COMPARATIVE STUDY OF THE AMINO ACID AND OTHER CHEMICAL COMPOSITIONS OF DRY EXTRACTS OF CURCUMA LONGA L. AND FERULA ASSAFOETIDA ROOTS

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ABSTRACT

The article presents the study results on defining the amino acid composition of dry extracts Curcuma Longa L. and Ferula Assafoetida L.

Amino acids serve as a binder in the decomposition and synthesis of nitrogen-fixing chemicals, and they constitute the body's most important supply of nitrogen. In a day, the human body may repair up to 400 g of protein. Proteins are transferred at varied rates, ranging from a few minutes to tens of days. In particular, a quarter of protein amino acids (about 100 g) are irreparably damaged. They must be replenished at the expense of nutritional and partly produced endogenous amino acids.

The amino acid content determines the natural structure, functioning, and nutritional quality of a protein [21]. Heat is frequently given to the protein's surroundings during food processing, and this input of energy can modify any or all of the original protein's structural, functional, and nutritional features. Foods are complicated systems, and it's crucial to remember that pH, water activity, food composition, and their interactions with temperature have diverse effects on protein characteristics.

The research examined the amino acid composition of both samples and compared them. As a result, heterocyclic acids dominated all other compounds discovered.

Keywords: Dry Extract, Curcuma Longa L., Ferula Assafoetida L., Root Extract, Amino Acid Composition, Chemical Composition

I. INTRODUCTION

Amino acids are known as structural unit of protein. Amino acids of proteins in humans and animals [1]. Many amino acids are produced in the body during metabolism. As a result, they are known as exchangeable amino acids, whereas non-exchangeable amino acids are not generated in the body or in limited amounts [2]. Glycine, alanine, proline, serine, cysteine, aspartate, asparagine, glutamate, glutamine, and tyrosine are some of the amino acids that can be exchanged. Arginine, kalin, histidine, isoleucine, leucine, lysine, methionine, threonine, tryptophan, and phenylalanine are non-exchangeable amino acids [3]. Lysine, methionine, cystine, threonine, and tryptophan are some of the amino acids that are involved in metabolism. Metabolic problems and health deterioration are caused by a lack of necessary amino acids in the body [1].

Amino acids are the only source of protein in the body, and their reserves are very low. Therefore, proteins are an essential compound for the human body at any age. They are important in the organism's development and the performance of important functions. Amino acids are important for the full growth and development of the body in young people and adults for the vital functions of organs, cell regeneration, renewal, blood formation, lymph, hormones, and enzymes [3, 4].
Furthermore, amino acids are involved in the formation of molecules that are responsible for innervation. It enables nerve impulses to move from the brain to organs and tissues [5].

Turmeric (Curcuma longa L.) is a perennial herbaceous plant from the ginger family (Zingiberaceae). Turmeric is a natural antibacterial agent that also helps to improve digestion and intestinal flora. It has been shown in the literature to be beneficial in the treatment of inflammation and joint pain. Its main active ingredient is curcumin in the plant content of 0.3 to 5.4% [19]. Curcuma has a wide range of pharmacological effects, mainly antioxidant, anticancer, antimicrobial, anti-inflammatory, and antidiabetic properties [3, 6]. Curcuma longa is a perennial herb that grows up to 1 m tall with tufted leaves and a short stem. The rhizomes, which are elliptical, oblong, pyriform, or cylindrical and typically short-branched, are the portions employed. They range in hue from yellow to yellowish-brown [20].

The following are only a few of the benefits that turmeric and curcumin-rich extracts have been demonstrated to offer:

- Anticarcinogenic Antioxidant
- Anti-inflammatory properties
- Antimicrobial agents
- Protective of the cardiovascular system
- Hepatoprotective properties
- Carminative and protectant for the gastrointestinal tract
- Protective for the brain

The asafoetida ferula is a perennial herbaceous plant of the Apiaceae family. It's most commonly used as a resin that hardens in the air. The resin released ferric acid, resin alcohols, feral esters, and coumarins. In modern medicine, its root is used in nervous diseases as an anti-inflammatory to lower blood pressure. And in some literature, the fern is mentioned as anthelmintic [1, 5]. Hysteria, several neurotic diseases, bronchitis, asthma, and whooping cough are all treated with it in modern herbalism. It was once used to treat infantile pneumonia and flatulent colic, among other things. Antispasmodic, carminative, expectorant, laxative, and sedative are all properties of gum resin. Gum's volatile oil is expelled via the lungs, making it an excellent asthma therapy. This plant may be found growing in the wild in Kashmir, Iran, and Afghanistan [16]. It has a terrible odour, is herbaceous and perennial, and may reach a height of 2 metres. The portion employed is asafoetida, an oleogum resin derived by incision from the root.

Moreover, the chemical compositions of these plants help us to derive how many advantages and disadvantages they have. Through researching them, we will found essential features of the plants that could be used in medicine.

The purpose of this work is to study the role of amino acids in important biological processes in the body, as well as the amino acid content and chemical composition of dry extracts from the plants Curcuma Longa L. and Ferula Assafoetida L.

II. MATERIALS AND METHODS

A centrifuge was used to extract proteins and peptides from the aqueous extract. 1 ml (precise volume) of 20% trichloroacetic acid was added to 1 ml of the sample for this purpose. After 10 minutes, the residue was obtained by centrifugation at 8000 rpm for 15 minutes. A lyophilized drier was used to separate and dry 0.1 mL of the precipitated liquid.

Phenylthiocarbomail (FTC) - high-efficiency liquid chromatography (HELC) analysis of free amino acid derivatives

The Steven A. Cohen Daviel method was used for FTC synthesis of free amino acid derivatives. In 1988, the first capillary electrophoresis separation of fluorescein thiocarbamyl derivatives of amino acids (FTC-amino acids) was described [6]. For the preparation of our derivatives, we used a modified version of that technique. In an amber tube, a 100 litre aliquot of 6 mM fluorescein isothiocyanate isomer 1 (FITC) in acetone was mixed with 300 μL of 3 mM L-arginine (99.5 percent) and L-aspartic acid (99.5 percent) solution and left to react overnight at room
temperature. The fluorescein thiocarbamyl derivative solutions were diluted to 2 mL using a 40 mM Na$_2$HPO$_4$ buffer at pH 7.8 the next day.

A Vision Workstation BioCAD Family HPLC with a Zorbax Eclipse-AAA column was used to purify the fluorescein thiocarbamyls (Agilent Technologies, Santa Clara, CA, USA). The mobile phases were 40 mM Na$_2$HPO$_4$ pH 7.8 and ACN:MeOH:water (45:45:10 v/v/v).

Detection of FTC-amino acids was performed on Agilent Technologies 1200 chromatograph. Column 75 x 4.6 mm Discovery HS C 18, solution A: 0.14 M CH$_3$COONa + 0.05% TEA ph 6.4, V: CH$_3$CN. Flow rate 1.2 ml/min, light absorption 269 nm.

III. RESULTS

The experiment was conducted using dry extracts from Curcuma Longa and Ferula Assafoetida roots. The procedure described above was used to determine the amino acid content. Table 1 shows a study of the amino acid content of Curcuma Longa dry extract.

<table>
<thead>
<tr>
<th>Amino acids</th>
<th>Concentration, mg/gr</th>
<th>Amino acids</th>
<th>Concentration, mg/gr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asparagine acid</td>
<td>0.06</td>
<td>Prolin</td>
<td>0.06</td>
</tr>
<tr>
<td>Glutamic acid</td>
<td>0.12</td>
<td>Tyrosine</td>
<td>0.08</td>
</tr>
<tr>
<td>Serin</td>
<td>0.04</td>
<td>Valin *</td>
<td>0.07</td>
</tr>
<tr>
<td>Glycine</td>
<td>0.04</td>
<td>Methionine *</td>
<td>0.02</td>
</tr>
<tr>
<td>Asparagin</td>
<td>0.04</td>
<td>Isoleucine *</td>
<td>0.08</td>
</tr>
<tr>
<td>Glutamine</td>
<td>0.13</td>
<td>Leucine *</td>
<td>0.07</td>
</tr>
<tr>
<td>Cysteine</td>
<td>0.23</td>
<td>Histidine</td>
<td>0.23</td>
</tr>
<tr>
<td>Treonin*</td>
<td>0.05</td>
<td>Tryptophan</td>
<td>0.07</td>
</tr>
<tr>
<td>Arginine</td>
<td>0.18</td>
<td>Phenylalanine *</td>
<td>0.03</td>
</tr>
<tr>
<td>Alanin</td>
<td>0.03</td>
<td>Lysine *</td>
<td>0.02</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1.63</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The results demonstrate that the dry extract contains 20 amino acids, with six of them marked with an asterisk indicating non-exchangeable amino acids.

Histidine (0.23 mg/gr), cysteine (0.23 mg/gr), arginine (0.18 mg/gr), and glutamine (0.13 mg/gr) were shown to have quantitative superiority among the detected amino acids in Curcuma Longa dry extract.

Figures 1 and 2 show the standard sample and the chromatogram peaks of amino acids in the Curcuma Longa dry extract.
In the next phase of our study, the amino acid composition of the dry extract obtained from Ferula Assafoetida L. was studied, and the results are presented in Table 2.

Table 2 The amino acid composition of the dry extract of Ferula Assafoetida L

<table>
<thead>
<tr>
<th>Amino acids</th>
<th>Concentration, mg/gr</th>
<th>Amino acids</th>
<th>Concentration, mg/gr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asparagine acid</td>
<td>0.17</td>
<td>Prolin</td>
<td>0.31</td>
</tr>
<tr>
<td>Glutamic acid</td>
<td>0.25</td>
<td>Tyrosine</td>
<td>0.20</td>
</tr>
<tr>
<td>Serin</td>
<td>0.15</td>
<td>Valin *</td>
<td>0.31</td>
</tr>
<tr>
<td>Glycine</td>
<td>0.78</td>
<td>Methionine *</td>
<td>0.05</td>
</tr>
<tr>
<td>Asparagin</td>
<td>0.77</td>
<td>Isoleucine *</td>
<td>0.26</td>
</tr>
<tr>
<td>Glutamine</td>
<td>0.41</td>
<td>Leucine *</td>
<td>0.18</td>
</tr>
</tbody>
</table>
Histidine (1.27 mg/g), cysteine (0.96 mg/g), glycine (0.78 mg/g), and asparagine (0.77 mg/g) were found to be quantitatively superior among the amino acids discovered in the dry extract of Ferula Assafoetida L.

It should be noted that heterocyclic acids predominated quantitatively in both extracts, whereas diaminodicarboxylic and monoaminomonomoicarboxylic acids are rare.

Figure 3 shows the amino acid chromatogram peaks in the Ferula Assafoetida L. extract.

<table>
<thead>
<tr>
<th>Amino Acid</th>
<th>Concentration (mg/g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cysteine</td>
<td>0.96</td>
</tr>
<tr>
<td>Histidine</td>
<td>1.27</td>
</tr>
<tr>
<td>Treonin*</td>
<td>0.26</td>
</tr>
<tr>
<td>Tryptophan</td>
<td>0.23</td>
</tr>
<tr>
<td>Arginine</td>
<td>0.26</td>
</tr>
<tr>
<td>Phenylalanine*</td>
<td>0.11</td>
</tr>
<tr>
<td>Alanin</td>
<td>0.30</td>
</tr>
<tr>
<td>Lysine*</td>
<td>0.02</td>
</tr>
<tr>
<td>Total</td>
<td>7.26</td>
</tr>
</tbody>
</table>

Both plants are common household remedies and ingredients in a variety of traditional treatments. The pharmacology of turmeric and its chemical elements has been thoroughly investigated, demonstrating that this substance is also effective in Western and Eastern medicine.

Although scientists less researched asafoetida than turmeric, possibly, its positive benefits may be explained pharmacologically. Asafoetida is consumed in levels equivalent to those found in the daily diet in conventional therapies. Turmeric consumption through curries and dals is higher daily than during treatment. Furthermore, the cures are only taken once a day for 1–4 days.

IV. DISCUSSION

Dry extracts of Curcuma Longa L. and Ferula Assafoetida L. revealed 6 non-exchangeable and 14 exchangeable amino acids after analysis. However, the amino acid content of the dry extract obtained from Ferula Assafoetida L. is superior in quantitative terms to the amino acid content of the dry extract derived from Curcuma Longa L. [4]

Both samples are high in amino acids, which should be recognized. Both extracts were high in heterocyclic amino acids (histidine), diaminodicarbon amino acids (arginine, lysine), and monoaminomonomoicarboxylic amino acids (lysine) (alanine, valine, glycine, isoleucine, leucine, methionine, serine, threonine, tyrosine, phenylalanine, etc.) Acids were discovered to be rather tiny. [5].

Fig. 3. Chromatogram of the amino acid composition of the dry extract of Ferula Assafoetida L.
According to D.Eigner and D. Scholz's research in Nepal[7], the chemical compositions of Curcuma Longa L. are moisture 13.1 percent, protein 6.3 percent, fat 5.1 percent, mineral matter 3.5 percent, and carbs 69.4 percent are the chemical ingredients. The following elements are found in the essential oil (5.8%) obtained by steam distillation of the rhizomes: -phellandrene 1%, sabinene 0.6 percent, cineol 1%, borneol 0.5 percent, zingiberene 25%, and sesquiterpenes 53%. Curcumin (3–4%) is the yellow pigment responsible for the hue [18].

As specified by our research Curcuma Longa L, like many spices, is full of many active phytochemicals [15]. The key components of turmeric include the following: Curcuminoids: 0.3% to 5.4%, Volatile oils (e.g., turmerone, atlantone, zingiberene, etc.): 3% to 7%, Resins (including terpenoids, triterpenoids, phenylpropenes, etc.): trace, Alkaloids: trace, Carbohydrates: 60% to 70%, Fat: 5% to 10%, Protein: 6% to 8%, Fiber: 2% to 7%, Vitamins: trace, Minerals: trace, Water: 6% to 13% [17]. We can see that there are numerous variances in the chemical compositions of Curcuma Longa L. in Nepal and other countries of the world. The reason is that soil, nature and other climate conditions can affect the chemical compositions of the plant in percent.

According to an examination of asafoetida, it contains 67.8% carbs per 100 gms, 16.0 percent moisture, 4.0 percent protein, 1.1 percent fat, 7.0 percent minerals, and 4.1 percent fibre. It contains a significant amount of calcium and phosphorus, iron, carotene, riboflavin, and niacin. It has a calorific value of 297 and contains 40-64 percent resinous material made up of ferulic acid, umbelliferone, [8,9] asaresinotannols, farnesiferols A, B, and C [10,11], about 25% gum made up of glucose, galactose, 1-arabinose, rhamnose, and glucuronic acid [12].

V. CONCLUSION

The dry extracts of both plants contain 20 amino acids, with six of them noted with an asterisk being non-exchangeable amino acids.

The dry extract derived from the plants Curcuma Longa L. and Ferula Assafoetida L. can be suggested as a potentially effective form of medicine and method of receiving a biologically active supplement based on the above results. [6].

Turmeric and asafoetida are used as examples to demonstrate some of the issues with interpreting efficacy. Both are significant components in traditional formulas.

Curcuma longa L. is widely used in Indian cooking, medical medicine, and to a lesser extent as a cosmetic and food preservative. Essential oils, minerals, polyphenolic, and terpenoid chemicals are among the substances present in CL.

Asafoetida is an oleo-gum-resin derived from the exudates of the roots of asafoetida, an Iranian indigenous medicinal plant. It is commonly used as a seasoning spice in a variety of meals all over the world. It has long been used to cure various ailments, including asthma, epilepsy, stomach aches, flatulence, intestinal parasites, poor digestion, and influenza. Asafoetida has been demonstrated to have antioxidant, antiviral, antifungal, cancer chemopreventive, antidiabetic, antispasmodic, hypotensive, and molluscicidal properties in recent pharmacological and biological investigations. Because asafoetida is so important in medicine, more research is needed before a clinical study.

CONFLICT OF INTEREST AND CONTRIBUTION OF AUTHORS

The authors declare the absence of obvious and potential conflicts of interest related to the publication of this article and report on each author's contribution.

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LIST OF REFERENCES