

Effect of Sprouting on the Anti-Nutritional Factors in *Vigna radiate* (L), *Macrotyloma uniflorum* (L), *Vigna mungo* (L) And *Cicer arietinum* (L)

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Abstract:- The aim was to ascertain whether the process of sprouting reduced the concentration of anti-nutritional factors in *Vigna radiata*, *Macrotyloma uniflorum*, *Vigna mungo* (L) and *Cicer arietinum* (L) belonging to *Fabaceae* family. Nutrition is the most important concern in everyone's diet plan and is also a need to have balanced food. Care must also be taken towards the anti-nutritional factors that inhibit the absorption of nutrients thereby decreasing the nutritional value of the food. The pulses were screened for major specific anti nutrients (tannins, phytic acid, alkaloids and cyanogenic glycosides) before and after sprouting. The process of sprouting decreased the concentration of tannins, phytic acids and cyanogenic glycosides whereas the alkaloid concentration was increased.

Keywords:- Alkaloids, Anti-Nutrients, Cyanogenic Glycoside, Nutrients, Phytic Acids, Sprouting, Tannins.

I. INTRODUCTION

Nutrients are the compounds which the body cannot produce and hence need to be supplemented. According to WHO these nutrients are to be supplemented from food and they play a vital role in disease prevention, growth and good health. Nutrients are majorly of two types namely, macro nutrients (carbohydrates, proteins and fat) and micro nutrients (vitamins and minerals). The nutrients are further broken down into smaller molecules in the body and then absorbed in the small intestine [6].

Anti-nutrients are the compounds that are present naturally in the plant sourced food which inhibit the absorption of nutrients. It is clearly not known how much of nutrient loss occurs due to their presence because it is based on the individual's metabolism. To lower the concentration of these anti-nutrients various types of processing techniques like milling, dehulling, soaking, germination, fermentation and cooking are followed [5].

All leguminous plants belong to family *Fabaceae* including more than sixteen thousand distinct species ranging in habitat from gaint trees to small annual herbs. The flowers of this plant have short hypanthium and a single carpel with a short gynopore and after fertilization produce fruits that are legumes.

Indian pulses are available in three types namely as whole pulse, split pulse with skin and split pulse without skin. Most of the foods in Indian cuisine make use of pulses, especially desserts are most commonly made with pulses. Often pulses are ground into flour to make a huge variety of food and even soaked and then ground into paste from pulses by different cooking methods [3].

II. MATERIALS AND METHODS

A. Sample collection and preparation

The samples were brought from a well-known nearby vendor shop and was checked for any adulteration before buying. The samples were divided into two equal halves and the first half was put into the mixer to make them into fine powder. The other half was kept in a closed moistened condition at room temperature for sprouting. After the sprouting was complete the samples were spread on a paper and were dried under the shade until all the moisture content is lost. Then the sprouted samples were also made into fine powder.

B. Determination of tannins

The tannins were determined by the Van-Buren and Robinson method. To 500mg sample 50ml of distilled water was added and incubated on a mechanical shaker for one hour. The incubated samples were filtered into a 50ml volumetric flask and the volume was made up. 5ml of the filtrate was taken in a test tube to which 2ml of 0.1M FeCl₃ in 0.1N HCl (dilute to ten folds) and 1ml of 0.008M potassium ferro cyanide were added and the absorbance was read in a UV spectrophotometer at 605nm. Various concentrations of tannic acid were taken as the standard [4].

C. Determination of phytic acid

Phytic acid was determined using a modified method by (Omotoso, 2006, Wheeler & Ferrel, 1971). To 5g of sample 50ml of 3% trichloroacetic acid was added on subjected to a shaking incubator for 30min at 156rpm. The sample mixtures were filtered and this suspension was centrifuged at 10000rpm for 15 min. The supernatant was collected to which 2ml of FeCl₃ (2mg/ml) solution was added and the samples were incubated for 45min at 90 degree Celsius. The solution was again centrifuged (10000rpm for 15min) and the pellets were collected which were washed with 10ml 3% trichloroacetic acid solution. The mixture was incubated for 5min at 90 degree Celsius and centrifuged (10000rpm for 15min). The pellets were

resuspended in one ml distilled water and 1.5 ml of 1.5N NaOH and the volume was brought up to 15ml with distilled water. The mixture was subjected to heating in boiling water bath for 30min and again centrifuged (10000rpm for 15min). Filter while hot and it was washed with 40ml hot distilled. The precipitate was collected to which 20ml of 3.2N HNO₃ was added the volume was made up to 50ml. Of the 50ml sample 2.5ml was taken and it was made up to 35ml with distilled water to which 10ml of 1.5M KCN was added and was calibrated to 50ml with distilled water. The samples were read at 480nm in a UV spectrometer with in 1min [4].

D. Determination of alkaloids

The presence of alkaloid was determined by precipitation method by (Harborne, 1973; Edeoga et al., 2005) with minor modifications. 2.5g of the sample was mixed with 200ml of 10% acetic acid on ethanol and incubated fir 4 hours at room temperature. The extract was filtered and concentrated to 50ml on a rotary evaporator at 60oC. To the concentrated extract 1ml of concentrated

ammonium hydroxide was added drop wise until the precipitation was complete. The solution was allowed to stand for the precipitate to settle. The residue was collected and dried at room temperature. The dry weight of the residue was recorded in grams [4].

E. Determination of cyanogenic glycosides

The concentration of cyanogenic glycoside was determined by (Onwuka and Olopade, 2005) with slight modifications. To 25ml of distilled water 2.5g of the sample was added and was allowed to stand for overnight. Incubated mixture was filtered, 1ml of the filtrate was taken in a test tube to which 4ml of alkaline picrate was added and incubated in a boiling water bath for 15 minutes. After the incubation the solutions were allowed to cool and the color change was read in the UV spectrophotometer at 490nm. Various concentrations of KCN solution were prepared for the standard curve. The concentration of cyanogenic glycoside were calculated using the equation cyanogenic glycosides (mg/100g) = concentration (mg)*10/weight of the sample [4].

III. RESULTS AND DISCUSSION

The four samples chosen are mentioned as follows

- S1: *Vigna radiata* SS1: Sprouted sample 1
- S2: *Macrotyloma uniflorum* SS2: Sprouted sample 2
- S3: *Vigna mungo* SS3: Sprouted sample 3
- S4: *Cicer arietinum* SS4: Sprouted sample 4

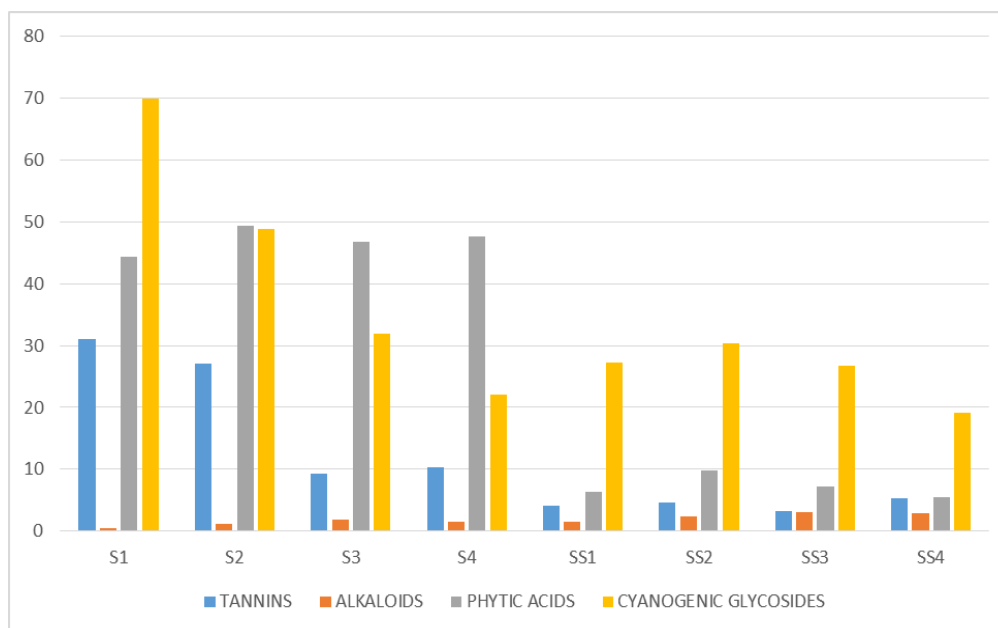


Fig 1

Tannins have found to affect protein digestibility by forming insoluble complexes and interfering with their bioavailability. Phytate being one of the major anti-nutrient reduces the bioavailability of metal ions like zinc and also affects the protein and starch digestion. Alkaloids are the compounds containing organic nitrogen which act as toxic substances in human liver. Cyanogens produce toxic products when hydrolyzed as they have the ability to link

with Fe²⁺, Mn²⁺ and Cu²⁺ which are the functional groups of many enzymes [4]. In the present study the concentration of tannins, phytic acids and cyanogenic glycosides have been decreased in the sprouted samples when compared to the non-sprouted samples, thereby increasing the bioavailability and digestibility of nutrients. Whereas the concentration of the alkaloids have been increased, alkaloid being one of the anti-nutrient it also has

several biological activity such as anti-inflammatory, anti-cancer, analgesics, anti-fungal, anti-microbial and so on. Hence increased concentration of alkaloid may show pharmacological activity thereby increasing the nutritional value of the food.

IV. CONCLUSION

Indian cuisine involves different types of plant sourced food especially cereals and pulses which provides a need to know the importance and the effect of anti-nutrients. In the present study presence of anti-nutrients in the samples disclosed them to be a source of anti-nutrients, but during the process of sprouting a noteworthy impact was noted on reducing the concentrations of anti-nutrients such as tannins, phytic acids, alkaloids and cyanogenic glycosides thereby increasing the quality and nutritional value of the food. Thus making them a source of natural nutraceuticals, whereas further more studies are to be made on the cooked and germinated food both *in vitro* and *in vivo*.

REFERENCES

- [1]. Aberounmand, A. and Deokule, S.S. (2010). Screening of some nutrients and anti-nutrients compounds in some plant foods of Iran and India. *Journal of Agricultural Technology* 6(4):777-781.
- [2]. Aneta Popova and Dasha Mihaylova (2019). Antinutrients in Plant-based Foods: A Review. *The Open Biotechnology Journal* 1874-0707/19.
- [3]. Embaby, H.E. (2010). Effect of soaking, dehulling, and cooking methods on certain antinutrients and *in vitro* protein digestibility of bitter and sweet lupin seeds. *Food Science and Biotechnology*. 19(4), 1055-1062
- [4]. Humaria Essack, Bharti Odhav, John Jason Mellem. (2017). Screening of traditional South African leafy vegetables for specific anti-nutritional factors before and after processing. *Food Science and Technology*.
- [5]. Leticia X. Lopez-Martinez, Nayely Leyva-Lopez, Erick P. Gutierrez-Grijalva, j. Basilio Heredia. (2017). Effect of cooking and germination on bioactive compounds in pulses and their health benefits. *Journal of Functional Foods*.
- [6]. Shivaprasad Mahadkar, Sujata Valvi and Varsha Rathod (2012). Screening of anti-nutritional factors from some wild edible plants. *Scholars research library*, 2(2):251-255.
- [7]. Seema Sharma, Dharmesh C. Saxena, Charanjit S. Riar (2015). Analysing the effect of germination on phenolic, dietary fibers, minerals and γ - amino butyric acid contents of barnyard millet (*Echinochloa fumentaceae*). *Food Biosciences* 13 (2016) 60-68.
- [8]. Nanna Roos, Jens Chirstian Sorensen, Hilmer Sorensen et.al (2013). Screening for anti-nutritional compounds in complementary foods and food aid products for infants and young children. Blackwell publishing Ltd Maternal and Child Nutrition, 9 (Suppl. 1). pp.47-71.
- [9]. Velisek, J. (2014). *The Chemistry of Food*, Nova Jersey: Wiley-Blackwell.
- [10]. Yadav, S.K., & Sehgal, S. (2003). Effect of domestic processing and cooking on selected antinutrient contents of some green leafy vegetables. *Plant Foods for Human Nutrition*, 58(3), 1-11.