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Study of Anti-Nutritive Factors in Some New Varieties of Oil Seeds

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Abstract

Oil seeds are an important source of protein in many developing countries. However this protein is not readily available because of anti-nutrients, hence information on the content of anti-nutrients is required. The objective of the study was to determine the status of anti-nutritive factors in some new varieties of oil seeds, viz Sunflower (Helianths annus) LSF -11, Sunflower (Helianths annus) LSF-8, Safflower (Carthamus tinctorius) PBNS-12, Safflower (Carthamus tinctorius) PBNS-40, and Ground nut (Arachis hypogea) JL-24. The anti-nutritional factors analysis showed that cyanogenic glucosides value ranged between 3.457-4.821 mg HCN/100g, tannins 0.4-0.646 g/100g, oxalates 0.0786-0.180 g/100g, and haemagglutinin activity 1:2-1:8 Blood group. No inhibition of trypsin was found in these varieties of oil seeds. The concentration of these anti-nutrients in these varieties are closely resembles with each other. Employing appropriate and effective processing techniques could help reduce or eliminate the adverse effects of these anti-nutritive constituents in plant protein sources.

Keywords: Anti-nutritive factors of oil seeds, Helianthus annus LSF -11 and LSF-8, Carthamus tinctiorius PBNS-12, and PBNS -40 and Arachis hypogea JL -24.

Introduction

Anti-nutritional factors are those substances generated in natural feedstuffs by the normal metabolism of species and by different mechanisms which exerts effect contrary to optimum nutrition [1]. These substances found in most foods and they are poisonous and they are protecting them-selves from being eaten. Since anti-nutrient occur in small quantities that they cause no harm [2]. Anti-nutritional factors are

mainly organic compounds, which when present in a diet, may affect the health of the animal or interfere with normal feed utilization, and they occur as natural constituents of plant and animal feeds, as artificial factors added during processing or as contaminants of the ecosystem [3]. Anti-nutritional factors (ANFs) in feedstuffs are classified according to their chemical nature and their activity in animals as: Chemical natures, in this category are acids, enzymes, nitrogenous compounds, saponins, tannins, glucosinolates and phenolic compounds. Factor interfering with the digestion, utilization and availability of minerals of dietary proteins and carbohydrates, for example, tannins, trypsin or protease inhibitors, saponins, and haemagglutinins. phytates or phytic acid, oxalates or oxalic acid, glucosinolates and gossypol [4].

Cynaogenic glucosides are widely distributed among 100 families of flowering plants and they are also found in some living micro organisms [5, 6]. Protein sources of plant origin containing high amounts of tannins and in particular hydrolysable tannins should be used with caution [7]. Recent research has indicated that condensed tannins in low concentrations have beneficial effect in animal and human nutrition and health [8, 9]. Trypsin inhibitors when ingested by man in large quantity disrupt the digestive process and may lead to undesirable physiological reaction [10]. Some other toxic substances present in seeds and which limit their nutritional value are goitrogens, cyanogens, phenolic compounds, plasmin, saponins, arginase inhibitor, metal binding constituents and anti-vitamins [11, 12].

The seeds under investigation were procured from oil seeds research station, Latur (Maharashtra), Marathwada Agricultural University, Parbhani and Mahatma Phule Krishi Vidyapeeth, Jalgaon (Maharashtra).

Materials and Methods

Cyanide and Tannin content of the seeds were determined by the method of AOAC [13]. Oxalates were determined by using the method of Talpatra et.al. [14].The method of Kakade et.al [15] was used for the determination of Trypsin inhibitor activity. Haemagglutanin activity was determined by the method as given by Liener I.E [16].

Result and Discussion

Cyanide content, tannin content, oxalate content, trypsin inhibitor activity and haemagglutanin activity of oil seeds under study are given in Table 1.

Cyanide content of seeds of Helianthus annus varieties LSF-11(4.184 mg/100g), LSF-8 (4.028 mg/100g), Carthamus tinctirious varieties PBNS-12 (3.457 mg/100g) PBNS- 40 (3.726 mg/100g) and Arachis hypogae JL- 24 (4.821 mg/100g) was found to be in close proximity with other oil seeds [17-19].

Oxalate content of seeds of Helianthus annus varieties LSF-11(0.112 g/100g), LSF-8 (0.099 g/100g), Carthamus tinctirious varieties PBNS-12 (0.0786 g/100g) PBNS- 40 (0.0854 g/100g) and Arachis hypogae JL- 24 (0.180 g/100g) is lower than the value reported by Gupta .M [20,21] for other varieties oil seeds.

Tannin content of seeds of Helianthus annus varieties LSF-11(0.646 g/100g),

LSF-8 (0.623 g/100g), Carthamus tinctirious varieties PBNS-12 (0.511 g/100g) PBNS- 40 (0.530 g/100g) and Arachis hypogae JL- 24 (0.400 g/100g) is found to be in the range of other oil seeds [21,22].

No trypsin inhibition activity was found in varieties of Helianthus annus varieties LSF-11 and LSF-8, Carthamus tinctirious varieties PBNS-12 and PBNS- 40 and Arachis hypogae JL- 24.

Helianthus annus varieties LSF-11 and LSF-8 have haemagglutanin activity in the range of 1:2 to 1:8. Carthamus tinctirious varieties PBNS-12 and PBNS-40 have no haemagglutinating activity. Arachis hypogae JL-24 have haemagglutinating activity up to the titrated value 1:8, which is in close resemblance with other oil seeds [22].

Statistical analysis

Results of triplicate samples of Helianthus annus (varieties LSF-11 and LSF-8) and Carthamus tinctirious (varieties PBNS-12 and PBNS- 40) were submitted to statistical analyses and were analyzed for statistical significance by using 'student t test'. Descriptive statistics (Mean, standard error mean and standard deviation) were calculated for triplicate determination using the SPSS 10 computer software package and significant differences between within treatments were determined using 5% significance level. The result of statistical analysis is given in Table 2 and Table 3.

Table 1: Antinutritive Factors in New Varieties of Oil Seeds under Investigation.

Oil seeds	Cyanide content mg HCN/100 gm	Tannin content g/100 g	Oxalate content g/100 g	Trypsin Inhibitor Activity (TIA) Percent inhibition	Haemagglutinin Activity (on Chicken Blood Group)	Haemagglutinin Activity (on Goat Blood Group)	Haemagglutinin Activity (on Human +O Blood Group)
Helianthus annus LSF-11	4.175	0.651	0.113	ND	1:16	1:32	1:8
Helianthus annus LSF-8	4.026	0.623	0.098	ND	1:8	1:16	1:2
Carthamus tinctirious PBNS-12	3.458	0.511	0.079	ND	ND	ND	ND
Carthamus	3.730	0.530	0.085	ND	ND	ND	ND

tinctiriou s PBNS-40							
Arachis hypogae JL-24	4.818	0.412	0.180	ND	ND	1:8	ND

ND: Not detected.

Table 2: Statistical Analysis of Helianthus Annus Varities.

Oil seeds	Cyanide content mg HCN/100gm	Tannin content g/100g	Oxalate content g/100g
Helianthus Annus LSF-11	4.175	0.651	0.113
Helianthus Annus LSF-11	4.026	0.623	0.098
Mean	4.101	0.637	0.106
S.D.	0.082	0.016	0.008
S.E.(m)	0.033	0.007	0.003
S.V. at 5%	0.0000	0.0006	0.0000

Table 3: Statistical Analysis of Carthamus Tinctirious Varities.

Oil seeds	Cyanide content mg HCN/100gm	Tannin content g/100g	Oxalate content g/100g
Carthamus Tinctirious PBNS-12	3.458	0.511	0.079
Carthamus Tinctirious PBNS-40	3.730	0.530	0.085
Mean	3.594	0.521	0.082
S.D.	0.149	0.011	0.004
S.E.(m)	0.061	0.004	0.002
S.V. at 5%	0.0000	0.0001	0.0009

S.E. (M) Standard Error Mean
S.D. Standard Deviation
S.V.at 5% Significance Level at 5%

Conclusion

The data presented in this study suggested that these oil seeds have relatively low levels of some anti-nutritive factors. The presence of anti-nutrients in plant protein sources for livestock feeding is a major constraint that reduces their full utilization. The anti-nutrients present in the seeds under investigation are found to be very low however employing appropriate and effective processing techniques to eliminate the

adverse effects of these anti-nutritive constituents in Helianthus annus LSF -11 and LSF-8, Carthamus tinctiorius PBNS-12, PBNS -40 and Arachis hypogea JL -24 and thereby further improve their nutritive value.

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References

[1] Akande, K.E.; Doma, U.D., 2010, Agu, H.O. and Adamu, H.M. Major Anti-nutrients found in plant protein sources: Their Effect on Nutrition. Pakistan Journal of Nutrition, 9(8), 827-832.

[2] Farzana Panhwar, 2005, Anti-nutritional factors in oil seeds as aflatoxin in ground nut. Digitalverlag Gmbh, Germany, 1-7.

[3] Barnes, A.R. and Amega, 1984, W.K. Utilization of cocoa pod husk meal by growing finishing pigs. Proc. 9th International coca research conference, Lome, Togo, 449-454.

[4] Nityanand, P. 1997, Textbook of Feed Processing Technology. Vikas Publishing House PVT Ltd., New Delhi, India.

[5] Harborne, J.B., 1972, Cyanogenic glucosides and their functions. In: Phytochemical ecology. Academic Press, Londan, 104-123.

[6] Harborne, J.B., 1993, Plant toxins and their effects on animals. In: Introduction to Ecological Biochemistry. Academic Press, London, 71-103.

[7] Becker K. and Makkar, H.P.S., 1999, Effects of dietary tannic acid and quebracho tannin on growth performance and metabolic rates of common carp. Aquaculture. 175, 327-335.

[8] Freed, D.L.J., 1991, Lectins in food: their importance in health and disease J. Nutritional Med. 2(1), 45-64.

[9] Huisman, J. and Tolman, G. H., 1992, Anti-nutritional factors in the plants proteins of diets for non-ruminants. In P.C. Garn worthy, W. Haresign and D. G. A. Cole (Eds), Recent Advances in Animal Nutrition. Butler worth-Heinemann Ltd, Oxford (UK), 3-31.

[10] Booth, A.N.; Robbins, D.J. and Kibellin, W.F.,1960, Effect of raw soybean meal and amino acids on pancreatic hypertrophy in rats. Proc. Soc. Expt. Biol. Med. 104: 68-72.

[11] Liener, I.E., 1980, Toxic constituents of plant foodstuffs. Second edition, New York and Londan, Academic press. 502.

[12] Tacon, A.G., 1992, J. Nutritional; fish pathology: Morphological sign of nutrient deficiency and toxicity in farmed fish. IAO Fisheries Technical paper No-330, FAO, Rome. 75.
[13] AOAC, 1970, Official method of analysis Washington D.C. 240-438.
[14] Talpatra, S.K.; Roy, S.C. and Sen, K.C., 1984, Indian J. of Vety. Sci. and Anim. Hus. 18, 99.
[15] Kakade N.N.; Simm, N.R. and Linener, I.E., 1969, Cereal Chemistry, 46, 518-526.
[16] Linear, I. E. Arch. Bio. Chem. and Biophysics.1955, 54, 223.
[17] Dominguez, H.; Nunez, M.J. and Lema, J.M., 1993, Chlorogenic acid removal during aqueous processing of sunflower kernels, Grasas Y. acuities (Espana). 44(4-5), 235-242.
[18] Montgomery, R.D., 1969, Toxic constituents of Plant feedstuffs (ed.I.E. Linear), New York. 143.
[19] Chubb, L.G., 1982, Anti-nutritive factors in animal feedstuffs in recent advance in animal nutrition (ed. W. Hare Sing). 21, 22-24.
[20] Bagepalli, S.; Rao, Narasinga and Totineri, Prabhavati, J. Sci. Food. Agric. 1982, 33, 89-96.
[21] Nagraj, G. Quality and Utility of oil seeds. Directorate of Oil Seeds Research (ICRA) Hydrabad, 1995.
[22] Gupta M. and Shrivastava S. K., Bio-Science Research Bulletin, 2005 Vol.21(No. 11) 11-16.