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Major Antinutrients and Phytochemical Investigation Found in an Iranian Edible Plant Source

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ABSTRACT

Compounds or substances which act to reduce nutrient intake, digestion, absorption and utilization and may produce other adverse effects are referred to as antinutrients or antinutritional factors. Plant sources contain in their raw state wide varieties of antinutrients which are potentially toxic. The some major antinutrients includes: saponins, phytic acid, protease inhibitors. The proximate and phytochemical composition of Chlorophytum comosum was determined. Our results show that Chlorophytum comosum root tubers is rich in carbohydrates (65.84% DW) and fibre (17.24% DW), with high contents of ash (10.38% DW), and crude protein (4.56% DW). The phytochemical screening revealed moderate phytate and alkaloids contents. Amounts of polyphenols, saponins and steroids were low, absence and very high respectively. Therefore, Chlorophytum comosum is a rich source of proteins, fibers and carbohydrates, and are potential source of nutraceuticals. These antinutrients pose a major constraint in the use of plant protein sources in livestock feeds without adequate and effective processing. The level or concentration of these anitnutrients in plant protein sources vary with the species of plant, cultivar and post-harvest processing treatments.

Keywords: phytochemical screening, *Chlorophytum comosum* Linn, proximate composition.

INTRODUCTION

Chlorophytum comosum an edible plant, occurs in the southern part of Iran. It is seems this plant root tubers contains high contents of antinutrients and phytochemicals. Antinutrients or antinutritional factors may be defined as those substances generated in natural feedstuffs by the normal metabolism of species and by different mechanisms (for example inactivation of some nutrients, diminution of the digestive process or metabolic utilization of feed) which exerts effect

contrary to optimum nutrition. Being an antinutritional factor is not an intrinsic characteristic of a compound but depends upon the digestive process of the ingesting animal. Trypsin inhibitors, which are antinutritional factors for monogastric animals, do not exert adverse effects in ruminants because they are degraded in the rumen [1]. Many plant components have potential to precipitate adverse effects on the productivity of farm livestock. These compounds are present in the foliage and seeds of virtually every plant that is used in practical feeding [3] and Fasidi and Olorunmaiye[12].

Fig.1: Habit of *Chlorophytum comosum* Linn.

Fig.2: Root tubers of *Chlorophytum comosum* Linn

Nutritional effect of major antinutrients in plant protein sources

The major antinutrients mostly found in plant protein sources are toxic amino acids, saponins, cyanogenic glycosides, tannins, phytic acid, gossypol, oxalates, goitrogens, lectin (phytohaemagglutinins), protease inhibitors, chlorogenic acid and amylase inhibitors.

MATERIALS AND METHODS

Collection of Plant Samples

Samples of fresh *Chlorophytum comosum* root tubers were bought from garden of Shiraz University, Iran. They were cleaned of dirt and stored for subsequent use in the analysis.

Determination of Proximate Composition

Dried root tubers were divided into two portions , A portion was used immediately for proximate analysis of crude protein, fat, ash, fiber, and total carbohydrate contents, all of which were carried out in triplicates according to standard methods [2]. The energy value was calculated using the Atwater factors 4, 9, and 4 for protein, fat, and carbohydrate, respectively.

Determination of the Phytochemical Composition

The dried root tuber portion was oven-dried, to a constant weight and ground into powders, which was then packed into dark polythene bags and stored in a desiccator for subsequent uses in the phytocmemical analysis. The phytochemical screening of the sample was carried out as described by Sofowora [23] and Harbone [13]. The sample was screened for alkaloids,

polyphenols, phytates, steroids and saponins. Quantitative determination of phytates and trpsin inhibitors were carried out in triplicates, using the method of AOAC [2].

RESULTS AND DISCUSSION

Table 1 shows the proximate composition of *Chlorophytum comosum* root tubers. *Chlorophytum comosum is* relatively rich in protein. The crude protein content observed here, for *Chlorophytum comosum*, is higher than was earlier reported by Onyeike and Ehirim [19] and those reported for *Chlorophytum comosum* (Elegbede,[7] ,and reported results by [Apori *et al.*, [3], [Okaraonye and Ikewuchi, [16], [Singh, [21]. A 100g serving can provide about 127-141% of the recommended dietary allowance (RDA) or recommended nutrient intake (RNI) (Table 1). This high protein content implies that this plant can contribute significantly to the daily human protein requirements, [FAO/WHO/UNU, [11]; Chaney,[5]. The crude lipid *Chlorophytum comosum* root tubers is less than was earlier reported by Onyeike and Ehirim [19] ; [Elegbede, 1998]; [Okaraonye and Ikewuchi,[16], comparable to that of *Chlorophytum comosum*, Singh, [21] but greater than reported rerults by [Oguntona, [14]. Its total carbohydrate content is greater than was earlier reported by Onyeike and ehirim [19]and Esenwah and Ikenebomeh[9] .

Table 1: Proximate composition of *Chlorophytum comosum* root tubers

Parameter	Dry weight
Total ash (%)	10.38
Crude protein (%)	4.54
Crude lipid (%)	2.00
Total carbohydrate (%)	65.84
Crude fiber (%)	17.24
Total metabolizable Energy (kcal /100 g)	299.52

Values are means of triplicate determinations

Table 2: Phytochemical profile of *Chlorophytum comosum* root tubers

Phytochemical	Result
Alkaloids	++
Polyphenols	+
Phytates	++
Saponins	-
Steroids	+++

Key: - =absence; + = slightly present; ++ = moderately present; +++ = highly present

Table 3: Some anti-nutritional contents of *Chlorophytum comosum* root tubers

Anti-nutrient	Composition
Phytates (mg/100g)	468.8
Trypsin inhibitors(TIU/g)	4.7

Values are Means ± SD of triplicate determinations

The Crude fiber content recorded in this study is greater than was earlier reported by Onyeike and Ehirim [19]; [Elegbede, 1998] ;[Okaraonye and Ikewuchi, [16], but less than repoted results by[Singh, 2004]. A 100g serving can provide about 11-13% RDA (Table 1).

Evidence from epidemiological studies suggest that increased fiber consumption may contribute to a reduction in the incidence of certain diseases like diabetes, coronary heart disease, colon cancer, high blood pressure, obesity, and various digestive disorders [Walker, [25]; FAO, [10]; Eriyamremu and Adamson, [8];. Dietary fibers alter the colonic environment in such a way as to protect against colorectal diseases. It provides protection by increasing fecal bulk, which dilutes the increased colonic bile acid concentrations that occur with a high-fat diet [Dillard and German, [6]. So, herein rests a likely benefit derivable from the consumption of this plant. Its ash content is less than reported results by Elegbede, [7];Oguntona, [14], but greater than was earlier reported by Onyeike and Ehirim [19]; [Okaraonye and Ikewuchi, [16]. The total metabolizable energy in *Chlorophytum comosum* root tubers is less than was earlier reported by and Ehirim [2001] ;Elegbede, [7], but greater than reported results byOguntona, [14] and [Okaraonye and Ikewuchi, [16] and Okhuoya and Okogbo[17]; and Olutiola et al. [18] . The phytochemical screening revealed that *Chlorophytum comosum* root tubers is very rich in steroids and moderately rich in alkaloids, and phytates (Table 2). All these have potential health promoting effects, at least under some circumstances [Basu *et al.*, [4]. Table 3 shows some of the anti-nutrients present in *Chlorophytum comosum* root tubers. We found low polyphenols content in this plant. It is lower than those reported by Apori *et al*. [3], [Osagie, [20] and [Ojiako and Igwe, [15].

Chlorophytum comosum has moderate phytate and trypsin inhibitors contents(Table 3.). It is lower than those reported by [Okaraonye and Ikewuchi, [16]; Oguntona, [14] ;[Ojiako and Igwe, [15]. Phytic acid binds calcium, iron, zinc and other minerals, thereby reducing their availability in the body [FAO, [10]. It also inhibits protein digestion by forming complexes with them [Singh and Krikorian, [22] and Uraih and Izuagbe[24]. However, the phytate content can further be lowered by processing [FAO, [10]. The knowledge of the phytate level in foods is necessary because high concentration can cause adverse effects on the digestibility (Nwokolo and Bragg, [28]. Phytate forms stable complexes with Cu2+, Zn2+, Co2+, Mn2+, Fe2+ and Ca2+. Saponins reduce the uptake of certain nutrients including glucose and cholesterol at the gut through intra-lumenal physicochemical interaction. Hence, it has been reported to have hypocholesterolemic effects (Price *et al*., [29] and thus they may aid in lessening the metabolic burden that would have been placed on the liver, D'Mello [26]; Cheeke and Shull[27].

Protease inhibitors are widely distributed within the plant kingdom, including the seeds of most cultivated legumes. Protease inhibitors have the ability to inhibit the activity of proteolytic enzymes within the gastrointestinal tract of animals (Liener and Kakade, [31]. Trypsin inhibitor and chymotrypsin inhibitor are protease inhibitors occurring in raw legume seeds. Protease inhibitors are the most commonly encountered class of antinutritional factors of plant origin. These inhibitor shave been reported to be partly responsible for the growth-retarding property of raw legumes. The retardation has been attributed to inhibition of protein digestion but there is evidence that pancreatic hyper-activity, resulting in increased production of trypsin and chymotrypsin with consequent loss of cystine and methionine is also involved (McDonald *et al*., [33]. Trypsin inhibitors have been implicated in reducing protein digestibility and in pancreatic

hypertrophy (Liener, [30]. Trypsin inhibitors are polypeptides that form well characterized stable complexes with trypsin on a one-to-one molar ratio, obstructing the enzymatic action . Protease inhibitors are inactivated by heat especially moist heat, because of even distribution of heat (Bressani and Sosa, [34]; Liener, [32].

CONCLUSION

In conclusion, our results show that *Chlorophytum comosum* is a rich source of proteins, fibers, and carbohydrates, and are a potential source of nutraceuticals. The presence of antinutrients in plant protein sources for livestock feeding is a major constraint that reduces their full utilization. To be able to justify the overall nutritional potential or value of any plant protein source, proper assessment of the type, nature and concentration of the antinutrients present in the protein source and also the bioavailability of nutrients to the ingesting animal is necessary. Employing appropriate and effective processing techniques or combination of techniques could help reduce or eliminate the adverse effects of these antinutritive constituents in plant protein sources and thereby improve their nutritive value. Supplementation of some minerals, animo acids and vitamins could help reduce or neutralize the negative effect of antinutritional factors in plant protein sources for livestock nutrition. The concentration or level of the antinutritive constituents in these protein sources vary with the species of plant, cultivar and post-harvest treatments (processing methods). Since antinutrients vary among plant cultivars, therefore the use of genetically improved low-antinutritive cultivars or varieties could be a possible option for livestock feeding.

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