ALFALFA *(MEDICAGO SATIVA L.)* - RELEVANT PROTEIN RAW MATERIAL FOR THE FOOD INDUSTRY

Iana CIUGUREANU, ORCID ID: 0009-0004-1910-7833
Technical University of Moldova, Food Technology Department, Chisinau, Republic of Moldova

Viorica BULGARU, ORCID ID: 0000-0002-1921-2009
Technical University of Moldova, Food Technology Department, Chisinau, Republic of Moldova

Angela GUREV, ORCID ID: 0000-0001-8493-5257
Technical University of Moldova, Food Technology Department, Chisinau, Republic of Moldova

Aliona GHENDOV-MOȘANU, ORCID ID: 0000-0001-5214-3562
Technical University of Moldova, Food Technology Department, Chisinau, Republic of Moldova

*Corresponding author: Iana Ciugureanu, e-mail: iana.ciugureanu@doctorat.utm.md

Introduction and Background

In the context of population growth, the diet must provide high-quality proteins, easily digestible and with a complete profile of essential amino acids, characteristics commonly found in animal sources. Vegetable proteins obtained from legumes and cereals have limitations, especially due to the incomplete supply of essential amino acids and less advantageous sensory properties. In this regard, it becomes important to identify alternative solutions for the valorization of vegetable proteins, such as those extracted from alfalfa *(Medicago sativa L.)*, which is distinguished by high biomass productivity, 3–10 times higher compared to oilseed, legume or cereal crops. In this context, the purpose of this research was to investigate the quality indices and antioxidant potential of alfalfa, with a view to its further exploitation in the food industry.

Methodology

The local alfalfa variety was used for the research. Dry weight (DW), protein, fat and ash content were determined using the official AOAC method. Amino acid composition was determined by standard protocols involving cation exchange chromatography. The total content of polyphenols and flavonoids (TPC and TFC) and antioxidant activity (via DPPH, ABTS) were determined by spectrophotometric analysis for aqueous and hydroethanolic alfalfa extracts.

Results

The protein content of the sample of alfalfa leaves and stems, harvested in the budding phase, was 28.63% of dry matter. The high amount of protein in the respective alfalfa variety was favored by the vegetation conditions that contributed to the accumulation of nitrogen compounds, as well as to the quality of the accumulated proteins, with soluble proteins predominating. The alfalfa samples showed a fat content of 2.34%, a value considered typical for leaf biomass. The results for the ash content were 11.55%, representing a fairly high proportion of mineral fraction in the original alfalfa. The amino acid profile of alfalfa revealed a broad composition, comprising both essential and non-essential amino acids. Among the amino acids quantified, aspartic acid (1.95 g/100 g DW) and glutamic acid (1.91 g/100 g DW) were predominant. In addition, the alfalfa sample was richer in proline (1.01 g/100 g DW), leucine (0.97 g/100 g DW) and valine (0.95 g/100 g DW). Lower concentrations were observed for cysteine and methionine. The TPC and TFC values for the aqueous extracts of alfalfa were lower (2093.6 mg GAE/100 g DW and 584.1 mg QE/100 g DW, respectively) compared to the alcoholic ones (2583.0 mg GAE/100 g DW and 810.3 mg QE/100 g DW, respectively). This difference can be attributed to the higher efficiency of 70% aqueous ethanol in extracting polyphenolic compounds. The results showed that the DPPH• radical scavenging capacity was higher in the hydroalcoholic extracts of alfalfa compared to the aqueous ones (583.2 and 485.3 mg TE/100 g DW, respectively). The antioxidant activity determined by the DPPH assay is specific to phenolic compounds and depends on their concentration. At the same time, the scavenging capacity of the $ABTS^{\bullet+}$ radical cation was considerably higher for aqueous alfalfa extracts (3190.4 mg TE/100 g DW) compared to hydroethanolic extracts (2093.6 mg TE/100 g DW).

Conclusions and Implications

Alfalfa harvested in the budding stage demonstrated a high nutritional value, characterized by an elevated protein content and a balanced amino acid profile dominated by aspartic and glutamic acids. Extracts

obtained with 70% aqueous ethanol showed superior polyphenol levels and higher DPPH radical-scavenging activity, while aqueous extracts exhibited stronger ABTS•+ scavenging capacity. Overall, the results highlight alfalfa as a valuable source of proteins and bioactive compounds with notable antioxidant potential.

Keywords: *antioxidant activity; bioactive compounds; green leafy protein sources; sustainable crop*

Acknowledgments. The authors would like to thank the National Project Stimulating Excellence in Research of National Agency for Research and Development of Moldova 25.80012.5107.21SE *"Optimization of the extraction technology of protein concentrates from alfalfa (Medicago Sativa L.) for the manufacture of new food products".*