Journal of Experimental Sciences Vol. 1, Issue 2, Pages 12-14 [2010]
www.jexpsciences.com

Regular Article

Estimation of Thiamine, Riboflavin and Pyridoxine from LPC of Some Plants

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Abstract

Thiamine, riboflavin and pyridoxine were estimated from leaf protein concentrate (LCP) of twenty plants viz *Adhatoda vasica, Benincasa hispida, Brassica oleracea V. botrytis, Brassica oleracea V. Capitata, Cassia tora, Centella Asiatica, Coccinia grandis, Coriandrum sativum, Cucusmis sativus, Eclipta alba, Erythrina varegata, Medicago sativa, Moringa oleofera, Phaseolus valgaris, Raphanus sativus, Sesbania grandiflora, Solanum nigrum, Trigonella foenum graecum and Vigna mungo. Higher yield of thiamine was recorded in LPC of Brassica oleracea V. botrytis, Brassica oleoracea V. capitata, Coriandrum sativum, Raphanus sativus* and *Vigna mungo*. LPC of *Adhatoda vasica* and *Trigonella foenum graecum* yielded maximum riboflavin while more pyridoxine was estimated from *Brassica oleracea, V. botrytis* and *Bennicasa hispida*.

Key words: LPC, Proteins, Vitamin B_6, Vitamin B_1

Introduction

Green vegetation is the primary replenishable source of food in the world; numerous technologies have been developed over the last 50 years to separate protein in leaf from accompanying fibrous material. The leaf extract or juice contains proteins, sugars, salts, lipids and vitamins along with the moisture in plant. When the juice is heated to over 80^{o}C, or acidified to pH 4, green protein rich curd referred as leaf protein concentrate (LPC) is produced. The LPC can be separated from deproteinised juice (DPJ) – brown whey like liquid – by filtration through cotton cloth. In this way green foliage can be fractionated mechanically into three fractions: (i) fibrous pressed crop, (ii) leaf protein concentrate and (iii) deproteinised juice (Pirie, 1978).

During green crop fractionation the pressed crop residue (PCR) which is also known fibrous residue, left after the extraction of juice, still contain from 9 to 16 % crude protein (CP; N x 6.25) in its dry matter (DM) depending on the species used for fractionation. This can be successfully used as a feed for cattle (Walker *et al.,* 1983; Joshi *et al.,* 1983). Leaf protein concentrate (LPC) contain from 40 – 70 % protein (on DM basis) along with appreciable quantities of β-carotene (pro-vitamin A), vitamin E and minerals. The LPC can be used as a protein-vitamin-minerals supplement in poultry, calf (Joshi *et al.,* 1983) or even human nutrition (Shah, 1983). Deproteinised juice (DPJ) contains soluble components of the plant cell.

Thiamin is present in practically all of the plant commonly used as food. The enrichment of flour, bread, corn and macaroni products with thiamin has increased considerably the availability of this vitamin in the diet. Since the vitamin B is water-soluble and some what heat- labile particularly in alkaline solutions. It may be lost in the cooking water. Thiamin deficiency affects predominantly the peripheral nervous system the gastrointestinal tract and the cardiovascular system. Thiamin has been shown to be more effective in the treatment of beriberi, alcoholic neuritis and the neuritis of pregnancy or of pellagra. Riboflavin B_2 widely distributed throughout the plants and animal kingdoms with very rich sources in anaerobic fermenting bacteria. Riboflavin is known to exist in various enzyme systems. The first riboflavin phosphate (riboflavin mononucleotide) is a constituent of the yellow enzyme. The relationship of blood levels of riboflavin to the amounts of the vitamin stored in the body remain to be elucidated. Urinary excretion of less than 50 μg riboflavin in 24 hours in usually associated with clinical signs of deficiency (Harries and Loraine, 1965). Riboflavin (formerly lactoflavin vitamin) constituent of tissue respiratory enzyme system as well as some enzyme (flavor protein) involved in amino acid and lipid metabolism.

It has been difficult to establish definitely the human requirement for vitamin by probably because the quantity needed is not large and because bacterial synthesis in the intestine provides a portion of that requirement. Vitamin B_6 is required by all animals investigated so for impaired growth result when immature animals are maintained on a vitamin B_6 free diet. Pyridoxine deficiency in humans may also be associated with a reversible hypo chromic microcytive anemia with a high serum iron similar to that observed in pyridoxine deficient animals. Vitamin B_6 is unquestionably required in the diet of humans although this vitamin is adequately supplied in the usual diets of adult's children and all but very young infants. Deficiency states in infants and in pregnant women have been described Mudd (1974). Pyridoxine essential to transulfaration and in conversion of tryptophan to niacin also as a coenzyme in transamination participants in metabolism of essential fatty acid, essential in synthesis of porphirins (eg. heme for hemoglobin and cytochromes).

During present investigation attempts were made to prepared wet LPC, dry LPC and DPJ from different crop with and intension to develop a system for commercial production of vitamins viz. vitamin B_1 (Thiamine), vitamin B_2 (Riboflavin), vitamin B_6.

Materials and Methods

Foliages of twenty plants viz *Adhatoda vasica, Benincasa hispida, Brassica oleracea V. botrytis, Brassica oleracea V. Capitata, Cassia tora, Centella Asiatica, Coccinia grandis, Coriandrum sativum, Cucusmis sativus, Eclipta alba, Erythrina varegata, Medicago sativa, Moringa oleofera*, *Phaseolus valgaris, Raphanus sativus, Sesbania grandiflora, Solanum nigrum, Trigonella foenum graecum* and *Vigna mungo* were collected from either field or market were immediately brought into the laboratory for fractionation and washed with water to remove adhering dust and mud particles. 1 kg of leaves was taken for the preparation of juice. The foliage was mixed to a fine pulp using domestic grinder or mortar and pestle. Pulp was placed on cotton cloth and manually pressed to extract the leaf juice.

One hundred ml of juice was taken for preparation of leaf protein concentrate (LPC). For this purpose, 20 ml distilled water was boiled in a beaker. The juice was slowly added to the boiling water with constant stirring and heated to 90 ± 5^{o}C. The heated juice was filtered through Whatman filter paper to isolate leaf protein concentrate (LPC) formed due to heating of juice. The LPC was dried in an oven till constant weight and the dry weight was recorded. The samples of WET, DRY LPC and DPJ were collected for analysis of thiamine, riboflavin and pyridoxine. Thiamine riboflavin and pyridoxine were estimated by standard method (Jordan, 2000).

Results and Discussion

It is clear from table 1 that the amount of thiamine was on average 250.1±43.84 mcg/100g in wet LPC. Higher yield of thiamine in wet LPC was recorded in *Brassica oleracea* V. *botrytis, Brassica oleracea* V. *capitata, Coriandrum sativum, Raphanus sativus* and *Vigna mungo.* The yield of vitamin B_1 in dry LPC was recorded on an

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average 182.75 ± 61.49 mcg/100 g. The maximum yield of vitamin B_1 was recorded in *Vigna mungo* minimum yield was recorded in *Erythrina varietgata* (80 mcg/100 g). Amount of vitamin B_1 was not observed in DPJ of any plant out of twenty.

Table 2 gives information about vitamin B_2 (Riboflavin) obtained during preparation of wet LPC, Dry LPC and DPJ of twenty plants. The amount of vitamin B_2 (Riboflavin) on an average 344 ± 76.14 mcg/100g observed in wet LPC. Maximum yield of vitamin B_2 (Riboflavin) on LPC was observed in *Adhatoda vasica* and *Trigonella foenum graecum*. The value for coefficient of variation (c.v. = 43.76%) showed more variation in wet LPC as compared to dry LPC and DPJ.

The amount of vitamin B_6 (pyridoxamine) was on an average 185.5 ± 27.24 mcg/100g in wet LPC. Higher yield of vitamin B_6 (pyridoxamine) in wet LPC was recorded in *Brassica oleoracea* V. *botrytis* and *Bennicasa hispida* lower yield was recorded in *Sesbania grandiflora*. The amount of vitamin B_6 was on an average 154.5 ± 30.52 mcg/100g in dry LPC. There was no any yield reported from DPJ. The maximum yield of vitamin B_6 was reported in *Brassica oleracea* v. *Botrytis, Rophanus sativus, Coriandrum sativum* and *Bennicasa hispida* (190 mcg/ 100g). The value for coefficient of variation (C.V. = 17.54%) showed more variation in Dry LPC as compared to that recorded for wet LPC. The amount vitamin B_6 was not observed in DPJ of any plant (Table 3). Thus, it can be concluded that LPC is novel source of vitamin B_1,B_2 and B_6.

Table 1. Thiamine (B_1) content of wet LPC, dry LPC and DPJ of twenty plants

Sr.No.	Name of the Plant	Composition per 100 g		
		Wet LPC (mcg)	Dry LPC (mcg)	DPJ (mcg)
1.	*Adhatoda vesica*	250	90	-
2.	*Benincasa hispida*	280	220	-
3.	*Brassica oleracea V. botrytis*	290	210	-
4.	*Brassica oleracea V. capitata*	290	220	-
5.	*Cassia tora*	200	110	-
6.	*Centella asiatica*	280	200	-
7.	*Coccinia grandis*	280	200	-
8.	*Coriandrum sativum*	290	230	-
9.	*Cucurbita maxima*	260	150	-
10.	*Cucusmis sativus*	280	210	-
11.	*Eclipta alba*	210	200	-
12.	*Erythrina varegata*	160	80	-
13.	*Medicago sativa*	280	190	-
14.	*Moringa oleifera*	160	90	-
15.	*Phaseolus valgaris*	210	200	-
16.	*Raphanus sativus*	290	210	-
17.	*Sesbania grandiflora*	210	170	-
18.	*Solanum nigrum*	232	200	-
19.	*Trigonella foenum graecum*	260	210	-
20.	*Vigna mungo*	290	265	-
	Mean	250.1	182.75	
	S.D.	43.84	61.49	
	C.V.	25.20	35.33	

Table 2. Riboflavin (B2) content of wet LPC, dry LPC and DPJ of twenty plants

Sr.No.	Name of the Plant	Composition per 100 g		
		Wet LPC (mcg)	Dry LPC (mcg)	DPJ (mcg)
1.	*Adhatoda vesica*	400	260	-
2.	*Benincasa hispida*	350	290	-
3.	*Brassica oleracea V. botrytis*	350	260	-
4.	*Brassica oleracea V. capitata*	350	260	-
5.	*Cassia tora*	315	250	-
6.	*Centella asiatica*	330	270	-
7.	*Coccinia grandis*	340	250	-
8.	*Coriandrum sativum*	300	270	-
9.	*Cucurbita maxima*	390	280	-
10.	*Cucusmis sativus*	340	270	-
11.	*Eclipta alba*	320	260	-
12.	*Erythrina varegata*	350	260	-
13.	*Medicago sativa*	340	260	-
14.	*Moringa oleifera*	340	270	-
15.	*Phaseolus valgaris*	320	260	-
16.	*Raphanus sativus*	340	280	-
17.	*Sesbania grandiflora*	305	240	-
18.	*Solanum nigrum*	310	250	-
19.	*Trigonella foenum graecum*	400	350	-
20.	*Vigna mungo*	390	315	-
	Mean	344	270.25	
	S.D.	76.14	24.95	
	C.V.	43.76	14.34	

Table 3. Pyridoxamine (B6) content of wet LPC, dry LPC and DPJ of twenty plants

Sr.No.	Name of the Plant	Composition per 100 g		
		Wet LPC (mcg)	Dry LPC (mcg)	DPJ (mcg)
1.	*Adhatoda vesica*	180	110	-
2.	*Benincasa hispida*	220	190	-
3.	*Brassica oleracea V. botrytis*	220	190	-
4.	*Brassica oleracea V. capitata*	210	180	-
5.	*Cassia tora*	150	120	-
6.	*Centella asiatica*	200	180	-
7.	*Coccinia grandis*	210	180	-
8.	*Coriandrum sativum*	210	190	-
9.	*Cucurbita maxima*	190	160	-
10.	*Cucusmis sativus*	210	180	-
11.	*Eclipta alba*	160	110	-
12.	*Erythrina varegata*	150	120	-
13.	*Medicago sativa*	210	180	-
14.	*Moringa oleifera*	160	130	-
15.	*Phaseolus valgaris*	160	130	-
16.	*Raphanus sativus*	210	190	-
17.	*Sesbania grandiflora*	140	130	-
18.	*Solanum nigrum*	150	120	-
19.	*Trigonella foenum graecum*	190	150	-
20.	*Vigna mungo*	180	150	-
	Mean	185.5	154.5	
	S.D.	27.24	30.52	
	C.V.	15.65	17.54	

References

Harries R.S., Loraine T.A. Woll I (1965). Vitamins and Hormones Advance in research and Application on annual publication) Academic press.

Jordan L. Cohen (1975). The Official compendia of standards. The united states Pharmocopedia (USP 24 NF 19). The United States Pharmocopedial Convention Press 12601. Twinbrook Parkway Rockville M. D. 20852.

Joshi, R.N. (1983). In "*Leaf protein concentrates*" (Telek L. and Graham, H.D. Ed.) AVI Publishing Company. Inc., West Port, Connecticut, pp. 673.

Mudd S.H. (1974). Pyridoxine responsive genetic disease. *Fed Proc*- 30:970.

Pirie, N.W. (1978). "*Leaf protein and other aspects of fodder fractionation*" Cambridge University Press, London.

Shah, F.H. (1983). In "*Leaf Protein Concentrates*" (Telek, L. and Graham, H.D., Eds.) AVI Publishing Co. Inc. Westport, Connecticut, pp. 760.

Walker, H.G. Jr. and Kohler, G.O. (1983). "*In Leaf Protein Concentrates*" (Telek, L and Graham, H.D., Ed.), AVI Publishing Company, INC Westport, Connecticut, pp. 550.