

## Study of biochemical investigation in lathyrism patients

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### Article History

Received: 29.08.2017

Accepted: 09.09.2017

Published: 30.09.2017



**Abstract:** *Lathyrus sativus* (khesari/ tohda or grass pea) is a highly nutritive legume crop containing 31 per cent protein, 41 per cent carbohydrate, 17 percent total dietary fiber. The protein content of khesari or grasspea seeds is highest among the other Indian pulses. It is high resistant to insect-pests and is drought-tolerant legume crop. It is often considered a lifesaver crop mainly in the drought affected areas of Madhya Pradesh, Bihar, Chattisgarh, Gujarat and Maharashtra, Andhra Pradesh, Rajasthan and Karnataka. A cross-sectional survey was carried out in all the members of 21 different families of eight different villages of Rewa (Panasi, Kostha, Jirla, Tyotha, Sirmour, Mohali) and Raisen (Goharganj, Gairatganj) districts were examined for their source of income, medical history, diet pattern and prevalence and stages of the disease. The characteristics symptoms of lathyrism like muscle weakness, spasticity, paraplegia, stiffness of joints, numbness, clumsiness in gait and pain in lumber region were also recorded. Samples of blood of patients and normal volunteers were collected from the all patients and normal volunteers were then analyzed for protein, toxin  $\beta$ -OAA and minerals (copper, zinc and manganese). Our study indicate that the pulse is still cultivated and consumed in villages of Rewa and Raisen district however regular consumption is reduced. Biochemical analysis of blood samples shows significant difference in  $\beta$ -OAA and mineral content between lathyrism patients and normal volunteers.

**Keywords:**  $\beta$ -OAA - grass pea - khesri dal - *Lathyrus sativus* - neurolathyrism

## INTRODUCTION

There has been a large amount of work done in India as well as outside India on biochemical studies of *Lathyrus sativus* and lathyrism with particular reference to understanding the etiology of lathyrism and mechanism of action of  $\beta$ -OAA. Despite declaration of Government ban on the production and consumption *Lathyrus*, it is still being cultivated and consumed in many parts of India especially draught prone areas. It has been observed that there is very little variation in the production as well as area under cultivation since 1993 when Pandey and Kashyap [1] reported the same.

The present study was undertaken to investigate the toxic effect of *Lathyrus sativus* in patients and some biochemical aspects related to the occurrence of disease that included the incidence of lathyrism, current status of the disease in Madhya Pradesh and to compare the effect of toxin ( $\beta$ -OAA) protein and mineral levels in normal volunteers and lathyrism patients

## MATERIALS AND METHODS

A group of human volunteers were randomly selected from selected villages of each of the Raisen and Rewa Districts of Madhya Pradesh. In all 30 cases from all members of 21 different families of 8 different villages viz. Panasi, Kostha, Jirla, Tyotha, Sirmour and Mohali of the most affected Rewa and Goharganj and Gairatganj from Raisen districts were examined for their source of income, medical history, diet pattern and stages of the disease.

The patients were also examined for characteristics symptoms like muscle weakness, spasticity, paraplegia, stiffness of joints, numbness, clumsiness in gait and pain in lumber region.

Blood samples of patients and normal volunteers were collected and analyzed for protein [3], toxin  $\beta$ -OAA [2], and minerals (copper, zinc and manganese) using Atomic absorption spectrophotometer [4].

## RESULTS

The result given in Table-1 show the average values, and standard deviation for socio economic status versus diet pattern of the low, middle and high income

group villages. There was insignificant difference in age, sex, height, weight and socio-economic status between patients and normal volunteers.

Table-2 shows the results on the incidence of lathyrism in different age groups of populations in Rewa and Raisen district of Madhya Pradesh. The maximum percentages of 28.5 % and 38 %cases were recorded in Rewa and in Raisen respectively, fell between 31-40 years of the age group. No patients were found below the age of 18 years. However, age of onset

of disease was below 30 years in most of the cases of Rewa and Raisen districts were found to be 33.3% and 42.8%, respectively.

The result of total protein,  $\beta$ -OAA and mineral (Zn, Cu, Mn) content in normal human volunteers and lathyrism patients are given in Table-3. The mean protein concentration in the serum of normal volunteers was 6.94gm% while no  $\beta$ OAA was present. There was no significant difference was observed protein content in between patients and normal volunteers.

**Table -1: Socio-economic and diet pattern in affected families**

Income group	Statistical Parameter	Average consumption ( g per day)				Incidence of disease (percent)
		Cereals	Pulses		Vegetables	
			Lathyrus	Other		
Low	Mean	178.57	90.0	90.0	133.33	21.74
	SD	26.73	60.33	59.67	82.92	
	SE	10.11	19.07	21.10	27.64	
Medium	Mean	200.0	82.50	137.50	144.45	17.80
	SD	40.83	51.44	23.15	30.05	
	SE	15.33	16.27	8.18	10.02	
High	Mean	215.15	72.50	181.25	166.12	19.12
	SD	40.83	65.03	37.20	41.69	
	SE	28.57	20.56	13.15	13.89	

**Table-2: Incidence of Lathyrism in the affected areas in different age-groups**

Age groups	District-wise percentage of Lathyrism cases	
	Rewa	Raisen
<20	14.2	19.0
21-30	14.2	9.5
31-40	28.5	38.0
41-50	19.0	19.0
51-60	14.4	9.5
>60	9.5	4.7

**Table-3: Comparison of biochemical parameters between Healthy individuals and Patients**

Biochemical parameters per 100g	Healthy volunteers	Lathyrism patients	P-value
Protein (g)	6.94±0.25	7.151±0.39	NS
$\beta$ -OAA(mg)	0.00±0.00	0.304±0.085	<0.05
Zn ( $\mu$ g)	96.54±3.83	66.04±1.34	<0.05
Cu ( $\mu$ g)	86.19±35.69	45.50±4.62	<0.05
Mn ( $\mu$ g)	5.76±0.72	2.81±0.59	<0.05

**DISCUSSION**

In the present study the dietary pattern of lathyrism patients was taken into consideration along with other parameters such as crop cultivation pattern, dietary consumption of *Lathyrus sativus* and other legumes, socioeconomic condition, occupation and literacy levels. On an average *Lathyrus sativus* consumption of an adult was been observed to be about

90 g, 82.50 g and 72.50 g per day in lower, middle and upper income group families, respectively. The data reveals that not all consumers who ate almost similar quantities of the pulse developed lathyrism. There was no definite trend observed in the consumption of Lathyrus with respect to family income and cases of lathyrism. Our results are in accordance with the other studies [5,6].

This study has shown the prevalence of lathyrism in the two endemic regions viz Rewa and Raisen districts. Family history for the disease was recorded in all the cases. Rewa district was found to be the most affected district of the Madhya Pradesh [1], possibly due to comparatively more poverty in Rewa district. In both the regions the highest percentage of patients were recorded in the age-group of 31-50 years. The result further indicate that there was no particular trend between the age of patients and the incidence of the disease, however, a peculiar finding was that there were no patients below the age of 18 years. This indirectly indicates there is a positive change in the consumption pattern among the upcoming children [7].

Our study indicates that in more than 65% cases, the age of onset was below 30 years and this is comparable to other studies [8] and Haimanott [9] also found the same result in their study. The results in Table-3 indicate that the mean protein concentration in normal volunteer was 6.94% as against 7.15% in case of patients. This difference was found to be insignificant while  $\beta$ -OAA was present only in the serum of lathyrism patients that has been found to be highly significant, statistically. These results are in accordance to those of other studies [10]. After 12 hours there was no  $\beta$ -OAA observed in blood plasma. The possibility may be explained for this, that toxin might have got bound to some sensitive site in the brain, resulting into neuro-lathyrism and consequently osteo-lathyrism. This finding is in accordance with two earlier independent reports by Cohn [11] and Khan [2].

The comparison of mineral concentration in normal volunteers and patients indicate the concentration of all the three minerals viz. Zn, Cu, and Mn in case of patients were 2.0 to 3.5 fold less, indicating highly significant difference between mineral content in sera of normal volunteers and lathyrism patients. This is in agreement with the earlier reports by Haque [5].

Further there was no correlation observed between the  $\beta$ -OAA and protein content. Also, there was no relationship observed between duration and level of consumption and occurrence of the disorder. Finally the present study reveals that lathyrism is still prevalent in many parts of Madhya Pradesh and other parts of India [12] in spite of the ban the production and consumption of *Lathyrus sativus* by government of India.

The disease has no treatment, only preventive measures can help. In a democratic country like India imposition of ban on production and consumption does

not appear to be the appropriate measures instead good processing methods to eliminate the toxin should be developed.

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