-essential amino acids can provide comprehensive health benefits, making it a valuable addition to the diet. Whether used in supplements, food products, or as part of a balanced meal plan, avocado powder can significantly contribute to achieving optimal nutritional status. The fatty acid profile of avocado powder demonstrates its nutritional richness and health-promoting properties. With a high concentration of monounsaturated fats, along with beneficial polyunsaturated fats and moderate saturated fats, avocado powder is an excellent addition to a health-conscious diet. Its versatile use in various food products can help consumers easily incorporate these beneficial fatty acids into their daily intake, supporting overall health and well-being.

References:

1. Astrup, A., Magkos, F., Bier, D. M., Brenna, J. T., de Oliveira Otto, M. C., Hill, J. O., ... & Krauss, R. M. (2020). Saturated fats and health: a reassessment and proposal for food-based recommendations: JACC state-of-the-art review. *Journal of the American College of Cardiology*, *76*(7), 844-857.
2. Das, U. N. (2008). Essential fatty acids and their metabolites could function as endogenous HMG-CoA reductase and ACE enzyme inhibitors, anti-arrhythmic, anti-hypertensive, anti-atherosclerotic, anti-inflammatory, cytoprotective, and cardioprotective molecules. *Lipids in health and disease*, *7*, 1-18.
3. Ferreira da Vinha, A., Silva, C. S., Soares, M. D. O., & Barreira, S. (2020). Avocado and its by-products: Natural sources of nutrients, phytochemical compounds and functional properties. *Current Research in Agricultural and Food Science*, *1*, 82-96.
4. Galán Saúco, V., & Cubero, J. I. (2010, August). Contribution of Spain and Portugal to the exchange and acclimatization of new and old world crops. In *XXVIII International Horticultural Congress on Science and Horticulture for People (IHC2010): Colloquia and Overview 916* (pp. 71-82).
5. Galindo-Tovar, M. E., Arzate-Fernández, A. M., Ogata-Aguilar, N., & Landero-Torres, I. (2007). The avocado (Persea americana, Lauraceae) crop in Mesoamerica: 10,000 years of history. *Harvard papers in botany*, *12*(2), 325-334.
6. Magtanong, L., Ko, P. J., & Dixon, S. J. (2016). Emerging roles for lipids in non-apoptotic cell death. *Cell Death & Differentiation*, *23*(7), 1099-1109.
7. Prato, E., & Biandolino, F. (2012). Total lipid content and fatty acid composition of commercially important fish species from the Mediterranean, Mar Grande Sea. *Food Chemistry*, *131*(4), 1233-1239.
8. Ros, E., & Mataix, J. (2006). Fatty acid composition of nuts–implications for cardiovascular health. *British journal of nutrition*, *96*(S2), S29-S35.
9. Sales-Campos, H., Reis de Souza, P., Crema Peghini, B., Santana da Silva, J., & Ribeiro Cardoso, C. (2013). An overview of the modulatory effects of oleic acid in health and disease. *Mini reviews in medicinal chemistry*, *13*(2), 201-210.