



## STUDY ON TOXICITY OF GRASS PEA (*LATHYRUSSATIVUS*) CONSUMPTION IN CHICKS

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### ABSTRACT

Consumption of grass pea or *Lathyrus sativus* for any length of time is known to cause lathyrism, a serious osteo and neurological disorder due to presence of  $\beta$ -oxalyl amino alanine, an amino acid. The present study was under taken to study the effect of feeding *Lathyrus sativus* to one week old chicks. Significant difference recorded in body weight, physical movement and behaviour of chicks between control group and experimental group. Feeding 25% *Lathyrus sativus* mixed with 75% normal diet showed dizzy, dull and sluggish behaviour from the very second day. The chicks fed on 100% legumedullness, sluggishness, paralysis of legs, stiffness etc. was observed within 12 to 24 hours and the all chicks died within 24 hours. It was thus concluded that the increase in the concentration of *Lathyrus sativus* in feed increased the mortality and also the time taken for occurrence of symptoms was reduced. There was a direct inverse relationship between the concentration of *Lathyrus sativus* and survival period of the chicks.

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### INTRODUCTION

It is known that consumption of grass pea or *Lathyrussativus* for any length of time can cause serious neurological disorder, known as lathyrism. The main neurotoxic compound in an amino acid,  $\beta$ -oxalyl amino alanine present in the seeds was isolated more than 30 years ago, in its crystalline form and has been fully characterized (1,2). Since then several attempts have been made to elucidate the biochemical basis underlying the neurological disorder (3).

A series of experiments, covering various aspects taking different animals and birds as experimental subjects have been reported by various researcher (4,5). The present study was under taken with the objective of evaluating the toxicity of seeds as a result of feeding *Lathyrussativus* in chicks. Further, the feeding of pure active compound  $\beta$ -Oxalyl Amino Alanine (BOAA) on growth and development of chicks was studied so as to compare the toxicity at different concentrations of the toxin.

### MATERIALS AND METHODS

The present study was carried out in Department of Biochemistry Gandhi Medical College Bhopal in association with Microbiology laboratory of the Central Institute of Agricultural Engineering, Bhopal. The study protocol was approved by the Institutional Ethical Committee.

Twenty five number of one week old healthy chicks having normal growth and weight were purchased from Foenix Hatchery, Bhopal and divided into 5 groups, each group consisting of 5 chicks each. All the chicks were maintained of normal base diet as per the guideline given by the Hatchery animal nutritionist.

For this study two groups were as follows:

**Group – I**– The control group was fed on diet free from *Lathyrus* seed pellets.

**Group –II**– The experimental group- was subdivided into 4 groups and fed with diet containing 25%, 50%, 75% and 100% of *Lathyrussativus* seed powder.

Powder of the seeds of *Lathyrussativus* was prepared by grinding into flour. Pellets were prepared by mixing in the normal diet taking care of the standard feed material.

Because the study had focused on effect of toxicity on normal growth and physiological activeness, they were kept under constant vigil for changes in their activity, body weight, diet consumption and physical movement. The appearance of different characteristics symptoms of disease at regular intervals was also recorded. All chicks of both groups were continuously observed for 10 days or until mortality.

#### Statistical Analysis

Data were analysed by using simple descriptive statistical tools. Data were expressed as mean $\pm$ SD, SE and %CV.

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**RESULTS**

The results in Table-1 show the effect of feeding *Lathyrussativus* free diet to chicks of control group. All chicks showed increase in body weight and average diet intake. The average weight gain during the study is 81.38 g and all chicks were normal and healthy.

**Table 1** Effect of feeding of normal diet.

Statistical parameter	Body weight (g)		Average diet intake (g/day)					
	Initial	Final	1	2	4	6	8	10
Mean	70.9	81.38	21.0	21.7	23.2	23.3	24.0	24.2
Std. dev.	±0.534	±1.023	±0.932	±0.391	±0.970	±0.875	±0.681	±0.884
Std. error	±0.239	±0.457	±0.416	±0.434	±0.434	±0.391	±0.304	±0.395
% CV	0.753	1.257	4.42	1.79	4.17	3.75	2.84	3.62

There was significant difference recorded in body weight, physical movement and behaviour of chicks between control group and experimental group.

The result in Table -2 on feeding 25% *Lathyrus sativus* mixed with 75% normal diet indicate that the chicks started showing dizzy, dull and sluggish behaviour from the very second day. They had stopped eating and a slight bending of legs was observed. The stiffening of legs and impaired movement was observed on the fourth day and by the sixth day they became absolutely inactive followed by complete paralysis, their necks got twisted and retracted and ultimately died.

**Table 2** Effect of feeding 25% *Lathyrussativus*.

Statistical parameter	Body weight (g)		Average diet intake (g/day)				
	Initial	Final	1	2	3	4	5
Mean	72.04	78.06	21.64	17.25	16.08	15.96	06.64
Std. dev.	±2.089	±2.563	±0.939	±1.036	±0.589	±0.841	±0.991
Std. error	±0.931	±1.146	±0.265	±0.342	±0.242	±0.427	±0.152
% CV	2.89	3.284	4.34	6.02	3.66	5.27	14.90

The result of the effect of feeding of diet containing 50% *Lathyrus sativus* is shown in Table -3. The adverse effect on all the chicks was still more deleterious. All the five chicks developed the similar symptoms within 48 hours died in 96 hours.

**Table 3** Effect of feeding 50% *Lathyrussativus*.

Statistical parameter	Body weight (gm)		Average diet intake (gm/day)			
	Initial	Final	1	2	3	4
Mean	72.44	77.46	21.02	10.04	6.22	3.48
Std. dev	±2.367	±2.205	±0.746	±1.314	±1.245	±1.035
Std. error	±1.058	±0.986	±0.333	±0.587	±0.557	±0.463
% CV	3.267	2.840	3.550	13.09	20.02	29.75

Table -4 shows the effect of feeding on the diet containing 75% *Lathyrus sativus*. All chicks were observed to develop dullness and sluggishness within 24-48 hrs. The diet consumption found to be negligible and paralysis of limb was observed. All the chicks were found to have died in 72 hrs.

**Table 4** Effect of feeding 75% *Lathyrussativus*

Statistical parameter	Body weight (g/day)		Average diet intake (gm/day)		
	Initial	Final	1	2	3
Mean	71.28	76.28	21.16	6.60	2.52
Std. dev	±2.093	±2.247	±0.594	±0.543	±0.342
Std. error	±0.936	±1.005	±0.265	±0.242	±0.152
% CV	2.916	2.908	2.807	8.229	13.57

The result in table -5 shows that the chicks fed on 100% *Lathyrus sativus* diet developed the characteristics symptoms

of the disorder like dullness, sluggishness, paralysis of legs, stiffness etc. within 12 to 24 hours and the death was found to have occurred in 24 hours .

**Table 5** Effect of feeding 100% *Lathyrussativus*.

Statistical parameter	Body weight (g/day)		Average diet intake (g/day)	
	Initial	Final	1	2
Mean	72.74	75.74	20.76	9.66
S.D.	±2.341	±2.389	±0.554	±0.343
S.E.	±1.047	±1.068	±0.248	±0.153
%CV	3.219	3.154	2.67	3.79

**DISCUSSION**

A series of experiments covering various aspects on animals and birds have been reported (6, 7 and 8).

In our study one-week old chicks were selected mainly due to the fact that higher animals such as monkeys are difficult to handle and the experiments involve comparatively longer duration. Moreover these larger animals are not available easily in large numbers and cost involved is also high. Chicks were fed on control (*Lathyrus sativus*) diet and compared with those fed with diet containing 25%, 50%, 75% and 100% of

*Lathyrus sativus*

Absolutely normal growth and perfect health was observed in chicks of control group. They were very active and also did not reflect any change in their behavior.

On feeding with 25% *Lathyrus sativus* diet, total consumption being same as those of control and the chicks survived for 6 days. The chicks in all cases, except those fed on *Lathyrus sativus* free diet, finally died.

The chicks fed with diet containing 50% of *Lathyrus sativus* were found to have become absolutely inactive in 48 hours and died in 96 hours. The symptoms appeared still faster in case where the feeding was done on diet containing 75% *Lathyrus sativus*. Our results are in accordance with other studies (9, 10).

The increase in the weight of chicks was however, not adversely affected by increasing the *Lathyrus sativus* concentrations. The characteristic symptoms of lathyrism occurred in similar fashion and same order but the duration of their occurrence was decreased.

The chicks fed with only *Lathyrus sativus* (Table-5) demonstrated dizzy, dull and sluggish behaviour within 6 hours. After 12 hours the overall activity of the animals was drastically reduced as observed by movement and chirping and all the chicks were found on the mat and did not responding to external stimuli. Complete paralysis of limbs, twisting and retraction of neck and finally opisthotonus and death was recorded within 24 hours. Thus 100% mortality was recorded in this group in 24 hours. The result was in agreement with those obtained for toxicity effect on chicks (11, 12).

The result (Table-6) clearly indicate that the increase in the concentration of *Lathyrus sativus* in chick-feed increased the mortality and also the time taken for occurrence of symptoms was reduced.(13,14). There was a direct inverse relationship between the concentration of *Lathyrus sativus* and survival period of the chicks.

**Table 6** Shows the survival periods of chicks fed on different concentration of *Lathyrus sativus*.

Period (Days)	% Concentration of <i>Lathyrussativus</i> in diet			
	25	50	75	100
1	1	1	1	1
2	2	2	2	-
3	3	3	-	-
4	4	4	-	-
5	5	5	-	-
6	6	-	-	-

The average weight gain between control and different experimental groups were observed to be moderate to highly significant

## CONCLUSION

Our result support that the neurotoxic substance present in seeds of BOAA (1,15,16) the causative factor for producing symptoms of lathyrism in chicks. Animal experimentation showed that  $\beta$ -OAA has accumulatory effect i.e. continuous consumption is harmful. Moreover there was direct correlation with body weight. This implies that the animals with higher body weight would get affected only when toxin content in the feed is high.

It was thus concluded that as compared to control, where no *Lathyrus sativus* was included in the diet, the gain in weight was definitely higher and faster and no mortality was recorded even after several weeks. This indicates that the presence of toxin in the protein source (*Lathyrus sativus*) also adversely affected the overall development of the chicks besides development of symptoms of lathyrism.

Due to the presence of neurotoxin in seeds of *Lathyrus sativus* this cannot be considerable for poultry feeding without detoxifying the seeds. Thus there is need for further research on detoxification process on commercial scale.

## References

- Rao, S.L.N., Adiga, P.R. and Sarma, P.S. (1964). The isolation of Ox-Dapro: a neurotoxin from the seeds of *Lathyrussativus*. *Biochemistry*, 3: 432-86.
- Murti, V.V.S., Seshadri, T.R. and T.A. (1964). Neurotoxic compounds of seeds of *Lathyrussativus*. *Phytochemistry* 3: 73-78.
- Rao, S.L.N., Malathi, K. and Sarma, P.S. (1969). *World. Rev.Nutr.Diet.*, 10:214-238.
- Chowdhury S.D. (1990). Effects of low and high dietary levels of beta-aminopropionitrile (BAPN) on the performance of laying chickens. *J.Sci.Fd Agric.* 52: 315-329.
- Rotter R.G., Marquardt R.R., Campbell C.G., (1991). The nutritional value of low lathyrigeniclathyrus for growing chicks. *Brit. Poultry Sci.* 32: 1055-1067.
- Stockman R. (1940). Lathyrism, *J. Pharmac. Expt.Ther.* 37: 43-53.
- Cheema P.S., Padmanabhan, G. and Sarma, P.S., (1971). Lathyrigen: In: Toxic constituents of plant food stuffs edited by Irwin Leiner. Academic Press. New York 267-91.
- Moslehuddin, A.B.M. and Hang, Y.D. (1987). Effect of processing methods on the nutritional value of *Lathyrussativus*, *Nutrition Report International*, 36: 42-45.
- Rukmini, C. (1969). Structure of the new toxin from the *Lathyrussativus*. *Ind.J.Chemi.*, 7:1062-63.
- Nagarajan, V., Mohan, V.S. and Gopalan, C. (1965). Toxic factors in *Lathyrussativus*, *Ind.J.Med.Res.*, 53: 269.
- Roy, D.N., Nagarajan, V. and Gopalan, C. (1963). Production of neurolathyrism in chicks by the injection of *Lathyrussativus* concentrates. *Curr.Sci.* 32: 116-18.
- Padmanabhan, G., Cheema, P.S., Malathi, K. and Laxman, J. (1971). Neurolathyrism, *J.Sci.Ind.Res.*, 30: 716-20.
- Chowdhury, S.D. (1988). Lathyrism in poultry- a review. *World's poultry Sci. J.* 44: 7-16.
- Roy, D.N. (1973). Effect of oral administration of beta-(N)-oxalylamino L-alanine (BOAA) with or without *Lathyrussativus* trypsin inhibitor (LS-TI) in chicks. *Environ. Physiol. Biochem.* 3: 192-95.
- Nunn, P.B. (1989). *Lathyrussativus* toxins: Identification and possible mechanisms, The grass pea: Threat and Promise. 89-94, Third World Medical Research Foundation, New York, USA.
- Lambein F., Ongena, G and Kuo, Y.H. (1990). B-Isoxazolinone-alanine is involved in the biosynthesis of  $\beta$  - N-Oxalyl-L- $\alpha$ - $\beta$ - Diamino propionic acid. *Phytochemistry*, 29:3793-96.

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