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"A COMPREHENSIVE REVIEW OF *AMARANTHUS SPP.* AS A NUTRIENT-DENSE FOOD SUPPLEMENT:
FOCUS ON MINERAL COMPOSITION AND HEALTH BENEFITS"

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Abstract: The purpose of the study is to highlight that the *Amaranthus spp.* plant contains a significant amount of nutrients that are beneficial to human health and, when included in a balanced diet, can improve or even combat certain diseases. The plant is an important source of proteins, crude fiber, carbohydrates, energy, and minerals.

The nutritional value of amaranth is very high, the leaves contain more protein and lysine than corn or other cereals, and more methionine than soy, both essential amino acids. It also contains significant amounts of beta-carotene, omega-6, and powerful antioxidants. The amaranth plant (specifically its species) is rich in vitamins, particularly A, K, B1, B3, B5, B6, B17, C, E, riboflavin, folic acid, and folate, as well as minerals like calcium, iron, magnesium, phosphorus, potassium, zinc, copper, and manganese. Amaranth contains significant amounts of provitamin A (beta-carotene) and is also rich in polyunsaturated fatty acids, particularly linoleic acid.

Amaranthus spp. contains a variety of valuable bioactive compounds, which are good for our health: polyphenols – powerful antioxidants that help combat oxidative stress; flavonoids – with anti-inflammatory and antioxidant properties; saponins – known for their antimicrobial and anti-inflammatory effects; dietary fiber – beneficial for digestive health; phytosterols – help reduce cholesterol. These compounds provide amaranth with health benefits, including cardiovascular protection and immune support.

Keywords: weed, healthy food, nutrients, and bioactive compounds.

Introduction

The study aims to answer two main questions: is it rich in minerals and if yes, is it a dense nutrient food?

Amaranth is rich in:

- Proteins
- Carbohydrates
- Fats
- Fiber
- Vitamins
- Minerals
- Antioxidants

Amaranth spp. contain a variety of valuable bioactive compounds that are benefit to our health:

- Polyphenols - powerful antioxidants that help to combat oxidative stress;
- Flavonoids - with anti-inflammatory and antioxidant properties;
- Saponins - known for their antimicrobial and anti-inflammatory effects;
- Dietary fiber – beneficial for digestive health;
- Phytosterols – help reduce cholesterol levels.

Material and method

To compare and recognize the most nutrient-dense forms of *Amaranthus* (plant, seeds, flour, and cooked seeds), multiple databases such as USDA, FoodB, and scientific papers were reviewed. The analysed materials are included in the text, tables, and references. The analysis of data was performed by direct comparison (table, treemap), ranking by nutrient content, and using Principal Component Analysis (PCA). All data are presented in different graphs. For direct comparison was used treemap from a data fingerprint.

For creating the ranking chart the method used is called „Line Plot with an Inverted Y-axis” suggested to visually exemplify rankings. Meanwhile rankings are better when they are lower (with 1 being the best), the y-axis is inverted to highlight that lower values are better ranks. The lines simplify the observation of the products that regularly perform well or poorly based on various metrics.

PCA is a mathematical model which is reducing the number of data, to form clusters showing the most important correlations. The joint plot graph helps visualize how the samples can be compared based on multiple variables and which variables contribute most to their variance. It's a powerful way to understand the key factors distinguishing these samples and their compositions.

Results and discussions

In order to answer the main questions, based on the studied literature data and database information the following results were analyzed using mathematical models.

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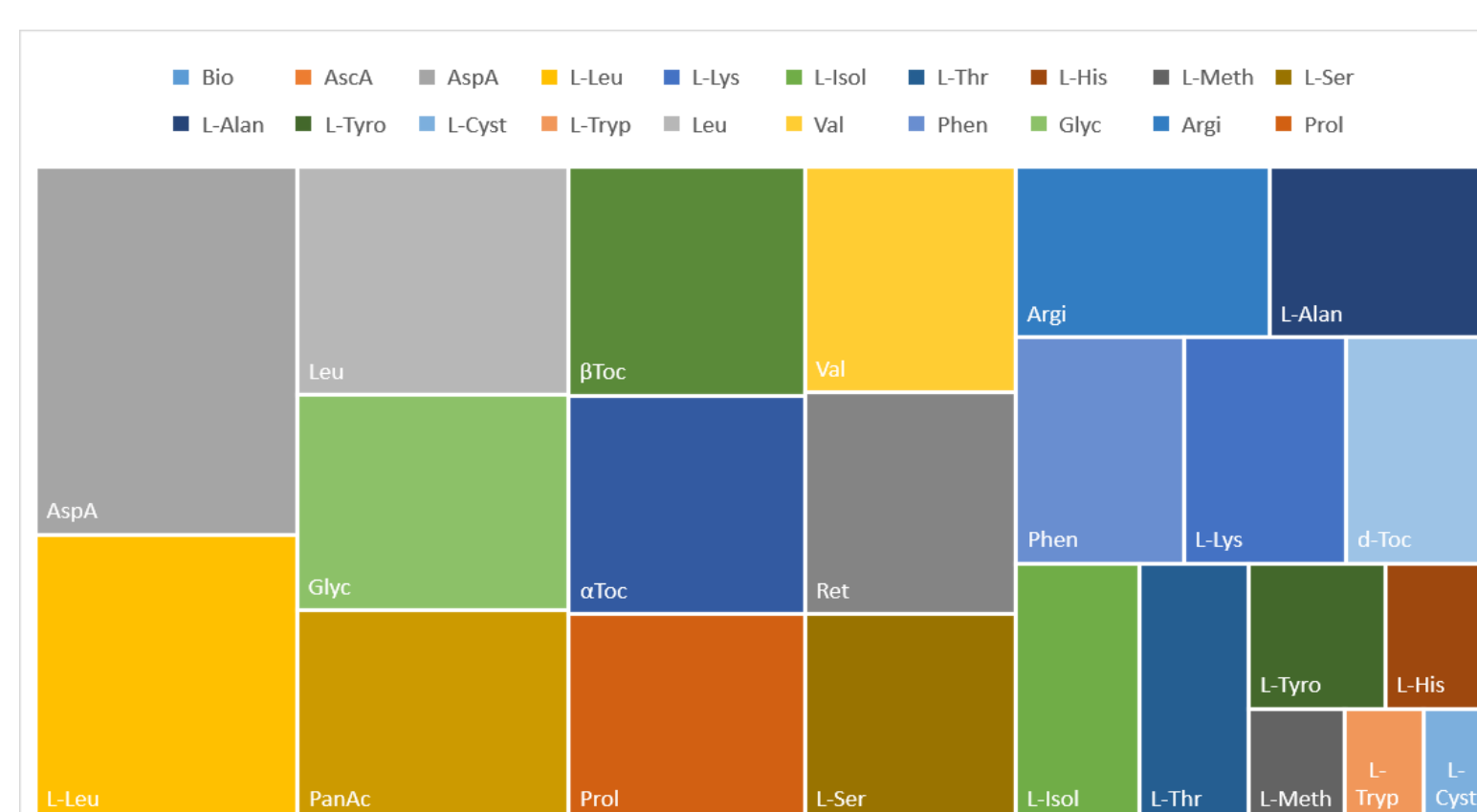


Figure 1. Data fingerprint

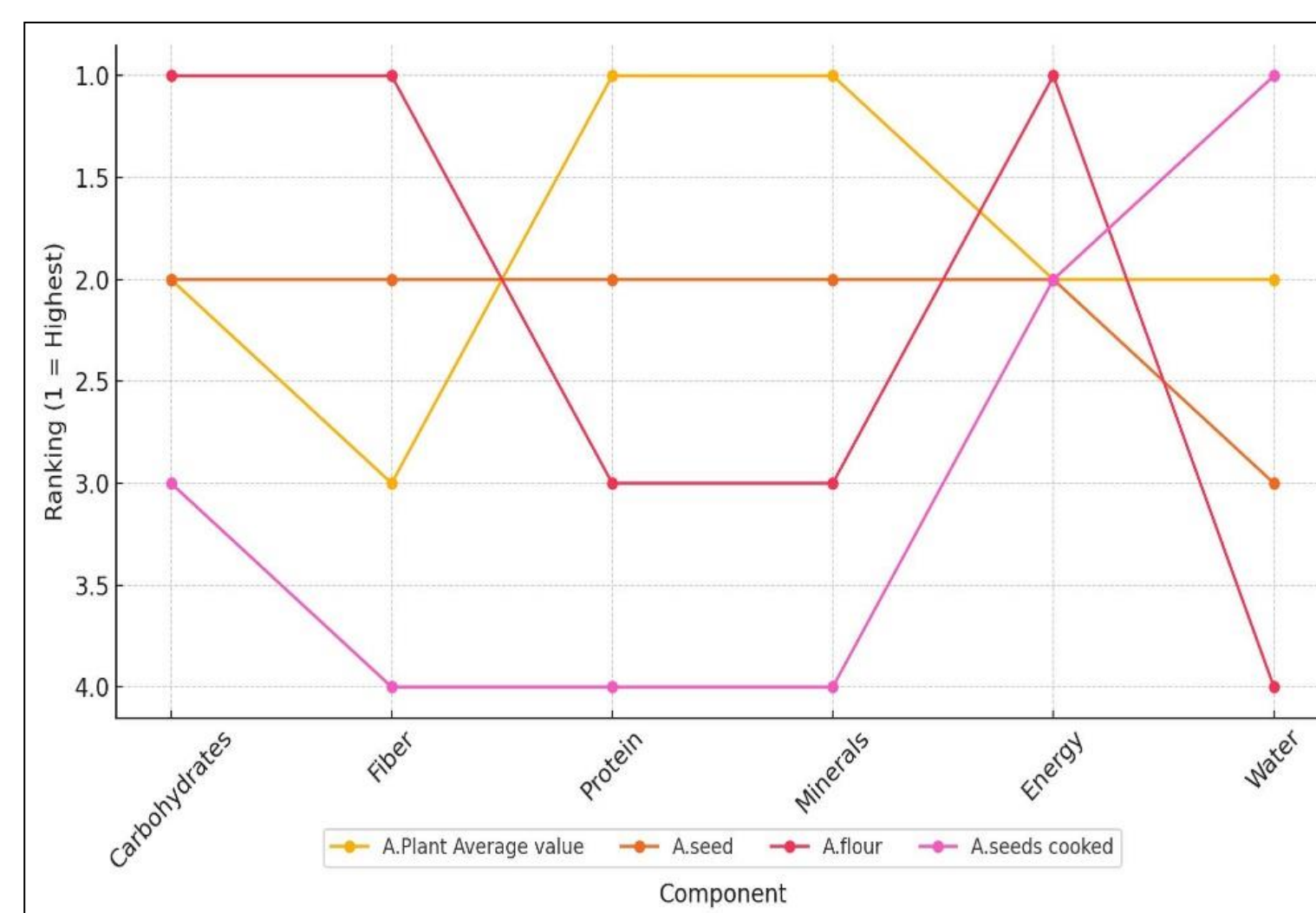


Figure 2. Ranking of
Nutritional Components
across Products (The ranking
chart was generated with the
help of an AI-based solution).

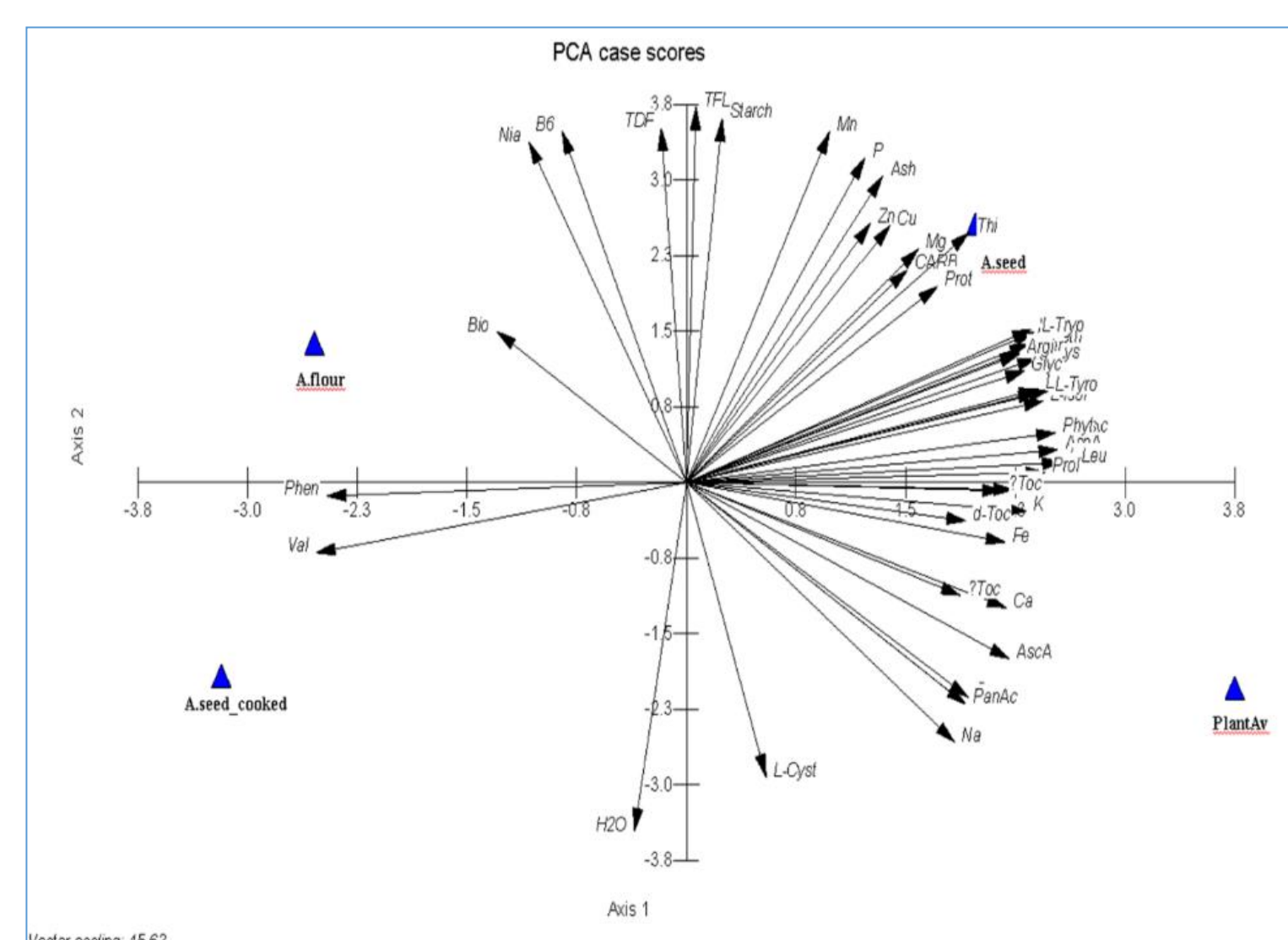


Figure 3. PCA Joint Plot
representation of analyzed
data

Conclusions

Amaranth flour is a great source of energy and carbohydrates, though it contains less water and moderate amounts of other nutrients. The leaves are especially nutrient-rich when is eaten fresh, providing high levels of protein and minerals. Amaranth seeds are a good source of both fiber and protein, but cooking them can reduce some of their nutrients. To maximize the health benefits of amaranth, it's best to consume it in raw or minimally processed forms, which help preserve its valuable nutrients.