LATHYRISM
A PREVENTABLE PARALYSIS

1983

NATIONAL INSTITUTE OF NUTRITION
INDIAN COUNCIL OF MEDICAL RESEARCH
HYDERABAD - 500 007
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First Printed	1964
Reprinted	1967
Reprinted	1974
Revised	1983

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follow-up studies were contributed by Dr K A.V.R. Krishnamachari and Dr. V. Ramesh Bhat of this Institute.

The Laboratories have now gone a step further and simple methods for the removal of the toxin, which can be usefully employed by the housewife or commercially have been developed. The Institute's work was also instrumental; in studying the variations in the toxin content of lathyrus grown in different regions and thus paved the way for a genetic approach towards evolving low-toxin varieties. The Institute has also developed a simple method of detection of lathyrus in the presence of commonly used pulses in the context of prevalence of adulteration of dals with lathyrus

This brochure has been prepared by the Extension and Training Division of the Nutrition Research Laboratories, on the basis of the results obtained through investigations carried out in the Field Unit at Rewa and in the National Institute of Nutrition.

In this brochure, an attempt has been made to present in simple language, intelligible to the general public, the basic facts regarding the disease. Prevention and control of this disease must eventually come through the promotion of a wide awareness of the nature of the problem and the means of preventing it among the general public. It is hoped that this brochure will help stimulate such interest and thus contribute to the amelioration of a disease which has continued to take a heavy toll for over two centuries.

DIRECTOR

What is Lathyrism

Lathyrism is a nervous disease that cripples man. It has been known to exist in India for nearly two hundred years and is still not eradicated Unfortunately, it affects the youth of the community, especially young men between the ages of 15 and 45 years. The disease does not kill but is incurable and makes tne victims cripples for life. Surveys have shown that there are over 32,000 victims of the disease in Rewa and Satna districts in Madhya Pradesh alone. Recurrent outbreaks of the disease have also been reported from

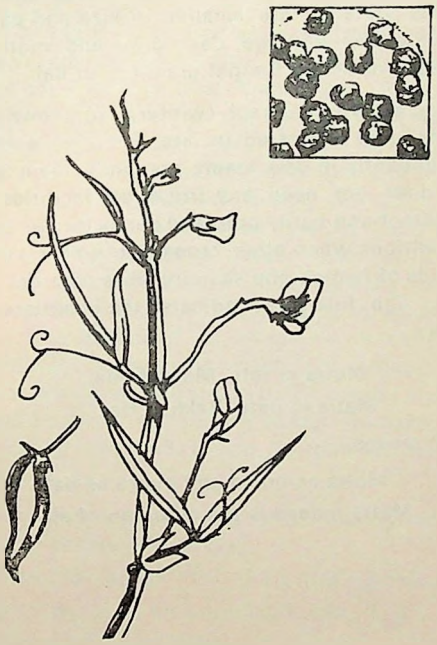

Fig. 1. Lathyrus sativus

several pockets in Eastern Uttar Pradesh, Bengal, Bihar and Punjab.

The disease is caused by eating large amounts of the pulse Lathyrus sativus (Khesari dal). This scourge, causing loss in productivity of hosts of young men in the community, can be easily prevented by not eating Lathyrus sativus or reducing its intake to a minimum.

Lathyrus sativus is extensively cultivated in Madhya Pradesh, Bihar and parts of eastern Uttar Pradesh, Bengal, Maharashtra, Mysore and Andhra Pradesh. It is known by different local names such as Matra, Teora, Batra, Gharas, Khesari, Lang, Lakh, Lakhori, Latri Dal or Lankalu. Throughout the country, it is known by the common name 'Khesari Dal'. The plant is a legume with needle–like elongated leaves and pink-purple flowers. The pods contain seeds triangular in shape. Some varieties are smaller in size and pale grey in colour, while others are large, dark grey and mottled. The dehusked seeds resemble Bengal gram or Tur dal.

Lathyrus sativus is a rabi (winter) crop sown in October-November and harvested in late February early March. It grows abundantly in dark loamy or sandy–loam soils. Its cultivation does not need any irrigation facilities. It is a drought resistant and hardy crop and hence thrives even under adverse conditions when other crops like wheat fail. Hence during periods of famine and scarcity, it is regarded as a life-saving crop. The folk verse indicates the importance of this famine-crop :

"Matra ki roti, Matra ki dal,
Matra ki pati, Rakhan Har."

which means—

"Matra as bread and matra as dal
Matra indeed is the guardian of all

History of Lathyrism in India

The first graphic description of the disease and its association with the consumption of Lathyrus pulse has been given in 1884 by General Sleeman, in his book **'Rambles and recolletcions of an Indian official.'**

"In 1829 and 1831 the spring crops in Saugor and surrounding villages were destroyed by hailstorms, rains and blight. During these years the 'Teori' which normally is left carelessly to grow among the wheat and other grains, remained uninjured and thrived with great luxuriance. In 1831, a rich crop of it was reaped and the villagers subsisted upon its grain during that and the following years, giving the stalks and leaves only to their cattle. In 1834, the sad effects of this food began to manifest themselves. The younger part of the population, from the age of thirty downwards, began to be deprived of the use of their limbs below the waist by paralytic strokes. About half the youth of this village, of both sexes, became affected during the year 1833-34 and **many of them have lost the use of their lower limbs entirely and are unable to move.** The youth of surrounding villages in which the 'Teori' formed the chief article of diet during the years 1831-32, have suffered to an equal degree. They described the attack as coming on suddenly, often while the person was asleep and without any warning symptoms whatever, and stated that a greater portion of young men were attacked than of the young women. **No person once attaked had been found to recover the use of limbs affected".**

From 1904 onwards the disease occurred in epidemic form in several provinces :

Central Provinces–1904, 1922, 1927, 1945, and 1951.

Gilgit Agency in Kashmir-1926 and 1927.

United Provinces-1930

Punjab–1939

Bhopal–1945 and 1947

Bihar-1944 and 1959

Rewa State-1922, 1927 and 1959

West Bengal-1960.

Sporadic outbreaks of Lathyrism have been reported as recently as 1966 from Rewa, Satna and Allahabad districts.

The following districts have been Known to have had out-breaks of Lathyrism :

Bihar	:	Patna, Monghyr, Darbhanga.
Madhya Pradesh:		Saugor, Bhopal, Hoshangabad, Narasinghpur, Jabalpur, Damoh, Bilaspur, Khandwa, Raipur, Chindwara, Seoni, Rewa, Satna, Panna, Tikamgarh, Durg, Rajnandgoan.
Orissa	:	Orissa
Punjab	:	Norowal
Uttar Pradesh	:	Allahabad, Mirzapur, Lucknow, Bareilly Pilibhit, Lakhimpur, Bahraich, Hardoi, Rampur, Gorakhpur, Azamgarh, Ballia, Sitapur, Unnao, Badaun, Basti.
West Bengal	:	Murshidabad.
Maharashtra	:	Bhandara

LATHYRISM IN INDIA

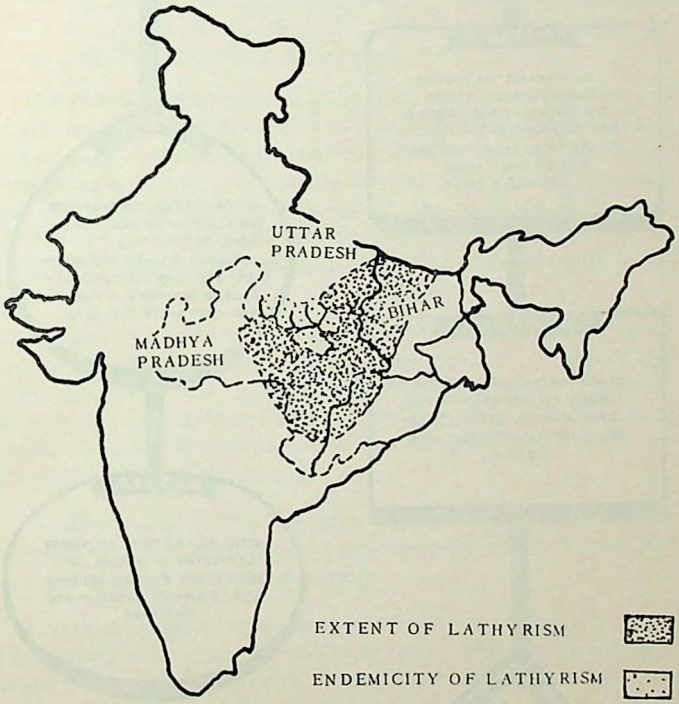

Fig 2

LATHYRISM IN THE WORLD

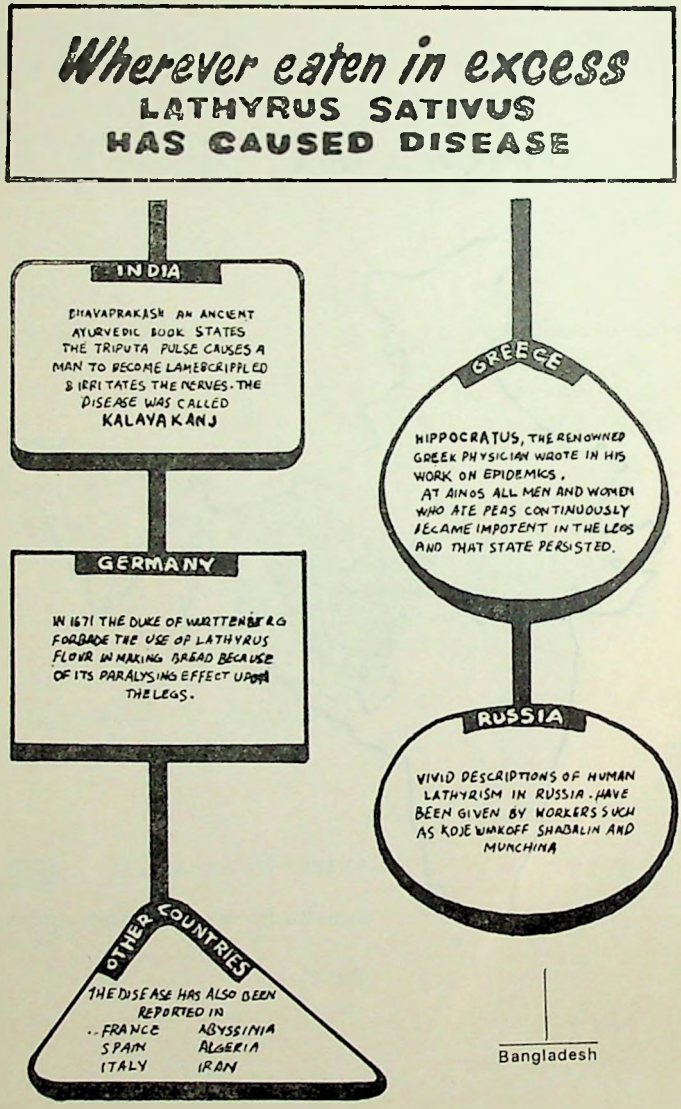

Fig 3

Lathyrism—The Disease

The Warning Sign

The disease may set in, in many ways. Usually, a few days prior to onset of actual paralysis, the individual experiences a sudden agonising pain in the calf muscles at night, after he has been resting and the legs are stretched.

The pain is accompanied by a spasmodic contraction of the calf muscles into the shape of a ball or lump, known locally as 'Lodakas'. A similar type of contraction occurs sometimes in the muscles at the back of the thighs. Along with the spasm there is a downward clenching of the toes and feet. The muscles remain in this contracted state for about 10 to 15 minutes, until the spasm passes off either with massage or by itself.

A week or two later, some of the individuals so affected develop the disease, while some others do not. Some of the latter remain in the 'Latent Stage' of the disease. They do not have the typical signs of physical disability. There is only a slight bending of the knees and awkwardness and difficulty on running or walking downhill

In other individuals, the spasm is infrequently repeated It ultimately stops after several months only when the patient develops the full fledged condition.

Lodakas (muscle spasm) is sometimes of a mild nature; nevertheless it heralds the onset of the disease. It is hence a sign of great public health importance to be used in any preventive programme for the following reason.

If the individual stops eating Lathyrus sativus after the first muscle spasm the disease is arrested and he does not develop Lathyrism in its full form

How the Disease Sets in

While Lodakas (muscle spasm) is the earliest indication of the disease, the onset may be of three types.

Acute onset:—In more than half the subjects the disease starts this way.

A young man goes to work. It rains and he takes shelter under a tree. When the rain stops, he resumes work. While work, he falls and finds himself unable to stretch his legs. There is a bending at the knee, joints and a heaviness in the limbs and it is with increasing difficulty that he walks to his hut. There may also be severe or mild pain round the knee and ankle joints and in the back and thighs. This stiffness of the muscles goes on increasing till the individual is unable to walk. It may take from ten days to a month for him to improve. After this period of complete disability, the paralysis gradually sets in. Women generally do not have an acute onset.

Sub-acute-onset: —This usually occurs about 15 days after Lodakas (muscle spasm). The attack is brought on by a sudden physical effort such as jumping across a brook, chasing cattle or getting out of bed after sleep. The physical effort is arrested and patient falls down. He rises and continues to walk but in a very short time he finds he cannot walk freely or normally. There is usually no pain, yet in a few hours the patient feels a stiffness and heaviness in his lower limbs. This stiffness of the muscles goes on increasing slowly. Owing to this stiffness, the walk becomes jerky and increasingly awkward. He is never bed-ridden and does his usual work. It may take from a month to a year before he progresses into any of the stages of the disease. Women are more prone to have a sub-acute onset.

Insidious-onset:—In this type of onset, the earliest symptoms such as muscle spasm and pain are not present. Moreover the pain, if any, is just mild and dull. This dull aching in the limbs, knee and ankle joints may continue for 2 to 3 months. At the same time, there is an increasing stiffness and heaviness in the limbs and a slow developing awkwardness of gait. Women do not progress further but in men this may increase, till in about 6 months time the patient may need one or two sticks to enable him to walk. Some of these cases even go into the final stage of complete paralysis.

The Stages of Lathyrism

First stage : The largest number of victims, including most female subjects, are found in this stage of the disease. It is characterised by a typical manner of walking with short steps and jerky movements, which is an important sign for diagnosis.

Owing to varying degrees of stiffness in the muscles of the lower limbs, the heels do not completely rest on the ground while walking, and leave the ground earlier than the toes of the preceding step. Thus the patient walks on toes, with knees slightly bent and ankles extended, resulting in jerky movements and a kind of scissors or crossed gait (crossing of the legs on walking). In order to correct the disturbed balance, the waist is sometimes tilted and the head sways from side to side.

At this stage, the patient manages to walk without the aid of a stick. This, therefore, may be called the Non-Stick Stage.

The patient may remain in this condition for the rest of his life. Or, he may pass on to the next stage.

FIG 4

Victims of Lathyrism showing the different Stages

(Centre) Non-stick stage
(Extreme right and left)
One stick stage.

Crawler stage

Second stage : It may take a Non-stick patient anywhere from a month to even 10 years to advance to this stage. On the other hand, a patient may go into the second stage directly after the onset.

Here all the signs of the first stage are present to a greater degree. The muscular stiffness has increased. There is appreciable bending at knee–joints and raising of heels while walking. This makes it necessary to perform all walking by tilting the pelvis to such a degree that a stick is necessary to maintain balance. This is, therefore, sometimes referred to as the One Stick Stage.

Third stage : It is not very common for an individual to go into this stage directly after the Onset. The number of patients in this stage are also less than in any of the previous stages.

Muscular stiffness is marked and the walking is slow and clumsy owing to considerable bending at knee-joints and crossed gait. The muscular rigidity is so great that the patient needs two sticks for support and there is marked tilting of the pelvis sideways to maintain balance. This is sometimes called the Two Stick Stage.

Final stage : A patient may pass through more than one of the previous stages to reach this extreme stage of the disease. By this time the patient is unable to walk upright on account of considerable bending of the knees and extreme stiffness of the lower limbs. Ultimately the legs give way at the knee–joints. The patient is then reduced to crawling or shuffling along by taking his weight on his hands.

Why Lathyrism Still Occurs

Seventy five percent of the victims of Lathyrism are landless labourers often indebted to the landlord. These 'Laguas' or 'Harwahas' are bound to serve the master till the loan is cleared. In terms of money, the per capita income may be as low as 40 paise per day. They are supposed to receive money wages but are generally paid for their labour in the form of foodgrains.

The owner of the land grows **Lathyrus sativus.** It grows easily, needs little irrigation or manuring and yields a luxurious crop. Moreover his cattle can eat the stem and leaves

It is the cheapest pulse in the market and won't fetch him much if he sells. He seldom eats it himself, so he mixes it with varying amounts of wheat, barley, or Bengal gram (if he has any) and hands out this 'Birri' to his labourers as wages. In fact, he very often sifts the grain so that he sieves the wheat out and gives the other grains to his men.

When there is a famine or drought, he needs the little wheat, barley or gram grown, for his own use. So he gives his men only **Lathyrus sativus.**

The labourer prepares rotis (chapathis) out of the **Lathyrus** flour. It is sweet and tasty and heavier than wheat or Bengal gram. So he gets into the habit of liking it and eating it. In fact, many a labourer feels more satisfied when he is given **Lathyrus sativus,** in preference to other cereals.

A few labourers, who realize the possible harmful effects, do not want to accept it. **But there is no choice. Lathyrus sativus** cannot be exchanged or sold for any other grain or

pulse because it fetches less. So they must eat it and risk becoming disabled for life,

Those who are not disabled continue working and eating **Lathyrus sativus** for life. The others become a burden on family and society. Many migrate to nearby towns as beggars only to create further social problems.

Can this vicious circle be broken somewhere ?

Diet and the Disease

The disease occurs only when the pulse is eaten in relatively larger quantities and other food substances are scarcer. On the other hand, a small amount may be eaten with no ill-effects. Diet surveys show that the affected families ate more than four times the amount tof **Lathyrus sativus** as compared to the unaffected families. Moreover as the income rose and the diet improved, the incidence of Lathyrism decreased. In fact the disease is almost never found among the land-owning groups and even among the skilled labourers and petty shop-keepers whose income is subsidised by their professional trades. The disease is most prevalent among unskilled labour who are more or less attached to the land owners and live at their mercy.

Lathyrus pulse is harvested in the month of March and the poor landless labourers start eating it right away and continue eating it up to August or September. Rotis are prepared from the whole Lathyrus flour or a mixture predominantly of Lathyrus flour. The rotis are generally eaten with some arhar dal and perhaps white radish (muli) or other vegetables when available. Sometimes, the whole or crushed pulse is boiled in water and eaten as a porridge with the addition of salt and condiments. **Green vegetables, milk, meat or eggs are rarely consumed.**

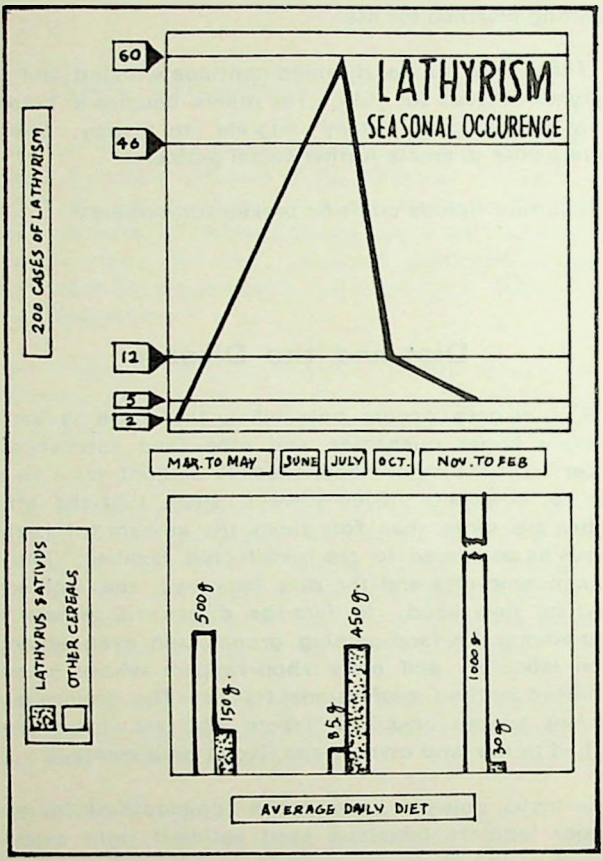

Fig. 5

The disease appears from June onwards and the largest number of cases occur in the month of July. These are the months when the poor are left with Lathyrus sativus as their sole food. Once the kharif crop is harvested in the months of October-November, the number of cases decrease

Surveys have shown that there are over 32,000 Lathyrism patients in the Districts of Rewa and Satna in Madhya Pradesh alone. Almost every village in these districts has had an experience of the disease at some time or the other. In some villages outbreaks of Lathyrism are reported to occur every third year. There are several families in these areas where every male in the family is affected, leaving only a few adult females. A study of 200 cases showed that 41 have more than one patient in the family while the other families have a patient each. It has been estimated that in Rewa and Satna Districts there are almost 3 lame people for every hundred persons. As these are mostly young and active men, every lame person means an economic loss and a social responsibility.

The Poison in the Pulse

A nervous excitation called 'thouros' has been associated with **Lathyrus sativus** since the days of Ancient Greece. Now, scientific studies have shown that **Lathyvus sativus** contains a harmful substance which may be called a 'Toxin'.

The toxin in **Lathyrus sativus** has been isolated by an intricate method. The harmful nature of this toxin is revealed by injecting small amounts of it into an animal such as the chick, duckling, pigeon or monkey.

Within an hour of the injection, the chick gets a paralysis of the legs. At the same time, its neck and head are bent backwards in a spasm. The bird remains so for some hours. If a large amount of the toxin is injected, the bird dies.

In areas where Lathyrism is rife, two third, and more of the daily diet is composed of **Lathyrus sativus** in the form of rotis. When an individual eats such large amounts of the pulse for long periods, the toxin affects the nervous system

This finally causes the muscle spasm and leads on to permanent paralysis.

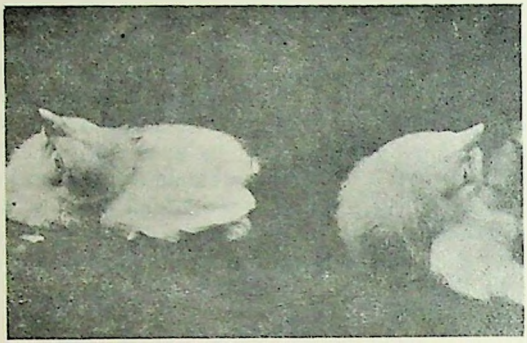

Fig. 6 Two Chicks

It has been found that harmful effects can be produced in 2 to 4 months time by eating a diet of which 40 per cent or more is made up of Lathyrus sativus.

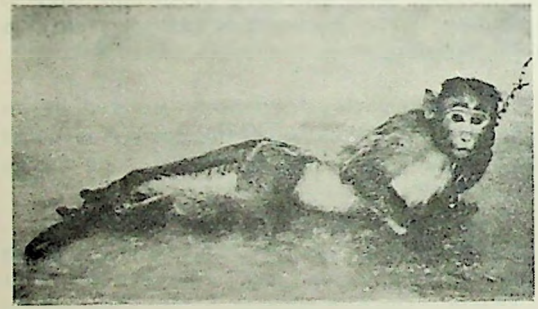

Fig. 6 (a)

Therefore, to avoid the toxic effect on the system, Lathyrus sativus should never form more than a quarter of the total amount of cereals and pulses eaten per day.

EXISTING MEAL PATTERN

Matra (Lathyrus sativus) Roti

Arhar Dal

Muli (White radish)

Fig. 7

IMPROVED MEAL PATTERN

Birri or Jao Matra Roti

(3/4 wheat or barley 1/4 Bengal gram dal & Lathyrus Sativus)

Arhar Dal

Muli (White radish)

Green Leafy vegetable (or the leafy top of Muli cooked)

Groundnuts or Milk

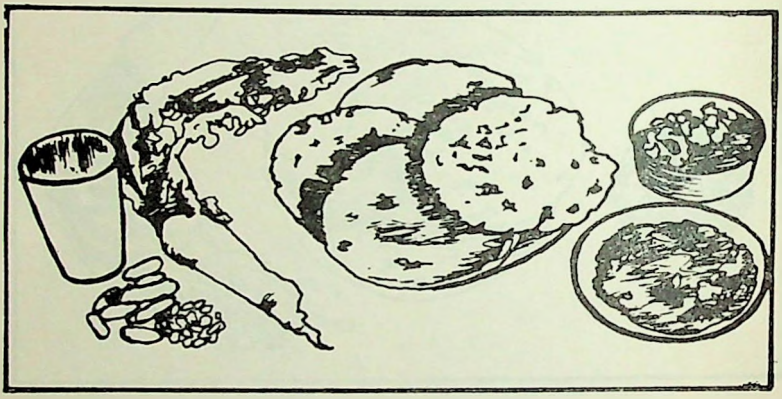

Fig. 7 (b)
A practical though not ideal meal pattern

PREVENTION

1. General Preventive Measures

The most important approach towards the prevention of the disease would be an intensive education programme to

make the people aware of the cause of the disease. Unless officials at every level are informed and their interest stimulated, specific preventive measures will have only limited success.

Such an intensive programme may be carried out through group talks and discussions with village leaders, labour and women's groups, using films and informative leaflets and posters. The initial compaign may be followed by specific information and advice at Health Centres and during home –visits.

A folk verse, which shows that the local people already associate the pulse with the disease, can be given wide publicity in the programme.

"Kariat matra piar pisan
Pisan khai se gor nasan.
Hale chandui matke kool,
Ja dekho matre ki sool".

Translated : The black pea with its yellow flour
From eating it comes trouble in legs;
Flapping top not and swaying hips,
Behold the ill-effects of eating Matra.

The following five factors can be stressed in the the Education Programme:

a) The cause of the disease and the danger of eating large quantities of Lathyrus pulse.

b) The fact that Lathyrus pulse can safely form not more than a quarter of the total amount of cereals and pulses eaten per day.

c) Inherent danger of paying wages in terms of **Lathyrus sativus**.

POISONOUS KHESARI DAL CAN BE RENDERED SAFE AND USED AS FOLLOWS

d) Recognition of early symptoms like muscle spasm and the immediate withdrawal of the pulse from the diet. This also applies to persons in the early stages of the disease.

e) The need for growing alternative crops in place of Lathyrus sativus.

Strict measures against the payment of wages in terms of Lathyrus sativus must be enforced.

A widespread Agricultural Extension Service to ,each the farmers how and what alternative crops to grow, must form an integral of the programme. Practical measures to act as incentives for the production of alternative crops may be Revenue remissions to those who stop growing Lathyrus sativus and increased Tax on Lathyrus producing lands.

Farmers must be encouraged to institute the practice of sharing the crops to facilitate the intake of a mixture of cereals and pulses.

The Nutrition Programmes, which are currently in operation in some States, have contributed significantly to the improvement of the nutrition of rural communities. The extension of such Nutrition Programme to areas where Lathyrism is endemic should be seriously considered.

2. Immediate Preventive Measures

Notwithstanding what is stated above, Lathyrus cultivation has come to stay as a life-saving crop in may parts of the country. The pulse contains 28 per cent protein of fairly good quality. If only the toxins, present in the seeds, could be removed by simple methods, the seeds could be used by one and all without ill effects. The National Institute of Nutrition at Hyderabad have carried out detailed investigat

tions on this problem and two major approaches have been guiding such research, viz. the processing approach and the genetic approach to render the seeds harmless for consumption.

(a) Processing methods to remove the toxin

(i) Steeping process: This method is quite simple and can be practised in every household. A large volume of water (4 times the quantity of seeds) is first brought to boil in a big vessel. When the water is just boiling, fire is removed and the seeds are poured into the hot water and left over for about two hours. After such steeping, the steep-water is drained off completely. The seeds are washed once with a fresh lot of cold water and this water is also drained off. The seeds are now sun-dried. Eighty to ninty per cent of the toxin is removed by this method. The stepwise treatment is indicated in the series of pictures (Fig. 8). The flour prepared from the processed seeds lends itself to making chapathis in the same way as the unprocessed pulse.

(ii) Parboiling process: This process is almost similar to parboiling paddy for preparation of parboiled rice. This method is suitable for processing of L. sativus seeds on a commercial scale and can be carried out in rice mills possessing equipment for parboiling. Here, the seeds are first soaked in cold water for 12 hours in masonry tanks. The water is drained off and wet seeds are charged in to a steaming kettle (to hold about 6 bags each) and steamed for 20 to 30 minutes. Steam is cut off and the hot seeds are again charged in the masonry tanks filled with cold water and and allowed to soak for about an hour. Steaming and subsequent soaking leach out the toxin to the extent of 80 to 90 per cent. The soak-water is drained off and the seeds are then sun dried on the ground in 'drying pials'.

(b) Genetic approach

About 600 samples of L. sativus seeds from several villages from seven or eight districts of Madhya Pradesh have

been screened for the concentration of the toxin present in the seeds. These screening trials have revealed that the toxin content varied from 0.1 to 2.5 per cent. This opens up the possibility of picking out varieties lowest in toxin content and is being carefully pursued. If these trials succeed, a low-toxin variety or a variety "free of toxin" may be used for propagating and introduced for a large-scale cultivation in areas where Lathyrus cultivation is already in vogue. Research at the Indian Agricultural Research Institute (IARI) New Delhi, has evolved a low-toxin variety (0.2% toxin called, **Pusa-24.** Efforts are being mace to multiply and popularise such low-toxins varieties in the lathyrus growing belts.

Further work at the Jawaharlal Nehru Krishi Viswa Vidyalaya (Agricultural University) showed that varieties of lathyrus—LSDI, LSDG, RPL 31, RPL 53 and Pusa-29 performed well utera conditions (6-8 Q/h.a.) and RL 211, RL 31, RL 298, RL 18, RPLK 29 did well under uplands (8-11 Q/h.a.). The varieties LSD6 and pusa-24 besides being high yielders are low in toxin with 9.2 to 0.3% level. Breeders will have to evolve such varieties of low toxin with distinct characteristics of flower, seed coat and grain type for easy identification by farmers. There should be a regular seed breeding programme for continuous supply of low toxin varities to the farmers, every year.

Method of detection:

The prevalence of adulteration of common pulses such as turdal, chana dal or its flour (basan) with lathyrus has called for a simple, rapid, specific and sensitive method for the detection of such adulteration. The Institute has developed such a simple method which can be carried out in any Public Health Laboratory.

Legislative feasibilities :

"The sale, possession for sale, offer for sale and exposure for sale of lathyrus or the use of lathyrus as an ingredient in the preparation of any article intended for sale" — has been

banned in most of the States of Indian Union, following certain provisions made in the Prevention of Food Adulteration Act (PFA Act). Madhya Pradesh has not passed the relevant legislations so far to make the sale of lathyrus an offence. The cultivation of lathyrus has so far not been banned. Under the existing situation, it would be impracticable implement a total ban on the cultivation of lathyrus. However, as a first step, a levy on the cultivation of lathyrus can be considered as a disincentive to the cultivation of lathyrus.

In the light of the development of the detoxification process, the rule under PFA Act may perhaps need modification, in the event of an open sale of detoxified needs in other states. The PFA Act could state that toxic varieties of seeds should not be used for sale in any form for human consumption.

Complete procurement by state organisations and sending the seeds for detoxification would be an ideal solution. However, this may not be practicable at this stage. As a beginning, a levy can be procured by the State Trading Corporation or State Marketing Federation so that the seeds should be detoxified and then sold through appropriate channels.

A team of scientists from the Institute has been regularly carrying out the follow–up in the endemic districts, specially in Rewa, Satna and Raipur during 1979, 1980 and 1982. These follow–up studies have revealed that after the severe drought in 1974, there have been practically no fresh cases of disease in the endemic districts. The marked decline in fresh incidence of the disease has been confirmed through different channels such as monitoring by N.I.N. team, reports from agricultural university (JNKVV), PHC reports, agricultural departments etc. On the basis of the monitoring activities, the NIN team has recommended general and specific approaches in regard to the social–management of the problems.

General :

1. For Social management of lathyrism, a multi-sectoral approach with proper coordination among agriculture, rural development and health sector besides cottage industries, cooperative and banking institutions are necessary.

2. The health sector through its PHC and sub–centres must closely monitor the rural community for any fresh cases of the disease, in the endemic districts.

Agricultural Sector :

1. Encouraging a change in the agricultural pattern with a definite shift towards the cultivation of wheat, barley, bengalgram and lentils than lathyrus.

2. Encouraging the cultivation of oil seeds such as linseed, safflower, mustard and soyabean.

3. Emphasis on horticultural crops for the region-specially mangoes, ber which appear to have good scope.

4. Introduction of new crops such as triticale and castor may be explored.

5. "Water-shed" approach for water conservation-popularisation of modern dry-land farming methods as suggested by All India Coordinated project on Dryland Farming of ICAR and ICRISAT.

6. A package of practices including supply of quality seeds, fertilisers, pesticides, spraying units with a net work of extension services through cooperatives.

7. Agricultural Research and Extension services through local agricultural colleges at Rewa and Raipur as also through Kutiliya Farming Centre and a similar Farm at Raipur.

8. Speedy implementation of the major and minor irrigation projects including Banasagar Project — may provide the shift in the agricultural pattern in the area.

Rural Development Sector

1. Encouraging developmental activities, specially during drought conditions, through NREP through the aid of "Food for Work" programme. This measure will reduce the consumption of lathyrus, specially the landless labourers.

2. During the drought seasons, the commercial markets may be supplied liberally with wheat. rice and chana through effective Public Distribution System.

3. Special efforts to be made to generate additional income by encouraging home–made industries through agencies as Khadi and Village Industries Commission and State Industries Department.

4. Organised collection of minor oil seeds such as mango kernels and such other measures to provide additional income and employment.

Monitoring Price Structure of Marketing

1. During the period 1960–1970, lathyrus was cheaper than cereals. But in recent years, cost of lathyrus has increased considerably compared to cereals. (Wheat Rs. 1. 70 per kg as against Rs. 2. 70 per kg for lathyrus). The price structure of common dals, has also increased considerbly.

2. It is necessary to monitor the consumption of lathyrus seeds in the rural areas, specially the landless labourers. It has been observed that cossumption of lathyrus as a staple in rural areas has declined considerably over the years.

3. Marketing trends need to be closely watched specially in regard to offtake and utilisation of pulses, including lathyrus. Due to shortage of common pulses, there could be possibility of the use of lathyrus for adulteration of pulses.