

Lathyrus database: Lathyrism >1969 Bibliography

leg. D. Enneking May 2003

Anonymous (1970). **The unsolved mysteries of lathyrism.** Inf Bull Br Biol Res Assoc **9**:121-124  
Lathyrism.

Gopalan, C. (1970). **A report on the first fifty years of the Nutrition Research Laboratories, Hyderabad.** Nutrition Reviews **28** (1):1-7

Source: Medline (70-73) 70128719

Deficiency diseases/ Aflatoxins adverse effects/ Anaemia Hypochromic prevention and control Nutrition Preschool/ Deficiency Diseases prevention and control/ Food Analysis/ Food Contamination/ History of Medicine 20th Cent/ India/ Infant/ Lathyrism prevention and control Liver Diseases chemically induced/ Nutrition Disorders prevention and control/ Nutrition Surveys/ Nutritional Requirements/ Pellagra epidemiology/ Pregnancy/ Pregnancy Complications Haematology drug therapy/ Protein Deficiency epidemiology/ Protein Deficiency therapy Vitamin A administration and dosage/ Vitamin A Deficiency epidemiology/ Vitamin A Deficiency therapy/ Deficiency Diseases epidemiology Nutrition/ Nutrition Disorders epidemiology/ Review/ Historical article/ Mycotoxins/ Aflatoxins/ Anaemia/ Carotene/ Contamination Deficiency/ Drugs/ Epidemiology lathyrism/ Food/ History/ India lathyrism/ Lathyrism/ Lathyrism complications/ Lathyrism drug therapy Lathyrism epidemiology/ Lathyrism history/ Lathyrism India/ Lathyrism mycotoxins/ Lathyrism nutrition/ Lathyrism prevention/ Lathyrism review/ Lathyrism therapy/ Liver/ Nutrition disorders/ Pellagra/ Prevention lathyrism/ Lathyrism prevention/ Protein/ Protein deficiency Reports/ Surveys/ Vitamin A/ Vitamins.

Gopalan, C. (1970). **Some recent studies in the Nutrition Research Laboratories, Hyderabad.** Am J Clin Nutr **23** (1):35-51

Source: Medline (70-73) 70103925

Adolescence/ Adult/ Aflatoxins poisoning/ Avitaminosis/ Calcium/ Carotene/ Child/ Child Preschool/ Deficiency Diseases complications/ Dogs Ducks/ Food Analysis/ Haplorhini/ India/ Infant/ Infant Nutrition Disorders/ Infant Newborn/ Iron/ Kwashiorkor/ Lathyrism etiology/ Nutrition Surveys/ Nutritional Requirements/ Pellagra/ Pigeons/ Pregnancy/ Protein Deficiency complications/ Socioeconomic Factors/ Vitamin A therapeutic use/ Vitamin A Deficiency/ Deficiency Diseases/ Nutrition/ Nutrition Disorders/ Protein Deficiency/ Mycotoxins/ Aflatoxins Deficiency/ Food/ India lathyrism/ Lathyrism/ Lathyrism Adolescence/ Lathyrism complications/ Lathyrism India/ Lathyrism mycotoxins Lathyrism nutrition/ Humans/ Poultry/ Protein/ Surveys/ Trace elements/ Vitamin A/ Vitamins.

Kohler, G. K. (1970). **Hirnnervenbefunde bei Lathyrismus. [Brain nerves findings in lathyrism].** Nervenarzt **41** (10):505-507

Source: Medline (70-73) 71036630

Accessory Nerve/ Hypoglossal Nerve/ Middle Age/ Vagus Nerve/ Brain Diseases etiology/ Lathyrism complications/ Optic Atrophy complications/ Neurology/ Age/ Brain/ Brain diseases/ Lathyrism/ Lathyrism etiology/ Nerves/ Optic.

Lemordant, D. (1970). **Lathyrisme et folklore. [Lathyrism and folklore].** Journal D'Agriculture Tropicale Et De Botanique Appliquee **17** (5/6):230-231

Source: Agricola (70\_78) CAIN 719047140, reprintDE

Lathyrus/ Poisonous plants/ Lathyrus folklore/ Agriculture/ Folklore Lathyrus/ Lathyrism/ Reprint.

Liener, I. E. (1970). **Toxic constituents of plant foodstuffs.** Proc Nutr Soc **29** (1):56-57

Source: Medline (70-73) 71026545

Blood Coagulation/ Erythrocytes drug effects/ Favism etiology/ Glycosides toxicity/ Goitre chemically induced/ Lathyrism etiology/ Lectin toxicity/ Plant Proteins toxicity/ Pyridoxine antagonists and inhibitors/ Rats/ Vitamin D antagonists and inhibitors/ Vitamin E antagonists and inhibitors/ Plant Poisoning/ Rodents/ Antinutritional factors/ Trypsin inhibitor/ Protease inhibitor/ Glycosides/ Blood/ Drugs/ Erythrocytes Favism/ Glycine max/ Goitre/ Lathyrism/ Lathyrism rats/ Lectin/ Plant proteins/ Protein/ Pyridoxine/ Tocopherols/ Toxicity/ Vitamin E Vitamins.

Philip, J. M. (1970). **Toxicity and naturally occurring chemicals in food.** R Soc Health J **90** (5):237-242

Source: Medline (70-73) 71093276

Beta aminopropionitrile toxicity/ Cyanides toxicity/ Lathyrism etiology/ Trypsin Inhibitors toxicity/ Antinutritional factors/ Trypsin inhibitor Protease inhibitor/ Agriculture/ Aminopropionitriles/ HCN/ Lathyrism/ BAPN/ Toxicity beta aminopropionitrile/ Toxicity.

Van Kampen, K. R. (1970). **Sudan grass and sorghum poisoning of horses: a possible lathyrogenic disease.** Journal of the American Veterinary and Medical Association **156** (5):629

Source: Medline (70-73) 70151235

Horse Diseases chemically induced/ Horse Diseases complications/ Lathyrism chemically induced/ Lathyrism etiology/ Plant Poisoning complications/ Horse Diseases etiology/ Lathyrism veterinary/ Nitriles adverse effects/ Plant Poisoning veterinary/ HCN/ Ruminants/ Cattle Horses/ Agriculture/ Cyanides/ Experimental lathyrism/ Horse diseases/ Horses lathyrism/ Lathyrism/ Lathyrism complications/ Lathyrism experimental/ Lathyrism France/ Lathyrism horses/ Nitriles/ Plant poisoning/ Sorghum.

Cheema, P. S.; Padmanaban, G., and Sarma, P. S. (1971). **Mechanism of action of Beta-N-oxalyl-L-alpha,beta-diaminopropionic acid, the Lathyrus sativus neurotoxin.** Journal of Neurochemistry **18** (11):2137-2144

Source: Medline (70-73) 72067718

Animals Newborn/ Brain drug effects/ Carbon Isotopes/ Rats/ Adenine Nucleotides metabolism/ Aminotransferases metabolism/ Ammonia metabolism/ Brain enzymology/ Glutaminase metabolism/ Lathyrism enzymology/ Peptide Hydrolases metabolism/ Toxin pharmacology Rodents/ Neurology/ Antinutritional factors/ Lathyrus sativus/ Ammonia/ Brain/ Drugs/ Enzymes/ Hydrolases/ Hydrolysis/ Lathyrism Lathyrism animals/ Lathyrism mechanisms/ Lathyrism rats/ Mechanism/ Metabolism plant/ NeuroToxin/ Peptides/ Toxin.

Keeler, R. F. and James, L. F. (1971). **Experimental teratogenic lathyrism in sheep and further comparative aspects with teratogenic locoism.** Canadian Journal of Comparative Medicine and Veterinary Science **35** (4):332-337

Source: Medline (70-73) 72214132

Abortion Veterinary/ Animals Newborn/ Pregnancy/ Selenium poisoning/ Sheep/ Sheep Diseases chemically induced/ Spine abnormalities Abnormalities Drug Induced veterinary/ Forelimb abnormalities/ Hindlimb abnormalities/ Lathyrism veterinary/ Plant Poisoning veterinary Sheep Diseases/ Animal/ Ruminants/ Toxicity/ Nutrition/ Neurology/ Agriculture/ Animal feed/ Drugs/ Experimental lathyrism/ Feed/ Feed ruminants/ Feed Lathyrus ochrus/ Heavy metals/ Hindlimbs/ Lathyrism/ Lathyrism animals/ Lathyrism experimental/ Lathyrism France Lathyrism nutrition/ Lathyrus ochrus/ Lathyrus toxicity/ Metals/ Nutrition plant/ Nutrition animal/ Plant poisoning/ Ruminant feed/ Ruminants nutrition/ Selenium/ Sheep feed/ Spine/ Trace elements.

Keeler, R. F. and James, L. F. (1971). **Failure of dietary supplementation to prevent the abortions and congenital malformations of lathyrism and locoism in sheep.** Canadian Journal of Comparative Medicine and Veterinary Science **35** (4):342-345

Source: Medline (70-73) 72214134

Lathyrism sheep/ Sheep lathyrism/ Experimental lathyrism sheep/ Sheep experimental lathyrism/ Ruminants/ Osteolathyrism/ Agriculture/ Diet Experimental lathyrism/ Dietary/ Lathyrism/ Lathyrism experimental/ Lathyrism France/ Lathyrism veterinary/ Sheep.

Mani, K. S.; Sriramachari, S.; Rao, S. L., and Sarma, P. S. (1971). **Experimental neurolathyrism in monkeys.** Indian Journal of Medical Research **59** (6):880-885

Source: Medline (70-73) 72047022

Aminopropionitrile adverse effects/ Haplorhini/ Lathyrism complications/ Paralysis etiology/ Neurology/ Beta aminopropionitrile/ Amino acids Aminopropionitriles/ India/ India lathyrism/ Lathyrism/ Lathyrism etiology/ Lathyrism India/ Neurolathyrism/ Paralysis/ Primates/ BAPN.

Mitchell, R. D. (1971). **The grass pea: distribution, diet, and disease.** Ass Pacific Coast Geogr Yearbook **33**:29-46

Mitchell (1971) investigated the geographical distribution of the disease lathyrism which results after excessive consumption of the legume, Lathyrus sativus, a medical problem that manifests as severe irreversible paralysis of the lower extremities .

Source: Agricola (70\_78) CAIN 729010449

Toxicity/ Lathyrism/ Nutrition/ Lathyrus sativus/ Diet/ Distribution plants/ Lathyrism nutrition/ Lathyrus toxicity/ Toxicity L. sativus Epidemiology lathyrism/ Lathyrism epidemiology/ Nutritional geography/ Geography nutritional.

Olney, J. W.; Ho, O. L., and Rhee, V. (1971). **Cytotoxic effects of acidic and sulphur containing amino acids on the infant nervous system.** Experimental Brain Research **14**:61-76

Lathyrism/ Sulfur/ ODAP/ NPAA toxicity/ Cytotoxicity NPAA/ Cytotoxicity amino acids/ Amino acids toxicity/ Neurology/ Amino acids Brain/ Cytotoxicity/ Infant/ Nervous system/ NPAA/ Toxicity ODAP/ Toxicity.

Singh, A.; Katiyar, B. C.; Ganguly, S. P.; Mukerjee, K. C., and Somani, P. N. (1971). **Paraplegia: an aetiological survey.** Journal of the Indian Medical Association **56** (8):219-223

Source: Medline (70-73) 71230923

Lathyrism complications/ Muscular Dystrophy complications/ Peripheral Nerve Diseases complications/ Spinal Cord Compression complications/ Syphilis complications/ Paraplegia etiology/ Neurology/ India/ India lathyrism/ Lathyrism/ Lathyrism etiology/ Lathyrism India Muscles/ Nerves/ Paraplegia/ Peripheral/ Spinal cord/ Surveys.

Anonymous? (1972). **Review of some recent studies in the National Institute of Nutrition Hyderabad.** Indian Journal of Medical Science **26** (3):189-195

Source: Medline (70-73) 72162737

India/ Lathyrism/ Nutritional Requirements/ Pellagra/ Protein Energy Malnutrition/ Nutrition/ Nutrition Disorders/ Famine/ Malnutrition Energy/ India malnutrition/ India lathyrism/ Lathyrism India/ Lathyrism nutrition/ Lathyrism review/ Protein/ Review.

Erbsloh, F. and Cremer, H. D. (1972). **Malnutrition and peripheral neuropathies.** Bibliotheca Nutritio Et Dieta **17**:46-56

Source: Medline (70-73) 72141947

Alcoholism complications/ Anaemia Pernicious etiology/ Beriberi etiology/ Demyelinating Diseases/ Electromyography/ Lathyrism complications/ Malabsorption Syndromes etiology/ Nerve Degeneration/ Neural Conduction/ Nicotinic Acids/ Pantothenic Acid/ Pellagra etiology/ Pyridoxine Deficiency complications/ Rats/ Riboflavin Deficiency complications/ Thiamine Deficiency complications/ Vitamin B Deficiency complications/ Vitamin B 12 Deficiency complications/ Nutrition Disorders complications/ Peripheral Nerve Diseases etiology Rodents/ Neurology/ Famine/ Malnutrition/ Anaemia/ Beriberi/ Binding sites/ Deficiency/ Demyelination/ Lathyrism/ Lathyrism electromyography/ Lathyrism etiology/ Lathyrism nerve degeneration/ Lathyrism nutrition/ Lathyrism rats/ Malabsorption/ Manihot esculenta Cassava/ Myelin/ Nerves/ Neural/ Nutrition/ Nutrition disorders/ Pellagra/ Peripheral/ Pyridoxine/ Riboflavin/ Syndrome/ Thiamine/ Vitamin B Vitamins.

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 Source: Medline (70-73) 74305516  
 Chick Embryo Preschool/ Dogs/ Haplorhini/ India/ Infant/ Lathyrism prevention and control/ Pellagra drug therapy/ Vitamin A Deficiency drug therapy/ Nutrition Disorders/ Carotene/ Ceylon/ Chickens/ Deficiency/ Drugs/ Embryo/ India lathyrism/ Lathyrism/ Lathyrism drug therapy/ Lathyrism India/ Lathyrism nutrition/ Lathyrism prevention/ Lathyrism therapy/ Nutrition/ Pellagra/ Prevention lathyrism/ Lathyrism prevention Vitamin A/ Vitamins.
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 Source: Grmek (1980)  
 Lathyrism/ Review/ Review lathyrism/ Lathyrism review.
- Nagarajan, V. (1972). **Neurolathyrism.** In: **Proc. First Asian Congress of Nutrition**, Tulpule, P. C. and Kamada, S. (Eds) Jaya Rao, Hyderabad: Nutrition Society of India, pp. 641-647.  
 Source: ref Pushpamma (1989)  
 Lathyrism review/ Lathyrism nutrition/ Lathyrism India/ Neurology/ India/ India lathyrism/ Lathyrism/ Neurolathyrism/ Nutrition/ Review.
- Panda, N. C.; Mitra, A., and Kedary, S. (1972). **Experimental lathyrism in chicks.** Indian Journal of Animal Science **42** (11):949-951  
 Source: Agricola (70\_78) CAIN 739189756  
 Lathyrism experimental/ Bioassay chicks/ Bioassay/ Osteolathyrism/ Experimental lathyrism/ India/ India lathyrism/ Lathyrism/ Lathyrism animals/ Lathyrism Bioassay/ Lathyrism India/ Poultry.
- Anonymous? (1973). **Possible mechanism of action of neurotoxin from Lathyrus sativus.** Nutrition Reviews **31** (9):282-283  
 Source: Medline (70-73) 74052515  
 Aspartic Acid pharmacology/ Chickens/ ODAP metabolism/ Ducks/ Escherichia coli drug effects/ Glutamates pharmacology/ Lathyrism Nervous system drug effects/ Neurospora crassa drug effects/ Oxalates pharmacology/ Permeases antagonists and inhibitors/ Pigeons Saccharomyces cerevisiae drug effects/ Toxin antagonists and inhibitors/ Vegetables adverse effects/ Plants Edible adverse effects/ Toxin pharmacology/ Antinutritional factors/ Lathyrus sativus/ Amino acids/ Amino acids reviews/ Aspartic acid/ ODAP toxicity/ Drugs/ Escherichia coli/ Glutamates/ Lathyrism mechanisms/ Lathyrism nutrition/ Lathyrism ODAP toxicity/ Lathyrus toxicity/ Mechanisms toxicity/ Metabolism Mutants/ Nervous system/ Neurology/ NeuroToxin/ Nutrition/ ODAP/ Oxalates/ Poultry/ Review/ Toxicity ODAP/ Toxicity L. sativus Toxicity L. sativus mechanisms/ Toxicity L. sativus poultry/ Toxicity mechanism ODAP/ Toxicity/ Toxin/ Vegetables.
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 NPAA toxicity DABA toxicity/ Lathyrism review/ Review lathyrism/ Thyroxin protective role/ Neurology/ DABA/ Dissertations/ Distribution plants/ Lathyrism/ Neurolathyrism/ NPAA/ NPAA review/ Review/ Toxicity.
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 Source: Medline (70-73) 73155541  
 Genetics/ Adolescence/ Child/ India/ Lathyrism chemically induced/ Lathyrism epidemiology/ Lathyrism genetics/ Middle Age/ Lathyrism complications/ Muscle Spasticity etiology/ Age/ Epidemiology lathyrism/ India lathyrism/ Lathyrism/ Lathyrism Adolescence/ Lathyrism etiology/ Lathyrism India/ Humans/ Muscles/ Muscle spasticity/ Paraplegia/ Spasticity/ Spastic paraplegia.
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 Source: Medline (70-73) 73155540  
 Cerebral Cortex pathology/ Chickens/ Disease Models Animal/ Lathyrism pathology/ Spinal Cord pathology/ Lathyrism complications/ Muscle Spasticity etiology/ Neurology/ Cerebral Cortex/ Lathyrism/ Lathyrism animals/ Lathyrism etiology/ Models/ Muscles/ Muscle spasticity Neurolathyrism/ Paraplegia/ Poultry/ Spasticity/ Spinal cord.
- Aall, C. (1974). **Report on lathyrism.** Dhaka.  
 Source: ref ex Kaul et al. (1989)  
 Lathyrism Bangladesh/ Bangladesh lathyrism/ Bangladesh/ Lathyrism/ Reports.
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 Source: reprintDE  
 Lathyrism review/ Review lathyrism/ Osteolathyrism review/ Review Lathyrus odoratus toxicity/ Toxicity L. odoratus/ Lathyrus odoratus Osteolathyrism/ Lathyrism/ Lathyrus toxicity/ Review/ Toxicity Osteolathyrism/ Toxicity/ reprint.
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 Source: Medline 75082682  
 Avidin analysis/ Cardiac Glycosides analysis/ Cyanosis etiology/ Diet/ Environmental Pollution/ Ergot Alkaloids analysis/ Favism etiology Food Additives/ Food Analysis/ Food Contamination/ Food Microbiology/ Food Preservation/ Food Processing Industry/ Goitre etiology Lathyrism etiology analysis/ Mercury analysis/ Pesticide Residues analysis/ Plants Edible/ Selenium analysis/ Toxin analysis/ Food Poisoning Antinutritional factors/ Agriculture/ Glycosides/ Mycotoxins/ Alkaloids/ Cardiac glycosides/ Contamination/ Environment/ Favism/ Food/ Food

processing/ Goitre/ Heavy metals/ Lathyrism/ Lathyrism mycoToxin/ Lathyrism nutrition/ Meat/ Mercury/ Metals/ Microbiology/ Nutrition Pesticides/ Pollution/ Processing/ Review/ Selenium/ Toxin/ Trace elements.

Das, A. D.; Sahani, K., and Medda, A. K. (1974). **Incidence of lathyrism in man.** Indian Journal of Physiology and Allied Sciences **28**:100-

Lathyrism India/ India lathyrism/ Incidence/ India/ Lathyrism/ Humans/ Physiology not plant.

Gottwald, W. and Benos, J. (1974). **Die neurologischen und psychiatrischen Syndrome der Sklerodermie [Neurological and psychological syndromes of scleroderma].** Fortschritte Der Neurologie-Psychiatrie Und Ihrer Grenzgebiete **42** (5):225-263

Source: Medline 74294586

Brain Diseases complications/ Diagnosis Differential/ Epilepsy complications/ Lathyrism diagnosis/ Raynaud's Disease complications Scleroderma Circumscribed diagnosis/ Scleroderma Systemic diagnosis/ Spinal Cord Diseases complications Disorders complications/ Nervous system diseases complications/ Scleroderma Circumscribed complications/ Scleroderma Systemic complications/ Neurology/ Syndrome/ Brain Brain diseases/ Diagnosis/ Lathyrism/ Lathyrism complications/ Mental/ Nervous system/ Psychology/ Spinal cord/ Nervous system diseases.

Powell, G. F.; Rasco, M. A., and Maniscalco, R. M. (1974). **A prolidase deficiency in man with iminopeptiduria.** Metabolism **23** (6):505-513

Source: Medline 74163833

Bioassay/ Child/ Chromatography Thin Layer/ Dansyl Compounds/ Diagnosis Differential/ Dipeptidases blood/ Erythrocytes enzymology Leukocytes enzymology/ Metabolism Inborn Errors complications/ Metabolism Inborn Errors diagnosis/ Peptides isolation and purification Peptides urine/ Proline urine/ Proteinuria diagnosis/ Time Factors/ Aminoaciduria Renal etiology/ Dipeptidases metabolism/ Lathyrism enzymology/ Metabolism Inborn Errors enzymology/ Syndrome/ Blood/ Chromatography/ Chromosomes/ Chromosome aberrations/ Deficiency Diagnosis/ Enzymes/ Erythrocytes/ Isolation/ Lathyrism/ Lathyrism Bioassay/ Lathyrism complications/ Lathyrism diagnosis/ Lathyrism etiology/ Humans/ Metabolism/ Peptides/ Proline/ Purification.

Strong, F. M. (1974). **Toxicants occurring naturally in foods.** Nutrition Reviews **32** (8):225-231

Source: Medline 74287281

Alkaloids/ Biotransformation/ Child/ Fish Products/ Food Additives/ Food Analysis/ Lathyrism etiology/ Mercury/ Nitriles/ Oxalates/ Plants Edible/ Solanine/ Terpenes/ Thioglycosides/ Thyroid Antagonists/ Food Poisoning/ Poisons analysis/ Toxin analysis/ Antinutritional factors Glycosides/ Mycotoxins/ Fish/ Food/ Heavy metals/ Lathyrism/ Lathyrism mycoToxin/ Lathyrism nutrition/ Humans/ Metals/ Nutrition/ Review Toxin.

Anonymous (1975). **Outbreak of paralysis in some villages of Unnao district, Uttar Pradesh A preliminary epidemiological study.** Lucknow, India: International Toxicology Research Center.

India lathyrism/ Lathyrism India/ India/ India Uttar Pradesh/ Lathyrism/ Paralysis/ Uttar Pradesh.

Deming, Q. B. (1975). **Hypertension and other risk factors.** Adv Exp Med Biol **63**:287-303

Source: Medline 76084882

Adult/ Age Factors/ Aged/ Atherosclerosis/ Blood Pressure/ Cholesterol blood/ Colchicine therapeutic use/ Cortisone therapeutic use Hypertension blood/ Hypertension complications/ Lathyrism complications/ Middle Age/ Rabbits/ Risk/ Sex Factors/ Hypertension physiopathology/ Rodents/ Age/ Blood/ Cholesterol/ Colchicine/ Hypertension/ Lathyrism/ Lathyrism Aged/ Lathyrism physiopathology/ Sex.

Dwivedi, M. P. and Mishra, S. S. (1975). **Recent outbreak of lathyrism and experience with propagation of detoxified Lathyrus sativus.** Proc. Nutr. Soc. India **19**:23-30

Lathyrism India/ India lathyrism/ Lathyrus sativus low ODAP/ Lathyrus sativus detoxification/ Detoxification L. sativus/ Lathyrus sativus Detoxification/ India/ India L. sativus/ Lathyrism.

Haskell, B. E. (1975). **The food that cripples.** Ill Res **17** (1):12-13 (author affiliation: Illinois, Agricultural Experiment Station/DNAL 100-IL64 Experiment-Station-State-Agricultural)

Source: Agricola (70\_78) CAIN 759027035

India lathyrism/ Lathyrism India/ Lathyrus sativus human consumption/ Human consumption L. sativus/ Lathyrus sativus/ Agriculture/ Food Human consumption/ India/ India L. sativus/ India L. sativus consumption/ Lathyrism/ Humans.

Johnstone, P (1975). **Tradition in Arabic medicine.** Palestine Exploration Quarterly **Jan-June**:23-37.

Includes (pp.33-34) a description by IBN JULJUL of lathyrism arising from excessive eating of Lathyrus sativus. IBN JULJUL. [Suppl. to Arabic tr. of the Herbal of Dioscurides. Bodleian MS Hyde, 34.] Note on lathyrism in Ibn Juljul's additions to a team tr. of Dioscorides' Materia Medica, at Cordova in the 950s CE. (G.F. Hourani, 1970, The early growth of the secular sciences in Andalusia, *Studia Islamica*, 32: 143-56, pp. 147, 151-2, 155-6).

Dioscorides/ Lathyrism/ Arabic medicine/ History.

Keeler, R. F. (1975). **Toxins and teratogens of higher plants.** Lloydia **38** (1):56-86

Source: Medline 75155362

Alkaloids/ Animal Diseases etiology/ Atropine/ Cardiac Glycosides/ Chemistry/ Lathyrism etiology/ Plant Poisoning etiology/ Protoveratrine Senecio/ Sparteine/ Steroids/ Teratogens pharmacology/ Terpenes/ Thiocyanates/ Tomatine/ Toxin pharmacology/ Tropanes/ Plants/ Teratogens

Antinutritional factors/ Beta aminopropionitrile/ Glycosides/ Aminopropionitriles/ Lathyrism/ Lathyrism animals/ Phytochemistry/ Plant poisoning/ Nicotiana/ BAPN/ Toxin.

López Aydillo, N. R. (1975). **I. A Proposito de la probable etiologia de la caida del vello en los enfermos latiricos espanoles. Resultado de la investigacion de toxinas en los hongos que se desarrollan en la superficie externa de las semillas del Lathyrus sativus (almortas).** [Propable etiology of alopecia in Spanish lathyric patients. Results of studies on fungal toxins developed on the exterior surface of the seed of *Lathyrus sativus* (blue vetch)]. Arch. Neurobiol. Madr **38** (4):321-54

Source: reprintDE

Animal/ Female/ Males/ Mice/ Alopecia/ Brain/ Lathyrus sativus microbiology/ Lathyrism mycotoxins/ Penicillium/ Isolation/ Purification Microbiology L. sativus/ Mycotoxins L. sativus/ Rodents/ Neurology/ Antinutritional factors/ Lathyrus sativus/ Mycotoxins/ Fungi/ Mycology Isolation/ Lathyrism/ Lathyrism animals/ Lathyrism etiology/ Microbiology/ Seed/ Spain/ Spain L. sativus/ Toxin/ reprint.

Novack, R. (1975) **The metabolism of sulfated mucopolysaccharide in experimental lathyrism.** [Phd thesis]: Temple University, 83 pp.

Biochemistry/ Osteolathyrism/ Dissertations/ Distribution plants/ Experimental lathyrism/ Lathyrism/ Lathyrism Biochemistry/ Lathyrism experimental/ Lathyrism France/ Metabolism.

Rao, S. L. N. (1975). **Metabolism of BOAA, the Lathyrus sativus neurotoxin.** Proc. Nutr. Soc. India **19**:31-34

Source: ref ex Kaul et al. (1989)

ODAP metabolism/ Lathyrism metabolism/ Lathyrism physiology/ Lathyrism biochemistry/ Lathyrus sativus/ India/ India L. sativus/ India lathyrism/ Lathyrism/ Lathyrism India/ Metabolism/ Neurotoxins/ ODAP/ Plant physiology.

Singh, L. (1975). **Lathyrus (khesari/teoda) cultivation in Madhya Pradesh and prevention of lathyrism.** Technical Bulletin, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, M. P., India **26**:pp 16.

Laxman Singh. 1975. "Lathyrus (Khesari/Teoda) Cultivation in Madhya Pradesh." Tech. Bull. 26. JNKW, Jabalpur.

Source: ref ex Lal and Swarup (1989), reprintDE

Lathyrus sativus cultivation/ India L. sativus production/ Lathyrus sativus production/ Lathyrus sativus/ Cultivation/ India/ India L. sativus/ India Madhya Pradesh/ India L. sativus production/ India lathyrism/ Khesari/ Lathyrism/ Lathyrism India/ Lathyrism prevention/ Madhya Pradesh/ Prevention lathyrism/ Lathyrism prevention/ reprint.

Aall, C. (1976). **Report on lathyrism investigation, visit to Kustia district.** Dhaka: FAO/UNDP.

Source: ref ex Haque and Mannan (1989)

Lathyrism Bangladesh/ Bangladesh lathyrism/ FAO/ Bangladesh/ Lathyrism/ Reports.

Chowdhury, L. N. (1976) **Reactions of collagen and ground substance in experimental lathyrism in the rat.** [PhD thesis]: University of Illinois At Chicago, Health Sciences Center, 170 pp.

Osteolathyrism/ Dissertations/ Distribution plants/ Experimental lathyrism/ Lathyrism/ Lathyrism experimental/ Lathyrism France/ Lathyrism rats/ Rats/ Rodents.

Geiger, B. J.; Steenbock, H., and Parsons, H. T. (1976). **Nutrition Classics. The Journal of Nutrition** **6:427-442, 1933. Lathyrism in the rat.** Beatrice J. Geiger, Harry Steenbock, and Helen T. Parsons. Nutrition Reviews **34** (8):240-241

Source: Medline 77012095

History of Medicine 20th Cent/ Rats/ Wisconsin/ Lathyrism history/ Rodents/ History/ Lathyrism/ Lathyrism nutrition/ Lathyrism rats/ Nutrition Review.

Hirano, A.; Llena, J. F.; Streifler, M., and Cohn, D. F. (1976). **Anterior horn cell changes in a case of neurolathyrism.** Acta Neuropathol Berl **35** (4):277-283

Light and electron microscopic studies were made of the anterior horn cells in a case of neurolathyrism. Eosinophilic inclusions were observed at the light microscopic level. Fine structural study revealed the presence of two types of cytoplasmic inclusions. The first were aggregates of filaments, approximately 80-100 A in width, arranged in small bundles. The second were crystalloid structures composed of elongated elements, about 800 A wide, with hexagonal cross sections. The relationship to each other and the significance of these inclusions are unknown.

Source: Medline 76274380; Reprinted with permission Copyright 1976 Springer Verlag

Aged/ Cellular Inclusions ultrastructure/ Spinal Cord Diseases pathology/ Anterior Horn Cells ultrastructure/ Lathyrism pathology/ Motor Neurons ultrastructure/ Neurology/ Age/ Anterior horn/ Lathyrism/ Lathyrism Aged/ Motor neurons/ Neurolathyrism/ Neurons/ Spinal cord.

Natarajan, K. R. (1976). **India's poison peas.** Chemistry **49**:12

Lathyrus sativus toxicity/ Lathyrism/ Lathyrus sativus/ Chemistry/ India/ India L. sativus/ India lathyrism/ Lathyrism India/ Lathyrus toxicity Poison/ Toxicity L. sativus/ Toxicity.

Raloff, J. (1976). **Poison Peas around the world**. Chemistry, Vol. 49, p. 6.

Source: CGC\_95\_2

Lathyrism/ Lathyrus spp toxicity/ Chemistry/ Lathyrus spp/ Lathyrus toxicity/ Poison/ Toxicity Lathyrus spp/ Toxicity.

Schilling, E. D. and Strong, F. M. (1976). **Nutrition Classics. Journal of the American Chemical Society 76: 2848, 1954. Isolation, structure and synthesis of a Lathyrus factor from L. odoratus.** Nutrition Reviews **34** (8):242

Source: Medline 77012096

Beta aminopropionitrile isolation and purification/ Chemistry/ Glutamates/ Lathyrism history/ Lathyrus odoratus/ Beta aminopropionitrile Aminopropionitriles/ History/ Isolation/ Lathyrism/ Lathyrism nutrition/ Nutrition/ Purification/ Review/ BAPN.

Streifler, M.; Arlazoroff, A.; Kessler, A., and Cohn, D. F. (1976). **[The lower motor neuron in chronic neurolathyrism]. Harefuah 90** (10):479-480

Source: Medline 77004495

Lathyrism electromyography/ Lathyrism pathology/ Lathyrism complications/ Lathyrism motor Neurons/ Lathyrism paraplegia etiology Lathyrism spasm etiology/ Neurology/ Electromyography/ Lathyrism/ Lathyrism etiology/ Motor neurons/ Neurolathyrism/ Neurons/ Paraplegia Spasm/ Spasticity.

Aall, C. (1977). **Report II on lathyrism in Bangladesh with suggestion for action plan**. Dhaka: FAO UNDP.

Source: ref ex Haque and Mannan (1989)

Lathyrism Bangladesh/ Bangladesh lathyrism/ FAO/ Bangladesh/ Lathyrism/ Reports.

Anonymous (1977). **Report on lathyrism in the Fogera area of Gondar administrative region**. Addis Ababa, Ethiopia: The Rehabilitation Agency for the Disabled, Ministry of Labour and Social Affairs.

Source: ref ex Tekle-Haimanot (1989)

Lathyrism Ethiopia/ Ethiopia lathyrism/ Ethiopia/ Lathyrism/ Rehabilitation/ Reports.

Cohn, D. F.; Streifler, M., and Schujman, E. (1977). **Das motorische Neuron im chronischen Lathyrismus. [The motor neuron in chronic neurolathyrism (author's transl).** Nervenarzt **48** (3):127-129

Source: Medline 77171469

Anterior Horn Cells pathology/ Chronic Disease/ Electromyography/ Leg innervation/ Lipofuscin/ Middle Age/ Motor Neurons pathology Muscular Atrophy etiology/ Muscular Atrophy physiopathology/ Neural Conduction/ Paralysis/ Lathyrism physiopathology/ Motor Neurons Neurology/ Age/ Anterior horn/ Lathyrism/ Lathyrism electromyography/ Lathyrism etiology/ Lathyrism motor neurons/ Lathyrism pathology Motor neurons/ Muscles/ Neural/ Neurolathyrism/ Neurons.

Kulkarni, S. W.; Attal, H. C., and Chouby, B. S. (1977). **An epidemiological study of lathyrism in Amagaon block of Bhandara district.** Indian Journal of Medical Research **66** (4):602-610

Source: Medline 78128932

Adolescence/ Adult/ Aged/ Child/ Child Preschool/ India/ Lathyrism prevention and control/ Middle Age/ Lathyrism epidemiology/ Age Epidemiology lathyrism/ India lathyrism/ Lathyrism/ Lathyrism Adolescence/ Lathyrism Aged/ Lathyrism India/ Lathyrism prevention/ Humans Prevention lathyrism/ Lathyrism prevention.

Lakshmanan, J. and Padmanaban, G. (1977). **Studies on the tissue and subcellular distribution of beta-N-oxalyl L alpha,beta diamino propionic acid, the Lathyrus sativus neurotoxin.** Journal of Neurochemistry **29** (6):1121-1125

Source: Medline 78088661

Haplorhini/ Lathyrism chemically induced/ Rats/ Amino acids Diamino metabolism/ Brain metabolism/ Neurotoxins metabolism/ Plants Toxic Spinal Cord metabolism/ Synaptosomes metabolism/ Rodents/ Neurology/ Lathyrus sativus/ Synaptosomes/ Amino acids/ Brain/ Lathyrism Lathyrism rats/ Lathyrus toxicity/ Metabolism plant/ Neurotoxins/ Spinal cord/ Synapses/ Tissue/ Toxicity L. sativus/ Toxicity.

Streifler, M.; Cohn, D. F.; Hirano, A., and Schujman, E. (1977). **The central nervous system in a case of neurolathyrism.** Neurology **27** (12):1176-1178

We examined the central nervous system of a 67-year-old man who showed symptoms of lathyrism after being imprisoned at age 35 and fed on a diet of chick peas, *Lathyrus sativus*. The most obvious changes were loss of axons and myelin in the pyramidal tract in the lumbar spinal cord. These alterations correlated with spastic paraparesis. Other changes at the same level were a mild degree of degeneration of anterior horn cells. Pallor of Goll's tracts and axonal swelling in Goll's nuclei were also observed. A few examples of senile plaques and neurofibrillary tangles were observed in Ammon's horn.

Source: Medline 78051413

Lathyrism Aged/ Lathyrism hippocampus pathology/ Lathyrism etiology/ Lathyrism medulla oblongata pathology/ Lathyrism motor Neurons pathology/ Lathyrism nerve degeneration/ Lathyrism pyramidal tracts pathology/ Lathyrism central Nervous system pathology/ Lathyrism pathology/ Neurology/ Lathyrus sativus/ Axons/ Lathyrism symptoms/ Age/ Anterior horn/ Central Nervous system/ Chickens/ Diet Hippocampus/ Lathyrism/ Lathyrism hippocampus/ Humans/ Medulla/ Motor neurons/ Myelin/ Nerves/ Nervous system/ Neurolathyrism Neurons/ Nuclei/ Pyramidal tract/ Spasticity/ Spastic paraparesis/ Spinal cord/ Symptoms lathyrism.

Attal, H. C.; Kulkarni, S. W.; Chouby, B. S.; Palkar, N. D., and Deotale, P. G. (1978). **A field study of lathyrism - some clinical aspects.** Indian Journal of Medical Research **167**:608-615

Source: reprintDE

Lathyrism India/ Lathyrism diagnosis/ Lathyrism therapy/ Lathyrism epidemiology/ Lathyrus sativus toxicity/ Lathyrus sativus/ Lathyrism symptoms/ Diagnosis/ Epidemiology lathyrism/ India/ India L. sativus/ India lathyrism/ Lathyrism/ Lathyrus toxicity/ Symptoms lathyrism Toxicity L. sativus/ Toxicity/ reprint.

Cohn, D. F.; Streifler, M.; Zamir, R.; Kott, E., and Rinot, Y. (1978). **HLA antigens in neurolathyrism.**

Neurology India **26** (2):55-57

Source: Medline 79053352

Aged/ Chronic Disease/ Middle Age/ Paralysis immunology/ HLA Antigens/ Lathyrism immunology/ Muscle Spasticity immunology Neurology/ Age/ Antigens/ HLA/ Immunology/ India/ India lathyrism/ Lathyrism/ Lathyrism Aged/ Lathyrism India/ Muscles/ Muscle spasticity/ Neurolathyrism/ Paralysis/ Spasticity.

Deshmukh, P. and Taylor, J. J. (1978). **Neurofibrillary tangles in experimental neurolathyrism in rats induced by imino dipropionitrile (IDPN). 1. Fine structural changes in the spinal cord and dorsal root ganglia.** Acta Neuropathol Berl **41** (1):17-22

Anterior horns of the spinal cord from cervical and lumbar regions and dorsal root ganglia from these same levels were studied for ultrastructural changes in imino-dipropionitrile (IDPN) treated rats. Normal saline-injected rats, treated identically, served as controls for this study. In the spinal cord axonal balloons or dystrophic axons appeared in lightly myelinated or unmyelinated axons within 24 h after the third injection of IDPN. At this time hind leg paralysis had not yet developed. In addition to axonal changes, a few dendrites also showed neurofibrillary degeneration. Central chromatolytic changes were observed in most of the neurons, with evidence of generalised oedema present within the cord. In the dorsal root ganglia axonal balloons were very prominent and showed neurofibrillary hypertrophy. Neurofibrillary material was also noted in the perikarya of medium-sized ganglion cells.

Source: Medline 78141459; Reprinted with permission Copyright 1978 Springer Verlag

Dendrites/ Edema/ Hypertrophy/ Lathyrism etiology/ Microscopy Electron/ Nervous system diseases chemically induced/ Neurofibrils/ Nitriles Rats/ Time Factors/ Ganglia Spinal pathology/ Lathyrism pathology/ Nervous system diseases pathology/ Spinal Cord pathology/ Rodents Neurology/ Axons/ Ganglia/ Injections/ Lathyrism/ Lathyrism rats/ Microscopy/ Nervous system/ Neurolathyrism/ Neurons/ Oedema/ Paralysis Roots/ Spinal cord/ Nervous system diseases.

Gebre-Ab, T.; Wolde-Gabriel Z.; Maffi, M.; Ahmed, Z.; Ayele, T. M., and Fanta, H. (1978).

**Neurolathyrism-a review and a report of an epidemic.** Ethiopian Medical Journal **16** (1):1-11

Ethiopia lathyrism/ Lathyrism Ethiopia/ Neurology/ Ethiopia/ Lathyrism/ Lathyrism review/ Neurolathyrism/ Reports/ Review.

Hamilton, D. (1978). **Some experience with paraplegia in a small hospital in Nepal.** Paraplegia **15** (4):293-301

Paraplegia is a common problem in developing countries. They are the most pitiable group of cases seen, but they can all be offered some help, however limited one's resources. The main causes are Potts Disease, arachnoiditis, tropical spastic paraplegia, trauma, lathyrism and cord compression. The usual trauma is falling from trees and the use of trained monkeys to gather leaves and nuts whilst humorous should not be dismissed. The author saw some 35 cases of paraplegia, of which four are described--two good results and two bad. The physician going to a developing country is advised to prepare himself for the care of these cases and to be prepared to motivate staff, patients and relatives. He will find local medical assistants are kind and enthusiastic and rapidly acquire the necessary skills. Nearly all cases should receive a simple and inexpensive anti-tuberculous regime, vitamins and a very generous diet. Necessary equipment required for the home should be locally made and nothing requiring more than simple maintenance should be used.

Source: Medline 78115080; Reprinted with permission. Copyright (1978) Stockton Press

Adult/ Child/ Nepal/ Paraplegia etiology/ Paraplegia therapy/ Diet/ Lathyrism/ Lathyrism etiology/ Lathyrism therapy/ Leaves/ Humans Paraplegia/ Primates/ Spasticity/ Spastic paraplegia/ Tropics/ Vitamins.

López Aydillo, N. R. and Ramirez Gomez, C. (1978). **II. Probable etiologia de la alopecia en los enfermos latiricos espanoles. Resultado de la investigacion de toxinas en los hongos que se desarrollan en la superficie externa de las semillas del 'Lathyrus sativus' (almortas). [II. Probable etiology of alopecia in the Spanish lathyrus patients. Results of study of toxins in fungi that develop in the external surface of the seeds of Lathyrus sativus].** Arch. Neurol. Madr **41** (6):461-486

Source: Medline 79081526, reprintDE

Aflatoxins analysis L. sativus/ Microbiology L. sativus/ Legumes toxins/ Mice/ Penicillium isolation and purification/ Pruritus chemically induced/ Seed/ Alopecia chemically induced/ Food Contamination mycotoxins/ Lathyrism complications/ Spain lathyrism/ Lathyrism Spain Rodents/ Antinutritional factors/ Lathyrus sativus/ Mycotoxins/ Aflatoxins/ Alopecia/ Contamination/ Food contamination/ Food/ Fungi Mycology/ Isolation/ Lathyrism/ Lathyrism etiology/ Lathyrism mycotoxins/ Microbiology/ Penicillium/ Purification/ Spain/ Spain L. sativus Toxin/ reprint.

Ramachandran, L. K. (1978). **Lathyrus: The sinister seed.** Scientific Reports of the Indian Agricultural Research Institute **15**:99-.

was cited as Sci. Rep.

Lathyrus sativus toxicity/ Lathyrism India/ India lathyrism/ Lathyrus sativus/ Agriculture/ Toxicity/ India/ India L. sativus/ Lathyrism/ Lathyrus toxicity/ Reports/ Seed/ Toxicity L. sativus.

Somogyi, J. C. (1978). **Natural toxic substances in food.** World Review of Nutrition and Dietetics **29**:42-59  
Source: Medline 78206461

Cinnamates pharmacology/ Favism etiology/ Lathyrism etiology/ Phenols pharmacology/ Thiamine antagonists and inhibitors/ Toxin analysis Food Analysis/ Antinutritional factors/ Favism/ Food/ Lathyrism/ Lathyrism nutrition/ Lathyrism review/ Nutrition/ Phenols/ Review/ Thiamine Toxic substances/ Toxin.

Culebras, A. (1979). **Chick peas and neurolathyrism [letter].** Neurology **29** (3):424

Source: Medline 79200072

Lathyrism etiology/ Legumes poisoning/ Neurology/ Chickens/ Lathyrism/ Neurolathyrism.

Liener, I. E. (1979). **Significance for humans of biologically active factors in soybeans and other food legumes.** Journal of the American Oil Chemist's Society **56** (3):121-129

Source: Medline 80138242

Biological Availability/ Cyanides/ Dietary Proteins/ Favism etiology/ Lathyrism etiology/ Lectin/ Plants Toxic/ Thyroid Antagonists/ Legumes Nutrition/ Antinutritional factors/ Trypsin inhibitor/ Protease inhibitor/ Diet/ Favism/ Food/ Glycine max/ HCN/ Dietary/ Lathyrism/ Lathyrism nutrition/ Humans/ Protein.

Mehta, T.; Zarghami, N. S.; Parker, A. J.; Cusick, P. K., and Haskell, B. E. (1979). **Neurotoxicity of orally or intraperitoneally administered L-3-oxalylamino-2-aminopropionic acid in the mouse.** Toxicology and Applied Pharmacology **48**:1-9

ODAP oral toxicity/ Bioassay mouse/ Rodents/ ODAP intraperitoneal toxicity/ Lathyrism ODAP toxicity/ Neurology/ Bioassay/ Lathyrism Lathyrism Bioassay/ Mice/ Neurotoxicity/ ODAP/ Toxicity ODAP/ Toxicity rodents bioassay/ Toxicity.

Bhat, R. V. and Krishnamachari, K. A. V. R. (1980). **Social management of lathyrism and venoocclusive disease in Madhya Pradesh.** Hyderabad, India: Food and Drug Toxicology Research Centre.

Source: ref ex Kaul et al. (1989)

Lathyrism prevention/ Lathyrism India/ India lathyrism/ Lathyrism socioeconomics/ Socioeconomics lathyrism/ Economics/ Drugs/ Food/ India India Madhya Pradesh/ Lathyrism/ Lathyrism economics/ Madhya Pradesh/ Management/ Prevention lathyrism.

Bhuiyan, A. Q. and Sarker, P. C. (1980). **Socio-economic conditions of lathyrism-affected families in Rajshahi and Kushtia districts.** Rajshahi: Shaw Unnayan.

Source: ref ex Kaul et al. (1989); NAL Call No RA1242 L35B48 1980

Lathyrism socioeconomics/ Socioeconomics lathyrism/ Bangladesh lathyrism/ Lathyrism Bangladesh/ Economics/ Bangladesh/ Lathyrism Lathyrism economics.

Borg, J.; Bakri, S., and Mazars, G. (1980). **A propos de la neurotoxicité de *Lathyrus sativus* L., plante alimentaire et médicinale de l'Inde.** Actes du Colloque sur les médecines traditionnelles de l'Asie, in Paris. Published in Strasbourg.

Source: Grmek (1980)

Lathyrism/ Lathyrism India/ India lathyrism/ History lathyrism/ Lathyrism history/ Lathyrus sativus/ Medicinal properties/ Traditional medicine.

Grmek, M. D. (1980). **La légende et la réalité de la nocivité des fèves [Legend and reality in relation to the toxicity of *Vicia faba*].** Pubbl. Stn. Zool. Napoli. II **2** (1):61-121 (author affiliation: École Partique de Hautes Etudes, 22, rue des Écoles, 75005 Paris, France)

[French] This paper reviews in detail the classical, historical, esoteric and scientific literature related to Favism and the Pythagorean ban on *Vicia faba* (kúamon apéchesthai - abstine from faba beans). It is an excellent source of citations. On pp. 80-87 a section titled "Aveuglement prudent des médecins et constat hippocratique du lathyrisme" lathyrism is discussed. P. 83 Citation of a passage from Hippocrates Epidemics [epédemies, livre II, répété dans livre VI; book II, repated in Book IV] A Ainos, lors d'une famine, ceux qui mangeaient continuellement des légumineuses devinrent impotens des membres inférieurs; cela persista; de plus, ceux qui mangeaient de l'ers eurent douleur aux genoux [ Epid. II 4,3 (Littré V 126) et Epid. VI 4, 11 (Littré V 310) ; translation differs sensibly from that of Littré]. Translated into English this reads: During famine at Ainos those who continuously ate legumes developed impotence of the lower limbs. This persisted. Others, who ate *Vicia ervilia* suffered pain in their knees." Ainos was a village in Thrace, the epidemic [dated to the last decade of the 5th century B.C. or first part of 4th century ; Grmek, M.D. (1980) La description hippocratique de la toux épidémique de Périnthe. Hippocratica, Paris pp. 199-221 [particularly pp.211-216]] was associated with war and economic deterioration [May, J.M.F (1950) Ainos, its history and coinage, Oxford, Oxford University Press]. Two terms are used in the greek text. Orobophagéontes and

ospriophagéontes [Orobos eaters, ospria eaters]. Galen in his commentary of Hippocrates [Galen, In Hippocratis libros I et II Epidemiarum commentaria. ; the famine in Ainos is not known in arabic translations, see Wenkebach, E. and Pfaff, F. (1934) *Corpus Medicorum Graecorum* V 10, 1, Leipzig and Berlin, Teubner] interpreted ospria as legumes which are not habitually used for the preparation of bread. Orobos = *Vicia ervilia* Willd. [used by Theophrastus and Dioscorides]. The symptom of knee pain is too general to allow any valuable conclusions regarding its etiology. A definite paraplegia following the ingestion of legumes, however, can be attributed retrospectively to the consumption of *Lathyrus* spp. [*L. sativus*, *L. cicera*, [D.E. addendum *L. clymenum*]]. The use of *Lathyrus sativus* as food in the graeco-roman world (André, 1961, p.38) is also attested by the comic poets [Anaxandrides, frgm. 41, 43; Alexis, frgm. 162, 12].

Source: reprintDE\_2001

Greece/ History of Medicine/ Ancient History/ Human/ Rome/ Favism/ Legumes/ adverse/ effects/ *Vicia/ V. faba/ Lathyrism/ Vicia ervilia Lathyrus sativus/ Dioscorides/ Hippocrates.*

Gupta, Y. P. (1980). **Khesari Dal consumption- A health hazard.** *Indian Farming*, Vol. 30, pp. 7-9.

*Lathyrus sativus* toxicity/ Lathyrism India/ India lathyrism/ *Lathyrus sativus* human consumption/ Human consumption *L. sativus/ Lathyrus sativus/ Dhal/ Human consumption/ India/ India L. sativus/ India L. sativus consumption/ Khesari/ Lathyrism/ Lathyrus toxicity/ Humans Toxicity L. sativus/ Toxicity.*

Librach, I. M. (1980). **Lathyrism.** *Br J Clin Pract* 43 (4):118-120

Source: Medline 80242455

Middle Age/ Paraplegia etiology/ Lathyrism complications/ Age/ Lathyrism/ Lathyrism etiology/ Paraplegia.

Padmanaban, G. (1980). **Lathyrogens.** [Chap 8 in] Liener, I. E. (Ed). **Toxic constituents of Plant foodstuffs**, 2nd. edn. ed., N.Y.: Academic Press, pp. 239-261.

Source: reprintDE

*Lathyrus sativus* toxicity/ Lathyrism review/ NPAA review/ Legume toxins/ Review/ Antinutritional factors/ *Lathyrus sativus/ Lathyrism Lathyrogens/ Lathyrus toxicity/ NPAA/ Toxicity L. sativus/ Toxicity/ Toxin/ reprint.*

Schneider, G.; Ruther, W.; Klapproth, A., and Schott, K. J. (1980). **Untersuchungen ueber die Wirkung der 'neurolathyrogenen' Substanz beta,beta'-Iminodipropionitril auf den Salzkrebs *Artemia salina*.** [Studies on the effect of the neurolathyrogenic substance beta,betaiminodipropionitrile on the branchiopod *Artemia salina*]. *Arzneimittelforschung* 30 (4):592-593

beta,beta'-Iminodipropionitrile (IDPN) is a neurotoxic substance, which induces choreiform movements for life in rats and mice. As for the phenotype this seems to be a suitable animal model for the comparison with Huntington's chorea in man. In our experiments we have tested the effect of IDPN on different developmental stages of the branchiopode *Artemia salina*. One-day old nauplii show the strongest reaction to the substance. As little as 10(-5) g IDPN/l culture medium induces in one-day old nauplii a characteristically altered swimming behaviour. This behavioural response of the one-day old nauplii may possibly serve as a basis for a simple qualitative biological assay for the detection of IDPN or its effective metabolite, respectively.

Source: Medline 80242171

Aging/ Behaviour Animal drug effects/ Chemistry/ Mice/ Rabbits/ Swimming/ *Artemia salina* drug effects/ Lathyrism chemically induced Nervous system drug effects/ Nitriles pharmacology/ Rodents/ Bioassay nauplii swimming behaviour (*Artemia salina*)/ Neurology/ Bioassay Chorea/ Drugs/ Lathyrism/ Lathyrism animal models/ Lathyrism animals/ Lathyrism Bioassay/ Lathyrism rats/ Humans/ Models/ Nervous system/ Neurotoxins/ Nitriles/ Rats.

Sharma, N. K.; Jain, M. K.; Khanijo, S. K., and Choudhary, R. N. (1980). **A study of paraplegia.**

**Lathyrism. Clinal profile (Thesis).** Rewa: University of Rewa.

Lathyrism symptoms/ Lathyrism India/ Lathyrism symptoms/ India/ India lathyrism/ Lathyrism/ Paraplegia/ Symptoms lathyrism.

Weintroub, S.; Cohn, D. F.; Salama, R.; Streifler, M., and Weissman, S. L. (1980). **Skeletal findings in human neurolathyrisms. Is there a human osteolathyrisms?** *European Neurology* 19 (2):121-127

In a review of the roentgenological files of 22 patients suffering from spastic paraplegia due to neurolathyrisms, 3 patients were found to present abnormal skeletal findings. 2 patients showed absence of union of the secondary ossification centres of the iliac crests, the ischial tuberosities and the vertebral bodies. Their age at the time of ingestion of poisonous *Lathyrus sativus* plants was 19 and 20 years. The 3rd patient had bowing and thickening of his right femoral shaft. He was 22 years old at the time of poisoning. These findings which are similar to those found in experimental osteolathyrisms have never been described in clinical neurolathyrisms. They are of a nature to throw some doubt on the correctness of the currently prevailing concept of sharp distinction between these two pathological entities.

Source: Medline 80224764; Reprinted with permission Copyright 1980 S Karger AG, Basel, Switzerland  
Lathyrism complications/ Lathyrism radiography/ Lathyrism/ Neurology/ *Lathyrus sativus/ Osteolathyrisms/ Age/ Bones/ Lathyrism review Lathyrism skeletal/ Humans/ Neurolathyrisms/ Paraplegia/ Review/ Skeletal/ Spasticity/ Spastic paraplegia/ Switzerland.*

Ahmad, K. and Jahan, K. (1981). **Studies of neurolathyrism. First national seminar on lathyrism**, Dhaka. Source: ref ex Haque and Mannan (1989)  
Lathyrism Bangladesh/ Bangladesh lathyrism/ Neurology/ Bangladesh/ Lathyrism/ Neurolathyrism.

Anonymous (1981). First National Seminar on Lathyrism, in Dhaka University. Published in unpublished.  
Lathyrism/ Lathyrus/ Bangladesh/ Food/ Lathyrism Bangladesh/ Lathyrism nutrition/ Nutrition.

Bhuiyan, A. Q. (1981). **Lathyrism in Bangladesh: A study of the victim families. First national seminar on lathyrism**, Dhaka. Source: ref ex Haque and Mannan (1989)  
Lathyrism Bangladesh/ Bangladesh lathyrism/ Lathyrism socioeconomics/ Bangladesh/ Lathyrism.

Cohn, D. F. and Streifler, M. (1981). **Human neurolathyrism, a follow up study of 200 patients. Part I: Clinical investigation.** Schweiz Arch Neurol Neurochir Psychiatr **128** (1):151-156  
Two hundred patients with chronic neurolathyrism were clinically examined, 25 to 35 years after exposure to the Lathyrus sativus pea. All the patients were prisoners in a labour camp under similar nutritional and physical conditions at the outbreak of the syndrome. The main symptoms were spastic paraparesis and a neurogenic bladder, both of varying degree. In addition lower motor neuron involvement with muscular atrophies was noticed in 14 cases and simulated amyotrophic lateral sclerosis. A lathyrus sensory neuropathy was found in 12 patients. No cranial lesions or psychiatric disorders were found. Laboratory tests including 5 CSF specimens were normal. HLA typing was unremarkable. Our overall impression was that chronic neurolathyrism in the long run shows a gradually slow progressive course.

Source: Medline 81225713

Adult/ Aged/ Follow Up Studies/ Legumes/ Middle Age/ Muscle Spasticity diagnosis/ Nervous system diseases diagnosis/ Neuromuscular Diseases diagnosis/ Paralysis diagnosis/ Sensation/ Lathyrism diagnosis/ Neurology/ Lathyrus sativus/ Lathyrism symptoms/ Syndrome/ Age Amyotrophic lateral sclerosis/ cAMP/ Diagnosis/ HLA/ Lathyrism/ Lathyrism Aged/ Lathyrism motor neurons/ Humans/ Motor neurons Muscles/ Muscle spasticity/ Nervous system/ Neurolathyrism/ Neuromuscular/ Neurons/ Paralysis/ Physical/ Spasticity/ Spastic paraparesis Switzerland/ Symptoms lathyrism/ Nervous system diseases.

Cohn, D. F. and Streifler, M. (1981). **Human neurolathyrism, a follow up study. Part II: Special investigations.** Schweiz Arch Neurol Neurochir Psychiatr **128** (1):157-163  
Special investigations were undertaken in the group of patients suffering from chronic neurolathyrism as described in part one of our work. X-ray films of the skeleton were taken of 45 patients. Pathologic findings similar to experimental osteolathyrism were revealed in 5 patients. These observations have not been described before. Sural nerve biopsies were taken from three patients with lathyrus sensory neuropathy. Electron microscopy revealed mainly thick myelin sheaths which extended into the axonal regions. The picture is similar to the 'tomaculous' neuropathy of Bradley. The lower motor neuron was involved in a few cases, manifested by delayed nerve conduction time and muscular atrophies.

Source: Medline 81225714

Adolescence/ Adult/ Bone Diseases diagnosis/ Follow Up Studies/ Legumes/ Motor Neurons physiology/ Nervous system diseases diagnosis Neuromuscular Diseases diagnosis/ Sensation/ Lathyrism diagnosis/ Neurology/ Osteolathyrism/ Bones/ Diagnosis/ Lathyrism/ Lathyrism Adolescence/ Lathyrism motor neurons/ Humans/ Microscopy/ Motor neurons/ Muscles/ Myelin/ Nerves/ Nervous system/ Neurolathyrism Neuromuscular/ Neurons/ Physiology not plant/ Skeletal/ Switzerland/ Nervous system diseases.

Jenek, F.; Tekle Haimanot, R., and Hamory, B. H. (1981). **Nontraumatic adhesive archnoiditis as a cause of spinal cord syndromes.** Paraplegia **19**:140-154

Source: ref ex Tekle-Haimanot (1989)

Lathyrism related/ Neurology/ Lathyrism/ Paraplegia/ Spinal cord/ Syndrome.

Kaul, A. K. and Islam, M. Q. (1981). **Khesari (Lathyrus sativus) cultivation in Bangladesh and lathyrism.** Proc. First National Workshop on Pulses

Lathyrus sativus cultivation/ Lathyrism Bangladesh/ Lathyrus sativus/ Bangladesh/ Cultivation/ Grain legumes/ Pulses/ Grain legumes Bangladesh/ Khesari/ Lathyrism.

Lambein, F. and De Vos, B. (1981). **Lathyrism in young chicks induced by isoxazolin-5-ones from Lathyrus odoratus seedlings.** Archives Internationales De Physiologie, De Biochimie Et De Biophysique **88**:B66-67 (author affiliation: Laboratory of Physiological Chemistry, State University of Ghent, K.L. Ledeganckstraat 35, B-9000 Gent, Belgium)

NPAA toxicity/ Isoxazolin-5-one toxicity/ Bioassay poultry/ Poultry bioassay/ Seedling/ Lathyrus odoratus/ Bioassay/ Isoxazolin-5-one Agriculture/ Chemistry/ Belgium/ Lathyrism/ Lathyrism Bioassay/ Lathyrus toxicity/ NPAA/ NPAA chemistry/ Poultry/ Seedling chemistry Seedling NPAA/ Toxicity L. odoratus/ Toxicity.

Osmani, S. R. and Rahman, A. (1981). **A study on income distribution in Bangladesh.** Dhaka: Institute of Development Studies.

Source: ref ex Haque and Mannan (1989)

Lathyrism socioeconomics/ Socieconomics Bangladesh/ Economics/ Bangladesh/ Lathyrism/ Lathyrism Bangladesh/ Lathyrism economics.

Pearson, S. and Nunn, P. B. (1981). **The neurolathrogen, beta-N-oxalyl-L-alpha,beta-diaminopropionic acid, is a potent agonist at 'glutamate preferring' receptors in the frog spinal cord.** Brain Research **206** (1):178-82

A neurotoxic amino acid, beta-N-oxalyl-L-alpha,beta-diaminopropionate (beta-ODAP), found in seeds of *Lathyrus sativus* and a possible causative agent of neurolathyrism, was equipotent with kainate as a depolarizing agent of frog spinal cord ventral roots. beta-ODAP and kainate appeared to act on a common receptor, as their actions could not be differentiated pharmacologically. These results could explain some of the symptoms of neurolathyrism.

Source: Medline 81135095; Reprinted with permission Copyright 1981 Elsevier Science B.V., Amsterdam, Netherlands

Kainic Acid pharmacology/ Rana pipiens/ Rana temporaria/ Receptors Endogenous Substances drug effects/ Spinal Cord drug effects/ Amino acids Diamino pharmacology/ Receptors Endogenous Substances physiology/ Spinal Cord physiology/ ODAP/ Neurology/ Lathyrus sativus Bioassay/ Bioassay L. sativus/ Lathyrus sativus bioassay/ Lathyrism symptoms/ Amino acids/ Brain/ Drugs/ Endogenous/ Glutamates/ Kainic acid/ Lathyrism/ Lathyrism Bioassay/ Neurolathyrism/ Neurotoxins/ Physiology not plant/ Receptors/ Reptiles/ Roots/ Seed/ Spinal cord Symptoms lathyrism.

Schneider, G.; Oepen, H., and Klapproth, A. (1981). **The effect of the neurolathrogenic substance beta, beta' iminodipropionitrile (IDPN) on some biological parameters in rats and mice.** Gen Pharmacol **12** (2):109-114

getreprint.

Source: Medline 81139582

Aging/ Body Weight drug effects/ Drinking drug effects/ Eating drug effects/ Growth drug effects/ Lathyrism chemically induced/ Mice/ Organ Weight drug effects/ Rats/ Reproduction drug effects/ Species Specificity/ Chorea chemically induced/ Nitriles pharmacology/ Rodents/ Body weight/ Chorea/ Drugs/ Lathyrism/ Lathyrism rats/ Nitriles/ Reproduction.

Streifler, M. and Cohn, D. F. (1981). **Chronic central nervous system toxicity of the chickling pea (*Lathyrus sativus*).** Clinical Toxicology **18** (12):1513-1517

Source: Agricola (79-84) IND 82049554

Lathyrism pathology/ Lathyrism central Nervous system pathology/ Neurolathyrism/ Forced labor camp/ Toxicity/ Neurology/ Lathyrus sativus cAMP/ Central Nervous system/ Lathyrism/ Lathyrus toxicity/ Nervous system/ Toxicity L. sativus.

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Lathyrus sativus India/ India L. sativus/ Lathyrism India/ India lathyrism/ Lathyrus sativus/ Delhi/ Food/ Geography/ India/ Lathyrism Humans/ Paraplegia/ Protein/ Seed/ Spasticity/ Spastic paraplegia.

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Neurolathyrism is a disease that has crippled many thousands in the Indian subcontinent and elsewhere during the past several centuries (1). It struck poor people who used the seeds of *Lathyrus sativus* as the principal item in their diet continuously for a period of at least two to three months. The disease appeared to affect humans almost exclusively. No experimental animal model was available to facilitate biomedical research on the subject until recently, when we produced the condition in guinea pigs (2). When guinea pigs having a subacute deficiency of L-ascorbic acid were fed for four to five weeks on a diet of cooked *L. sativus* seeds supplemented with minerals and the usual vitamins except for L-ascorbic acid, they developed typical symptoms of neurolathyrism, affecting the hind limbs. The same condition also appeared within two to three hours following intraperitoneal administration of an extract of *L. sativus* (3) in guinea pigs previously made deficient in ascorbic acid by omitting it from a normal diet that did not include any *L. sativus* seeds. We further found that L-ascorbic acid not only protected the animals from the neurotoxic effect of *L. sativus*, but also had a curative effect on those that had earlier become paralysed by the toxicity of the seeds. We subsequently produced the same symptoms of neurolathyrism in monkeys made deficient in ascorbic acid by feeding them cooked *L. sativus* seeds or by administering extracts of *L. sativus* intraperitoneally. Thus, a subacute deficiency of L-ascorbic acid that was not severe enough to produce scorbutic symptoms was found to be a precondition for the appearance of neurolathyrism attributed to *L. sativus* seeds. This also explained the failure to produce experimental neurolathyrism in laboratory animals that do not require any dietary supply of L-ascorbic acid or that were provided this vitamin in the experimental diet before we suspected that its

deficiency could be a predisposing factor. Finally, a neurotoxin,  $\beta$ -N-oxalyl L -a,  $\beta$ -diamino propionic acid (ODAP), isolated from *L. sativus* seeds (4), was administered intraperitoneally in two-day-old chicks. It produced neurological symptoms such as retraction of the head and paralysis of the legs, indicating damage to the central nervous system. REFERENCES: 1. S. L.N. Rao, K. Malathi, and P.S. Sarma, *World Review of Nutrition and Dietetics*, 10: 214 (Karger, Basel, New York, 1969); 2. K. Ahmad and K. Jahan, *The Third Asian Congress of Nutrition*, Jakarta, Indonesia, 6-10 Oct. 1980, p. 190; 3. V. Nagarajan and C. Gopalan, "Production of Neurolathyrism in Chicks by Injection of *Lathyrus sativus* Concentrates," *Current Sci*, 32: 116(1963h); 4. S.L.N Rao, P.R. Adiga, and P.S. Sarma, "Isolation and Characterisation of  $\beta$ -N-oxalyl L a,  $\beta$ -diamino Propionic Acid, a Neurotoxin from Seeds of *Lathyrus sativus*," *Biochem.*, 3: 432 (1964).  
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One hundred and seventy two cultivars of Khesari (*Lathyrus sativus* L) were analysed for the lathyrism causing toxin, namely, B-N-oxalyl-L-L-B-diamino propionic acid (BOAA). Three cultivars having significantly lower toxin content were identified. No association was found between any of the agronomic or morphological character. BOAA content was not correlated with protein content in the grain. Low toxin content of lines was found to be suitable under varied environmental conditions.

Source: reprintDE

NPAA/ Screening/ Agronomy/ Bangladesh/ ODAP/ *Lathyrus sativus*/ Agriculture/ Genetic resources/ Cultivars/ Environmental variation ODAP/ Environment/ Khesari/ Lathyrism Bangladesh/ *Lathyrus sativus* agronomy/ Neurotoxins/ Protein/ Protein content/ Toxin/ reprint.

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Source: Medline 83107362

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Source: Medline 83211293

Genetics/ Adolescence/ Adult/ Aminopropionitrile poisoning/ Bone and Bones pathology/ Lathyrism genetics/ Lathyrism pathology/ Lathyrism diagnosis/ Toxicity/ Lathyrus sativus/ Aminopropionitriles/ Bones/ Diagnosis/ Lathyrism/ Lathyrism Adolescence/ Lathyrus toxicity/ BAPN Toxicity beta aminopropionitrile/ Toxicity L. sativus.

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Source: CGC\_95\_2

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Lathyrism/ Lathyrus sativus/ Lathyrism nutrition/ Nutrition.

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Lathyrus sativus India/ India L sativus/ Lathyrism review/ Lathyrus sativus/ Constraints/ Delhi/ Grain legumes/ Pulses/ Grain legumes India/ India/ India L. sativus production/ India lathyrism/ Lathyrism/ Lathyrism India/ Review.

Cohn, D. F. and Streifler, M. (1983). **Intoxication by the chickling pea (Lathyrus sativus): nervous system and skeletal findings.** Arch Toxicol Supplement 6:190-193

Two hundred patients with chronic neurolathyrism were examined 25-35 years after the appearance of signs and symptoms of intoxication of the chickling pea. Their daily food intake, in a German forced labor camp during World War II, consisted of 400 g Lathyrus sativus peas cooked in water plus 200 g bread baked of barley and straw. Apart from the classic signs of neurolathyrism, i.e., a spastic paraparesis, in five cases, the skeletal findings observed were similar to experimental osteolathyrism. There was an absence of ossification centers of the iliac crests, ischial tuberosities and vertebrae; and bowing with thickening of the femoral shaft also occurred. These bony changes in human lathyrism have not been described before.

Source: Medline 84023104; Reprinted with permission Copyright 1983 Springer Verlag

Adolescence/ Adult/ Bone Diseases radiography/ Follow Up Studies/ Middle Age/ Osteogenesis/ Bone Diseases etiology/ Lathyrism physiopathology/ Nervous system diseases etiology/ Neurology/ Lathyrus sativus/ Osteolathyrism/ Straw/ Agriculture/ Lathyrism symptoms Age/ Hordeum/ Bones/ Bread/ cAMP/ Food/ Forced labor camp/ Germany/ Intake/ Lathyrism/ Lathyrism Adolescence/ Lathyrism etiology Lathyrism radiography/ Lathyrism skeletal/ Lathyrus toxicity/ Humans/ Nervous system/ Neurolathyrism/ Skeletal/ Spasticity/ Spastic paraparesis/ Symptoms lathyrism/ Toxicity Osteolathyrism/ Toxicity L. sativus/ Toxicity/ Water/ Nervous system diseases.

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Among the many biologically active and potentially toxic factors known to be present in plant foodstuffs normally consumed by man, those that are present in legumes have received the most attention. Two categories of legume toxins will be considered - those whose effects have been extensively studied in experimental animals but whose significance in man must remain open to conjecture, and those which are known to produce toxic effects in man but whose identity remains uncertain because similar effects are not readily reproduced in animal models. The protease inhibitors have, over the years, been the object of much study in experimental animals where they have been observed to have an adverse effect on growth and to cause pancreatic enlargement. The relevance of these observations to human nutrition remains obscure, however, because of our lack of knowledge concerning the effect of soybean trypsin inhibitors on the human pancreas. Lectins from certain legumes such as the common bean (*Phaseolus vulgaris*) have been shown to be toxic to animals upon oral ingestion presumably because of the damage which they inflict upon binding to the cells lining the intestinal mucosa. Lectins may therefore be responsible for reported cases of human intoxication associated with the consumption of inadequately cooked beans. Lathyrism and favism are diseases in man which are associated with the consumption of *Lathyrus sativus* and *Vicia faba* respectively. Evidence leading to the probable identification of the causative factors of these diseases and the steps necessary for their elimination will be discussed.

Source: Medline 84023099; Reprinted with permission Copyright 1983 Springer Verlag  
Favism etiology/ Lathyrism etiology/ Lectin toxicity/ Protease Inhibitors toxicity/ Diet/ Food Contamination/ Antinutritional factors/ Trypsin inhibitor/ Protease inhibitor/ Lathyrus sativus/ Contamination/ Favism/ Food/ Glycine max/ Lathyrism/ Lathyrism animal models/ Lathyrism animals/ Lathyrism nutrition/ Lathyrus toxicity/ Lectin/ Humans/ Models/ Nutrition plant/ Nutrition animal/ Nutrition/ Phaseolus vulgaris Toxicity L. sativus/ Toxicity/ Toxin/ Vicia/ Vicia faba.

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Spencer, P. S. and Schaumburg, H. H. (1983). **Lathyrism: a neurotoxic disease**. Neurobehavioral Toxicology and Teratology 5 (6):625-629

Lathyrism, one of the oldest neurotoxic diseases known to Man, results from excessive consumption of the chickling pea, *Lathyrus sativus*, and certain related species. Once prevalent throughout Europe, N. Africa, Middle East and parts of the Far East, the disease is presently restricted to India, Bangladesh and Ethiopia. Lathyrism is a form of irreversible, non-progressive spastic paraparesis associated with poorly understood degenerative changes in spinal cord. Domestic animals, notably the horse, also develop hindlimb paralysis after prolonged feeding on *Lathyrus* fodder. Experimental animal models of lathyrism have been reported but none has been satisfactorily investigated, and concurrence between these experimental diseases and the human condition is unproven. The culpable agent in *Lathyrus* species that precipitates paralysis also is unknown. Current attention is focused on the glutamate analog, beta-(N)-oxaly-l-amino-L-alanine acid (BOAA). While this compound is present in those *Lathyrus* species that induce spastic paraparesis and, in large doses, reportedly causes neuropathological changes similar to glutamate neurotoxicity, there is little to compare these neuropathological changes with those found in human lathyrism. Chronic primate feeding studies utilizing BOAA need to be carried out to determine whether this agent is responsible for human lathyrism. Some species of *Lathyrus*, notably *Lathyrus odoratus*, are unable to induce human lathyrism but contain a compound, beta-aminopropionitrile (BAPN), that induces pathological changes in bone ('osteolathyrism') and blood vessels ('angiolathyrism') of experimental animals without damaging the nervous system. However, related compounds, dimethylaminopropionitrile (DMAPN) and beta, beta'-iminodipropionitrile (IDPN), are chronic neurotoxins in humans and animals, respectively.(ABSTRACT TRUNCATED AT 250 WORDS).

Source: Medline 84142544  
Beta Alanine isolation and purification/ Beta Alanine toxicity/ Disease Models Animal/ Lathyrism diagnosis/ Lathyrism veterinary/ Plants Toxic analysis/ Saimiri/ Lathyrism etiology/ Neurotoxins isolation and purification/ ODAP/ Neurology/ Forage/ Lathyrus sativus/ Lathyrus odoratus

Osteolathyrism/ Horses/ Agriculture/ Beta Alanine analogs and derivatives/ Africa/ Aminopropionitriles/ Bangladesh/ Blood/ Bones/ Diagnosis Ethiopia/ Europe/ Experimental lathyrism/ Feeding/ Fodder/ Glutamates/ Hindlimbs/ Horse diseases/ Horses lathyrism/ India/ India L. sativus India L. sativus consumption/ India lathyrism/ Isolation/ Lathyrism/ Lathyrism animal models/ Lathyrism animals/ Lathyrism Bangladesh Lathyrism Ethiopia/ Lathyrism experimental/ Lathyrism France/ Lathyrism horses/ Lathyrism India/ Lathyrus toxicity/ Primates/ Humans Middle East/ Models/ Nervous system/ Neurotoxicity/ Neurotoxins/ Paralysis/ Prevalence/ Purification/ Spasticity/ Spastic paraparesis/ Spinal cord/ Toxicity ODAP/ Toxicity Osteolathyrism/ BAPN/ Toxicity beta aminopropionitrile/ Toxicity L. odoratus/ Toxicity L. sativus/ Toxicity.

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Experimental cyanide exposure in animals causes demyelination and circumstantial clinical and laboratory evidence suggest that there are human parallels. In Leber's hereditary optic atrophy there appears to be a defect in the conversion of cyanide to thiocyanate because of deficient rhodanese activity. For transmitters of the disease smoking carries the risk of blindness and in the most severely affected patients, there is diffuse neurological disease. It is possible that other hereditary optic atrophies (dominant and recessive) may also reflect inborn errors of cyanide metabolism. In the retrobulbar neuritis and optic atrophy of vitamin B12 deficiency there may be a conditional abnormality of cyanide metabolism in smokers, and likewise in so-called tobacco-alcohol amblyopia in which there are more complex nutritional deficiencies. Epidemiological evidence (differing sex ratios, excess of smokers) indicates that defective cyanide metabolism may contribute to the development of sub-acute combined degeneration of the cord in vitamin B12 deficiency. In protein-malnourished populations consuming large amounts of cyanide or cyanogens, viz. in tropical Africa where the staple diet includes cassava containing large amounts of linamarin, similar maladies occur as acquired disorders. There may be a similar explanation for lathyrism. The known pathways of human cyanide metabolism are reviewed and evidence supporting the clinical data is presented.

Source: Medline 84058805; Reprinted with permission Copyright 1983 Academic Press

Lathyrism similarity to Cyanide toxicity/ Africa/ Cyanides/ Deficiency/ Demyelination/ Diet/ HCN/ Lathyrism/ Lathyrism animals/ Lathyrism review/ Humans/ Manihot esculenta/ Cassava/ Metabolism/ Myelin/ Optic/ Population/ Protein/ Review/ Risk/ Sex/ Thiocyanates/ Nicotiana Toxicity/ Tropics/ Vitamins.

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[Lathyrism, Lathyrus sativus, India].

Source: Agricola (79-84) IND 84113221 ; reprintDE

India/ Lathyrus sativus/ Grain legumes/ Pulses/ Grain legumes India/ India L. sativus/ India lathyrism/ Lathyrism/ Lathyrism India/ reprint.

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Source: Medline 84255470

Central Nervous system diseases chemically induced/ Central Nervous system diseases physiopathology/ Cloiquinol/ Disease Models Animal Dogs/ Lathyrism pathology/ Paraplegia pathology/ Axons ultrastructure/ Central Nervous system diseases pathology/ Nerve Degeneration Neurology/ Axons/ Syndrome/ Central Nervous system/ Lathyrism/ Lathyrism animals/ Lathyrism nerve degeneration/ Lathyrism physiopathology/ Humans/ Models/ Nerves/ Nervous system/ Paraplegia/ Nervous system diseases.

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Effect of kesari dal (Lathyrus sativus used as food by poor people in India and known to cause lathyrism) on kidney enzymes of mice was investigated by biochemical and histochemical methods in a 12 week feeding trial [10 refs, En].

Source: FSTA 17(12) 1985

Lathyrus/ Lathyrism physiopathology/ Lathyrism animal models/ Lathyrism bioassay rats/ Lathyrism pathology/ Kidneys/ Bioassay L. sativus Bioassay rodent/ Bioassays/ Biochemistry.

Ahmad, K. and Jahan, K. (1985). **Neurolathyrism and L-ascorbic acid.** Food and Nutrition Bulletin 7 (1):missing in online article (author affiliation: Kamaluddin Ahmad and Khursheed Jahan; Institute of Nutrition and Food Science, University of Dacca, Dacca, Bangladesh)

#### Experiments with Chicks

These studies demonstrate the toxicity of MSG in one-day-old chicks weighing 32-35 g. Different amounts of MSG were put into 0.5 ml of water and administered intraperitoneally. The results are presented in table 1. While a dose of 2 g/kg body weight caused only mild symptoms, toxicity became severe when the dose was raised to 2.5 g/kg.

The preventive action of AA against the toxicity of MSG at a dose of 2.5 g/kg in these chicks is presented in table 2, part A, which shows that 0.75 mg of AA given intraperitoneally 10 minutes before the administration of MSG protected all the birds.

#### Experiments with Guinea-pigs and Monkeys

These studies were made to demonstrate the curative action of AA against MSG toxicity in adult guinea-pigs and monkeys, which are not able to biosynthesize AA. Guinea-pigs weighing 300-350 g and monkeys weighing 2.5-3 kg were selected. They were made deficient in AA by feeding an AA-deficient diet until serum AA levels fell to 0.3-0.4 mg/dl. At this point no scorbutic symptoms were seen. A dose of 2 g/kg of MSG was administered to each animal intraperitoneally in a 0.5-ml aqueous solution. Results are shown in table 2, parts B and C. All the animals became sick, but 5 mg of AA given subcutaneously cured all of the guinea-pigs, and 50 mg cured all monkeys. These doses were arbitrary.

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Studies on the preventive and curative action of ascorbic acid on the neurological toxicity of monosodium glutamate

K. Ahmad and K. Jahan

Institute of Nutrition and Food Science, University of Dhaka, Dhaka, Bangladesh

## INTRODUCTION

Olney and Ho and others have described the toxic effect of subcutaneous administration of large doses of monosodium glutamate (MSG) in young mice (1, 2). Degenerative changes in the retina of the infant mouse after subcutaneous treatment with MSG was reported earlier by Lucas and Newhouse (3). Potts et al. also showed that MSG caused irreversible retinal pathology (4, 5). The use of MSG in infant formula diets has raised concern lest it cause any health hazard. It was suggested that MSG could also be responsible for the Chinese-restaurant syndrome (6, 7). Studies have also exonerated MSG from this incrimination (8).

In the course of their studies on neurolathyrism caused by *Lathyrus sativus* (LS), various neurological manifestations were reported by V. Nagarajan and C. Gopalan in one-day-old chicks when the latter were given extracts of LS seeds intraperitoneally (9). Subsequently a neuroactive amine, b-N-oxalyl-L-a, b-diaminopropionic acid (ODAP), was isolated from the seeds of LS that mimicked the neurological symptoms caused by the extract (10,12). We found that such symptoms did not appear in the chicks when they were given ascorbic acid (AA) some 10 to 15 minutes before the administration of the toxic extract of LS. It was further found that adult guinea-pigs and monkeys, which need a dietary source of AA, developed paralysis of the hind legs and sometimes respiratory difficulty if an extract of LS was administered to them after they had been fed an AA-deficient diet for some weeks to lower their serum AA level to 0.2-0.4 mg/dl. At this stage of deficiency there were no scorbutic symptoms (such as subcutaneous haemorrhage). The conditions paralleled to a great extent those seen in human neurolathyrism, but no such symptoms were seen in those animals that were not made deficient in AA prior to the administration of the toxic extract. These symptoms were found to be reversible if AA was given immediately after the appearance of symptoms. It was concluded that AA counteracted the neurotoxicity of ODAP from LS (13,14). We now provide additional data.

Glutamate has been recognized to be both neuroexcitatory and neurotoxic. Biological actions of ODAP and glutamate (MSG) have been correlated (15). It occurred to us that the toxic effect of MSG reported in young animals could possibly be counteracted by AA. As described below, it has been our finding that AA does protect young animals from the neurological symptoms that arise from administration of a high dose of MSG. AA can both prevent and cure the toxic effects of MSG. Therefore, the incorporation of AA with MSG in food preparations might possibly preclude toxic reactions to MSG in human subjects.

TABLE 1. Toxicity of Monosodium Glutamate in One-Day-Old Chicks Weighing 32 to 35 Grams

Amount of MSG	Number of Animals	Observations and Remarks
MSG 1.5 g/kg of body weight	30	No apparent abnormality noted.
2 g/kg of body weight	30	All animals showed drowsiness after 20-30 minutes.
2.5 g/kg of body weight	30	All developed neck drooping; 18 developed paralysis of legs, neck rigidity, and convulsions after 45-90 minutes. 25 recovered and 5 were found dead the following morning.
3 g/kg of body weight	30	27 developed neck rigidity, extensor paralysis of legs, and convulsions; hyperextension of knee and ankle joints; the remaining 3 showed tremor and failed to walk. 15 died in the following 12 hours; all but 2 died within 48 hours.
MSG was administered in a 0.51-ml aqueous solution intraperitoneally.		

TABLE 2. Preventive and Curative Action of Ascorbic Acid (AA) in Glutamate (MSG) Toxicity

Number of Animals	Amount of MSG g/ kg Body Wt.	Amount of AA, mg per Animal	Observations and Remarks
A. One-day-old chicks, 32-35 g			
50	2.5	0.75a	These are minimum amounts of AA needed for prevention of neurological symptoms in all animals. AA was given 10 minutes before MSG.
B. AA-deficient guinea-pigs (300-350 g); serum AA 0.3-0.5 mg/dl			
20	2.0	5b	8 animals developed drowsiness and neck droop; the rest developed weakness and paralysis of hind legs, tremor, convulsions, etc. 45-60 minutes after intraperitoneal injection of MSG. Animals were cured by administration of AA subcutaneously soon after appearance of symptoms.c
C. AA-deficient monkeys (2.5-3 kg); serum AA 0.3-0.5 mg/dl			
6	2.0	50b	All animals developed paralysis of hind legs 1 1/2-3 hours after intraperitoneal administration of MSG; 4 developed respiratory distress. All animals were cured by administration of AA intramuscularly immediately after appearance of symptoms.c

- a. Minimum preventive dose per chick
- b. Administered after the symptoms appeared (arbitrary curative dose)
- c. The animals were later put on a diet supplemented with ascorbic acid-guinea-pigs 5 mg/day; monkeys 50 mg/day.

## EXPERIMENTS AND RESULTS

### Experiments with Chicks

These studies demonstrate the toxicity of MSG in one-day-old chicks weighing 32-35 g. Different amounts of MSG were put into 0.5 ml of water and administered intraperitoneally. The results are presented in table 1. While a dose of 2 g/kg body weight caused only mild symptoms, toxicity became severe when the dose was raised to 2.5 g/kg.

The preventive action of AA against the toxicity of MSG at a dose of 2.5 g/kg in these chicks is presented in table 2, part A, which shows that 0.75 mg of AA given intraperitoneally 10 minutes before the administration of MSG protected all the birds.

### Experiments with Guinea-pigs and Monkeys

These studies were made to demonstrate the curative action of AA against MSG toxicity in adult guinea-pigs and monkeys, which are not able to biosynthesize AA. Guinea-pigs weighing 300-350 g and monkeys weighing 2.5-3 kg were selected. They were made deficient in AA by feeding an AA-deficient diet until serum AA levels fell to 0.3-0.4 mg/dl. At this point no scorbutic symptoms were seen. A dose of 2 g/kg of MSG was administered to each animal intraperitoneally in a 0.5-ml aqueous solution. Results are shown in table 2, parts B and C. All the animals became sick, but 5 mg of AA given subcutaneously cured all of the guinea-pigs, and 50 mg cured all monkeys. These doses were arbitrary.

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Source: Medline 85161143

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Source: ref ex Tekle-Haimanot (1989)

Lathyrism related/ Neurology/ Lathyrism/ Tropics.

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beta-N-Oxalylamino-L-alanine (BOAA) is a dicarboxylic diamino acid present in *Lathyrus sativus* (chickling pea). Excessive oral intake of this legume in remote areas of the world causes humans and animals to develop a type of spastic paraparesis known as lathyrism. BOAA is one of several neuroactive glutamate analogs reported to stimulate excitatory receptors and, in high concentrations, cause neuronal vacuolation and necrosis. The present study investigates the action of BOAA in vitro on CNS high-affinity transport systems for glutamate, gamma-aminobutyric acid (GABA), aspartate, glycine, and choline and in the activity of glutamate decarboxylase (GAD), the rate-limiting enzyme in the decarboxylation of glutamate to GABA. Crude synaptosomal fractions (P2) from rat brain and spinal cord were used for all studies. [3H]Aspartate transport in brain and spinal cord synaptosomes was reduced as a function of BOAA concentration, with reductions to 40 and 30% of control values, respectively, after 15-min preincubation with 1 mM BOAA. Under similar conditions, transport of [3H]glutamate was reduced to 74% (brain) and 60% (spinal cord) of control values. High-affinity transport of [3H]GABA, [3H]glycine, and [3H]choline, and the enzyme activity of GAD, were unaffected by 1 mM BOAA. While these data are consistent with the excitotoxic (convulsant) activity of BOAA, their relationship to the pathogenesis of lathyrism is unknown.

Source: Medline 85133654; Reprinted with permission Copyright 1989 Raven Press

Beta Alanine pharmacology/ Aspartic Acid metabolism/ Biological Transport Active drug effects/ Brain drug effects/ Choline metabolism Glutamates metabolism/ GABA metabolism/ Rats/ Rats Inbred Strains/ Spinal Cord drug effects/ Synaptosomes drug effects/ Alanine analogs and derivatives/ Brain metabolism/ Neuroregulators metabolism/ Spinal Cord metabolism/ Synaptosomes metabolism/ Rodents/ ODAP Neurology/ *Lathyrus sativus*/ Beta Alanine analogs and derivatives/ Synaptosomes/ Aminobutyric Acids/ Aspartic acid/ Brain/ Central Nervous system/ Drugs/ Enzymes/ GABA/ Glutamates/ Glycine/ In vitro/ Intake/ Lathyrism/ Lathyrism animals/ Lathyrism rats/ Humans/ Metabolism Nervous system/ Receptors/ Spasticity/ Spastic paraparesis/ Spinal cord/ Strains/ Synapses.

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Source: reprintDE

Lathyrus sylvestris/ Lathyrus latifolius/ Bruchus affinis/ Lathyrus sylvestris B. affinis/ Lathyrus latifolius B. affinis/ Entomology/ Bruchids Bioassay/ Agriculture/ Bruchus/ Coleoptera/ Flowers/ France/ Lathyrism Bioassay/ Lathyrus sylvestris/ reprint.

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Source: reprintDE

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The hypothesis is that Alzheimer's disease, Parkinson's disease (PD), and motoneurone disease are due to environmental damage to specific regions of the central nervous system and that the damage remains subclinical for several decades but makes those affected especially prone to the consequences of age-related neuronal attrition. This proposal is based on the association between environmental factors and certain neurodegenerative diseases (eg, methylphenyltetra-hydropyridine and parkinsonism, poliovirus infection and post-poliomyelitis syndrome, chickling pea ingestion and lathyrism, an unidentified environmental factor and amyotrophic lateral sclerosis-PD complex of Guam, and trauma and pugilist's encephalopathy) and on the long latent period between exposure to environmental factor and the appearance of symptoms in some of these disorders. The practical implications of this hypothesis are that epidemiological attention should be focussed on the environment in early rather than late life, prevention may be a realistic goal if the cause of subclinical damage can be identified, a search should be undertaken for causal mechanisms linking subclinical neuronal damage due to an environmental factor and the normal ageing process, and (4) better understanding of the regional selective vulnerability of the nervous system to the ageing process might allow a rational approach to treatment.

Source: Medline 87038379

Adult/ Alzheimer's Disease pathology/ Environmental Exposure/ Guam/ Lathyrism pathology/ Lathyrism physiopathology/ Neuromuscular Diseases pathology/ Neurons pathology/ Neurons physiopathology/ Parkinson Disease pathology/ Poliomyelitis pathology/ Poliomyelitis physiopathology/ Pyridines adverse effects/ Time Factors/ Aging/ Alzheimer's Disease etiology/ Motor Neurons/ Neuromuscular Diseases etiology/ Parkinson Disease etiology/ Lathyrism symptoms/ Syndrome/ Age/ Amyotrophic lateral sclerosis/ Central Nervous system Environment/ Infection/ Lathyrism/ Lathyrism etiology/ Lathyrism mechanisms/ Lathyrism prevention/ Mechanism/ Motor neurons/ Nervous system/ Neurodegenerative/ Neurology/ Neuromuscular/ Neurons/ Prevention lathyrism/ Lathyrism prevention/ Pyridines/ Symptoms lathyrism.

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Source: reprintDE

Lathyrus sativus toxicity/ Osteolathyrism L. sativus/ Lathyrus sativus/ Osteolathyrism/ France/ Lathyrism/ Lathyrus toxicity/ Humans/ Toxicity Osteolathyrism/ Toxicity L. sativus/ Toxicity/ reprint.

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Source: reprintDE

Genetics/ Lathyrus sativus genetics/ Genetics L sativus/ Lathyrus sativus low ODAP/ Lathyrus sativus/ Breeding/ France/ Genetics ODAP ODAP/ reprint.

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Toxic substances/ Lathyrism/ Antidotes/ Poultry diseases/ Cattle diseases/ Horse diseases/ Poisonous plants/ Ruminants/ Lathyrus sativus/ Cattle Horses/ Agriculture/ Horses lathyrism/ India/ India L. sativus/ India lathyrism/ Lathyrism animals/ Lathyrism horses/ Lathyrism India Lathyrism therapy/ Lathyrus toxicity/ Plant poisoning/ Poultry/ Ruminants L. sativus/ Toxicity L. sativus/ Toxicity L. sativus poultry/ Toxicity.

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Source: reprintDE

Lathyrus latifolius/ Nectar production L. latifolius/ Lathyrus latifolius nectar production/ Entomology/ Agriculture/ Floral/ France/ Honey Insects/ Nectar/ reprint.

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Source: reprintDE

Lathyrus sylvestris/ Lathyrus latifolius/ Perennials/ Vegetative propagation L. sylvestris/ Vegetative propagation L. latifolius/ France/ Lathyrus sylvestris/ Reproduction/ Sexual/ reprint.

Islam, M. S.; Saha, C. S.; Shaikh, M. A. Q., and Lahiri, B. P. (1986). **Spectrum of variability in seed size and content of protein and BOAA in grasspea (*Lathyrus sativus L.*) germplasm.** Bangladesh Journal of Nuclear Agriculture 2:6-9.

Seeds of grasspea contain an unusual amino acid, B-(N)-Oxalyl-amino-L-alanine (BOAA) which is responsible for an incurable paralysis of the lower limbs of men, called lathyrism. This study included sixteen local and seven exotic cultivars of grasspea to ascertain the variability and the relationship existing among seed size and content of protein and BOAA in the seeds. Weight of 1000 seeds varied from 40-67 gm and the

exotic germplasm had comparatively bigger seeds than the local cultivars. The protein and BOAA percent ranged from 24.54 to 34.05 and 0.22 to 2.08, respectively. A significant positive correlation was obtained only between seed size and protein content (0.775) but negative association was obtained between seed size and BOAA. There was no association between the content of protein and BOAA. Therefore, it may be feasible to develop low neurotoxin varieties by selecting for bold seed size following hybridization of bold seeded and low neurotoxin types with those having small seeds and high neurotoxin.

Source: CODIS 88-100600

Lathyrus sativus ODAP/ Lathyrus sativus protein/ Genetic resources L. sativus Bangladesh/ Seed size L. sativus Bangladesh/ Bangladesh L. sativus genetic resources/ Genetic variation L. sativus Bangladesh/ Lathyrus sativus/ Agriculture/ Genetic resources/ Amino acids/ Bangladesh Cultivars/ Genetic variation/ Lathyrism/ Lathyrism Bangladesh/ Humans/ Neurotoxins/ ODAP/ Paralysis/ Protein/ Protein content/ Seed/ Seed size/ Varieties/ Genetic resources L. sativus.

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Source: reprintDE

Lathyrus/ Lathyrus sativus/ Lathyrus sativus/ France/ reprint.

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Source: reprintDE

Lathyrus sativus ODAP/ Lathyrus sativus Bangladesh/ Bangladesh L. sativus/ ODAP genetic variation/ Agronomy/ Lathyrus sativus Agriculture/ Genetic resources/ Bangladesh/ France/ Genetic variation/ Lathyrism Bangladesh/ Lathyrus sativus agronomy/ ODAP/ Screening reprint.

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Source: reprintDE

Lathyrus/ Archaeobotany/ History/ Lathyrus sativus/ Lathyrus cicera/ France/ Lathyrism history/ Lathyrism L. cicera/ reprint.

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Source: reprintDE

Isoxazolin-5-one transport L. odoratus/ Lathyrus odoratus/ Isoxazolin-5-one/ France/ reprint.

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Source: reprintDE

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Source: reprintDE

Lathyrus/ Lathyrus sativus/ Lathyrus sativus/ France/ India/ India L. sativus/ India Madhya Pradesh/ India lathyrism/ Lathyrism/ Lathyrism India/ Madhya Pradesh/ reprint.

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Source: reprintDE

NPAA Lathyrus/ NPAA/ Biosynthesis/ Isoxazolin-5-one/ France/ Lathyrism/ NPAA biosynthesis/ reprint.

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Source: reprintDE

Lathyrus/ Lathyrus sativus/ Lathyrus sativus/ Chromosomes/ Evolution/ France/ Heterochromatin/ reprint.

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Source: reprintDE

Lathyrus sativus toxicity/ ODAP mechanism of action/ Lathyrus sativus/ France/ Lathyrism/ Lathyrism mechanisms/ Lathyrus toxicity Mechanisms toxicity/ ODAP/ Toxicity ODAP/ Toxicity L. sativus/ Toxicity L. sativus mechanisms/ Toxicity mechanism ODAP/ Toxicity reprint.

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Source: reprintDE

Lathyrus/ History/ Archaeobotany/ France/ Lathyrus sativus/ Lathyrus cicera/ Age/ Lathyrism France/ Lathyrism history/ Lathyrism L. cicera reprint.

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Source: reprintDE

Lathyrus toxicity/ Oxalyl-amino acids neurotoxicity/ NPAA/ NPAA L. sativus/ Neurology/ Lathyrus sativus/ Amino acids/ France/ Lathyrism Neurotoxicity/ Neurotoxins/ Toxicity L. sativus/ Toxicity/ reprint.

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Source: reprintDE

Lathyrus/ Lathyrus sativus/ Lathyrus sativus/ Chromosomes/ Differentiation/ DNA/ Evolution/ France/ reprint.

Plitmann, U.; Heyn, C. C., and Weinberger, H. (1986). **Comparative taxonomy of some wild species allied to Lathyrus sativus**. In: Kaul, A. K. and Combes, D. (Eds). **Lathyrus and Lathyrism. Proceedings of the International Symposium 9-13 September France**, New York: Third World Medical Research Foundation, pp. 8-21.

Source: reprintDE

Lathyrus sativus related spp/ Taxonomy Lathyrus spp/ Taxonomy L. sativus et al./ Lathyrus gorgoni/ Lathyrus pseudocicera/ Lathyrus sativus Taxonomy/ France/ Lathyrus spp/ Taxonomy L. sativus/ Wild species/ Wild/ reprint.

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Source: reprintDE

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Source: reprintDE

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Source: reprintDE

ELISA/ Enzymes/ France/ Isolectins/ Lathyrus spp/ Lectin/ reprint.

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Source: reprintDE

Amino acids/ Amino acid sequence/ France/ Lectin/ Molecular/ Speciation/ Lathyrus spp/ reprint.

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Source: reprintDE

Lathyrus toxicity review/ France/ Lathyrism review/ Lathyrus toxicity/ Review/ Toxicity/ reprint.

Sharma, A. K.; Chowdhury, R. K., and Mukherjee, S. (1986). **DNA content and repetitive DNA in Lathyrus sativus at intraspecific level.** Kaul, A. K. and Combes, D. (Eds). **Lathyrus and Lathyrism. Proceedings of the International Symposium 9-13 September France**, New York: Third World Medical Research Foundation, pp. 80-85.

Source: reprintDE

Lathyrus/ Lathyrus sativus/ Lathyrus sativus/ DNA/ DNA content/ France/ Intraspecific/ Repetitive DNA/ reprint.

Simola, L. K. (1986). **Structural and chemical aspects of evolution of Lathyrus species.** In: Kaul, A. K. and Combes, D. (Eds). **Lathyrus and Lathyrism. Proceedings of the International Symposium 9-13 September France**, New York: Third World Medical Research Foundation, pp. 225-239.

Source: reprintDE

Leaf anatomy/ NPAA/ NPAA tissue distribution/ NPAA plant development/ Lathyrus seed protein serology/ Seed protein serology/ Lathyrus niger/ Lathyrus maritimus/ Lathyrus sylvestris/ Lathyrus japonicus/ Anatomy plant/ Chemotaxonomy/ Evolution/ France/ Lathyrus sylvestris Leaves/ Plant development/ Protein/ Seed/ Seed proteins/ Taxonomy/ Tissue distribution/ reprint.

Singh, S. P. and Misra, B. K. (1986). **50 years of Lathyrus sativus research.** In: Kaul, A. K. and Combes, D. (Eds). **Lathyrus and Lathyrism. Proceedings of the International Symposium 9-13 September France**, New York: Third World Medical Research Foundation, pp. 240-245.

Source: reprintDE

Lathyrus sativus research history/ Lathyrus sativus/ France/ History/ Lathyrism/ Lathyrism history/ reprint.

Spencer, P. S. and Kaul, A. K. (1986). **INILSEL (International networks for the improvement of Lathyrus sativus and eradication of lathyrism). Outline and preliminary proposal.** In: Kaul, A. K. and Combes, D. (Eds). **Lathyrus and Lathyrism. Proceedings of the International Symposium 9-13 September France**, New York: Third World Medical Research Foundation, pp. 325-330.

Source: reprintDE

Lathyrus/ Lathyrus sativus/ Lathyrus sativus/ France/ INILSEL/ reprint.

Spencer, P. S.; Ludolph, A. C.; Dwivedi, M. P.; Roy, D. N.; Hugon, J., and Schaumburg, H. H. (1986). **Lathyrism: Evidence for role of the neuroexcitatory amino acid BOAA.** The Lancet Nov.1986:1066-1067

Source: reprintDE

NPAA toxicity/ ODAP toxicity/ Lathyrus sativus toxicity/ Lathyrism etiology/ Lathyrus sativus/ Amino acids/ Amino acids toxicity/ Lathyrism Lathyrism ODAP toxicity/ Lathyrus toxicity/ NPAA/ ODAP/ Toxicity ODAP/ Toxicity L. sativus/ Toxicity/ reprint.

Spencer, P. S.; Roy, D. N.; Ludolph, A.; Hugon, J.; Dwivedi, M. P., and Schaumburg, H. H. (1986). **Lathyrism: evidence for role of the neuroexcitatory amino acid BOAA.** The Lancet 2 (8515):1066-1067  
Lathyrism, a form of motorneuron disease induced by excessive consumption of the legume Lathyrus sativus (chickling pea), presents as signs of pyramidal tract involvement. Primate feeding studies show that beta-N-oxalylamino-L-alanine (BOAA), a potent neuroexcitatory amino acid in the chickling pea, induces corticospinal dysfunction similar to that seen in animals consuming a fortified diet of this legume. BOAA, a potent agonist of the excitatory neurotransmitter glutamate, is likely to be causally associated with lathyrism in man.

Source: Medline 87038378

Beta Alanine toxicity/ Adolescence/ Adult/ Child/ Disease Models Animal/ Lathyrism chemically induced/ Macaca fascicularis/ Alanine analogs and derivatives/ Central Nervous system drug effects/ Lathyrism physiopathology/ ODAP/ Neurology/ Lathyrus sativus/ Beta Alanine analogs and derivatives/ Amino acids/ Amino acids toxicity/ Central Nervous system/ Diet/ Drugs/ Feeding/ Glutamates/ Lathyrism/ Lathyrism Adolescence/ Lathyrism animals/ Lathyrus toxicity/ Macaca/ Primates/ Humans/ Models/ Motor neurons/ Nervous system/ Neuroexcitatory Neurons/ Pyramidal tract/ Toxicity ODAP/ Toxicity L. sativus/ Toxicity.

Spencer, P. S.; Roy, D. N.; Palmer, V. S., and Dwivedi, M. P. (1986). **Lathyrus sativus L: The need for a strain lacking human and animal neurotoxic properties.** In: Kaul, A. K. and Combes, D. (Eds). **Lathyrus and Lathyrism. Proceedings of the International Symposium 9-13 September France**, New York: Third World Medical Research Foundation, pp. 297-305.

Source: reprintDE

ODAP/ Lathyrism/ Lathyrus sativus/ France/ Lathyrism animals/ Humans/ Neurotoxins/ Strains/ reprint.

Tiwari, O. P.; Agrawal, I., and Lal, M. S. (1986). **Studies on population densities in Lathyrus sativus L. in Madhya Pradesh, India.** In: Kaul, A. K. and Combes, D. (Eds). **Lathyrus and Lathyrism. Proceedings of the International Symposium 9-13 September France**, New York: Third World Medical Research Foundation, pp. 184-186.

Source: reprintDE

Lathyrus/ India L. sativus/ Madhya Pradesh L. sativus/ Lathyrus sativus/ France/ India/ India Madhya Pradesh/ India lathyrism/ Lathyrism Lathyrism India/ Madhya Pradesh/ Population/ reprint.

Toulemonde, C. and Vartanian, N. (1986). **Drought resistance of diploid and tetraploid cytotypes of Lathyrus pratensis L.** In: Kaul, A. K. and Combes, D. (Eds). **Lathyrus and Lathyrism. Proceedings of the International Symposium 9-13 September France**, New York: Third World Medical Research Foundation, pp. 187-196.

Source: reprintDE

Lathyrus pratensis/ Drought resistance L. pratensis/ Cytology L. pratensis/ Climate/ Cytology/ Drought/ Drought resistance/ France/ Resistance Tetraploid/ reprint.

Valero, M.; Youssef, A., and Vernet, P. (1986). **Is there polymorphism in the breeding system of Lathyrus latifolius?** Kaul, A. K. and Combes, D. (Eds). **Lathyrus and Lathyrism. Proceedings of the International Symposium 9-13 September France**, New York: Third World Medical Research Foundation, pp. 105-117.

Source: reprintDE

Lathyrus latifolius breeding polymorphism/ Polymorphism L. latifolius/ Breeding/ Genetics/ France/ Lathyrus latifolius/ Polymorphisms/ reprint.

Yamamoto, K.; Fujiware, T., and Blumenreich, I. D. (1986). **Isozymic variation and interspecific crossability in annual species of the genus Lathyrus.** Kaul, A. K. and Combes, D. (Eds). **Lathyrus and Lathyrism. Proceedings of the International Symposium 9-13 September France**, New York: Third World Medical Research Foundation, pp. 118-129.

Source: reprintDE

Lathyrus/ Lathyrus hierosolymitanus/ Lathyrus pseudocicera/ Lathyrus blepharicarpus/ Lathyrus marmoratus/ Lathyrus gorgonii/ Lathyrus hirsutus/ Lathyrus nissolia/ Lathyrus aphaca/ Lathyrus articulatus/ Interspecific hybridisation sect. Cicercula/ Isozymes L. sativus/ Isozymes L. hierosolymitanus/ Isozymes L. pseudocicera/ Isozymes L. blepharicarpus/ Isozymes L. marmoratus/ Isozymes L. gorgonii/ Isozymes L. cicera/ Isozymes L. odoratus/ Isozymes L. hirsutus/ Isozymes L. ochrus/ Isozymes L. tingitanus/ Isozymes L. clymenum/ Isozymes L. nissolia/ Isozymes L. aphaca/ Isozymes L. articulatus/ Lathyrus sativus/ Lathyrus cicera/ Lathyrus ochrus/ Lathyrus clymenum/ Lathyrus tingitanus/ Lathyrus odoratus/ Isozymes/ Biochemistry/ Cicercula/ France/ Interspecific/ Interspecific hybridisation/ Lathyrism Biochemistry/ Lathyrism L. cicera/ Lathyrism L. clymenum/ Lathyrus gorgoni/ reprint.

Bisby, F. A.; Allkin, R.; Otto, B. A., and Almeida, M. T. (1987). **Genetic resources of medically important Viciae (vetches and peas).** In: Mota, M. and Baeta, J. (Eds). **International symposium on conservation of genetic resources of aromatic and medicinal plants, 9-11 May, 1984, Oeiras, Portugal**, Oeiras, Portugal: pp. 51-56. (author affiliation: Viciae Database Project, Dep. Biol., Southampton Univ., SO9 5NH, UK).

The Viciae Seed Collection of Southampton University, whose recent accessions have been mainly of seed collected from wild plants or seed multiplied from such sources, includes accessions of Vicia, Lathyrus, Lens and Pisum. The collection has been used to investigate the blood-group specific lectins produced by several Vicia species. Of the 8 accessions thought to be *V. graminea* (a source of anti-N lectins), 7 were tentatively identified as *V. epetolaris* and only one as *V. graminea*. The collection has also been used to investigate lathyrism, a nervous disorder caused by excess 2-amino-3-oxalylaminopropionic acid from *Lathyrus sativus* seeds in the diet. Other *Lathyrus* species containing the neurotoxin are listed.

Source: Copyright CAB Abstracts (87-89) P716729

Lathyrus/ Gene banks/ UK/ Vicia/ Vicia graminea/ Plant composition/ Lectin/ Vicia epetolaris/ Neurotoxins/ Lathyrus sativus/ Viciae Agriculture/ Genetic resources/ Blood/ Conservation/ Databases/ Diet/ Genes/ Lens/ Medicinal/ Pisum/ Portugal/ Seed/ Wild.

Campbell, C. G. and Briggs, C. J. (1987). **Registration of low neurotoxin content Lathyrus germplasm LS 8246.** *Crop Science* 27 (4):821 (author affiliation: Agriculture Canada Research Station, Morden, Manitoba, R0G 1J0, Canada)

This *L. sativus* germplasm line is low in the neurotoxin beta-N-oxalyl-L-alpha-beta-diamino propionic acid (ODAP), a causal agent of the neurodegenerative disorder lathyrism. It was developed from a single plant of

Pusa 24, a low-ODAP line bred in India. ODAP concentration in seed of LS8246 ranged from 259 to 401 µg/g over 3 years, compared to 2615 µg/g for Pusa 24 in a single year.

Source: Copyright CAB Abstracts (87-89) P662114

Genetic resources releases/ Canada/ Plant composition/ Neurotoxins/ ODAP/ Lathyrus sativus/ Agriculture/ Genetic resources/ India/ India L. sativus/ India lathyrism/ India Lathyrus genetic resources/ Lathyrism/ Lathyrism India/ Manitoba/ Neurodegenerative/ Neurology/ Seed.

Choi, D. W. (1987). **Ionic dependence of glutamate toxicity.** *Journal of Neuroscience* 7:369-379

ODAP/ Glutamates toxicity ionic influence/ ODAP toxicity ionic dependence/ Lathyrism/ Neurology/ Glutamates/ Glutamates toxicity Lathyrism ODAP toxicity/ Toxicity ODAP/ Toxicity.

Gupta, Y. P. (1987). **Anti nutritional and toxic factors in food legumes: a review.** *Plant Foods for Human Nutrition* 37 (3):201-228 (author affiliation: Division of Agricultural Biochemistry, Indian Agricultural Research Institute, New Delhi)

A comprehensive review on the presence of certain important anti-nutritional and toxic factors in food legumes has been conducted. These substances include proteolytic inhibitors, phytohemagglutinins, lathrogens, cyanogenetic compounds, compounds causing favism, factors affecting digestibility and saponins. These factors are shown to be widely present in leguminous foods which are important constituents of the diet of a large section of the world's population, and particularly, of people in the developing countries.

Source: Medline 89184239

Cookery/ Favism etiology/ Glycosides adverse effects/ Hydrocyanic Acid adverse effects/ Lathyrism etiology/ Lectins adverse effects/ Protease Inhibitors adverse effects/ Saponins adverse effects/ Legumes adverse effects/ Biochemistry/ Nutritional value/ Antinutritional factors/ Protease inhibitor/ Agriculture/ Saponins/ Glycosides/ Delhi/ Diet/ Digestibility/ Favism/ Food/ India/ India Dietary/ Dietary/ India lathyrism/ Lathyrism Lathyrism Biochemistry/ Lathyrism India/ Lathyrism nutrition/ Lathyrism review/ Lathrogens/ Humans/ Nutrition plant/ Nutrition/ Population Review.

Jha, K. (1987). **Effect of the boiling and decanting method of Khesari (Lathyrus sativus) detoxification, on changes in selected nutrients.** *Archivos Latinoamericanos De Nutricion* 37 (1):101-7 (author affiliation: College of Basic Sciences and Humanities, Rajendra Agricultural University, Pusa, Samastipur, India)

It is a well-known fact that the legume Khesari (*Lathyrus sativus*) causes lathyrism, a disease characterised by paralysis of the lower limbs in human beings. The toxic constituent is an amino acid identified as B-Oxalyl-Amino L-Alanine (BOAA). It has been reported that if the legume is boiled for two hours and the water is then decanted, almost 85% of the toxic amino acid is eliminated. Therefore, this investigation constitutes an effort to prevent the loss of other nutrients, simultaneously to the elimination of toxicity. As has been observed, as much as half the protein content, as well as 80.36% total sugars, 63.13% reducing sugars, 86.05% amino acids, and all thiamine, riboflavin and niacin are lost from dhal (dehulled, separated cotyledons), while the respective losses from the whole seeds are 47.25%, 45.73%, 74.69% and 80.00%, and all vitamins, in just a one-hour treatment. The losses of the toxic amino acid from dhal and whole seeds are 71.46% and 68.74%, respectively. The data for losses occurring in the two-hour and three-hour treatment are also described.

Source: reprintDE

Lathyrus sativus detoxification/ Lathyrus sativus nutritive value/ Processing L. sativus/ Toxicity/ ODAP/ Nutritional value/ Lathyrus sativus Agriculture/ Amino acids/ Cotyledons/ Detoxification/ Dhal/ India/ India L. sativus/ India lathyrism/ Khesari/ Lathyrism/ Lathyrism India Lathyrus toxicity/ Humans/ Nutrients/ Paralysis/ Processing/ Protein/ Protein content/ Riboflavin/ Seed/ Thiamine/ Toxicity ODAP/ Toxicity L. sativus/ Vitamins/ Water detoxification/ Water/ reprint/ Detoxification L. sativus/ Lathyrus sativus detoxification.

Lewin, R. (1987). **Environmental hypothesis for brain diseases strengthened by new data.** *Research News.*

Source: CGC\_95\_2

Lathyrism/ Incomplete/ Neurology/ Brain/ Brain diseases/ Environment.

Ludolph, A. C.; Hugon, J.; Dwivedi, M. P.; Schaumburg, H. H., and Spencer, P. S. (1987). **Studies on the aetiology and pathogenesis of motor neuron diseases. 1. Lathyrism: clinical findings in established cases.** *Brain* 110 (1):149-165

Lathyrism is a toxic disease of the motor system constantly associated with primary consumption of the seed of *Lathyrus sativus* (chickling or grass pea). Neurological examination was performed on 38 affected subjects drawn from four regions of the Indian subcontinent endemic for lathyrism. All showed a consistent and largely symmetric pattern of neurological deficit similar to that displayed by 5 Europeans with longstanding lathyrism now living in Israel. Hallmarks of lathyrism include a pyramidal pattern of motor weakness combined with greatly increased tone in the thigh extensors and adductors and in the gastrocnemius muscles so that the more severely affected walk on the balls of their feet with a lurching scissoring gait. Extensor plantar responses are uniformly present in such cases, and the knee and ankle tendon reflexes are exaggerated and often clonic. Hoffmann signs and exaggerated biceps and/or triceps tendon jerks are also found in the most severely affected. Sensory signs are absent, although perverse sensations in the legs are frequently

reported at the onset. Walking difficulties commonly begin suddenly but may also appear subacutely or insidiously. Some individuals experience partly reversible symptoms suggestive of a diffuse CNS excitation of somatic, motor and autonomic function.

Source: Medline 87101976; Reprinted with permission Copyright 1987 Macmillian Journals Ltd, UK  
Adult/ Bangladesh/ Child/ India/ Lathyrism etiology/ Middle Age/ Muscles physiopathology/ Lathyrism physiopathology/ Motor neuron disorders etiology/ Neurology/ Lathyrus sativus/ Palestine/ Lathyrism symptoms/ Age/ Brain/ Central Nervous system/ Endemic/ Gait/ India L. sativus/ India L. sativus consumption/ India lathyrism/ Lathyrism/ Lathyrism Bangladesh/ Lathyrism India/ Lathyrism motor neurons/ Lathyrus toxicity/ Humans/ Motor neurons/ Muscles/ Nervous system/ Neurons/ Reflexes/ Seed/ Symptoms lathyrism/ Toxicity L. sativus/ Toxicity/ UK.

Mannan, M. A.; Haque, A., and Mohammad, Q. D. (1987). **Lathyrism [letter]**. The Lancet **1** (8525):167

Source: Medline 87114353

Amino acids Diamino toxicity/ Lathyrism etiology/ Amino acids/ Lathyrism/ Toxicity.

Moslehuddin, A. B. M.; Hang, Y. D., and Stoewsand, G. S. (1987). **Evaluation of the toxicity of processed Lathyrus sativus seeds in chicks**. Nutrition Reports International **36** (4):851-855 (author affiliation: Dep. Food Science and Technology, Cornell Univ., Geneva, NY 14456, USA)

Lathyrus sativus seeds were processed for removal or destruction of their natural toxins. Partly purified concentrates from those seeds were injected intraperitoneally into 1-day-old male White Leghorn chicks as a bioassay of the effectiveness of the processing methods. When the raw seed concentrate was given to the chicks, they showed typical neurological signs such as head retraction, neck bending and stiffening followed by immediate death. Similar symptoms were observed in chicks injected with the concentrates of the seeds soaked overnight in water or in saturated calcium carbonate followed by steaming, autoclaving and fermenting at 30°C for 30 h. All chicks died within 4 h of treatment. There were 31% and 39% survivals with the concentrates of seeds soaked overnight in water followed by washing and steaming, and seeds soaked overnight in water followed by washing, steaming and fermenting at 30° for 30 h, respectively. Results from these chick bioassays showed that washing L. sativus seeds partly removes its neurotoxins. Fermentation, steaming or autoclaving seemed to have little effect on toxin removed.

Source: Copyright CAB Abstracts (87-89) N055865 reprintDE

Lathyrus sativus toxicity/ Bioassay chicks/ Poultry diseases/ Detoxification L. sativus/ Processing L. sativus/ Lathyrus sativus detoxification Antinutritional factors/ Lathyrus sativus/ Bioassay/ Agriculture/ Bioassay L. sativus/ Lathyrus sativus bioassay/ Lathyrism symptoms/ Calcium Chickens/ Detoxification/ Evaluation/ Fermentation/ Food/ Food processing/ Food processing L. sativus/ Fowls/ Injections/ Lathyrism Lathyrism Bioassay/ Lathyrism nutrition/ Lathyrus toxicity/ Males/ Neurotoxins/ Nutrition animal/ Nutrition/ Poultry/ Processing/ Processing methods L. sativus/ Purification/ Reports/ Seed/ Symptoms lathyrism/ Toxicity L. sativus/ Toxicity L. sativus poultry/ Toxicity/ Toxin/ USA Water detoxification/ Water/ Reprint.

Nunn, P. B.; Seelig, M.; Zagoren, J. C., and Spencer, P. S. (1987). **Stereospecific acute neuronotoxicity of 'uncommon' plant amino acids linked to human motor system diseases**. Brain Research **410** (2):375-379  
The L-isomer of beta-N-methylamino-L-alanine (BMAA), present in free form in seed of Cycas circinalis, elicits in spinal cord cultures a pattern of acute postsynaptic neuronal vacuolation comparable to that induced by beta-N-oxalylamino-L-alanine (BOAA), an excitotoxic amino acid of greater potency isolated from seed of Lathyrus sativus. The neuronotoxic properties of these compounds may be linked to the etiology of motor-system degenerative disorders (amyotrophic lateral sclerosis and lathyrism, respectively) found in human groups that have used these plant seeds for food.

Source: Medline 87243558; Reprinted with permission Copyright 1987 Elsevier Science B.V., Amsterdam, Netherlands

Beta Alanine toxicity/ Cells Cultured/ Mice/ Neuromuscular Diseases pathology/ Seed/ Spinal Cord pathology/ Alanine analogs and derivatives Amino acids Diamino toxicity/ Neuromuscular Diseases chemically induced/ Spinal Cord drug effects/ ODAP/ Rodents/ Neurology/ Lathyrus sativus/ Beta Alanine analogs and derivatives/ Beta N-methylamino-L-alanine/ Amino acids/ Amyotrophic lateral sclerosis/ Brain/ Cycas/ Drugs Food/ Isomerism ODAP/ Isomerism/ Lathyrism/ Lathyrism etiology/ Lathyrism pathology/ Lathyrus toxicity/ Humans/ Neuromuscular/ ODAP isomerism/ Spinal cord/ Toxicity ODAP/ Toxicity L. sativus/ Toxicity.

Roman, G. C. (1987). **Tropical myelopathies and myeloneuropathies**. Bulletin of the Pan American Health Organization **21** (3):293-305 (author affiliation: Dep. Neurology, Texas Tech Univ., H.S.C. School of Medicine, Lubbock, TX 79439, USA)

Information available on known tropical myelopathies is reviewed and their main forms and features are described. The two main forms of tropical myelopathy are tropical ataxic neuropathy, a myeloneuropathy with prominent sensory ataxia, and tropical spastic paraparesis, a myelopathy with predominantly spastic paraplegia and minimal sensory deficit. These conditions arise from many causes associated with malnutrition, postinfectious tropical malabsorption, chronic cyanide intoxication from excessive cassava consumption, and lathyrism.

Source: Copyright CAB Abstracts (87-89) N072549 also published in Spanish in Boletín de la Oficina Sanitaria Panamericana (1986) 101, 452-462.

Nervous system diseases aetiology/ Nutrition/ Tropics/ Lathyrism/ Tropical myelopathies/ Tropical myeloneuropathies/ T Myelopathies Myeloneuropathies/ Neurology/ Famine/ Malnutrition/ Ataxia/ Australia/ Cyanides/ HCN/ Lathyrism nutrition/ Malabsorption/ Humans Manihot esculenta/ Cassava/ Myelopathy/ Nervous system/ Paraplegia/ Review/ Spain/ Spasticity/ Spastic paraparesis/ Spastic paraplegia/ USA Nervous system diseases.

Roman, G. C.; Schoenberg, B. S.; Madden, D. L., and et al. (1987). **Human T-lymphotrophic virus type 1 antibodies in the serum of patients with tropical spastic paraparesis in the Seychelles.** Arch. Neurol **44**:605-607

Source: ref ex Tekle-Haimanot (1989)

Lathyrism related/ HTLV/ Virology/ Antibodies/ Immunology/ Lathyrism/ Lathyrism serum/ Lathyrism viral infection/ Humans/ Spasticity Spastic paraparesis/ Tropics.

Ross, S. M.; Seelig, M., and Spencer, P. S. (1987). **Specific antagonism of excitotoxic action of 'uncommon' amino acids assayed in organotypic mouse cortical cultures.** Brain Research **425** (1):120-127 (author affiliation: Department of Neuroscience, Albert Einstein College of Medicine, Bronx, N.Y. 10461)

Beta-N-Methylamino-L-alanine (BMAA) and beta-N-oxalylamino-L-alanine (BOAA) are chemically related excitant amino acids present in the seeds of *Cycas circinalis* and *Lathyrus sativus*, respectively. Consumption of these seeds has been linked to Guam amyotrophic lateral sclerosis (BMAA) and lathyrism (BOAA) (a form of primary lateral sclerosis). We report that the acute neuronotoxic actions of these amino acids are blocked selectively by specific glutamate receptor antagonists. Administration of BOAA and BMAA to neonatal mouse cortex explants (EC100 = 28 microM and 1.6 mM, respectively) rapidly induces postsynaptic vacuolation (PSV) and neuronal degeneration characterized by dark/shrunken (D/S) cells. BOAA-mediated neuronotoxic effects are attenuated in a concentration-dependent manner by cis-2,3-piperidine dicarboxylic acid (PDA), an antagonist of quisqualate (QA)-preferring and kainate (KA)-preferring glutamate receptors. PDA maximally protected against BOAA-induced PSV by 84% at 1 mM and D/S cells by 80% at 0.5 mM. BMAA-induced cellular changes were antagonised selectively in a concentration-dependent manner by 2-amino-7-phosphono-heptanoic acid (AP7), an N-methyl-D-aspartate (NMDA) glutamate-receptor antagonist. AP7 maximally protected against BMAA-induced PSV and D/S by 88% at 1.0 and 0.5 mM, respectively. These protective actions were selective and specific since AP7 failed to attenuate BOAA-induced alterations, and PDA was ineffective in ameliorating BMAA-induced changes. Other glutamate receptor antagonists (glutamic diethyl ester and streptomycin) failed to protect the explants from the destructive action of either toxin. Taken collectively, our data indicate that the acute neuronotoxic actions of BOAA and BMAA (or a metabolite) operate through different glutamate receptor species. (ABSTRACT TRUNCATED AT 250 WORDS).

Source: Medline 88108792; Reprinted with permission Copyright 1987 Elsevier Science B.V., Amsterdam, Netherlands

Beta Alanine antagonists and inhibitors/ Beta Alanine pharmacology/ Amino acids pharmacology/ Amino acids Diamino pharmacology/ Dose Response Relationship Drug/ Mice/ Mice Inbred Strains/ Neurotoxins pharmacology/ Osmolar Concentration/ PIPICOLIC ACIDS pharmacology Tissue Culture/ Alanine analogs and derivatives/ Amino acids Diamino antagonists and inhibitors/ Cerebral Cortex drug effects/ Neurotoxins antagonists and inhibitors/ Rodents/ NPAA/ ODAP toxicity/ Toxicity ODAP/ Neurology/ Lathyrus sativus/ Beta Alanine analogs and derivatives/ Beta N-methylamino-L-alanine/ Amino acids/ Amyotrophic lateral sclerosis/ Antagonism amino acids/ Aspartic acid/ Brain Cerebral Cortex/ Cycas/ Drugs/ Glutamates/ Glutamates receptors/ Guam/ Kainic acid/ Lathyrism/ Lathyrism ODAP toxicity/ Lathyrus toxicity Neurotoxins/ NMDA/ NPAA rodents/ ODAP/ PIPICOLIC acid/ Receptors/ Reports/ Seed/ Strains/ Streptomycin/ Toxicity L. sativus/ Toxicity Toxin.

Ross, S. M. and Spencer, P. S. (1987). **Specific antagonism of behavioural action of 'uncommon' amino acids linked to motor system diseases.** Synapse **1** (3):248-253

Beta-N-methylamino-L-alanine (BMAA) and beta-N-oxalylamino-L-alanine (BOAA) are chemically related amino acids present in the seeds of *Cycas circinalis* and *Lathyrus sativus*, respectively. Consumption of these seeds has been linked to Guam amyotrophic lateral sclerosis (BMAA) and lathyrism (BOAA; a form of primary lateral sclerosis). A single large dose of BOAA or BMAA causes seizures in newborn mice and postsynaptic neuronal oedema and degeneration in CNS explants. We report that the acute neurotoxic actions of these amino acids are blocked selectively by specific glutamate-receptor antagonists (administered intracerebroventricularly) (i.c.v.) prior to the amino acid. Administration of BOAA i.c.v. to neonatal mice (ED100 = 50 micrograms) elicits a spectrum of time-dependent behavioural states including arm and leg rigidity, convulsions, and resting tremor. These are blocked in a dose-dependent manner by cis-2,3-piperidine dicarboxylic acid (PDA), an antagonist of quisqualate (QA)-preferring (A2) and kainate (KA)-preferring (A3) glutamate receptors (ED50s; 2.8 micrograms, rigidity; 1.4 micrograms, convulsions; 2.4 micrograms, resting tremor). BMAA induces a transitory hyperexcitable state followed by a long-lasting whole-body shake/wobble (ED100 = 1,000 micrograms, i.c.v.). These responses are antagonised selectively and dose-dependently by 2-amino-7-phosphonoheptanoic acid (AP7), an N-methyl-D-aspartate (NMDA) or A1 glutamate-receptor antagonist (ED50 = 0.45 microgram). Taken collectively, our data indicate that the acute neuronotoxic actions

of BOAA and BMAA (or a metabolite) operate through different glutamate-receptor species. BMAA likely exerts most of its action indirectly via the A1 glutamate receptor, while BOAA acts principally at the A2 and or A3 receptor.

Source: Medline 89100770

Beta Alanine pharmacology/ Amino acids administration and dosage/ Amino acids Diamino pharmacology/ Cerebral Ventricles drug effects Dose Response Relationship Drug/ Injections Intraventricular/ Mice/ Pilocarpic Acids pharmacology/ Reference Values/ Amino acids pharmacology/ Cerebral Ventricles physiology/ Motor Activity drug effects/ Rodents/ ODAP/ Neurology/ Lathyrus sativus/ Beta Alanine analogs and derivatives/ Beta N-methylamino-L-alanine/ Amino acids/ Amyotrophic lateral sclerosis/ Antagonism amino acids/ Aspartic acid Central Nervous system/ Convulsions/ Cycas/ Drugs/ Glutamates/ Glutamates receptors/ Guam/ Injections/ Kainic acid/ Lathyrism/ Nervous system/ Neurotoxins/ NMDA/ Oedema/ Physiology not plant/ Pilocarpic acid/ Receptors/ Reports/ Seed.

Spencer, P. S. (1987). **Guam ALS/parkinsonism dementia: a long latency neurotoxic disorder caused by 'slow toxin(s)' in food?** *Canadian Journal of Neurological Sciences* **14** (3 Suppl):347-357 (author affiliation: Department of Neuroscience, Albert Einstein College of Medicine, Bronx, N.Y. 10461)

Parkinsonism (P) with progressive dementia (D) of the Alzheimer type is recognized as a clinical variant of a form of amyotrophic lateral sclerosis (ALS) that has occurred in high incidence among the Chamorro people of the islands of Guam and Rota in the Marianas chain of Micronesia. The declining annual incidence, upward shifting of the age of onset, narrowing of the sex ratio, and occurrence of the disease among non-Chamorros, point to a disappearing environmental causation peculiar to the traditional culture of these islands. Evidence is presented in support of the proposal that heavy use of certain toxic plants, notably cycads, a traditional source of food and medicine for the Chamorro people, plays an important aetiological role. Clinical and epidemiological approaches are offered to test for a relationship between ALS/P-D and long-latency plant toxicity.

Source: Medline 88052270

Alzheimer's Disease etiology/ Alzheimer's Disease physiopathology/ Amyotrophic Lateral Sclerosis etiology/ Amyotrophic Lateral Sclerosis physiopathology/ Guam/ Lathyrism physiopathology/ Neurotoxins adverse effects/ Parkinson Disease Symptomatic chemically induced Parkinson Disease Symptomatic physiopathology/ Alzheimer's Disease epidemiology/ Amyotrophic Lateral Sclerosis epidemiology/ Diet Parkinson Disease Symptomatic epidemiology/ Plants Toxic/ Toxicity/ Neurology/ Age/ Amyotrophic lateral sclerosis/ Environment Epidemiology lathyrism/ Food/ Incidence/ Lathyrism/ Lathyrism epidemiology/ Lathyrism etiology/ Neurotoxins/ Sex/ Toxic plants/ Toxin.

Spencer, P. S.; Hugon, J.; Ludolph, A. C.; Nunn, P. B.; Ross, S. M.; Roy, D. N., and Schaumburg, H. H. (1987). **Discovery and partial characterization of primate motor system toxins.** *Ciba Found Symp.* Vol. 126, pp. 221-238. ISBN: ISSN 0300-5208.

beta-N-Oxalylamino-L-alanine (BOAA) and beta-N-methylamino-L-alanine (BMAA) are chemically related excitant amino acids isolated from the seed of *Lathyrus sativus* (BOAA) and *Cycas circinalis* (BMAA), consumption of which has been linked to lathyrism (an upper motor neuron disorder) and Guam amyotrophic lateral sclerosis (ALS), respectively. Both diseases are associated with degeneration of motor neurons. Experimentally, single doses of BOAA or BMAA induce seizures in neonatal mice and postsynaptic neuronal oedema and degeneration in explants of mouse spinal cord and frontal cortex. Preliminary studies show that these behavioural and pathological effects are differentially blocked by glutamate-receptor antagonists. In macaques, several weeks of daily oral doses of BOAA produce clinical and electrophysiological signs of corticospinal dysfunction identical to those seen in comparably well-nourished animals receiving a fortified diet based on seed of *Lathyrus sativus*. By contrast, comparable oral dosing with BMAA precipitates tremor and weakness, bradykinesia and behavioural changes, with conduction deficits in the principal motor pathway. BOAA and BMAA (or a metabolite thereof) are the first members of the excitotoxin family to have been shown to possess chronic motor-system toxic potential. These observations provide a rational basis for searching for comparable endogenous neurotoxins in sporadic and inherited forms of human motor neuron disease.

Source: Medline 87217798

Lathyrism etiology/ Macaca/ Neuromuscular Diseases etiology/ Alanine analogs and derivatives/ Amino acids Diamino poisoning/ Motor Neurons/ Neuromuscular Junction drug effects/ Neurons drug effects/ ODAP/ NPAA toxicity/ Rodents/ Neurology/ Antinutritional factors *Lathyrus sativus*/ Beta Alanine analogs and derivatives/ Beta N-methylamino-L-alanine/ Amino acids/ Amino acids toxicity/ Amyotrophic lateral sclerosis/ Cycas/ Diet/ Drugs/ Endogenous/ Frontal cortex/ Glutamates/ Guam/ Lathyrism/ Lathyrism animals/ Lathyrism motor neurons *Lathyrus toxicity*/ Primates/ Humans/ Mice/ Motor neurons/ Neuromuscular/ Neurons/ Neurotoxins/ NPAA/ NPAA rodents/ Oedema Receptors/ Seed/ Spinal cord/ Toxicity ODAP/ Toxicity *L. sativus*/ Toxicity/ Toxin.

Spencer, P. S.; Ross, S. M.; Nunn, P. B.; Roy, D. N., and Seelig, M. (1987). **Detection and characterization of plant derived amino acid motorsystem toxins in mouse CNS cultures.** *Prog Clin Biol Res* **253**:349-361

Source: Medline 88125156

Beta Alanine pharmacology/ Beta Alanine toxicity/ Cell Survival drug effects/ Cells Cultured/ Central Nervous system drug effects/ Central Nervous system pathology/ Mice/ Neurons drug effects/ Alanine analogs and derivatives/ Central Nervous system cytology/ Lathyrism chemically induced/ Neuromuscular Diseases chemically induced/ Neurons cytology/ Neurotoxins pharmacology/ Plants Toxic/ Rodents Antinutritional factors/ Beta Alanine analogs and derivatives/ Amino acids/ Amino acids toxicity/ Cytology/ Drugs/ Lathyrism/ Lathyrism pathology/ Nervous system/ Neurology/ Neuromuscular/ Neurons/ Neurotoxins/ Survival/ Toxicity/ Toxin.

Agid, Y.; Pertuiset, B., and Dubois, B. (1988). **Motoneuron disease as manifestation of lupin seed toxicity [letter].** The Lancet **1** (8598):1347

Source: Medline 88232059

Lathyrism Alkaloids adverse effects/ Lathyrism etiology/ Neuromuscular Diseases/ Neuromuscular diseases Lathyrus/ Toxicity/ Alkaloids Lathyrism/ Lathyrus toxicity/ Lupinus/ Motor neurons/ Neuromuscular/ Neurology/ Neurons/ Seed.

Arya, L. S.; Qureshi, M. A.; Jabor, A., and Singh, M. (1988). **Lathyrism in Afghanistan.** Indian Journal of Pediatrics **55** (3):440-442

Source: Medline 89138569

Afghanistan lathyrism/ Lathyrism Afghanistan/ Lathyrism Adolescence/ Adolescent lathyrism/ Afghanistan/ India/ India lathyrism/ Lathyrism Lathyrism India.

Briggs, C. J. (1988). **Analysis of b-N-oxalylamino-L-alanine.** Paper Presented at the Conference on Lathyrus Sativus L and the Eradication of Lathyrism 2-6 May 1988 London, UK (Ciba Foundation, London)

ODAP analysis/ Lathyrus sativus/ ODAP/ UK.

Chowdhury, S. D. (1988). **Lathyrism in poultry: a review.** World's Poultry Science Journal **44** (1):7-16 (author affiliation: Division of Biochemistry and Physiology, Wye College, Univ. London, Wye, Ashford, Kent TN25 5AH, UK)

The effects on poultry of the toxic constituents of legume seeds of the genus Lathyrus which give rise to lathyrism in humans and experimental animals are reviewed and discussed. The limited amount of information available indicates that the toxic effects depend mainly on the species and age of birds, the amount of toxins absorbed, the route of administration and the duration of exposure. Seeds of Lathyrus species (a low cost protein source) could be utilised to a greater extent in poultry diets provided safe inclusion levels were established and ways of improving feed value estimated and applied. With regard to safety margins, the results of a recent study using laying fowls suggest that the seeds of certain species contain sufficiently low concentrations of toxins for them to be used without any deleterious effects on egg production or egg shell quality.

Source: reprintDE

Lathyrus/ Toxicity/ Poultry/ Lathyrism/ Leguminosae/ Seed/ Poisonous plants/ Biochemistry/ Nutritional value/ Antinutritional factors Agriculture/ Age/ Diet/ Egg production/ Eggs/ Feed/ Feed value/ Fowls/ Lathyrism animals/ Lathyrism Biochemistry/ Lathyrism review Lathyrus toxicity/ Layers/ Humans/ Physiology not plant/ Protein/ Quality/ Review/ Toxin/ UK/ reprint.

Chowdhury, S. D. and Davis, R. H. (1988). **Lathyrism in laying hens and increases in egg weight.** Veterinary Record **123**:272-275

Source: reprintDE

Osteolathrogens poultry/ Egg weight beta aminopropionitrile toxicity/ Toxicity Osteolathyrism/ Osteolathyrism/ Agriculture Aminopropionitriles/ Eggs/ Lathyrism veterinary/ Layers/ Poultry/ BAPN/ Toxicity beta aminopropionitrile/ Toxicity/ reprint.

Dumas, M.; Giordano, C.; Ndiaye, I. P.; Hugon, J.; Vallat, J. M., and Sonan, T. (1988). **Le concept de neuro-myelopathie tropicale. [The concept of tropical neuromyelopathy].** Bull. Soc Pathol Exot Filiales **81** (2):183-188 (author affiliation: Institut d'Epidemiologie Neurologique et de Neurologie Tropicale, Faculte de Medecine, Limoges)

Since the beginning of this century, the concept of tropical neuromyelopathy (T. N. M.) was progressively elaborated in tropical areas. This disorder is constituted by three main clinical syndromes (e.g.: polyneuropathy, spastic paraplegia, ataxia). Abnormal clinical, electrophysiological and pathological features, observed in all clinical forms argue in favor of a diffuse pathobiological process of the nervous system. The association with positive HTLV-1 serology, has recently induced a great interest for the spastic forms of T. N. M. Tropical spastic paraplegia tend to be individualised. This attitude differs from the global concept of T. N. M. which allows gathering similar clinical syndromes. This T. N. M. group should be kept intact until the discovery of new aetiology. Toxic (manioc, lathyrism) or deficiency (hypovitaminosis, malabsorption) causes are incriminated. Otherwise aetiology are unknown.

Source: Medline 88327978; Reprinted with permission Copyright 1988 Masson S.A. Paris, France

Ataxia etiology/ Muscle Spasticity/ HTLV Infections complications/ Nervous system diseases etiology/ Paraplegia etiology/ Ataxia/ Australia Deficiency/ France/ HTLV/ Infection/ Lathyrism/ Lathyrism complications/ Lathyrism etiology/ Lathyrism viral infection/ Malabsorption Muscles/ Nervous system/ Neurology/ Paraplegia/ Spasticity/ Spastic paraplegia/ Syndrome/ Tropics/ Nervous system diseases.

Hugon, J.; Ludolph, A. C.; Roy, D. N.; Schaumburg, H. H., and Spencer, P. S. (1988). **Studies on the etiology and pathogenesis of motor neuron diseases. II. Clinical and electrophysiologic features of pyramidal dysfunction in macaques fed Lathyrus sativus and IDPN.** Neurology **38** (3):435-442 (author affiliation: Department of Neuroscience, Albert Einstein College of Medicine, Bronx, NY 10461)

A primate model of lathyrism has been produced in well-nourished male cynomolgus monkeys chronically fed a fortified diet composed of *Lathyrus sativus* (chickling or grass pea) and given daily per os an alcoholic extract of this legume. Animals given a diet of non-neurotoxic *Cicer arietinum* (chick pea) cross-matched with the nutritional properties of the experimental diet served as controls. Another group of animals received the same diet and oral doses of beta, beta'-iminodipropionitrile (IDPN), a reference compound that has been termed an 'experimental neurolathyrigen.' Monkeys fed *Lathyrus* developed clinical and electrophysiologic evidence of corticospinal deficits after 3 to 10 months of feeding. Animals administered IDPN showed clinical and/or electrophysiologic changes in the PNS and CNS motor and sensory pathways, and signs of cerebellar dysfunction. Since the two primate disorders are separable on clinical and electrophysiologic grounds, further use of the term 'experimental neurolathyrigen' to describe the neurotoxic properties of IDPN seems inappropriate. These findings demonstrate the feasibility of developing a model of early human lathyrism in adequately nourished nonhuman primates.

Source: 88157140

Electrophysiology/ Lathyrism physiopathology/ Macaca fascicularis/ Motor Activity drug effects/ Motor Activity physiology/ Muscles physiopathology/ Neuromuscular Diseases physiopathology/ Diet/ Legumes/ Motor Neurons/ Neuromuscular Diseases etiology/ Nitriles poisoning/ Pyramidal Tracts physiopathology/ Lathyrism primate model/ Neurology/ Lathyrus sativus/ Central Nervous system/ Chickens/ Cicer arietinum/ Drugs/ Feeding/ Lathyrism/ Lathyrism animals/ Lathyrism etiology/ Lathyrism motor neurons/ Macaca/ Primates/ Males/ Humans Models/ Motor neurons/ Muscles/ Nervous system/ Neuromuscular/ Neurons/ Neurotoxins/ Nitriles/ Physiology not plant/ Primate model lathyrism/ Pyramidal tract.

Lambein, F. (1988). **Chemistry and biochemistry of *Lathyrus sativus***. Presented at the Conference on *Lathyrus Sativus* and Eradication of Lathyrism. 2-6 May 1986, London, U.K. (Ciba Foundation London.)

*Lathyrus sativus* chemistry/ *Lathyrus sativus* biochemistry/ Biochemistry *L. sativus*/ Chemistry *L. sativus*/ Phytochemistry *L. sativus*/ *Lathyrus sativus*/ Chemistry/ Lathyrism/ Lathyrism Biochemistry/ Phytochemistry.

Lowgren, M. (1988) **Studies on protein quality in legumes with special reference to factors interfering with protein utilisation and digestibility of brown beans (*Phaseolus vulgaris* L.)** [FILDR thesis]. Uppsala: University of Uppsala, Sweden, 46 pp.

Legumes, which contribute about 20% of the daily protein needs of an adult, contain a number antinutritional substances. The thesis deals with the effect of the antinutritional factors lectins (haemagglutinins), trypsin inhibitors and tannins on the digestibility and utilisation of proteins in legumes, especially brown beans (*Phaseolus vulgaris* L.) and the effect of processing e.g. soaking, heat treatment and sprouting. The complementary effect of proteins from the lathyrism causing legume khesari dhal (*Lathyrus sativus*) in cereal-based weaning diets resulted in high true digestibility (TD). The antinutritional substances lectins and trypsin inhibitors, were inactivated when the temperature reached above 80°C during boiling as well as during slow cooking of brown beans. Soaking had no effect on the biological value (BV), TD or net protein utilisation (NPU) of yellow peas (*Pisum sativum* sens. ampl. (L.) Govorov), soybeans (*Glycine max* (L.) Merr) or brown beans when evaluated on rats. Heat treatment improved BV, TD and NPU in soybeans and brown beans but not in yellow peas. Sulphur amino acid supplementation improved the BV and NPU in raw yellow peas and soybeans. The digestibility of brown bean and casein based diets decreased when lectins and hull, which contain tannins, were added. Brown beans sprouted for 10 d, showed gradually decreasing haemagglutinating and trypsin inhibitor activities, to approximately 10% of the original activity. This implies that high activities remain after 4 d, which is a common sprouting time. However, sprouting of chick peas (*Cicer arietinum* L.) and mung beans (*Vigna radiata* (L.)), both containing low levels of antinutrients, did not improve BV, TD and NPU.

Antinutritional factors heat treatment/ Antinutritional factors sprouting/ *Lathyrus sativus* nutritive value/ Nutritive value *L. sativus*/ Lectin Nutritional value/ Antinutritional factors/ Trypsin inhibitor/ Protease inhibitor/ Polyphenols/ Tannins/ *Lathyrus sativus*/ Amino acids/ Chickens *Cicer arietinum*/ Cookery/ Dhal/ Diet/ Digestibility/ *Glycine max*/ Heat/ Heat treatment/ Khesari/ Lathyrism/ Lathyrism rats/ *Vigna radiata* *Phaseolus vulgaris*/ *Pisum sativum*/ Processing/ Protein/ Protein quality/ Quality/ Rats/ Rodents/ Soaking/ Sulfur/ Sulfur amino acids/ Sweden Temperature/ Uppsala/ Utilisation/ *Vigna*.

Maru, M.; Getahun, A., and Hoshna, S. (1988). **Prevalence of paralytic poliomyelitis in rural and urban populations in Ethiopia: report of a house to house survey**. *American Journal of Tropical Medicine and Hygiene* **38** (3):633-635 (author affiliation: Gondar College of Medical Sciences, Gondar Regional Health Department, Ethiopia)

A house-to-house survey was carried out to determine the prevalence of poliomyelitis. During the survey 37,219 households were visited and 17,941 children 5-9 years old were found. Of 231 lame children, lameness compatible with paralytic poliomyelitis was found in 131, of these 91% had their condition before the age of 3 years. Nineteen percent needed a stick support for walking while 12% were unable to walk even with support. This problem was more common in rural populations. The prevalence of paralytic poliomyelitis was 7.3/1,000 children 5-9 years old.

Source: Medline 90365114; Reprinted with permission Copyright 1988 American Journal of Tropical Medicine and Hygiene

Cerebral Palsy complications/ Child/ Ethiopia epidemiology/ Lathyrism complications/ Paralysis congenital/ Paralysis etiology/ Poliomyelitis complications/ Prevalence/ Rural Population/ Urban Population/ Wounds and Injuries complications/ Paralysis epidemiology/ Poliomyelitis epidemiology/ Age/ Epidemiology lathyrism/ Ethiopia/ Lathyrism/ Lathyrism epidemiology/ Lathyrism Ethiopia/ Lathyrism etiology/ Humans Paralysis/ Population/ Reports/ Rural/ Surveys/ Tropical medicine/ Tropics.

Roy, D. N. (1988). **The neurotoxic disease lathyrism.** *National Medical Journal of India* 1:70-80  
Lathyrism review/ Neurology/ India/ India lathyrism/ Lathyrism/ Lathyrism India/ Neurotoxins/ Review.

Ryberg, B.; Blomberg, J., and Klasse, P. J. (1988). **Tropical spastic paraparesis associated with human T-lymphotropic virus type 1 in an East African naturalised in Sweden.** *British Medical Journal* 195:1380  
Source: ref ex Tekle-Haimanot (1989)  
Lathyrism related/ HTLV/ Virology/ Lathyrism/ Lathyrism viral infection/ Humans/ Spasticity/ Spastic paraparesis/ Sweden/ Tropics.

Singh, N. K. (1988). **Lathyrism - a spreading malaise.** *India Today* 13 (March 31):179-181  
Source: ref ex Lal and Swarup (1989)  
Lathyrism India/ India lathyrism/ India/ Lathyrism.

Valdivieso, R.; Quirce, S., and Sainz, T. (1988). **Bronchial asthma caused by Lathyrus sativus flour.** *Allergy* 43 (7):536-539 (author affiliation: Servico de Alergia, Hospital Ramon y Cajal, Madrid, Spain)  
A 10-year-old child with asthmatic attacks related to Lathyrus sativus flour inhalation was studied in our department. Skin test and specific bronchial provocation challenge were positive. Specific IgE antibodies to Lathyrus sativus flour was demonstrated by indirect enzyme immunoassay. We suggest that our patient's allergic symptoms were due to the development of Type I allergic reactivity to L. sativus antigens.  
Source: Medline 89164709; Reprinted with permission Copyright 1988 Munksgaard International Publishers Ltd., Copenhagen  
Lathyrus sativus bronchial asthma/ Bronchial Provocation Tests asthma L. sativus/ Immunoenzyme Techniques/ Lathyrism etiology/ Skin Tests Asthma etiology/ Hypersensitivity Immediate/ Legumes adverse effects/ Lathyrus sativus/ Lathyrism symptoms/ Allergy/ Antibodies/ Antigens Asthma/ Child/ Enzymes/ Flour/ Immunology/ Lathyrism/ Lathyrism Spain/ Humans/ Skin/ Spain/ Spain L. sativus/ Symptoms lathyrism.

Abegaz, B. M.; Kebede, N., and Asmelash, S. (1989). **HPLC analysis of beta-N-oxalylamino-L-alanine, the neurotoxin in the legume Lathyrus sativus.** In: Spencer, P. S. and Fenton, M. B. (Eds). **The grass pea: Threat and promise Proceedings of the International Network for the Improvement of Lathyrus sativus and the eradication of Lathyrism**, New York: Third World Medical Foundation, pp. 128-132. (author affiliation: Department of Chemistry, Addis Ababa University, P.O.Box 1176, Addis Ababa, Ethiopia).  
A method has been developed, using high performance liquid chromatography, for the analysis of beta-N-oxalyl-L-alanine (BOAA), the neurotoxic substance found in the legume Lathyrus sativus. Derivatization is not employed. It is possible to detect BOAA in the extract of one seed of L. sativus using this method. We have also been able to detect another neurotoxic component, beta-N-methylamino-L-alanine (BMAA) from the seeds of Cycas circinalis. <sup>13</sup>C NMR data has also been generated for both compounds.  
Source: reprintDE  
Chemistry/ Lathyrus sativus/ Beta Alanine analogs and derivatives/ Beta N-methylamino-L-alanine/ Chromatography/ Cycas/ Ethiopia/ HPLC HTLV/ Lathyrism Ethiopia/ Lathyrism viral infection/ Neurotoxins/ NMR/ ODAP/ ODAP analysis/ Seed/ reprint.

Barat, G. K.; Ghose, C., and Singh, J. (1989). **Methods for the estimation of BOAA.** In: Spencer, P. S. and Fenton, M. B. (Eds). **The grass pea: Threat and promise Proceedings of the International Network for the Improvement of Lathyrus sativus and the eradication of Lathyrism**, New York: Third World Medical Foundation, pp. 122-127.  
Source: reprintDE  
INILSEL/ ODAP analysis/ Lathyrus sativus/ ODAP/ reprint.

Bashir, M. (1989). **Status of Lathyrus sativus in Pakistan.** In: Spencer, P. S. and Fenton, M. B. (Eds). **The grass pea: Threat and promise Proceedings of the International Network for the Improvement of Lathyrus sativus and the eradication of Lathyrism**, New York: Third World Medical Foundation, pp. 175-178.  
Source: reprintDE  
Pakistan/ INILSEL/ Pakistan L sativus/ Lathyrus sativus Pakistan/ Lathyrus sativus/ reprint.

Bekele, A. (1989). **Nutritional situation in Ethiopia: Potential for Lathyrus sativus.** In: Spencer, P. S. and Fenton, M. B. (Eds). **The grass pea: Threat and promise Proceedings of the International Network for the Improvement of Lathyrus sativus and the eradication of Lathyrism**, New York: Third World Medical Foundation, pp. 191-197.

Source: reprintDE

INLSEL/ Lathyrus sativus human consumption/ Nutrition L sativus/ Ethiopia nutrition/ Ethiopia L sativus/ Lathyrus sativus Ethiopia Lathyrus sativus/ Ethiopia/ Human consumption/ Lathyrism/ Lathyrism Ethiopia/ Lathyrism nutrition/ Humans/ Nutrition/ reprint.

Bell, E. A. (1989). **Lathyrus neurotoxin: History and overview**. In: Spencer, P. S. and Fenton, M. B. (Eds). **The grass pea: Threat and promise Proceedings of the International Network for the Improvement of Lathyrus sativus and the eradication of Lathyrism**, New York: Third World Medical Foundation, pp. 86-88.

Source: reprintDE

INLSEL/ Lathyrus toxicity review/ Review Lathyrus toxins/ Antinutritional factors/ Lathyrus sativus/ History/ Lathyrism/ Lathyrism history Lathyrism review/ Lathyrus toxicity/ Neurotoxins/ Review/ Toxicity L. sativus/ Toxicity/ Toxin/ reprint.

Bharati, M. P. and Neupane, R. K. (1989). **Lathyrus sativus cultivation and screening of germplasm in Nepal**. In: Spencer, P. S. and Fenton, M. B. (Eds). **The grass pea: Threat and promise Proceedings of the International Network for the Improvement of Lathyrus sativus and the eradication of Lathyrism**, New York: Third World Medical Foundation, pp. 159-167.

Source: reprintDE

INLSEL/ Lathyrus sativus production/ Lathyrus sativus cultivation/ Lathyrus sativus Nepal/ Nepal L sativus production/ Genetic resources L sativus Nepal/ Lathyrus sativus/ Agriculture/ Genetic resources/ Cultivation/ Nepal/ Screening/ reprint.

Bridges, R. J.; Kadri, M. M.; Monaghan, D. T.; Nunn, P. B.; Watkins, J. C., and Cotman, C. W. (1989). **Inhibition of 3H-AMPA binding by the excitotoxin beta-oxaly-L-alpha,beta-diaminopropionic acid**.

European Journal of Pharmacology **145**:357-359

ODAP toxicity/ Biochemistry lathyrism/ AMPA receptors/ Lathyrism/ Lathyrism Biochemistry/ Lathyrism ODAP toxicity/ ODAP/ Receptors Toxicity ODAP/ Toxicity.

Briggs, C. J. (1989). **Analysis of beta-N-Oxalylamino-L-alanine (BOAA)**. In: Spencer, P. S. and Fenton, M. B. (Eds). **The grass pea: Threat and promise Proceedings of the International Network for the Improvement of Lathyrus sativus and the eradication of Lathyrism**, New York: Third World Medical Foundation, pp. 109-121.

Source: reprintDE

INLSEL/ ODAP analysis/ Lathyrus sativus/ Beta Alanine analogs and derivatives/ ODAP/ reprint.

Campbell, C. G. (1989). **Improvement of Lathyrus sativus**. In: Spencer, P. S. and Fenton, M. B. (Eds). **The grass pea: Threat and promise Proceedings of the International Network for the Improvement of Lathyrus sativus and the eradication of Lathyrism**, New York: Third World Medical Foundation, pp. 139-146.

Source: reprintDE

INLSEL/ Lathyrus sativus improvement/ Lathyrus sativus development/ Lathyrus sativus/ reprint.

Campbell, C. G. (1989). **World germplasm resources of Lathyrus sativus**. In: Spencer, P. S. and Fenton, M. B. (Eds). **The grass pea: Threat and promise Proceedings of the International Network for the Improvement of Lathyrus sativus and the eradication of Lathyrism**, New York: Third World Medical Foundation, pp. 179-182.

Source: reprintDE

INLSEL/ Lathyrus sativus germplasm/ Genetic resources L sativus/ Lathyrus sativus/ Agriculture/ Genetic resources/ reprint.

Combes, D.; Delbos, M., and Regnault-Roger, C. (1989). **Genetic Resources of Lathyrus sativus in France**. In: Spencer, P. S. and Fenton, M. B. (Eds). **The grass pea: Threat and promise. Proceedings of the International Network for the Improvement of Lathyrus sativus and the eradication of Lathyrism**, New York: Third World Medical Foundation, pp. 183-190.

Source: reprintDE

INLSEL/ France L. sativus/ Genetic resources L. sativus/ Lathyrus sativus/ Agriculture/ Genetic resources/ France/ reprint.

Debela, S. (1989). **Brief remarks on grass pea production in Ethiopia**. In: Spencer, P. S. and Fenton, M. B. (Eds). **The grass pea: Threat and promise. Proceedings of the International Network for the Improvement of Lathyrus sativus and the eradication of Lathyrism**, New York: Third World Medical Foundation, pp. 147-151.

Source: reprintDE

INLSEL/ Lathyrus sativus production/ Ethiopia L. sativus production/ Lathyrus sativus/ Ethiopia/ Lathyrism Ethiopia/ reprint.

Dwivedi, M. P. (1989). **Epidemiological aspects of lathyrism in India**. Spencer, P. S. and Fenton, M. B. (Eds). **The grass pea: Threat and promise. Proceedings of the International Network for the**

**Improvement of Lathyrus sativus and the eradication of Lathyrism**, New York: Third World Medical Foundation, pp. 1-16.

Source: reprintDE

INLSEL/ Lathyrism epidemiology/ Lathyrism India/ India lathyrism/ Lathyrus sativus/ Epidemiology lathyrism/ India/ India L. sativus Lathyrism/ reprint.

Hang, Y. D. (1989). **Post-production methods of vitamin supplementation of Lathyrus sativus**. In: Spencer, P. S. and Fenton, M. B. (Eds). **The grass pea: Threat and promise. Proceedings of the International Network for the Improvement of Lathyrus sativus and the eradication of Lathyrism**, New York: Third World Medical Foundation, pp. 205-210.

Source: reprintDE

INLSEL/ Post harvest processing L. sativus/ Lathyrus sativus fermentation/ Lathyrus sativus/ Fermentation/ Lathyrism/ Postharvest/ Processing Vitamins/ reprint.

Haque, A. and Mannan, M. A. (1989). **The problem of lathyrism in Bangladesh**. Spencer, P. S. and Fenton, M. B. (Eds). **The grass pea: Threat and promise. Proceedings of the International Network for the Improvement of Lathyrus sativus and the eradication of Lathyrism**, New York: Third World Medical Foundation, pp. 27-35.

Source: reprintDE

INLSEL/ Lathyrism Bangladesh/ Bangladesh lathyrism/ Lathyrus sativus/ Bangladesh/ Lathyrism/ reprint.

Jayaraman, K. S. (1989). **Neurolathyrism remains a threat in India**. *Nature* **339** (6225):495

Source: Medline 89281699

India/ Lathyrism ethnology/ Nervous system diseases ethnology/ Neurology/ India lathyrism/ Lathyrism/ Lathyrism India/ Nervous system Neurolathyrism/ Nervous system diseases.

Kaul, A. K. (1989). **Future strategy for the collection, characterization, storage and utilization of Lathyrus**. In: Spencer, P. S. and Fenton, M. B. (Eds). **The grass pea: Threat and promise. Proceedings of the International Network for the Improvement of Lathyrus sativus and the eradication of Lathyrism**, New York: Third World Medical Foundation, pp. 188-190.

Source: reprintDE

INLSEL/ Genetic resources Lathyrus/ Lathyrus sativus germplasm/ Lathyrus sativus/ Agriculture/ Genetic resources/ Storage/ Strategy/ reprint.

Kaul, A. K.; Hamid, M. A., and Akanda, R. U. (1989). **An agro-economic survey of two lathyrism-prone areas in Bangladesh**. In: Spencer, P. S. and Fenton, M. B. (Eds). **The grass pea: Threat and promise. Proceedings of the International Network for the Improvement of Lathyrus sativus and the eradication of Lathyrism**, New York: Third World Medical Foundation, pp. 41-54.

Source: reprintDE

INLSEL/ Lathyrism Bangladesh/ Bangladesh lathyrism/ Lathyrism socioeconomics/ Socioeconomics Bangladesh/ Bangladesh socioeconomics Economics/ Lathyrus sativus/ Bangladesh/ Lathyrism/ Lathyrism economics/ Surveys/ reprint.

Keenoy, P. M.; Urzay Iribarnegaray, C.; Quevedo Arechederra, M. A.; Urtusagasti Orue, G., and Brouard Urquiaga, J. M. (1989). **Latirismo y anestesia: a proposito de un caso. [Lathyrism and anesthesia: apropos of a case (letter)]**. *Rev Esp Anesthesiol Reanim* **36** (2):124

Source: Medline 89387799

Middle Age/ Anesthesia General/ Lathyrism physiopathology/ Neuromuscular Blocking Agents/ Age/ Lathyrism/ Neuromuscular.

Kisby, G. E.; Roy, D. N., and Spencer, P. S. (1989). **A sensitive HPLC method for detection of beta-N-oxalylamino-L-alanine in Lathyrus sativus and animal tissue**. In: Spencer, P. S. and Fenton, M. B. (Eds). **The grass pea: Threat and promise. Proceedings of the International Network for the Improvement of Lathyrus sativus and the eradication of Lathyrism**, New York: Third World Medical Foundation, pp. 133-138.

Source: reprintDE

INLSEL/ ODAP analysis/ Lathyrus sativus/ Beta Alanine analogs and derivatives/ HPLC/ HTLV/ Lathyrism animals/ Lathyrism viral infection/ ODAP/ Tissue/ reprint.

Lal, M. S. and Swarup, I. (1989). **Socio-economic issues in relation to production and consumption of Lathyrus sativus in India**. In: Spencer, P. S. and Fenton, M. B. (Eds). **The grass pea: Threat and promise. Proceedings of the International Network for the Improvement of Lathyrus sativus and the eradication of Lathyrism**, New York: Third World Medical Foundation, pp. 55-60.

Source: reprintDE

INLSEL/ Lathyrus sativus production/ Lathyrus sativus cultivation/ Lathyrus sativus socioeconomics/ Socioeconomics L. sativus/ Economics Lathyrus sativus/ Cultivation/ India/ India L. sativus/ India L. sativus consumption/ India L. sativus production/ India lathyrism/ Lathyrism Lathyrism economics/ Lathyrism India/ reprint.

Lambein, F. (1989). **Chemistry and biochemistry of Lathyrus sativus**. In: Spencer, P. S. and Fenton, M. B. (Eds). **The grass pea: Threat and promise. Proceedings of the International Network for the Improvement of Lathyrus sativus and the eradication of Lathyrism**, New York: Third World Medical Foundation, pp. 61-75.

Source: reprintDE

INILSEL/ Lathyrus sativus toxicity/ Lathyrus sativus Isoxazolin-5-one/ Biochemistry L. sativus/ Chemistry L. sativus/ NPAA L. sativus Lathyrus sativus/ Isoxazolin-5-one/ Chemistry/ Lathyrism/ Lathyrism Biochemistry/ Lathyrus toxicity/ NPAA/ NPAA chemistry/ Toxicity L. sativus/ Toxicity/ reprint.

Nunn, P. B. (1989). **Lathyrus sativus toxins: Identification and possible mechanisms**. In: Spencer, P. S. and Fenton, M. B. (Eds). **The grass pea: Threat and promise. Proceedings of the International Network for the Improvement of Lathyrus sativus and the eradication of Lathyrism**, New York: Third World Medical Foundation, pp. 89-96.

Source: reprintDE

INILSEL/ Lathyrus sativus toxicity/ Toxicity L. sativus/ Toxicity L. sativus mechanisms/ Mechanisms toxicity/ Review L. sativus toxicity Antinutritional factors/ Lathyrus sativus/ Lathyrism/ Lathyrism mechanisms/ Lathyrism review/ Lathyrus toxicity/ Review/ Toxicity/ Toxin reprint.

Palmer, V. S.; Kaul, A. K., and Spencer, P. S. (1989). **International network for the improvement of Lathyrus sativus and the eradication of lathyrism (INILSEL): a TWMRF initiative**. In: Spencer, P. S. and Fenton, M. B. (Ed). **The grass pea: Threat and promise Proceedings of the International Network for the Improvement of Lathyrus sativus and the eradication of Lathyrism**, New York: Third World Medical Foundation, pp. 218-233.

Source: reprintDE

INILSEL/ Manifesto/ Lathyrus sativus research funding/ Lathyrus sativus/ reprint.

Pushpamma, P. (1989). **Post-production processing of Lathyrus sativus in India**. In: Spencer, P. S. and Fenton, M. B. (Eds). **The grass pea: Threat and promise. Proceedings of the International Network for the Improvement of Lathyrus sativus and the eradication of Lathyrism**, New York: Third World Medical Foundation, pp. 198-204.

Source: reprintDE

INILSEL/ Lathyrus sativus detoxification/ Detoxification L. sativus/ Post harvest processing L. sativus/ India L. sativus/ Lathyrus sativus India Lathyrus sativus/ Detoxification/ India/ India lathyrism/ Lathyrism/ Lathyrism India/ Postharvest/ Processing/ reprint.

Quader, M.; Ahad Miah, M. A.; Wahiduzzaman, M., and Rahman, S. (1989). **Present status of Lathyrus sativus research in Bangladesh**. In: Spencer, P. S. and Fenton, M. B. (Eds). **The grass pea: Threat and promise. Proceedings of the International Network for the Improvement of Lathyrus sativus and the eradication of Lathyrism**, New York: Third World Medical Foundation, pp. 152-158.

Source: reprintDE

INILSEL/ Bangladesh L. sativus research/ Lathyrus sativus Bangladesh/ Lathyrus sativus/ Bangladesh/ Lathyrism Bangladesh/ reprint.

Rathod, K. L. (1989). **Status of Lathyrus sativus in India with special reference to Madhya Pradesh**. In: Spencer, P. S. and Fenton, M. B. (Eds). **The grass pea: Threat and promise. Proceedings of the International Network for the Improvement of Lathyrus sativus and the eradication of Lathyrism**, New York: Third World Medical Foundation, pp. 168-174.

Source: reprintDE

INILSEL/ India L. sativus/ Lathyrus sativus India/ Lathyrus sativus Madhya Pradesh/ Madhya Pradesh L. sativus/ Lathyrus sativus/ India India Madhya Pradesh/ India lathyrism/ Lathyrism/ Lathyrism India/ Madhya Pradesh/ reprint.

Riley, K. W. (1989). **Lathyrus improvement: IDRC support**. In: Spencer, P. S. and Fenton, M. B. (Eds). **The grass pea: Threat and promise. Proceedings of the International Network for the Improvement of Lathyrus sativus and the eradication of Lathyrism**, New York: Third World Medical Foundation, pp. 211-217.

Source: reprintDE

INILSEL/ Lathyrus sativus research funding/ Lathyrus sativus/ reprint.

Ross, S. M. and Spencer, P. S. (1989). **Beta-N-oxalylamino-L-alanine: Potential mechanisms of neurotoxicity**. In: Spencer, P. S. and Fenton, M. B. (Eds). **The grass pea: Threat and promise. Proceedings of the International Network for the Improvement of Lathyrus sativus and the eradication of Lathyrism**, New York: Third World Medical Foundation, pp. 97-108.

Source: reprintDE

INILSEL/ ODAP toxicity/ ODAP toxicity mechanism/ Toxicity L. sativus mechanisms/ Neurology/ Lathyrus sativus/ Beta Alanine analogs and derivatives/ Lathyrism/ Lathyrism mechanisms/ Lathyrism ODAP toxicity/ Lathyrus toxicity/ Mechanisms toxicity/ Neurotoxicity/ ODAP Toxicity ODAP/ Toxicity L. sativus/ Toxicity/ reprint.

Roy, D. N.; Kisby, G. E.; Robertson, R. C., and Spencer, P. S. (1989). **Toxicology of Lathyrus sativus and the neurotoxin BOAA**. In: Spencer, P. S. and Fenton, M. B. (Eds). **The grass pea: Threat and promise. Proceedings of the International Network for the Improvement of Lathyrus sativus and the eradication of Lathyrism**, New York: Third World Medical Foundation, pp. 76-85.

Source: reprintDE

INILSEL/ Lathyrus sativus toxicity/ ODAP toxicity/ Amino acid composition L. sativus/ Lathyrus sativus/ Amino acids/ Amino acid composition/ Lathyrism/ Lathyrism ODAP toxicity/ Lathyrus toxicity/ Neurotoxins/ ODAP/ Toxicity ODAP/ Toxicity L. sativus/ Toxicity reprint.

(1989). Spencer, P. S. and Fenton, M. B. (Eds). **The grass pea: Threat and promise. Proceedings of the International Network for the Improvement of Lathyrus sativus and the eradication of Lathyrism**, New York: Third World Medical Foundation.

Source: reprintDE

INILSEL/ Lathyrus sativus/ reprint.

Tekle Haimanot, R. (1989). **Lathyrism in Ethiopia**. In: Spencer, P. S. and Fenton, M. B. (Eds). **The grass pea: Threat and promise. Proceedings of the International Network for the Improvement of Lathyrus sativus and the eradication of Lathyrism**, New York: Third World Medical Foundation, pp. 36-40.

Source: reprintDE

INILSEL/ Lathyrism Ethiopia/ Ethiopia lathyrism/ Lathyrus sativus/ Ethiopia/ Lathyrism/ reprint.

Weiss, J. H.; Koh, J.-Y., and Choi, D. W. (1989). **Neurotoxicity of  $\beta$ -N-methylamino-L-alanine(BMAA) and  $\beta$ -N-oxalylamino-L-alanine(BOAA) on cultured cortical neurons**. *Brain Research* **497**:64-71.

Recent studies have implicated the ingestion of the structurally related plant excitotoxins, beta-N-methylamino-L-alanine (BMAA), and beta-N-oxalylamino-L-alanine (BOAA), in the pathogenesis of two human motor system diseases, the amyotrophic lateral sclerosis-Parkinsonism-dementia complex of Guam (Guam ALS-PD), and lathyrism, respectively. We have investigated the toxicity of these amino acids on cultured mouse cortical neurons in the presence of physiological concentrations of bicarbonate (a required toxic cofactor for BMAA neurotoxicity). A 24 h exposure to 10 microM - 3 mM BMAA, or to 300 nM - 100 microM BOAA, induced, concentration-dependent neuronal degeneration without glial damage; the neurotoxic EC50 for BMAA was about 1 mM, and the EC50 for BOAA was about 20 microM. At high concentrations, both compounds destroyed essentially the entire neuronal population. Neurotoxicity also depended on exposure duration, with reduced injury at an exposure time of 1 h, and increased injury at an exposure time of 3 days. Despite the fact that ingestion of BMAA and BOAA both lead to motor system damage, previous studies have suggested that the two excitotoxins act primarily on different glutamate receptor subtypes: BMAA on N-methyl-D-aspartate (NMDA) receptors, and BOAA on non-NMDA receptors. Consistent with these studies, the neurotoxicity of high concentrations of BMAA was substantially attenuated by 1 mM D-amino-5-phosphonovalerate (D-APV), whereas BOAA neurotoxicity was less sensitive to D-APV but was attenuated by 2 mM kynurenate.(ABSTRACT TRUNCATED AT 250 WORDS).

Source: reprintDE; reprinted with permission Copyright 1989 Elsevier Science B.V., Amsterdam, Netherlands NPAA/ ODAP bioassay/ ODAP cortical neuron bioassay/ Lathyrus sativus toxicity/ Rodents/ Neurology/ Lathyrus sativus/ Bioassay/ Beta Alanine analogs and derivatives/ Beta N-methylamino-L-alanine/ Bioassay L. sativus/ Lathyrus sativus bioassay/ Amino acids/ Amino acids toxicity/ Amyotrophic lateral sclerosis/ Aspartic acid/ Brain/ Glutamates/ Glutamates receptors/ Guam/ Heavy metals/ Lathyrism/ Lathyrism Bioassay/ Lathyrus toxicity/ Humans/ Metals/ Mice/ Neurons/ Neurotoxicity/ Neurotoxins/ NMDA/ NPAA rodents/ ODAP/ Population Receptors/ Toxicity ODAP/ Toxicity L. sativus/ Toxicity rodents bioassay/ Toxicity/ reprint.

Acharya, G. P. and Pathak, U. N. (1990). **A pilot study on lathyrism in eastern Terai of Nepal**. *Journal of the Institute of Medicine (Nepal)* **12** (3):233-239 (author affiliation: Dep. Med., TU Inst. Med. Nepal, Nepal) A pilot study on Lathyrism in two districts of Eastern Terai of Nepal, Mohatari and Dhanusa, detected eight cases of Lathyrism. The study also collected information on cultivation and consumption pattern of Lathyrus sativus.

Source: Copyright Biological Abstracts (91)

Lathyrism/ Nepal L sativus/ Lathyrus sativus/ Cultivation/ Nepal.

Allen, C. N.; Ross, S. M., and Spencer, P. S. (1990). **Properties of the neurotoxic non-protein amino acids beta-N-methylamino-L-alanine (BMAA) and beta-N-oxalylamino-L-alanine (BOAA), in ALS**. In: Ross, F. C. and Norris, F. H. (Eds). **New Advances in Toxicology and Epidemiology**, London: Smith-Gordon, pp. 49-56.

Source: ref ex Roy (pers. comm.)

ODAP toxicity/ Lathyrism/ NPAA toxicity/ Beta Alanine analogs and derivatives/ Beta N-methylamino-L-alanine/ Amino acids/ Epidemiology lathyrism/ Lathyrism epidemiology/ Lathyrism ODAP toxicity/ Neurotoxins/ NPAA/ ODAP/ Protein/ Toxicity ODAP/ Toxicity.

Meldrum, B. S. and Garthwaite, J. (1990). **Excitatory amino acid neurotoxicity and neurodegenerative disease.** Trends in Pharmacological Sciences **11**:379-387

Lathyrism/ ODAP/ Neurodegenerative disease/ Review/ Neurology/ Amino acids/ Amino acids reviews/ Excitatory amino acid/ Lathyrism review/ Neurodegenerative/ Neurotoxicity.

Murphy, T. H.; Schnaar, R. L., and Coyle, J. T. (1990). **Immature cortical neurons are uniquely sensitive to glutamate toxicity by inhibition of cystine uptake.** FASEB J **4**:1624-1633

Sulfur/ Lathyrism/ ODAP uptake/ Sulfur amino acid transport/ Toxicity/ Amino acids/ Cystine/ Glutamates/ Immaturity/ Neurology/ Neurons ODAP/ Sulfur amino acids/ Toxicity ODAP.

Nicolls, D. G. and Attwell, D. (1990). **The release and uptake of excitatory amino acids.** Trends in Pharmacological Sciences **11**:462-468

Lathyrism/ ODAP/ Neuroexcitatory amino acid uptake/ Neuroexcitatory amino acid release/ Amino acids/ Excitatory amino acid Neuroexcitatory.

Roy, B. C.; Naved, A. F.; Chowdhury, A. K. A., and Yusuf, H. K. M. (1990). **BOAA content of Lathyrus sativus varieties grown in Bangladesh.** Bangladesh Journal of Scientific Research **8** (1):49-58 (author affiliation: Dhaka Univ. (Bangladesh). Dept. of Biochemistry)

The toxin (BOAA, beta-N3 oxalylamino-L-alanine) contents of *Lathyrus sativus* (khesari) grown in different regions of Bangladesh (from Chittagong to Dinajpur and from Sylhet to Khulna) were measured by a standardized calorimetric method. The major varieties grown in Barisal, Charbadna, Jamalpur and Pahartali contained 486, 837, 540 and 527 mg BOAA per 100 g dried seed. Other values ranged from 552 mg/100 g at Bola and 570 mg/100 g at Khulna to 905 mg/100 g at Dinajpur and 973 mg/100 g at Rangpur. However, in Faridpur, the neighbouring district of Barisal or Khulna, the seed had a rather high value of 848 mg/100 g; on the other hand, in the Northern district of Bogra, which is near to Rangpur, the BOAA content was only 628 mg/100 g. In Rajshahi and Kushtia (regions known as the lathyrism pocket), the BOAA contents were 686 and 636 mg/100 g, respectively, values intermediate between those observed in seeds grown in Bola and Khulna, or Rangpur and Dinajpur. The data thus indicate that there is no clear-cut correlation between BOAA content of seeds grown in different regions of Bangladesh, nor does there exist any positive correlation between toxin content of *Lathyrus* seeds and the prevalence of lathyrism.

Source: CODIS 91-056470

ODAP L. sativus/ *Lathyrus sativus* ODAP/ *Lathyrus sativus* germplasm/ *Lathyrus sativus* Bangladesh/ Bangladesh L. sativus/ Lathyrism epidemiology/ Epidemiology lathyrism/ Biochemistry/ *Lathyrus sativus*/ Agriculture/ Genetic resources/ Beta Alanine analogs and derivatives Bangladesh/ Khesari/ Lathyrism/ Lathyrism Bangladesh/ Lathyrism Biochemistry/ ODAP/ Prevalence/ Seed/ Toxin/ Varieties/ Varieties L. sativus/ *Lathyrus sativus* varieties/ Genetic resources L. sativus.

Tekle Haimanot, R.; Abebe, M.; Gebre-Mariam, A.; Forsgren, L.; Holmgren, G.; Heijbel, J., and Ekstedt, J. (1990). **Community-based study of neurological disorders in rural central Ethiopia.** Neuroepidemiology **9**:263-277

Lathyrism Ethiopia/ Ethiopia lathyrism/ Lathyrism epidemiology/ Epidemiology lathyrism/ Ethiopia/ Lathyrism/ Rural.

Tekle Haimanot, R.; Kidane, Y.; Wuhib, E.; Kalissa, A.; Alemu, T.; Zein, Z. A., and Spencer, P. S. (1990). **Lathyrism in rural Northwestern Ethiopia: a highly prevalent neurotoxic disorder.** International Journal of Epidemiology **19** (3):664-672 (author affiliation: Faculty of Medicine, PO Box 4147, Addis Ababa University, Ethiopia)

Lathyrism is a disorder of the central motor system, induced by heavy consumption of the grass-pea, *Lathyrus sativus*, an environmentally tolerant legume containing a neurotoxic excitatory amino acid. A complete door-to-door resurvey of the Dembia and Fogera regions of northwestern Ethiopia, areas endemic for lathyrism, revealed an estimated mean disease prevalence of 0.6%-2.9%. Most patients developed the disease in the epidemic of 1976/77, although new cases appear to have occurred with an estimated mean annual incidence of 1.7:10 000. Production and consumption of grass-pea is increasing in Ethiopia, making attempts to develop special strains to prevent lathyrism increasingly important.

Source: Copyright CAB Abstracts (90-91) R848142

East Africa/ Grain legumes/ Food consumption/ Ethiopia lathyrism/ Nervous system diseases/ Neurology/ *Lathyrus sativus*/ Africa/ Amino acids Endemic/ Epidemiology lathyrism/ Excitatory amino acid/ Food/ Pulses/ Lathyrism Ethiopia/ Incidence/ Lathyrism/ Lathyrism epidemiology Humans/ Nervous system/ Neurotoxins/ Prevalence/ Rural/ Strains/ Tolerance.

Young, A. B. and Fagg, G. E. (1990). **Excitatory amino acid receptors in the brain: membrane binding and receptor autoradiographic approaches.** Trends in Pharmacological Sciences **11**:126-133

Brain excitatory neuroreceptors/ Lathyrism/ ODAP receptors/ Neurology/ Amino acids/ Brain/ Excitatory amino acid/ Membranes/ ODAP Receptors.

Bridges, R. J.; Hatalski, C.; Shim, S. N., and Nunn, P. B. (1991). **Glutotoxic properties of the Lathyrus excitotoxin beta-N-oxalyl-L-alpha,beta-diaminopropionic acid (beta L ODAP)**. Brain Research **561** (2):262-268 (author affiliation: Department of Neurology, Irvine Research Unit on Brain Aging, University of California 92717 USA)

beta-N-Oxalyl-L-alpha,beta-diaminopropionic acid (beta-L-ODAP) is an excitatory amino acid agonist found in the seeds of *Lathyrus sativus* that is believed to be the major causative agent in the pathology of human lathyrism. We have found that in addition to its previously recognized neurotoxic properties, beta-L-ODAP is also gliotoxic. When added to cultures of neonatal rat astrocytes, beta-L-ODAP induced a series of morphological changes (e.g., extensive vacuole formation, pale and swollen nuclei with obvious nucleoli, and cellular swelling) that led to the eventual lysis of the glial cells. If the beta-L-ODAP was removed prior to the lysis of the astrocytes, many of the early morphological changes appeared to be reversible. When quantitated by a loss of the lactate dehydrogenase activity, beta-L-ODAP lysed the astrocytes with an LD50 of 2.1 +/- 0.2 mM following 48 h of exposure. Lower concentrations of beta-L-ODAP were found to be more toxic if the duration of the exposure was increased. The results suggest that the overall impact of the toxin on the CNS may represent the cumulative action of beta-L-ODAP at a number of distinct points on both neurons and astrocytes. The potential that these multiple sites of action may affect the normal regulation of extracellular glutamate and, consequently, disturb the balance between its normal and pathological roles is discussed. Source: Medline 92200206; Reprinted with permission Copyright 1991 Elsevier Science B.V., Amsterdam, Netherlands

Lathyrus sativus ODAP/ Animals Newborn/ Astrocytes drug effects/ Cell Survival drug effects/ Cells Cultured/ Molecular Structure/ Rats Structure Activity Relationship/ Amino acids Diamino pharmacology/ Astrocytes cytology/ Cerebral Cortex cytology/ Neurotoxins pharmacology/ Rodents/ ODAP/ NPAA/ ODAP toxicity/ Toxicity ODAP/ Neurology/ Lathyrus sativus/ Amino acids/ Astrocytes/ Brain California/ Central Nervous system/ Cerebral Cortex/ Cytology/ Drugs/ Excitatory amino acid/ Glutamates/ Lactate dehydrogenase/ Lactate Lathyrism/ Lathyrism animals/ Lathyrism ODAP toxicity/ Lathyrism pathology/ Lathyrism rats/ Lathyrus toxicity/ Humans/ Molecular Nervous system/ Neurons/ Neurotoxins/ NPAA rodents/ Nuclei/ Regulation/ Seed/ Survival/ Toxicity L. sativus/ Toxicity/ Toxin/ USA.

Deshpande, S. S. and Sathe, S. K. (1991). **Toxicants in plants**. In: Sharma, R. P. and Salunkhe, D. K. (Eds). **Mycotoxins and phytoalexins**, Boca Raton: CRC Press, pp. 671-730.

Naturally occurring antinutritional and toxic factors from important plant food sources are discussed. No attempt has been made to cover all known natural toxic substances from plants, and this review covers certain evolutionary, structural, biochemical, technological, nutritional and toxicological aspects of the most important antinutritional factors occurring in the human food chain. The main headings are: carbohydrates, proteins and amino acids, lipids and fatty acids, minerals, vitamins, antivitamin, proteinase inhibitors, amylase inhibitors, lipase inhibitors, lectins (phytohaemagglutinins), phytate, tannins (polyphenols), cyanogenic glycosides, glucosinolates, favism, lathyrism, toxic amino acids, saponins, steroidal alkaloids of potato, allergens, gossypol, safrole, oestrogens, oxalates, removal of antinutrients.

Source: Copyright CAB Abstracts (92) V682150

Toxicity/ Toxic substances/ Poisonous plants/ Plants/ Lectin/ Antinutritional factors/ Amylase inhibitor/ Polyphenols/ Tannins/ Phytoalexins Saponins/ Glycosides/ Mycotoxins/ Alkaloids/ Amylase/ Amino acids/ Amino acids reviews/ Carbohydrates/ Evolution/ Fats/ Fatty acids Favism/ Food/ HCN/ Lathyrism mycotoxins/ Lathyrism review/ Lipids/ Humans/ Mineral/ Oxalates/ Phytates/ Protein/ Review/ Toxic amino acids/ Vitamins.

Haque, A.; Hossain, M., and Wouters, G. (1991). **Epidemiological and clinical study of lathyrism in Bangladesh: preliminary report**. Bangladesh Journal of Neuroscience **7** (2):60-71

Source: Lambein\_95\_5

Bangladesh lathyrism/ Lathyrism Bangladesh/ Lathyrism epidemiology/ Neurology/ Bangladesh/ Epidemiology lathyrism/ Lathyrism/ Reports.

Hussain, M. (1991). **Future of Khesari cultivation in Bangladesh**. In: Kumar, J.; Sahni, B. B., and Usha Raman (Eds). **Advances in pulses research in Bangladesh. Proceedings of the second national workshop on pulses, 6-8 June 1989, Joydebpur, Bangladesh**, Patancheru, India: ICRISAT, pp. 183-189. (author affiliation: Bangladesh Agricultural Research Institute, Mymensingh, Bangladesh).

Khesari (*Lathyrus sativus* L.) is the most important pulse crop of Bangladesh. A strong epidemiological association is known to exist between human consumption of Khesari and the incidence of lathyrism. A toxin in its seed called -N-axalyl-L-, -diaminopropionic acid (ODAP) is believed to be the causative principle. About 6000 patients are affected by lathyrism in this country. Often malnourished young males are the victims. The area under khesari cultivation remains high because of its drought resistance, its minimal managerial requirement, and its protein-rich seeds. Of all the processing procedures, lime water is reported to remove the toxin from the seeds to a great extent. Vitamin C is reported to protect consumers from lathyrism. Attempts to develop a toxin-free cultivar have so far proved unsuccessful. Oxalyl derivatives of some amino acids as well as isoxazolinone derivatives were found in the synthesis of ODAP but its biosynthetic pathway is still not understood. This may in part offer an explanation for the unsuccessful search for toxin-free cultivars.

The search should continue for low-toxin lines with high seed yield, and for easy, effective procedures to remove the toxin before the seeds are consumed. Studies on the relationship between drought and salinity resistance and the -N-oxalyl aminoalazine (BOAA) content may be carried out.

Source: P292937 ; reprintDE

Grain legumes/ Evaluation/ Bangladesh/ Composition/ ODAP/ Agronomy/ Forage/ Salinity/ Lathyrus sativus/ Isoxazolin-5-one/ Agriculture Amino acids/ Ascorbic acid/ Vitamin C/ Climate/ Cultivars/ Cultivation/ Drought/ Drought resistance/ Fodder/ Pulses/ Grain legumes Bangladesh/ Grain legumes India/ Human consumption/ Incidence/ India/ India L. sativus/ India L. sativus consumption/ India lathyrism Khesari/ Lathyrism/ Lathyrism Bangladesh/ Lathyrism India/ Lathyrism vitamin C/ Lathyrus sativus agronomy/ Lime/ Males/ Humans Processing/ Protein/ Resistance/ Seed/ Seed yield/ Toxin/ Vitamins/ Water/ Yield/ Yield fodder/ Yield L. sativus/ reprint.

Jubete, F. F. (1991). **Los Titarros. El cultivo de Lathyrus en Castilla y Leon. [Cultivation of Lathyrus sativus and L. cicera in Castilla and Leon, Spain]**. Junta de Castilla y Leon. Consejera de Agricultura y Ganaderia, 175 pp Coleccion de Estudios Agrarios No. 1. ISBN: 84-7939-011-5 (author affiliation: Prof. Fernando Franco Jubete, Escuela Tecnica Superior de Ingenierias Agrarias, Universidad de Valladolid, Avda. de Madrid, 57, ph: (979) 72 90 48 - 72 90 69, 34071 Palencia, Spain).

Titarro is the Spanish name for Lathyrus cicera. This publication is based on a study (1984 -1989) for a doctoral dissertation with the title 'Iniciacion a la seleccion de Lathyrus cicera L. en la provincia de Palencia' (1990) and provides a comprehensive treatise of Lathyrus spp. in the regions of Castilla and Leon, Spain, with particular emphasis on crop development of L. cicera, incl. botany, agronomy, genetic resources and their evaluation, breeding. It is interesting to note that cultivated L. cicera is frequently a mixture (semilla de comuna) of Vicia ervilia (yeros, ca 10%), V. sativa (vezas ca 3 %), barley (ca 21%) and other impurities (ca 13%). Date is not given in the publication.

Source: DE\_96\_9; reprintDE

Monograph L. cicera/ Lathyrus cicera monograph/ Lathyrus cicera Spain/ Spain L. cicera/ Spain Lathyrus spp/ Lathyrus spp Spain/ Vicia ervilia Vicia sativa/ Legume mixtures/ Lathyrism Spain/ Spain Lathyrism/ Mixtures communal/ Communal mixtures/ Semillas de comuna/ Traditional names/ Cultivation L. cicera/ Lathyrus cicera agronomy/ Lathyrus cicera climatic factors/ Lathyrus cicera cultivation/ Lathyrus cicera distribution/ Lathyrus cicera fodder value/ Lathyrus cicera feeding/ Lathyrus cicera intercropping/ Lathyrus cicera L./ Lathyrus cicera phenology/ Forage/ Lathyrus sativus/ Lathyrus cicera/ Agriculture/ Genetic resources/ Agronomy mixtures/ Hordeum/ Climate/ Cultivation/ Dissertations/ Distribution plants/ Evaluation genetic resources/ Feeding/ Fodder/ Intercropping/ Lathyrism/ Lathyrism L. cicera/ Lathyrus sativus agronomy/ Lathyrus spp/ Mixtures crops/ Monograph/ Phenology/ Landrace mixtures/ Spain/ Spain L. sativus/ Traditional names/ Vicia/ Genetic resources evaluation/ reprint.

Spencer, P. S.; Allen, C. N.; Kisby, G. E.; Ludolph, A. C.; Ross, S. M., and Roy, D. N. (1991). **Lathyrism and western Pacific amyotrophic lateral sclerosis: etiology of short and long latency motor system disorders.** *Adv Neurol* 56:287-299 (author affiliation: Center for Research on Occupational and Environmental Toxicology, Oregon Health Sciences University, Portland 97201)

Source: Medline 91306771

beta Alanine analogs and derivatives/ Amyotrophic Lateral Sclerosis chemically induced/ Amyotrophic Lateral Sclerosis physiopathology Lathyrism chemically induced/ Lathyrism physiopathology/ Nerve Degeneration/ Nervous system diseases chemically induced/ Nervous system diseases physiopathology/ Neuromuscular Diseases chemically induced/ Neuromuscular Diseases physiopathology/ Neurons drug effects/ Plants Toxicity/ Amyotrophic Lateral Sclerosis etiology/ Lathyrism etiology/ Neuromuscular Diseases etiology/ Neurology/ Beta Alanine analogs and derivatives/ Amyotrophic lateral sclerosis/ Drugs/ Environment/ Lathyrism/ Lathyrism nerve degeneration/ Nerves/ Nervous system Neuromuscular/ Neurons/ Oregon/ Toxicity/ Nervous system diseases.

Wadia, N. H. (1991). **Unusual degenerative and environmental diseases seen in India.** *Mitteilungen Der Osterreichischen Gesellschaft Fur Tropenmedizin Und Parasitologie* 13:59-69 (author affiliation: Jaslok Hospital and Research Centre, Bombay, India)

Malnutrition and its effect on the nervous system and toxicity caused by consuming the legume Lathyrus sativus, leading to lathyrism, as seen in India is reviewed.

Source: Copyright CAB Abstracts (94-94.6) N583292

Deficiency diseases/ Lathyrus sativus malnutrition/ Malnutrition deficiency diseases/ Nervous system diseases malnutrition/ Malnutrition India Lathyrism/ Toxicity/ Famine/ Malnutrition/ Lathyrus sativus/ Deficiency/ Environment/ India/ India L. sativus/ India malnutrition/ India lathyrism/ Lathyrism India/ Lathyrus toxicity/ Humans/ Nervous system/ Neurology/ Toxicity L. sativus/ Nervous system diseases.

Campbell, C. G. (1992). **Genotypic characters for reduced neurotoxin content in Lathyrus sativus.** *Lathyrus and Lathyrism Newsletter* 4:9-10

Source: reprintDE

Lathyrus sativus genetics/ Genetics L sativus/ Breeding/ ODAP genetics/ Genetics ODAP/ Lathyrus sativus/ Genetics/ Neurotoxins/ ODAP reprint.

Drory, V. E.; Rabey, M. J., and Cohn, D. F. (1992). **Electrophysiologic features in patients with chronic neurolathyrism.** *Acta Neurologica Scandinavica* 85 (6):401-403 (author affiliation: Department of Neurology, Tel-Aviv Sourasky Medical Center, Israel)

Neurolathyrism is a toxic nutritional disorder induced by the ingestion of the chick-pea 'Lathyrus sativus' and characterised by a pure motor spastic paraparesis. Eight patients with long-standing disease underwent nerve

conduction and electromyographic studies. Two of them (25%) showed electrophysiological signs of lower motor neuron disease in their lower limbs. Subclinical affection of the anterior horn cells occurs probably more frequently than expected in chronic neurolathyrism.

Source: Medline 92351736; Reprinted with permission Copyright 1992 Munksgaard Publishers, Copenhagen Aged/ Electromyography/ Lathyrism diagnosis/ Muscles innervation/ Neurologic Examination/ Peripheral Nerve Diseases diagnosis/ Peripheral Nerves physiopathology/ Reaction Time physiology/ Food Poisoning physiopathology/ Lathyrism physiopathology/ Legumes poisoning/ Neural Transmission physiology/ Peripheral Nerve Diseases physiopathology/ Neurology/ Lathyrus sativus/ Palestine/ Age/ Anterior horn/ Chickens Diagnosis/ Food poisoning/ Food/ H Reflex/ Lathyrism/ Lathyrism Aged/ Lathyrism electromyography/ Lathyrism motor neurons/ Lathyrus toxicity/ Motor neurons/ Muscles/ Nerves/ Neural/ Neurolathyrism/ Neurons/ Peripheral/ Physiology not plant/ Reflexes/ Spasticity/ Spastic paraparesis/ Toxicity L. sativus/ Toxicity/ Transmission.

Gopalan, C. (1992). **The contribution of nutrition research to the control of undernutrition: the Indian experience.** *Annual Reviews of Nutrition* **12**:1-17 (author affiliation: Nutrition Foundation of India, New Delhi)

Since diseases directly related to undernutrition are the major public health problems of India, nutrition research in the country has been largely directed towards elucidating their causes and identifying the most feasible methods for their prevention and control. This effort is an interdisciplinary exercise carried out in the laboratory, the clinic, and the field, with close interaction among biochemists, clinicians, and epidemiologists. Some of the identified solutions have found practical application; but, as in other areas of scientific endeavour, a gap exists between the acquisition of knowledge in the laboratories and its application in the field. Today, thanks to research efforts of the last few decades, we have the knowledge with which most diseases related to undernutrition can be prevented. Unfortunately, however, we do not always have the means of applying this knowledge under real-life conditions in the field. Even so, nutrition research during the last few decades has contributed significantly to the amelioration of undernutrition among poor communities in India.

Source: Medline 92368694

India/ Lathyrism prevention and control/ Nutrition Disorders aetiology/ Pellagra prevention and control/ Protein Energy Malnutrition prevention and control/ Vitamin A Deficiency prevention and control/ Nutrition review/ Nutrition Disorders prevention and control/ Review malnutrition Malnutrition review/ Famine/ Malnutrition/ Carotene/ Deficiency/ Delhi/ Energy/ India malnutrition/ India lathyrism/ Lathyrism/ Lathyrism India/ Lathyrism nutrition/ Lathyrism prevention/ Lathyrism review/ Nutrition/ Nutrition disorders/ Pellagra/ Prevention lathyrism/ Lathyrism prevention/ Protein/ Review/ Vitamin A/ Vitamins.

Khan, J. K.; Lambein, F., and Yusuf, H. K. (1992). **Beta-isoxazolinone-alanine and Lathyrism research - Optimisation of its isolation and purification.** *Dhaka University Studies. Part E* **7** (1):83-86

The biosynthetic precursor for the neurotoxin ODAP present in *Lathyrus sativus* (Khesari) is an unstable non-amino acid beta-(isoxazolin-5-on-2-yl) - alanine BIA. A scheme for its purification was optimised. A three- step procedure leads to a pure crystalline compound.

Source: CGC\_95\_2 ; reprintDE

ODAP/ Lathyrus sativus/ Isoxazolin-5-one/ Beta Alanine analogs and derivatives/ Amino acids/ Isolation/ Khesari/ Neurotoxins/ Purification reprint.

Krogsgaard, L. P. and Hansen, J. J. (1992). **Naturally occurring excitatory amino acids as neurotoxins and leads in drug design.** *Toxicology Letters (Amsterdam)* **64-65** sec No:409-416 (author affiliation: Department of Organic Chemistry, Royal Danish School of Pharmacy, Copenhagen)

The central excitatory neurotransmitter (S)-glutamic acid (Glu) activates at least three types of receptors the NMDA, AMPA, and kainic acid (KAIN) receptors. These receptors mediate the neurotoxicity of a number of naturally-occurring Glu analogues. Thus, domoic acid, a KAIN receptor agonist, has probably been the cause of severe neurologic illness in people who consumed domoic acid poisoned food. beta-N-oxalylaminoalanine (beta-ODAP), an AMPA receptor agonist, has been associated with lathyrism, a spastic paraparesis caused by dietary intake of *Lathyrus sativus*. The neurotoxic *Amanita muscaria* constituent ibotenic acid, a nonselective NMDA receptor agonist, has been used as a lead structure for the development of the specific NMDA receptor agonist AMAA, AMPA, and a number of therapeutically interesting AMPA and KAIN receptor agonists.

Source: Medline 93110690, Reprinted with permission (1992) Elsevier Science Ireland Ltd.

Alzheimer's Disease etiology/ Drug Design/ Ibotenic Acid pharmacology/ Receptors Glutamate drug effects/ Receptors N Methyl D Aspartate drug effects/ Review/ Neurotoxicity review/ ODAP/ Chemistry/ Neurology/ Lathyrus sativus/ Amino acids/ Amino acids reviews/ AMPA receptors/ Aspartic acid/ Diet/ Dietary intake/ Domoic acid/ Drugs/ Excitatory amino acid/ Food/ Glutamates/ Heavy metals/ Ibotenic acid Dietary/ Intake/ Kainic acid/ Lathyrism etiology/ Lathyrism review/ Lathyrus toxicity/ Metals/ Neurotoxicity/ Neurotoxins/ NMDA/ Receptors Spasticity/ Spastic paraparesis/ Toxicity ODAP/ Toxicity L. sativus/ Toxicity.

Rasmussen, M. A.; Foster, J. G., and Allison, M. J. (1992). **Lathyrus sylvestris (flatpea) toxicity in sheep and ruminal metabolism of flatpea neurolathyragens.** In: James, L. F.; Keeler, R. F.; Bailey, E. M.; Cheeke, P. R., and Hegarty, M. P. (Eds). **Poisonous plants. Proceedings of the Third International Symposium**, Ames: Iowa State University Press, pp. 377-381. (author affiliation: USDA-ARS, PO Box 70, Ames, IA 50010, USA).

Ruminal metabolism of neurolathrogens may be an important factor in the adaptation of ruminants to the legume flatpea. Initial studies indicated that flatpea lathrogens were rapidly released after consumption and that animals consuming this legume were at risk of intoxication. Further studies indicated that 17- and 38-day stepwise adaptation periods inadequately protected sheep from flatpea intoxication. Symptoms of intoxication when consumption approached 75% dietary flatpea included muscular tremors, incoordination, seizures and death. Only after prolonged consumption (<4 months) of a nonlethal diet consisting of 50% flatpea did sheep successfully adapt to 100% dietary flatpea which they consumed with no complications. The exchange of rumen contents between alfalfa [lucerne]-fed and flatpea-fed sheep resulted in the formerly tolerant, flatpea-fed animal developing symptoms of lathyrism within 48 h. In contrast, the formerly naive, alfalfa-fed animal subsisted on 100% flatpea for 15 days with no indication of lathyrism. This evidence suggests that adaptation to flatpea is due to alterations in rumen metabolism. The rate of 2,4-diaminobutyric acid (DABA) degradation in rumen contents obtained from both unadapted and adapted sheep ranged between 0.2-0.3  $\mu\text{mol/ml/h}$ . The similarity of these degradation rates suggests that although DABA is the predominant lathrogen in flatpea, other lathrogenic compounds may be of greater importance in the aetiology of flatpea intoxication and protective adaptation.

Source: Copyright CAB Abstracts (94-94.6) V894450

Leguminosae/ Nervous system diseases/ Rumen microorganisms/ Poisonous plants/ Lathyrus/ Lathyrus sylvestris/ Toxicity/ Sheep/ Ruminants Antinutritional factors/ Adaptation/ Lathyrus tingitanus/ DABA/ Agriculture/ Lathyrism symptoms/ Medicago sativa/ Degradation Detoxification/ Diet/ Dietary/ Lathyrism/ Lathyrism animals/ Lathyrism complications/ Lathrogens/ Lathyrus sylvestris/ Lathyrus toxicity Medicago/ Metabolism/ Microorganisms/ Muscles/ Nervous system/ Neurology/ Risk/ Rumen/ Symptoms lathyrism/ Tolerance/ Toxicity L. sylvestris/ Toxin/ USA/ USDA.

Shen, L. M.; Orcutt, D. M., and Foster, J. G. (1992). **Influence of polyethylene glycol and aeration method during imbibition on germination and subsequent seedling growth of flatpea (*Lathyrus sylvestris*)**. Seed Science and Technology **20** (3):349-357 (author affiliation: Department of Plant Pathology, Physiology and Weed Science, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061, USA)

*L. sylvestris* seeds imbibed in media containing polyethylene glycol 8000 (PEG) at concentrations of 0 (water), 25, 35 or 50% (w/v). Imbibition solutions were aerated continuously with ambient air, bubbled with pure oxygen for 3 min every 12 h or were not provided with supplemental oxygen. Seeds were imbibed for 0.5, 1.0, 1.5, 2.5 or 3 d. Germination percentages were determined for all treatments, and seedling vigour was determined for aeration treatments. In seeds imbibed in PEG-free media, germination was better when air was supplied during imbibition. However, seeds imbibed in PEG-free media aerated with oxygen exhibited symptoms of toxicity, and seedlings derived from this treatment exhibited the greatest reduction in shoot and root growth. PEG diminished the adverse effects of oxygen on germination. That 50% PEG was less effective in this respect suggested the contribution of an osmoticum effect that was confirmed by the reduced germination rate of seeds imbibed in air-aerated and non-aerated 25% PEG media. Root growth appeared to be the most sensitive response to oxygen and osmotic treatments of seeds. It was concluded that osmoconditioning was of little value as a mean of improving germination of *L. sylvestris* seeds and performance of seedlings.

Source: Copyright CAB Abstracts (94-94.6) G650736

*Lathyrus sylvestris*/ Seed germination/ Osmotic pretreatment/ Oxygen/ Aeration/ Germination/ Seed treatment/ Osmotic priming/ water relations Imbibition/ Seed/ Toxicity/ Seedling/ Plant physiology/ Lathyrism symptoms/ Lathyrism/ *Lathyrus sylvestris*/ *Lathyrus* toxicity/ Osmotic/ Polyethylene/ Pretreatment/ Roots/ Root growth/ Seedling germination/ Seedling growth/ Seedling vigour/ Shoots/ Symptoms lathyrism/ Toxicity *L. sylvestris*/ USA/ Virginia/ Water/ Weed.

Tylleskär, T.; Banea, M.; Bikangi, N.; Cooke, R. D.; Poulter, N. H., and Rosling, H. (1992). **Cassava cyanogens and konzo, an upper motorneuron disease found in Africa**. The Lancet **339**:208-11

Source: reprintDE

Cassava toxicity/ Neurodegenerative diseases Konzo/ Lathyrism/ HCN/ Detoxification Cassava/ Processing/ Bitter varieties Cassava/ Sulfur Thiocyanates/ Sweden/ Myelopathy/ Spastic paraparesis/ Africa/ Cyanides/ Detoxification/ Konzo/ Lathyrism chronic Cassava toxicity/ *Manihot esculenta*/ Cassava/ Motor neurons/ Neurodegenerative/ Neurology/ Neurons/ Spasticity/ Toxicity/ Varieties/ reprint.

Geda, A.; Briggs, C. J., and Venkataram, S. (1993). **Determination of the neurolathrogen beta-N-oxalyl-L-alpha,beta-diaminopropionic acid using high performance liquid chromatography with fluorometric detection**. Journal of Chromatography **635** (2):338-341

Source: Agricola (92-94.6) IND 93027976

ODAP analysis/ Method/ Lathyrism/ Neurotoxins/ HPLC/ *Lathyrus sativus*/ Chromatography/ ODAP.

Hugon, J.; Ludolph, A. C.; Spencer, P. S.; Roldan, S. G., and Dumas, J. L. (1993). **Studies of the etiology and pathogenesis of motor neuron diseases .3. Magnetic cortical stimulation in patients with lathyrism**.

Acta Neurologica Scandinavica **88** (6):412-416 (author affiliation: Hugon J Univ Limoges Fac Med Inst Neurol Trop 2 Rue Docteur Marcland F-87025 Limoges France)

Neurophysiological assessments of central motor pathways were conducted of 11 Spanish subjects with varying degrees of spastic paraparesis (lathyrism). The disease has been induced more than 40 years ago by subsistence on the neurotoxic chick pea *Lathyrus sativus*. Patient evolution was carried out by magnetic cortical and electric spinal stimulations and recordings of the contralateral muscle responses. Central motor conduction times corresponding to lower limbs were clearly more prolonged in those severely affected patients with marked difficulty walking (Stages 4 and 3). Central conduction times corresponding to upper limbs were delayed in only 1 patient. Taken together with clinical and published neuropathological data, these findings suggest that established lathyrism is essentially a central motor system disorder primarily affecting corticospinal tracts regulating the lower limbs. [References: 26].

Source: Copyright Current Contents

Lathyrism/ Spastic paraplegia/ Motor evoked potentials/ Clinical neurophysiology/ Human-brain/ Responses/ Sclerosis/ Cortex.

Hugon, J.; Ludolph, A. C.; Spencer, P. S.; Roldan, S. G., and Dumas, J. L. (1993). **Studies on the etiology and pathogenesis of motor neuron diseases. III. Magnetic cortical stimulation in patients with lathyrism.** *Acta Neurologica Scandinavica* **88** (6):412-416 (author affiliation: Hugon J Univ Limoges Fac Med Inst Neurol Trop 2 Rue Docteur Marcland F-87025 Limoges France; Limoges Univ Hosp Dept Neurol Limoges France; Humboldt Univ Berlin Charite Hosp Dept Neurol O-1086 Berlin Germany; Oregon Hlth Sci Univ Ctr Res Occupat & Environm Toxicol Dept Neurol Portland, Or 97201 USA; Hosp Gen Gregorio Maranon Madrid Spain)

Neurophysiological assessments of central motor pathways were conducted of 11 Spanish subjects with varying degrees of spastic paraparesis (lathyrism). The disease has been induced more than 40 years ago by subsistence on the neurotoxic chick pea *Lathyrus sativus*. Patient evolution was carried out by magnetic cortical and electric spinal stimulations and recordings of the contralateral muscle responses. Central motor conduction times corresponding to lower limbs were clearly more prolonged in those severely affected patients with marked difficulty walking (Stages 4 and 3). Central conduction times corresponding to upper limbs were delayed in only 1 patient. Taken together with clinical and published neuropathological data, these findings suggest that established lathyrism is essentially a central motor system disorder primarily affecting corticospinal tracts regulating the lower limbs. [References: 26].

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Lathyrism Spain/ Spain lathyrism/ Spastic Paraplegia/ Motor Evoked Potentials/ Clinical Neurophysiology/ Neurology/ Lathyrus sativus Chickens/ Evolution/ France/ Germany/ Lathyrism/ Lathyrism etiology/ Lathyrism motor neurons/ Motor neurons/ Muscles/ Neurons/ Oregon Paraplegia/ Spain/ Spain L. sativus/ Spasticity/ Spastic paraparesis/ Spinal cord/ USA.

Jahan, K. and Ahmad, K. (1993). **Studies on neurolathyrism.** *Environmental Research* **60** (2):259-266 (author affiliation: Institute of Nutrition and Food Science, University of Dhaka, Bangladesh)

Neurolathyrism is a neurological condition seen among people who eat the seeds of *Lathyrus sativus* (LS) as a principal source of food energy for 2 months or more. It is characterised by severe muscular rigidity and paralysis of the lower limbs. beta-N-Oxalyl-L-alpha,beta-diaminopropionic acid is the principal toxin found in the seed. No experimental animal model for neurolathyrism could be produced by feeding either the seeds or the toxin, although the condition has been known for centuries. We discovered that experimental neurolathyrism could be produced in guinea pigs and primates that needed an external supply of ascorbic acid by making them subclinically deficient in ascorbic acid and feeding them the seeds of LS or extracts thereof. Autoclaving the seeds of LS with lime removes the toxin.

Source: Medline 93231097; Reprinted with permission Copyright 1993 Academic Press

Ascorbic acid metabolism/ Ascorbic acid Deficiency complications/ Ascorbic acid Deficiency metabolism/ Disease Models Animal/ Food Contamination/ Guinea Pigs/ Haplorhini/ Lathyrism chemically induced/ Lathyrism complications/ Lathyrism metabolism/ Legumes adverse effects/ Muscular Diseases chemically induced/ Lathyrism/ Neurology/ Lathyrus sativus/ Bioassay/ Bioassay L. sativus/ Lathyrus sativus bioassay/ Ascorbic acid/ Vitamin C/ Bangladesh/ Contamination/ Deficiency/ Energy/ Environment/ Extraction/ Feeding/ Food/ Lathyrism animal models/ Lathyrism animals/ Lathyrism Bangladesh/ Lathyrism Bioassay/ Lathyrism nutrition/ Lathyrism vitamin C/ Lime/ Primates Metabolism/ Models/ Muscles/ Neurolathyrism/ Nutrition animal/ Nutrition/ Paralysis/ Rodents/ Seed/ Toxin/ Vitamins.

Khan, J. K.; Kuo, Y.-H.; Haque, R.; Lambein, F., and Haque, A. (1993). **Review on the role of excitatory amino acids in neurological disorders with emphasis on neurolathyrism: a hypothesis for the susceptibility for neurolathyrism.** *Bangladesh Journal of Neuroscience* **9** (1):24-33.

Activation of glutamate receptors by excitatory amino acids is believed to play a role in the pathogenesis of neurologic diseases. The concentration of amino acids in cerebrospinal fluid differs between neurolathyrism patients and controls. The concentration of the inhibitory neurotransmitter, glycine, shows a clear correlation with the duration of the disease, which resembles sporadic upper motor neurone diseases. Glutamate, zinc and glycine affect activity at the N-methyl-D-aspartate (NMDA) class of glutamate receptor. Zinc in mossy fibre axon is dynamically linked to neural signalling processes. It is proposed that  $\alpha$ -ODAP, being a strong

zinc-chelator, can make metal ion complexes within CNS that may lead to the expression of toxicity. A role for zinc deficiency in the susceptibility for neurolathyrism is postulated.

Source: reprintDE

Lathyrus sativus toxicity/ NPAA/ ODAP/ Lathyrism zinc/ Zinc lathyrism/ Zinc/ Metals/ Neurology/ Lathyrus sativus/ Amino acids/ Amino acids reviews/ Aspartic acid/ Axons/ Bangladesh/ Central Nervous system/ Cerebrospinal fluid/ Deficiency/ Excitatory amino acid/ Fibre Glutamates/ Glutamates receptors/ Glycine/ Heavy metals/ Lathyrism/ Lathyrism Bangladesh/ Lathyrism cerebrospinal fluid/ Lathyrism review Lathyrus sativus zinc/ Lathyrus toxicity/ Motor neurons/ Nervous system/ Neural/ Neurolathyrism/ Neurons/ NMDA/ NPAA review/ ODAP Zinc/ Receptors/ Review/ Susceptibility/ Toxicity ODAP/ Toxicity L. sativus/ Toxicity/ Trace elements/ Zinc deficiency/ reprint.

Kothari, S. L. (Ed) (1993). **Eat Kesari Dal (Lathyrus sativus) for better health at low cost.** Nagpur, M. S.: Academy of Nutrition Improvement.

Advocates that Lathyrus sativus is safe to eat and ignores malnutrition and poverty as being causally linked to lathyrism.

Source: reprintDE

Pamphleteering L. sativus/ India L. sativus consumption/ Lathyrus sativus India/ Human consumption L. sativus India/ Famine/ Malnutrition Poverty/ Economics/ Lathyrus sativus/ Dhal/ Human consumption/ India/ India L. sativus/ India malnutrition/ India lathyrism/ Khesari Lathyrism/ Lathyrism economics/ Lathyrism India/ Lathyrism nutrition/ Humans/ Nutrition/ reprint.

Kumari, V.; Mehera, R. B.; Bajju, D. B., and Hima Bindu, K. (1993). **Genetic basis of flower colour production in grass pea. *Lathyrus* and *Lathyrism* Newsletter 5:10**

Source: reprintDE

Flower colour genetics L. sativus/ Lathyrus sativus flower colour genetics/ Genetics flower colour L. sativus/ Breeding/ Genetics/ Lathyrus sativus/ Colour/ Flower colour/ Flower colour genetics/ Flowers/ Genetics flower colour/ reprint.

Miller, S.; Nunn, P. B., and Bridges, R. J. (1993). **Induction of astrocyte glutamine synthetase activity by the Lathyrus toxin beta N oxalyl L alpha,beta diaminopropionic acid (beta L ODAP).** *Glia* 7 (4):329-336 (author affiliation: Department of Psychobiology, University of California, Irvine 92717)

beta-N-Oxalyl-L-alpha,beta-diaminopropionic acid (beta-L-ODAP) is thought to be the causative agent in lathyrism due to its neuroexcitatory and neurotoxic properties. We have recently reported that beta-L-ODAP is also gliotoxic at high concentrations (Bridges et al.: Brain Res 561:262, 1991). Evidence is now presented that low, subgliotoxic concentrations of beta-L-ODAP may alter the ability of astrocytes to regulate glutamate concentrations in the CNS by increasing astrocyte glutamine synthetase activity. When astrocytes cultured from rat cortex were exposed to 100 microM beta-L-ODAP for 24 h, the resulting glutamine synthetase activity was 155% of control levels. This effect was enantiomer- and isomer-specific, dose-dependent, and required protein translation as the induction was blocked with cycloheximide. The effect of beta-L-ODAP on glutamine synthetase was not mimicked by alpha-amino-3-hydroxy-5-methyl-isoxazole-4-propionate (AMPA) or kainate, suggesting that the induction was not transduced solely through activation of cell surface non-N-methyl-D-aspartate (NMDA) glutamate receptors. An intracellular site of action of beta-L-ODAP is proposed because its effect on glutamine synthetase activity could be blocked by the amino acid uptake blocker dihydrokainate.

Source: Medline 93307820

Animals Newborn/ Astrocytes cytology/ Astrocytes drug effects/ Cell Death drug effects/ Cells Cultured/ Cerebral Cortex cytology/ Cerebral Cortex enzymology/ Cycloheximide pharmacology/ Dactinomycin pharmacology/ Dose Response Relationship Drug/ Enzyme Induction Glutamine Synthetase metabolism/ Ibotenic Acid analogs and derivatives/ Ibotenic Acid pharmacology/ Kainic Acid pharmacology/ Lactate Dehydrogenase analysis/ N Methylaspartate pharmacology/ Rats/ Rats Sprague Dawley/ Structure Activity Relationship/ Amino acids Diamino pharmacology/ Astrocytes enzymology/ Glutamine Synthetase biosynthesis/ Neurotoxins pharmacology/ Rodents/ ODAP/ Neurology/ Amino acids/ AMPA receptors/ Aspartic acid/ Astrocytes/ Biosynthesis/ Brain/ California/ Central Nervous system/ Cerebral Cortex/ Cycloheximide Cytology/ Drugs/ Enzymes/ Glutamates/ Glutamine/ Glutamates receptors/ Ibotenic acid/ Intracellular/ Isomerism ODAP/ Isomerism/ Kainic acid/ Lactate/ Lathyrism/ Lathyrism animals/ Lathyrism enzymology/ Lathyrism rats/ Metabolism plant/ Nervous system/ Neuroexcitatory Neurotoxins/ NMDA/ ODAP biosynthesis/ ODAP isomerism/ Protein/ Receptors/ Toxin/ Toxin biosynthesis.

Misra, U. K.; Sharma, V. P., and Singh, V. P. (1993). **Clinical aspects of neurolathyrism in Unnao, India.** *Paraplegia* 31 (4):249-254 (author affiliation: Department of Neurology, Sanjay Gandhi Postgraduate Institute of Medical Sciences, Lucknow, India)

To study the clinical picture of lathyrism in Unnao, India and compare it with that reported from other endemic areas, 41 patients from Unnao were studied. Their mean age was 42.9 years (range 22-85) and the mean duration of the illness was 17.1 years (range 2-30). They had been regularly consuming Lathyrus sativus (LS). The patients complained of walking difficulty due to weakness and leg stiffness (32 each), and of frequency of micturition (4). Gait abnormalities included spastic gait (24), toe walking (18) and the necessary use of walking sticks (13). Weakness was mild to moderate, and was less prominent than was spasticity. In 8 patients the physical signs were asymmetrical. Peripheral neuropathy was present in only one patient, but muscle atrophy and widespread fasciculations were not found. A higher frequency of peripheral neuropathy and lower motor neuron involvement has been reported from Bangladesh and Israel. Severe spasticity in the

absence of prominent weakness in lathyrism may be due to the involvement of certain specific groups of corticospinal fibres.

Source: Medline 93261714; Reprinted with permission. Copyright (1993) Stockton Press

Adult/ Aged/ Aged 80 and over/ Diet/ Gait/ India/ Lathyrism therapy/ Middle Age/ Muscle Spasticity physiopathology/ Lathyrism physiopathology/ Neurology/ Lathyrus sativus/ Palestine/ Age/ Bangladesh/ Endemic/ Fibre/ India Dietary/ Dietary/ India L. sativus/ India lathyrism/ Lathyrism/ Lathyrism Aged/ Lathyrism Bangladesh/ Lathyrism India/ Lathyrism motor neurons/ Motor neurons/ Muscles/ Muscle spasticity/ Neurolathyrism/ Neurons/ Paraplegia/ Peripheral/ Physical/ Spasticity.

Pai, K. S. and Ravindranath, V. (1993). **L-BOAA induces selective inhibition of brain mitochondrial enzyme NADH-dehydrogenase.** *Brain Research* **621** (2):215-221 (author affiliation: Ravindranath V Natl Inst Mental Hlth & Neurosci Dept Neurochem Hosur Rd Bangalore 560029 Karnataka India Natl Inst Mental Hlth & Neurosci Dept Neurochem Hosur Rd Bangalore 560029 Karnataka India)

Lathyrism, a human neurological disorder has been linked to the excessive consumption of a plant toxin, beta-oxalylamino-L-alanine L-B present in *Lathyrus sativus*. The present study was carried out to elucidate the biochemical mechanisms underlying L-BOAA-induced toxic insult. Incubation of sagittal slices of mouse brain with L-BOAA resulted in dose and time-dependent inhibition of mitochondrial NADH-dehydrogenase (NADH-DH). Significant inhibition of NADH-DH was seen following incubation of brain slices with very low concentration of L-BOAA (0.1 pM). L-BOAA also induced lactate dehydrogenase (LDH) leakage from the slice into the medium in dose-dependent manner. The inhibition of NADH-DH preceded LDH leakage from the slices into the medium. L-BOAA had no effect on other mitochondrial enzymes, namely, isocitrate dehydrogenase or cytochrome c oxidase. Incubation of isolated mouse brain mitochondria with L-BOAA also resulted in inhibition of NADH-DH. L-BOAA-induced inhibition of NADH-DH was prevented by non-N-methyl-D-aspartate (non-NMDA) glutamate receptor antagonists in general and alpha-amino-3-hydroxy-5-methylisoxazole-4-propionate (AMPA) receptor antagonist (NBQX) in particular. Other glutamate agonists examined namely, N-methyl-D-aspartate, beta-N-methylamino-L-alanine (L-BMAA), L-glutamic acid, N-acetylaspartylglutamate (NAAG), quisqualic acid, kainic acid or AMPA did not have any effect on NADH-DH activity in slices although they induced LDH leakage from the slice into the medium. Incubation of brain slices with L-BOAA did not induce lipid peroxidation or changes in glutathione levels. Prior incubation of slices with glutathione (GSH) or GSH-isopropyl ester did not prevent L-BOAA-induced inhibition of NADH-DH. However, incubation of isolated mitochondria with L-BOAA in the presence of GSH-isopropyl ester prevented L-BOAA-induced inhibition of NADH-DH, indicating the protective effect of mitochondrial glutathione in the prevention of L-BOAA-induced toxicity. [References: 41]. Source: ref ex Roy (pers. comm.); Reprinted with permission Copyright 1993 Elsevier Science B.V.,

Amsterdam, Netherlands

Quinoxalinediones/ Glutamates Receptor/ ODAP toxicity/ ODAP brain NADH-dehydrogenase/ NADH-dehydrogenase ODAP/ Lathyrus sativus toxicity/ Toxicity mechanism ODAP/ Neurology/ Lathyrus sativus/ Beta Alanine analogs and derivatives/ Beta N-methylamino-L-alanine/ Amino acids/ AMPA receptors/ Aspartic acid/ Brain/ Enzymes/ Excitatory amino acid/ Glutamates/ Glutamates receptors/ Glutathione/ India/ India L. sativus/ India L. sativus consumption/ India lathyrism/ Isocitrate dehydrogenase/ Kainic acid/ Lactate dehydrogenase/ Lactate/ Lathyrism/ Lathyrism India/ Lathyrism mechanisms/ Lathyrism ODAP toxicity/ Lathyrism prevention/ Lathyrus toxicity/ Lipids/ Humans/ Mechanisms toxicity/ Mental/ Mice/ Mitochondria/ NADH/ NBQX/ NMDA/ ODAP/ Prevention lathyrism Lathyrism prevention/ Receptors/ Rodents/ Sulfur amino acids/ Toxicity ODAP/ Toxicity L. sativus/ Toxicity L. sativus mechanisms/ Toxicity Toxin.

Pai, K. S.; Shankar, S. K., and Ravindranath, V. (1993). **Billionfold difference in the toxic properties of the two excitatory amino acids, L-BOAA and L-BMAA: biochemical and morphological studies using mouse brain slices.** *Neuroscience Research* **17** (3):241-248 (author affiliation: Ravindranath V Natl Inst Mental Hlth & Neurosci Dept Neurochem Hosur Rd Bangalore 560029 Karnataka India)

Plant amino acids beta-N-oxalylamino-L-alanine (L-BOAA, present in *Lathyrus sativus*) and beta-N-methylamino-L-alanine (L-BMAA, present in *Cycas circinalis*) have been implicated in the pathogenesis of human neurological disorders lathyrism and amyotrophic lateral sclerosis-Parkinson's dementia complex of Guam (ALS-PD), respectively. In view of the conflicting reports that have emerged on the role of L-BMAA in ALS-PD, we reinvestigated the comparative toxicity of L-BMAA and L-BOAA. We report here the potent toxicity of L-BOAA as examined in an in vitro model consisting of sagittal slices of mouse brain. Incubation of sagittal slices of mouse brain with L-BOAA (1 pM) resulted in significant leakage of lactate dehydrogenase (LDH) and potassium from the slices into the medium. Under similar conditions, L-BMAA-induced LDH leakage from the slices into the medium was observed only at very high concentration of the toxin, namely 1 mM. N-Methyl-D-aspartate (NMDA) receptor antagonists ameliorated the toxic effects of L-BMAA, while non-NMDA receptor antagonists (quinoxalinediones) protected against the toxicity of L-BOAA. Incubation of slices with L-BOAA for 1 h resulted in extensive vacuolation and degeneration of neurons in the thalamus and brain stem, and to a lesser extent in the hippocampus and cerebellar nuclei. The large sized neurons appeared to be affected to a greater extent than the smaller ones. The neurons in other

areas of the brain also revealed variable degree of degeneration with swelling of axons and dendrites. Thus, the present study demonstrates the potent toxicity of L-BOAA and elucidates for the first time, the billion-fold difference in the concentration of L-BOAA and L-BMAA required to elicit similar toxic response in vitro, using mouse brain slices. The study also demonstrates the selective vulnerability of certain regions of the brain to toxic insult by L-BOAA. [References: 19].

Source: ref ex Roy (pers. comm.)

Neurotoxicity/ Excitatory Amino Acid/ Quinoxalinediones/ NMDA receptor/ Glutamates Receptor/ ODAP toxicity/ Beta N-methylamino-L-alanine toxicity/ Toxicity ODAP/ NPAA toxicity/ Brain slice bioassay/ Bioassay brain slice/ Rodents bioassay/ Bioassay rodent/ Neurology/ Lathyrus sativus/ Bioassay/ Beta Alanine analogs and derivatives/ Beta N-methylamino-L-alanine/ Bioassay L. sativus/ Lathyrus sativus bioassay/ Axons/ Amino acids/ Amyotrophic lateral sclerosis/ Aspartic acid/ Brain/ Cytosol/ Dendrites/ Glutamates/ Glutamates receptors/ Guam/ Hippocampus/ In vitro/ India/ India L. sativus/ India lathyrism/ Lactate dehydrogenase/ Lactate/ Lathyrism/ Lathyrism Bioassay/ Lathyrism hippocampus/ Lathyrism India/ Lathyrism ODAP toxicity/ Lathyrus toxicity/ Humans/ Mental/ Mice/ Models/ Neurons/ NMDA/ NPAA/ Nuclei/ ODAP/ Potassium/ Receptors/ Reports/ Rodents/ Toxicity L. sativus/ Toxicity rodents bioassay/ Toxicity/ Toxin.

Rasmussen, M. A.; Allison, M. J., and Foster, J. G. (1993). **Flatpea intoxication in sheep and indications of ruminal adaptation.** *Veterinary and Human Toxicology* **35** (2):123-127

In a series of experiments lambs were adapted to feeding with pellets containing seed-bearing flatpea (*Lathyrus sylvestris* L.) by increasing flatpea content from 50% to 100% in steps of 10% for periods of 7 days at each level. The rumen contents of some adapted lambs were exchanged with the rumen contents of lambs fed alfalfa. All exchanged lambs were fed flatpea in hay at 2200 g/day. In a third experiment lambs adapted to flatpea at 60% for 7 days were fed 100% flatpea for 62 days. These lambs were then fed monensin (30 mg/kg daily). Signs of intoxication included seizure, muscular trembling and spasmodic torticollis, and were similar to those seen in ammonia toxicosis in ruminants. Accumulation of ammonia may be a direct consequence of flatpea ingestion since 2,4-diaminobutyric acid (DABA), a toxic constituent, is known to inhibit hepatic urea synthesis. Other modes of toxicity for DABA and other flatpea toxins may contribute to this process of intoxication. The results suggest that ruminal microbes are responsible for flatpea detoxification and protection. The adaptation of sheep to flatpea may be due to increased ruminal detoxification. Ruminal protective functions can be disrupted through abrupt monensin feeding or the replacement of non-adapted for adapted rumen contents. This disruption temporarily suppresses mechanisms of ruminal detoxification and the sheep can reacquire vulnerability to flatpea intoxication.

Source: Agricola (92-94.6) IND 20380600, Reprinted with permission Copyright (1993) American College of Veterinary Toxicologists

Animal experiments/ Poisoning/ Rumen microorganisms/ Monensin/ Lathyrus/ Sheep/ Poisonous plants/ Lathyrus sylvestris/ Toxicity Detoxification/ Ruminants/ Antinutritional factors/ Adaptation/ DABA/ Hay/ Agriculture/ Lathyrism symptoms/ Medicago sativa/ Ammonia Feeding/ Feed ruminants/ Feed Lathyrus ochrus/ Feed Lathyrus sylvestris/ Lambs/ Lathyrism/ Lathyrism animals/ Lathyrism mechanisms/ Lathyrism veterinary/ Lathyrus ochrus/ Lathyrus sylvestris/ Lathyrus toxicity/ Liver/ Humans/ Mechanisms toxicity/ Medicago/ Microorganisms/ Muscles/ Rumen/ Ruminant feed/ Seed/ Sheep feed/ Symptoms lathyrism/ Toxicity L. sylvestris/ Toxin/ Urea.

Rowe, L. D.; Ivie, G. W.; DeLoach, J. R., and Foster, J. G. (1993). **The toxic effects of mature flatpea (*Lathyrus sylvestris* L cv *Lathco*) on sheep.** *Veterinary and Human Toxicology* **35** (2):127-133 (author affiliation: Food Animal Protection Research Laboratory, USDA-ARS, Route 5, Box 810, College Station, TX 77845, USA)

Groups of 5 adult ewes, assigned by weight and reproductive status (barren or in last 10 weeks of pregnancy), were fed pelleted diets containing mature, seed-bearing flatpea at 0, 35.0, 52.5 or 70.0% for 42 days, or at increasing levels of 17.5, 35.0, 52.5 and 70.0% over 42 days. The dose-related responses to the diets included a fluctuating reduction in feed intake for diets containing 35% and above of flatpea, potentially fatal acute central nervous signs at levels as low as 35%, and reduced weight gains at levels of 52.5% and over. A wasting condition developed in one ewe fed at 52.5%. Four of 5 ewes and one lamb fed increasing levels developed acute signs of poisoning. One of these ewes developed acute neurotoxicosis when fed at the 52.5% level; 3 other ewes and one orphaned lamb (40 days old) developed neurotoxicosis at the 70.0% level. 18 lambs were born to 16 flatpea-fed ewes in this study; there was no evidence that flatpea feeding adversely affected late pregnancy, parturition, lactation or lamb health.

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Animal experiments/ Wasting diseases/ Lathyrus spp sheep poisoning/ Poisonous plants sheep/ Lathyrus sylvestris toxicity/ Ewes/ Reproduction Intake/ Ruminants/ Agriculture/ Lathyrism symptoms/ Diet/ Dietary intake/ Feed/ Feeding/ Feed ruminants/ Feed intake/ Feed Lathyrus ochrus/ Feed Lathyrus sylvestris/ Food/ Dietary/ Lambs/ Lathyrism/ Lathyrism animals/ Lathyrism veterinary/ Lathyrus ochrus/ Lathyrus sylvestris/ Lathyrus spp/ Lathyrus toxicity/ Humans/ Poisonous plants/ Pregnancy/ Ruminant feed/ Seed/ Sheep/ Sheep feed/ Symptoms lathyrism/ Toxicity L. sylvestris/ Toxicity Lathyrus spp/ Toxicity/ USA/ USDA.

Spencer, P. S.; Ludolph, A. C., and Kisby, G. E. (1993). **Neurologic diseases associated with use of plant components with toxic potential.** *Environmental Research* **62** (1):106 (author affiliation: Center for Research on Occupational and Environmental Toxicology, Oregon Health Sciences University, Portland 97201)

Epidemics of neurotoxic disease in developing regions of the world are often associated with dietary dependence on plant components with inherent toxic potential or which have spoiled and become contaminated with mycotoxins. Diseases triggered by plant toxins include lathyrism and cassavism, types of irreversible spastic parapareses associated with staple diets of grass pea and bitter cassava root, respectively. Mildewed sugarcane poisoning, an encephalopathy and tardive dystonia, illustrates the neurotoxic effects of a widely distributed plant and fungal toxin. Food and medicinal use of the neurotoxic cycad plant is thought to have a role in the etiology of western Pacific amyotrophic lateral sclerosis and parkinsonism-dementia. Plant-associated neurotoxicity is a significant and preventable cause of morbidity in certain regions of Africa, Asia, and Oceania.

Source: Medline 93314607; Reprinted with permission Copyright 1993 Academic Press

Plants Toxic chemistry/ Nervous system diseases chemically induced/ Plants Toxic/ Neurology/ Antinutritional factors/ Mycotoxins/ Africa Amyotrophic lateral sclerosis/ Asia/ Chemistry/ Diet/ Environment/ Food/ Fungi/ Mycology/ Dietary/ Lathyrism etiology/ Lathyrism mycotoxins/ Manihot esculenta/ Cassava/ Medicinal/ Microbiology/ Nervous system/ Neurotoxicity/ Neurotoxins/ Oregon/ Phytochemistry Prevention lathyrism/ Lathyrism prevention/ Roots/ Spasticity/ Toxin/ Nervous system diseases.

Tekle Haimanot, R.; Abegaz, B. M.; Wuhib, E.; Kassina, A.; Kidane, Y.; Kebede, N.; Alemu, T., and Spencer, P. S. (1993). **Pattern of *Lathyrus sativus* (grass pea) consumption and beta-N-oxalyl-alpha,beta-diaminopropionic acid (beta-ODAP) content of food samples in the lathyrism endemic region of Northwest Ethiopia.** *Nutrition Research* **13** (10):1113-1126 (author affiliation: Faculty of Medicine, Addis Ababa University, P.O.Box 4147, Addis Ababa)

Grass pea, a legume whose consumption is associated with human lathyrism, is an important food crop among the poorer sectors of society in many parts of Ethiopia. A nutritional survey, focussing on the preparation and consumption of grass pea, in 224 families of two villages of a lathyrism endemic area in northwestern Ethiopia has been undertaken. Grass pea is grown in only one of the two villages. Raw as well as cooked food samples were collected and the levels of beta-ODAP determined by the OPT-method. Grass pea foods were also prepared in the laboratory following methods used in the villages and analysed for their toxin level to derive information if certain procedures were capable of reducing the level of toxin. Steeping grass pea in excess water leaches out ca 30% of the beta-ODAP. Grass pea bread (kitta) and roasted seeds (kollo) showed elevated levels of beta-ODAP as compared to the seeds used in the preparation of these foods. Lower levels of beta-ODAP were found in boiled snacks (nifro) and the flour form (shiro).

Source: Lambein\_95\_5

Lathyrism Ethiopia/ Ethiopia lathyrism/ Ethiopia nutritional survey/ Lathyrus sativus food preparation/ ODAP L. sativus food/ Human consumption L. sativus/ Lathyrus sativus/ Agriculture/ Bread/ Endemic/ Ethiopia/ Flour/ Food L. sativus/ Food preparation/ Food/ Human consumption/ Lathyrism/ Lathyrism nutrition/ Humans/ Nutrition/ Nutrition surveys/ ODAP/ Seed/ Surveys/ Toxin/ Water.

Tekle Haimanot, R.; Kidane, Y.; Wuhib, E.; Kassina, A.; Endeshaw, Y.; Alemu, T., and Spencer, P. S. (1993). **The epidemiology of lathyrism in north and central Ethiopia.** *Ethiopian Medical Journal* **31** (1):15-24 (author affiliation: Faculty of Medicine, Addis Ababa University, Ethiopia)

Lathyrism is a neurotoxic disorder caused by excessive, prolonged consumption of the hardy, environmentally tolerant legume, the grass-pea, *Lathyrus sativus*, which contains the neurotoxic amino acid beta-N-oxalylamino-L-alanine acid (BOAA). The disease develops after heavy consumption of grass-pea for over two months. It is uniformly manifested by a predominantly motor spastic paraparesis with varying degrees of disability. A door-to-door epidemiological survey for the disease using trained lay health workers was carried out in the major areas of northwest and central Ethiopia where *L. sativus* is grown. For security reasons, some of the other endemic areas were not accessible for the survey. The survey involved a population of 1,011,272. A total of 3,026 affected persons were identified. The disease was found to be widespread in the northwest and central highland areas of the country. The prevalence rates ranged from 1/10,000 to 7.5/1,000. The highest prevalences were in North and South Gonder, and East and West Gojam. The male:female ratio of cases was 2.6:1; the females exhibited a milder form of the disease. The cultivation of *L. sativus* is increasing in Ethiopia, which makes the development of low-BOAA strains very important in order to control the high incidence of lathyrism, a crippling disease which affects the productive young members of the society. Source: Medline 93170259 ; reprintDE, reprinted with permission Copyright 1993 Ethiopian Medical Journal Adolescence/ Adult/ Child/ Child Preschool/ Diet Surveys/ Ethiopia epidemiology/ Incidence/ Lathyrism etiology/ Lathyrism prevention and control/ Population Surveillance/ Prevalence/ Rural Population/ Lathyrism epidemiology/ ODAP/ Neurology/ Lathyrus sativus/ Beta Alanine analogs and derivatives/ Amino acids/ Cultivation/ Diet/ Endemic/ Epidemiology lathyrism/ Ethiopia/ Female/ Lathyrism/ Lathyrism Adolescence/ Lathyrism Ethiopia/ Lathyrism prevention/ Males/ Humans/ Neurotoxins/ Population/ Prevention lathyrism/ Lathyrism prevention Rural/ Spasticity/ Spastic paraparesis/ Strains/ Surveys/ Tolerance/ reprint.

Willis, C. L.; Meldrum, B. S.; Nunn, P. B.; Anderton, B. H., and Leigh, P. N. (1993). **Neuronal damage induced by beta-N-oxalylamino-L-alanine, in the rat hippocampus, can be prevented by a non-NMDA antagonist, 2,3-dihydroxy-6-nitro-7-sulfamoyl-benzo(f)quinoxaline.** *Brain Research* **627** (1):55-62 (author

affiliation: Willis Cl Inst Psychiat Dept Neurol Denmark Hill London Se5 8af England; Inst Psychiat Dept Neurosci London Se5 8af England; Univ London Kings Coll Div Biomed Sci London Wc2r 2ls England) The neurotoxin beta-N-oxalylamino-L-alanine (BOAA), found in *Lathyrus sativus* seeds, is thought to be the causative agent of neurolathyrism. We have investigated the in vivo mechanism of action of BOAA by focal injection (1 µl) in the dorsal hippocampus of male Wistar rats and comparing the pathological outcome with the effects of injections (1 µl) of α-amino-3-hydroxy-5-methyl-isoxazole-4-propionate (AMPA), kainate (KA) or N-methyl-D-aspartate (NMDA). Cellular damage induced by the excitatory amino acids in the pyramidal (CA1-CA4) and dentate granule neurones (DG) was assessed histologically 24 h after the injection. The study shows that BOAA (50 nmol) induces hippocampal toxicity with a highly selective pattern of regional cellular damage. The CA1, CA4 and DG subfields show 70-90% neuronal injury whereas CA2 and CA3 show only minimal damage. This pattern of cellular damage is similar to that induced by AMPA (1 nmol) and NMDA (25 nmol) but not KA (0.5 nmol). BOAA-induced neurotoxicity is prevented in a dose-dependent manner by focal co-injection of the non-NMDA receptor antagonist 2,3-dihydroxy-6-nitro-7-sulfamoyl-benzo(F)quinoxaline (NBQX) (1-25 nmol) but not by a dose of MK-801 (3 mg/kg i.p.) which is neuroprotective against an injection of NMDA. Delayed focal injections of NBQX (25 nmol) up to 2 h after the BOAA injection result in a significant protection of all pyramidal and granular cell regions. These results indicate that the in vivo hippocampal toxicity of BOAA is mediated by AMPA receptors rather than by KA or NMDA receptors. Neurones in the rat hippocampus do not die immediately when exposed to BOAA but via a delayed process involving sustained AMPA receptor activation. Excitotoxic processes acting via AMPA receptors may play a role in the chronic loss of motor neurones seen in amyotrophic lateral sclerosis. [References: 39].

Source: Reprinted with permission Copyright 1993 Elsevier Science B.V., Amsterdam, Netherlands  
 ODAP/ NBQX/ Neurotoxicity/ Neurolathyrism/ Motor neuron disorder/ Excitatory amino acid/ ODAP toxicity prevention/ Lathyrism/ Bioassay rodent/ Rats/ KA receptors/ NMDA receptors/ Neurology/ Biochemistry/ Lathyrus sativus/ Bioassay/ Beta Alanine analogs and derivatives Bioassay L. sativus/ Lathyrus sativus bioassay/ Amino acids/ Amino acids toxicity/ AMPA receptors/ Amyotrophic lateral sclerosis/ Aspartic acid/ Brain/ Denmark/ England/ Hippocampus/ Injections/ Kainic acid/ Lathyrism Bioassay/ Lathyrism Biochemistry/ Lathyrism hippocampus Lathyrism mechanisms/ Lathyrism ODAP toxicity/ Lathyrism prevention/ Lathyrism rats/ Lathyrus toxicity/ Males/ Mechanisms toxicity/ Motor neurons/ Neurons/ Neurotoxins/ NMDA/ Prevention lathyrism/ Lathyrism prevention/ Receptors/ Rodents/ Seed/ Toxicity ODAP/ Toxicity L. sativus/ Toxicity L. sativus mechanisms/ Toxicity mechanism ODAP/ Toxicity rodents bioassay/ Toxicity/ UK.

Abegaz, B. M.; Nunn, P. B.; De Bruyn, A., and Lambein, F. (1994). **Thermal isomerization of N-oxalyl derivatives of diamino acids**. In: Abegaz, B. M.; Tekle Haimanot, R.; Palmer, V. S., and Spencer, P. S. (Eds). **The grass pea and lathyrism. Proceedings of the second international Lathyrus/lathyrism conference in Ethiopia**, New York: Third World Medical Research Foundation, pp. 89-96.

Source: reprintDE

NPAA/ NPAA chemistry/ ODAP chemistry/ Chemistry/ Ethiopia/ Lathyrism Ethiopia/ ODAP/ ODAP isomerism/ Isomerism ODAP Temperature/ reprint.

Abegaz, B. M.; Tekle Haimanot, R.; Palmer, V. S., and Spencer, P. S. (1994). (Eds). **The grass pea and lathyrism. Proceedings of the second international Lathyrus/lathyrism conference in Ethiopia**, New York: Third World Medical Research Foundation.

Source: reprintDE

Lathyrism/ Lathyrus sativus/ Ethiopia/ Lathyrism Ethiopia/ reprint.

Addis, G. and Narayan, R. K. J. (1994). **Quantitative variation in the amount of neurotoxin, beta-N-oxalyl-α,β-diamino-propionic acid, in Lathyrus sativus during ontogeny**. In: Abegaz, B. M.; Tekle Haimanot, R.; Palmer, V. S., and Spencer, P. S. (Eds). **The grass pea and lathyrism. Proceedings of the second international Lathyrus/lathyrism conference in Ethiopia**, New York: Third World Medical Research Foundation, pp. 83-88.

Species of *Lathyrus* accumulate a variety of secondary metabolites in their seeds, many of which are potentially toxic to man and animals. beta-N-oxalyl-L-α,β-diaminopropionic acid (ODAP) assumes the greatest significance. It is a non-protein amino acid which causes both human and animal lathyrism. A study was conducted to assess variations in the amount of ODAP between *Lathyrus* species, between varieties of *Lathyrus sativus* and between tissues and organs in *L. sativus* during different developmental stages. High-voltage electrophoresis, thin-layer chromatography and chemical analysis were used during the investigation. Significant variations in the amount of ODAP between *Lathyrus* species and between varieties of *L. sativus* were observed. Results further established that during ontogeny, the biosynthesis and accumulation of ODAP was tissue specific and developmentally regulated. The reproductive organ tissues accumulated more ODAP than vegetative parts during development.

Source: reprintDE

Lathyrus sativus development/ ODAP biosynthesis/ Development L sativus ODAP/ Biosynthesis/ Lathyrus sativus/ Amino acids/ Chemical analysis/ Chromatography/ Electrophoresis/ Ethiopia/ Lathyrism animals/ Lathyrism Ethiopia/ Lathyrus toxicity/ Humans/ Neurotoxins/ ODAP Ontogeny/ Protein/ Reproduction/ Seed/ Tissue/ Toxicity ODAP/ Toxicity L. sativus/ Toxicity/ Varieties/ reprint.

Araya, W. A. (1994). **Adaptation of low neurotoxin lines of grass pea (L sativus) introduced from Canada and tested at Adet, Ethiopia.** In: Abegaz, B. M.; Tekle Haimanot, R.; Palmer, V. S., and Spencer, P. S. (Eds). **The grass pea and lathyrism. Proceedings of the second international Lathyrus/lathyrism conference in Ethiopia**, New York: Third World Medical Research Foundation, pp. 79-82.

Low neurotoxic lines of grass pea supplied by Dr. Campbell, Manitoba Research Station, Canada, were tested out at Adet Research Center, Ethiopia in 1991/92. The tests were carried out in a Cambisol soil type. The materials were planted on Oct. 3, 1991 in a single-rowed non-replicated nursery. Objectives were (i) to test, under Adet conditions, the adaptability of introduced low neurotoxin lines from Canada, and (ii) to identify genes or characters from low neurotoxin lines that could be incorporated into local genotypes. Data collected included days to flowering, days to maturity, powdery mildew (0-9 scale), height (cm), pods/plant, flower color, and growth habit. The yield was not measured because of conditions during the test period were beyond control; however, yield components were determined. The results showed that the local check had the highest number of pods/plant comparatively. NC8a-95 and NC8a-97/1 had the highest pods/plant of the low neurotoxin lines; NC8a-97/1 also had the highest number of seeds/pod (3 seeds/pod). None of the low neurotoxin lines were free of powdery mildew attack. Promising lines, which included NC8a-97/1, NC8a-157, NC8a-84, LS 8246, and NC8a-95, should be tested further in variety and verification trials to determine their performance or to incorporate the low neurotoxin character from the germplasm into promising local genotypes.

Source: reprintDE

Lathyrus sativus adaptation/ Adaptation L sativus Ethiopia/ Lathyrus sativus low ODAP/ Powdery mildew/ Phytopathology/ Adaptation/ Soil Lathyrus sativus/ Agriculture/ Genetic resources/ Canada/ Colour/ Erysiphe/ Ethiopia/ Evaluation genetic resources/ Flowering/ Flowers/ Fungi Mycology/ Genes/ Genotypes/ Habit/ Height/ Lathyrism Ethiopia/ Manitoba/ Maturity/ Microbiology/ Neurotoxins/ Pods/ Seed/ Soil microbiology/ Soil type/ Yield/ Yield components L. sativus/ Yield L. sativus/ Diseases plant/ reprint.

Araya, W. A. (1994). **An effort to improve grass pea (L sativus) in some parts of Ethiopia.** In: Abegaz, B. M.; Tekle Haimanot, R.; Palmer, V. S., and Spencer, P. S. (Eds). **The grass pea and lathyrism. Proceedings of the second international Lathyrus/lathyrism conference in Ethiopia**, New York: Third World Medical Research Foundation, pp. 73-78.

One of the solutions for the problem of lathyrism is the identification and utilisation of low-ODAP lines of grass pea. A total of 20 grass pea varieties was tested at Adet Research Center, Ethiopia for a period of two years in 1989/90 and 1990/91. The test was done in a randomised complete block design with four replications. The data collected included number of days to flowering, maturity, height (cm), pods/plant, seeds/pod, 1000 grain weight, grain yield, and ODAP content. There was no significant yield difference among the varieties in 1990/1991. When averaged over the two years, PGRCE 46066 was the highest yielding variety with a yield level of 3426 kg ha<sup>-1</sup>. The ODAP level of the varieties varied in different seasons; however, there were varieties where the variation was negligible. When averaged over the two years, PGRCE 201538 had a minimum ODAP level of 0.35%. PGRCE 201513, one of the best yielding varieties of those tested, had the lowest ODAP levels. More elaborate studies on the relationship between ODAP content and environment interaction are required.

Source: reprintDE

Lathyrus sativus Ethiopia/ Ethiopia L sativus improvement/ ODAP/ Lathyrus sativus/ Environment/ Ethiopia/ Flowering/ Height/ Lathyrism Ethiopia/ Maturity/ Pods/ Seed/ Seed yield/ Utilisation/ Varieties/ Varieties L. sativus/ Lathyrus sativus varieties/ Yield/ Yield L. sativus/ reprint.

Cohn, D. F. (1994). **Does neurolathyrism affect longevity?** In: Abegaz, B. M.; Tekle Haimanot, R.; Palmer, V. S., and Spencer, P. S. (Eds). **The grass pea and lathyrism. Proceedings of the second international Lathyrus/lathyrism conference in Ethiopia**, New York: Third World Medical Research Foundation, pp. 33-35.

Source: reprintDE

Lathyrism longevity/ Neurology/ Ethiopia/ Lathyrism/ Lathyrism Ethiopia/ Longevity/ Neurolathyrism/ reprint.

Dibabe, A.; Araya, W. A.; Hundie, B.; Ensermu, R.; Haile, W.; Ashagrie, Y.; Yalew, A., and Seyoum, W. (1994). **The status of grass pea (Lathyrus sativus) research and production in Ethiopia.** In: Abegaz, B. M.; Tekle Haimanot, R.; Palmer, V. S., and Spencer, P. S. (Eds). **The grass pea and lathyrism. Proceedings of the second international Lathyrus/lathyrism conference in Ethiopia**, New York: Third World Medical Research Foundation, pp. 45-60.

Grass pea (Lathyrus sativus) occupies 8.7 % of the total area and 7.6 % of the total production of food legumes in Ethiopia. It is produced in areas with adverse agricultural conditions. It performs well on heavy

black soils which promote waterlogging. Grass pea production is mainly concentrated in the northwest zone (58.0%), the central zone (16.3%), the north-east (12.8%), and the northern as well as the southeast region of Ethiopia (12.9). Like most crops in Ethiopia, grass pea grain is used for human consumption and the straw as animal feed. One of the ways to utilise the crop properly is through the identification of grass pea varieties with low ODAP toxin and reasonable yield. A total of 177 grass pea germplasm accessions has been identified and varieties with a ODAP content of 0.2-0.5 % advanced to the next stages. The seed yield data of the variety trials conducted in 1989 and 1991 revealed that the overall mean yields were 2856 kg/ha and 3297 kg/ ha, respectively. PGRC/E46060 gave the highest yield of 3385 kg/ha in 1989, whereas PGRC/E46066 gave the highest yield of 3661 kg/ha in 1991. There was no correlation between ODAP content and yield components. The major diseases that attack grass pea are rust and powdery mildew. The major insects are aphids, thrips and bollworm. Aphids are the most important pest. Most of the farmer's fields assessed were low in weed infestation. Weeds such as *Hygrophylla auriculata*, *Guizotia scabra*, *Cynodon dactylon*, *Lactuca serriola*, *Pennisetum romosum* and *Daucus carota* were found to be the major weeds of grass pea in the northwestern region of Ethiopia. A survey on the nodulation pattern of grass pea was done in the major grass pea-growing areas of the northwest. Most of the nodules in the samples collected were not effective in fixing nitrogen from the atmosphere.

Source: reprintDE

Lathyrus sativus research Ethiopia/ Ethiopia L. sativus research/ ODAP/ Agronomy/ Farming systems/ Waterlogging/ Phytopathology/ Soil Lathyrus sativus/ Entomology/ Straw/ Agriculture/ Genetic resources/ Animal feed/ Aphids/ Erysiphe/ Ethiopia/ Feed/ Feed Lathyrus sativus Flooding/ Food/ Fungi/ Mycology/ Guizotia/ Human consumption/ Insects/ Lathyrism/ Lathyrism animals/ Lathyrism Ethiopia/ Lathyrus sativus agronomy/ Humans/ Microbiology/ Nitrogen/ Nodulation/ Pests/ Powdery mildew/ Rust/ Seed/ Seed yield/ Soil microbiology/ Surveys/ Toxin Varieties/ Variety trials/ Varieties L. odoratus/ Varieties L. sativus/ Lathyrus sativus varieties/ Lathyrus odoratus varieties/ Water/ Weed/ Yield Yield components L. sativus/ Yield L. sativus/ Diseases plant/ reprint.

Jimenez-Roldan, S.; Ludolph, A. C.; Hugon, J.; Hens, M.; Mateo, D.; Kisby, G. E., and Spencer, P. S. (1994). **Lathyrism in Spain: Progressive central nervous system deficits more than 45 years after onset.** In: Abegaz, B. M.; Tekle Haimanot, R.; Palmer, V. S., and Spencer, P. S. (Eds). **The grass pea and lathyrism. Proceedings of the second international Lathyrus/lathyrism conference in Ethiopia**, New York: Third World Medical Research Foundation, pp. 10-25.

During the famine following the Spanish Civil war (1936-1939), outbreaks of human lathyrism occurred in the Spanish provinces of Catalonia and Castilia because of heavy consumption of food containing *Lathyrus* spp. seed, a neurotoxic legume. In June 1988, we studied 14 male subjects, aged 49-70 years, who developed lathyrism during childhood or adolescence, for evidence of recent clinical deterioration. Each patient displayed a characteristic pattern of neurological deficit, and 10 complained of deterioration of motor performance (increased leg stiffness, shortening of steps and a tendency to scrape the floor with toes) which had developed over the previous 2-10 years. This was reportedly accompanied by the appearance, or by an increase of severity and frequency, of painful nocturnal calf-muscle cramping. Five of the 10 no longer consumed *Lathyrus*, while 3 or 4 with seemingly static illness reported continued occasional intake. However, 8 of 9 patients showed measurable levels of the *Lathyrus* neurotoxin, alpha-N-oxalyl-L-alpha,beta-diaminopropionic acid (ODAP). Age, disease duration, clinical severity at onset, and continued consumption of *Lathyrus* spp., could not be associated with susceptibility to deterioration. Finally, the clinical presentation and pattern of neurological deficit in Spanish peasants with lathyrism closely resembles that of Bangladesh, Ethiopian, Indian, and Israeli patients, but was clearly different from the rapidly progressive disease seen in sporadic amyotrophic lateral sclerosis.

Source: reprintDE

Lathyrism Spain/ Spain lathyrism/ Ruminants/ ODAP/ Neurology/ Famine/ Malnutrition/ Cattle/ Agriculture/ Age/ Amyotrophic lateral sclerosis/ Bangladesh/ Calves/ Central Nervous system/ Ethiopia/ Food/ India/ India malnutrition/ India lathyrism/ Intake/ Lathyrism/ Lathyrism Adolescence/ Lathyrism Aged/ Lathyrism Bangladesh/ Lathyrism Ethiopia/ Lathyrism India/ Lathyrus spp/ Males/ Humans/ Muscles/ Nervous system/ Neurotoxins/ Poultry/ Seed/ Spain/ Susceptibility/ reprint.

Haque, A.; Hossain, M.; Khan, J. K.; Kuo, Y.-H., and Lambein, F. (1994). **New findings and symptomatic treatment for neurolathyrism, a motor neuron disease occurring in North West Bangladesh.** *Paraplegia* **32**:193-195.

Neurolathyrism is a form of spastic paraparesis caused by the neuroexcitatory amino acid 3-N-oxalyl-L-2,3-diaminopropanoic acid (L-ODAP) present in the seeds and foliage of *Lathyrus sativus*. Tolperisone HCl, a centrally acting muscle relaxant, has been shown to reduce significantly the spasticity in neurolathyrism patients. Sporadic occurrence of HTLV-1 infection (0.9%) and of osteolathyrism was found among the neurolathyrism patients. Osteolathyrism is linked to the consumption of the green shoots of *Lathyrus sativus*.

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Lathyrism viral infection/ HTLV-1 lathyrism/ Tolperisone lathyrism treatment/ Symptomatic treatment lathyrism/ Muscle relaxant lathyrism treatment/ Lathyrism treatment/ Lathyrism Bangladesh/ Bangladesh lathyrism/ Osteolathyrism Bangladesh/ Bangladesh ODAP/ Neurology Lathyrus sativus/ Osteolathyrism/ Amino acids/ Bangladesh/ HTLV/ Infection/ Lathyrism/ Lathyrism motor neurons/ Lathyrism treatment Motor neurons/ Muscles/ Neuroexcitatory/ Neurolathyrism/ Neurons/ ODAP/ Paraplegia/ Seed/ Shoots/ Spasticity/ Spastic paraparesis/ reprint.

Lambein, F.; Haque, R.; Khan, J. K.; Kebede, N., and Kuo, Y.-H. (1994). **From soil to brain: Zinc deficiency increases the neurotoxicity of *Lathyrus sativus* and may affect the susceptibility for the motorneuron disease neurolathyrism.** *Toxicol* **32** (4):461-466 (author affiliation: Laboratory of Physiological Chemistry, Faculty of Medicine, University of Ghent, Ledeganckstraat 35, B-9000 Gent, Belgium)

Zinc deficiency and oversupply of iron to the roots of grass pea (*Lathyrus sativus*) induce increases in the content of the neurotoxin beta-L-ODAP (3-oxalyl-L-2,3-diaminopropanoic acid) in the ripe seeds. The transport of zinc to the shoots is enhanced by the addition of beta-L-ODAP. The neurotoxin of *Lathyrus sativus* is proposed to function as a carrier molecule for zinc ions. Soils, depleted in micronutrients from flooding by monsoon rains (Indian subcontinent) or otherwise poor in available zinc and with high iron content (Ethiopian vertisols), may be responsible for higher incidence of human lathyrism, one of the oldest neurotoxic diseases known to man. A role for brain zinc deficiency in the susceptibility for lathyrism is postulated.

Source: reprintDE

Lathyrus sativus Zinc/ Zinc deficiency/ Nutrient manipulation Zinc/ Lathyrism susceptibility/ ODAP Zinc/ Soil Zinc/ Brain Zinc/ Neurology Lathyrism zinc/ Zinc lathyrism/ Zinc/ Waterlogging/ Soil/ Lathyrus sativus/ Brain/ Chemistry/ Deficiency/ Ethiopia/ Flooding/ Belgium/ Heavy metals/ Incidence/ India/ India L. sativus/ India lathyrism/ Iron/ Lathyrism/ Lathyrism Ethiopia/ Lathyrism India/ Humans/ Metals/ Motor neurons/ Neurolathyrism/ Neurons/ Neurotoxicity/ Neurotoxins/ Nutrients/ ODAP/ Roots/ Seed/ Shoots/ Susceptibility/ Trace elements Vertisols/ Soil vertisol/ Water/ reprint.

Lambein, F.; Wouters, G.; Haque, A.; Hussain, M., and Yusul, H. K. M. (1994). **Recent progress in the Bangladesh-Belgium Inter-University Project.** In: Abegaz, B. M.; Tekle Haimanot, R.; Palmer, V. S., and Spencer, P. S. (Eds). **The grass pea and lathyrism. Proceedings of the second international Lathyrus lathyrism conference in Ethiopia**, New York: Third World Medical Research Foundation, pp. 127-139.

Source: reprintDE

INLSEL/ Lathyrus sativus research Belgium/ Lathyrus sativus research Bangladesh/ Lathyrus sativus/ Bangladesh/ Ethiopia/ Belgium Lathyrism Bangladesh/ Lathyrism Ethiopia/ reprint.

Miller, S. E. (1994) **Aspects of glutamatergic function in astrocytes: glutamine synthetase regulation and metabotropic glutamate receptors** [PhD thesis]: University of California, Irvine, 157 pp.

The traditional view that astrocytes are passive support cells has begun to give way to a new consensus that these cells have dynamic roles in development, in the response to injury and disease, and in chemical and electrical signalling. In this context, this dissertation examines two aspects of astrocyte glutamatergic function using cultured cortical astrocytes as the model system. First, the effects were examined of exogenously applied excitatory amino acids on glutamine synthetase (GS), a key enzyme in glutamate metabolism. Two excitatory amino acids were identified which induced GS activity:  $\beta$ -N-Oxalyl-L- $\alpha$ , $\beta$ -diaminopropionic acid ( $\beta$ -L-ODAP), the putative *Lathyrus* toxin, and the metabotropic glutamate receptor (mGluR) agonist 1-aminocyclopentane-trans-1,3-dicarboxylic acid (trans-ACPD). The abilities of these compounds to induce GS activity were concentration-dependent, stereoselective, and could be reduced by the protein translation inhibitor cycloheximide. The possible significance of these alterations in GS activity for the regulation of glutamate homeostasis is discussed. The ability of the mGluR agonist trans-ACPD to increase GS activity suggested that mGluRs might have important roles in astrocyte function and led to the second series of studies which examined mGluR signal transduction and its regulation in astrocytes. The presence of two metabotropic signal transduction pathways for glutamate was demonstrated: stimulation of phosphoinositide hydrolysis and inhibition of cyclic AMP accumulation. The antagonist  $\alpha$ -methyl-4-carboxyphenylglycine was shown to block stimulation of phosphoinositide hydrolysis but not inhibition of cyclic AMP accumulation, providing a means to pharmacologically dissociate these two pathways. The glutamate transport inhibitor, L-trans-2,4-pyrrolidine dicarboxylic acid, was shown to also be an mGluR agonist in astrocytes and was particularly effective at reducing cyclic AMP accumulation. The phosphoinositide pathway was modifiable according to the chemical conditions of the culture environment. When astrocytes were cultured in a serum-free defined medium, trans-ACPD produced much larger stimulations of phosphoinositide hydrolysis than had been estimated in previous studies using conventional culture techniques. This increased stimulation appeared to be selective for mGluR agonists and was accompanied by a large increase in the expression of the mGluR5 subtype, as determined by Western immunoblotting. Further studies in serum-free culture revealed that both trans-ACPD-stimulated

phosphoinositide hydrolysis and mGluR5 expression could be increased by previous exposure of the astrocytes to basic fibroblast growth factor, epidermal growth factor, or transforming growth factor- $\alpha$ .

Lathyrism/ ODAP toxicity mechanism/ Glutamates receptors/ Glutamine synthetase regulation/ Biochemistry/ Neurology/ Nerve cells  
Astrocytes/ Amino acids/ California/ cAMP/ Cycloheximide/ Dissertations/ Distribution plants/ Environment/ Enzymes/ Epidermis/ Excitatory amino acid/ Glutamates/ Glutamine/ Hydrolysis/ Lathyrism Biochemistry/ Lathyrism mechanisms/ Lathyrism ODAP toxicity/ Lathyrism serum  
Lathyrus toxicity/ Mechanisms toxicity/ Metabolism plant/ Models/ Nerves/ ODAP/ Protein/ Receptors/ Regulation/ Toxicity ODAP/ Toxicity mechanism ODAP/ Toxicity/ Toxin.

Misra, U. K. and Pandey, C. M. (1994). **H reflex studies in neurolathyrism.** Electroencephalography and Clinical Neurophysiology **93** (4):281-285 (author affiliation: Misra Uk Sanjay Gandhi Postgrad Inst Med Sci Dept Neurol Post Box 375 Lucknow Uttar Pradesh India Sanjay Gandhi Postgrad Inst Med Sci Dept Biostat Lucknow Uttar Pradesh India)

Sixteen patients with lathyrism, age ranging between 18 and 55 years and duration of illness between 2 and 25 years, underwent H reflex studies with the aim of studying motor neurone excitability. The patients had marked spasticity (Ashworth score ranging between 2 and 5) and mild to moderate leg weakness. Knee and ankle reflexes were exaggerated in all and the plantar response was extensor in 14 patients. The H reflex abnormalities included increased HM ratio indicating increased motoneurone excitability, significant lack of vibratory inhibition indicating altered transmission in the premotoneuronal portion of the H reflex pathway, and lack of reciprocal inhibition ( $P < 0.01$ ). These H reflex abnormalities were not related to spasticity, weakness, clonus or plantar response. The H reflex recovery curve in 6 patients revealed increased excitability throughout the recovery curve. The secondary facilitation started and peaked slightly earlier than normal, and the late depression was not marked indicating change in excitability of motoneurons or of interneurons. [References: 21].

Source: Copyright Current Contents

H Reflex/ Spasticity/ Paraplegia/ Motor neuron excitability/ Lathyrism/ Neurology/ Age/ Clinical neurophysiology/ Electroencephalography  
India/ India Uttar Pradesh/ India lathyrism/ Lathyrism India/ Motor neurons/ Neurolathyrism/ Neurons/ Reflexes/ Transmission/ UK/ Uttar Pradesh.

Misra, U. K. and Sharma, V. P. (1994). **Peripheral and central conduction studies in neurolathyrism.** Journal of Neurology, Neurosurgery and Psychiatry **57**:572-577 (author affiliation: Dept of Neurology, Sanjay Gandhi Post Graduate Institute of Medical Sciences, Lucknow-226 001, India)

To study the involvement of motor and sensory pathways in neurolathyrism, 19 patients with lathyrism from Unnao, India, where lathyrism is endemic, were studied. The mean age of the patients at the time of the onset of illness was 35.8 (range 18-70) years. The mean duration of illness was 15.6 (range 2-30) years. The clinical picture comprised walking difficulty due to stiffness and mild weakness in all 19 patients, cramps in the legs in five, frequency or urgency of micturition in five, and flexor spasms in three. There was pronounced leg spasticity with a mean Ashworth score of 4.1 (range 2.9-5). Central motor conduction to the tibialis anterior muscle (CMCT-TA) was slow in 14 of the 17 patients (21 sides). Slowing of peripheral motor nerve conduction, although less pronounced, was significant in the upper limb in four and in the lower limb in seven sides. The tibial somatosensory evoked potentials were normal and peroneal nerve conduction was marginally impaired. Values for CMCT-TA correlated with the degree of spasticity ( $p < 0.02$ ) whereas weakness, crossed adductor reflexes, and clonus did not. The wide variability of CMCT-TA in lathyrism may be due to involvement of different types of fibres. Large diameter fibre involvement may cause pronounced slowing. Small diameter fibre involvement could produce appreciable spasticity and mild weakness but a lesser degree of slowing or even normal conduction.

Source: Lambein\_95\_5

Lathyrus/ Lathyrism/ Study of patients/ India Lathyrism/ Lathyrism India/ Symptoms lathyrism/ Neurology/ Lathyrism symptoms/ Age  
Endemic/ Fibre/ India/ Muscles/ Nerves/ Neurolathyrism/ Peripheral/ Reflexes/ Spasm/ Spasticity.

Moges, G. (1994). **Possibilities of flow-injection immobilised enzyme-based assay for beta-N-oxalyl-L-alpha,beta-diaminopropionic acid.** In: Abegaz, B. M.; Tekle Haimanot, R.; Palmer, V. S., and Spencer, P. S. (Eds). **The grass pea and lathyrism. Proceedings of the second international Lathyrus lathyrism conference in Ethiopia**, New York: Third World Medical Research Foundation, pp. 97-104. A successful program of eradicating lathyrism depends primarily on the reliability of measuring ODAP, a neurotoxin found in the seeds of *Lathyrus sativus*. The present methods of assay for ODAP are slow and do not distinguish the beta-isomer from the nontoxic alpha-form. One approach towards specificity in analysis is to use appropriate enzymes that catalyse the reactions of biomolecules. This presentation examines enzymes that may be used to catalyse the reactions of ODAP and its products, with emphasis on analytical potentials. Rapid assays can be developed by using immobilised (insolubilised) enzyme reactors in flow-injection analysis (FIA) and in post-column detections for high performance liquid chromatography (HPLC). Some FIA results

in measuring pyruvate and ammonia (products of a two-step reaction of ODAP) with immobilised L-lactate dehydrogenase (LDH) and L-glutamate dehydrogenase (GluDH) reactors are discussed.

Source: reprintDE

Enzyme catalysis/ Flow injection analysis/ ODAP/ Enzyme based assay ODAP/ ODAP enzyme assay/ ODAP analysis/ Lathyrus sativus Ammonia/ Bioassay/ Chromatography/ Enzymes/ Ethiopia/ Glutamates/ HPLC/ HPLV/ Injections/ Isomerism ODAP/ Isomerism/ Lactate dehydrogenase/ Lactate/ Lathyrism Bioassay/ Lathyrism Ethiopia/ Lathyrism viral infection/ Neurotoxins/ ODAP isomerism/ Seed/ reprint.

Negere, A. and Mariam, S. W. (1994). **An overview of grass pea (*Lathyrus sativus*) production in Ethiopia.** In: Abegaz, B. M.; Tekle Haimanot, R.; Palmer, V. S., and Spencer, P. S. (Eds). **The grass pea and lathyrism. Proceedings of the second international Lathyrus/lathyrism conference in Ethiopia**, New York: Third World Medical Research Foundation, pp. 67-72.

Source: reprintDE

Lathyrus sativus production Ethiopia/ Ethiopia L. sativus production/ Lathyrus sativus/ Ethiopia/ Lathyrism/ Lathyrism Ethiopia/ reprint.

Nunn, P. B. (1994). **What molecular mechanisms cause the signs and symptoms of neurotoxicity?** In: Abegaz, B. M.; Tekle Haimanot, R.; Palmer, V. S., and Spencer, P. S. (Eds). **The grass pea and lathyrism. Proceedings of the second international Lathyrus/lathyrism conference in Ethiopia**, New York: Third World Medical Research Foundation, pp. 36-43.

Source: reprintDE

Lathyrism mechanisms/ Neurology/ Lathyrism symptoms/ Ethiopia/ Lathyrism/ Lathyrism Ethiopia/ Lathyrism mechanisms/ Mechanism Molecular/ Neurotoxicity/ Symptoms lathyrism/ reprint.

Soyka, D. (1994). **Toxic encephalopathies.** *Nervenheilkunde* **13** (4):149-154 (author affiliation: Soyka D Christian Albrechts Univ Kiel Neurol Klin Niemannsweg 147 D-24105 Kiel Germany) [German] Many substances may cause both toxic lesions and clinical syndromes related to the central nervous system. In this paper some aspects of pathogenesis as well as diagnostic problems are reviewed. In particular intoxications with some metals and metalloids, gases and organic compounds including solvents are considered. [References: 21].

Source: Copyright Current Contents

Neurotoxicology/ Encephalopathies/ Pathogenesis/ Diagnostic problems/ Nervous-system/ Lathyrism/ Disease/ Lead/ Review.

Tadasse, D. (1994). **Grass pea (*Lathyrus sativus*): Genetic resources conservation and utilization in Ethiopia.** In: Abegaz, B. M.; Tekle Haimanot, R.; Palmer, V. S., and Spencer, P. S. (Eds). **The grass pea and lathyrism. Proceedings of the second international Lathyrus/lathyrism conference in Ethiopia**, New York: Third World Medical Research Foundation, pp. 61-66.

Source: reprintDE

Ethiopia L. sativus genetic resources/ Genetic resources L. sativus Ethiopia/ Lathyrus sativus/ Agriculture/ Genetic resources/ Conservation Ethiopia/ Lathyrism Ethiopia/ Genetic resources L. sativus/ reprint.

Tekle Haimanot, R.; Kidane, Y.; Wuhib, E.; Kassina, A.; Endeshaw, Y.; Alemu, T., and Spencer, P. S. (1994). **The epidemiology of lathyrism in Ethiopia.** In: Abegaz, B. M.; Tekle Haimanot, R.; Palmer, V. S., and Spencer, P. S. (Eds). **The grass pea and lathyrism. Proceedings of the second international Lathyrus lathyrism conference in Ethiopia**, New York: Third World Medical Research Foundation, pp. 1-9.

Source: reprintDE

Lathyrism Ethiopia/ Ethiopia lathyrism/ Lathyrism epidemiology/ Epidemiology lathyrism/ Ethiopia/ Lathyrism/ reprint.

Tiwari, K. R. (1994) **Inheritance of the neurotoxin beta-N-oxalyl-L-alpha,beta-diaminopropionic acid (ODAP) in grass pea (*Lathyrus sativus* L.) seeds** [MSc thesis]. Winnipeg: Dep. Plant Science, University of Manitoba, 144 pp.

Excellent study and comprehensive review, well worth reading. F2 progeny segregated over entire parental range. ODAP biosynthesis is inherited quantitatively. Cytoplasmic factors appear to be involved. Low x low ODAP crosses resulted in low ODAP progeny. Young seeds contain higher ODAP levels than fully matured seeds! Grass pea (*Lathyrus sativus* L.) is an important food, feed and fodder legume drought resistant crop. A strong epidemiological association is known to exist between consumption of grass pea and lathyrism. A neurotoxin, beta-N-Oxalyl-L-alpha,beta-diaminopropionic acid (ODAP) has been identified to be the causative principle. This study was undertaken to investigate the mode of inheritance of the neurotoxin, a prerequisite for the development of neurotoxin free or low neurotoxin lines. Five grass pea lines with low to high ODAP concentration were inter-crossed in all possible combinations (both crosses and reciprocals). Parents, P1 and P2 progenies were evaluated under field condition and ODAP analyzed by ortho-phthalaldehyde spectrophotometric method. Many of the progenies of low x low ODAP crosses were found to be low in ODAP concentration which indicated that the low ODAP lines shared some genes in common for seed ODAP content. However, wider variation of ODAP in P2 progenies as compared to

parental and F<sub>2</sub> progenies, suggested the presence of different modifier genes between lines. The F<sub>2</sub> progenies of the low ODAP x high ODAP crosses were intermediate in ODAP concentration which indicated lack of complete dominance either by low or high ODAP. The F<sub>2</sub> progenies segregated covering the entire parental range. The continuous variation, together with very close to normal distribution of the F<sub>2</sub> population both of low x low and low x high ODAP, crosses indicated ODAP to be quantitatively inherited. Reciprocal crosses produced different results in some cases indicating a maternal effect on ODAP concentration. Broad sense heritability of ODAP concentration was estimated to be in the range of 17 to 93%. Source: reprintDE.

ODAP genetics/ Breeding ODAP/ ODAP inheritance/ Genetics ODAP/ Genetics L. sativus/ Lathyrus sativus genetics/ Genetics cytoplasmic factors/ ODAP biosynthesis cytoplasm/ Lathyrus sativus review/ Forage/ Lathyrus sativus/ Agriculture/ Biosynthesis/ Canada/ Climate/ Drought Feed/ Feed Lathyrus sativus/ Fodder/ Food/ Genes/ Genetics/ Heritability/ Lathyrism review/ Manitoba/ Maternal/ Neurotoxins/ O phthalaldehyde/ ODAP/ ODAP biosynthesis/ Population/ Resistance/ Review/ Seed/ reprint.

Trent, M. B. and Boor, P. J. (1994). **Vascular amine oxidase activities during synergistic vasculotoxicity.** *Toxicology* **89** (1):67-77 (author affiliation: Boor Pj Univ Texas Med Branch Dept Pathol F-05 Galveston, Tx 77555 Usa)

Allylamine (AA) and beta-aminopropionitrile (beta APN) are well known vascular toxins with a demonstrated synergistic toxic effect, i.e. given together they cause extensive smooth muscle cell necrosis of the aortic media. In this study, we investigated the possibility that the enzymes involved in the separate toxicity of AA (semicarbazide-sensitive amine oxidase, or SSAO) and beta APN (lysyl oxidase, or LyO), could be the target(s) of their synergistic toxicity. Adult male Sprague-Dawley rats were given AA alone (AA), 100 mg/kg day, beta APN alone (beta APN), 1 g/kg/day, or both chemicals (AA + beta APN) by gavage for 1, 2, 5 or 10 days. SSAO and LyO were assayed in aorta, lung, and bone. SSAO activity in aortas of rats treated with AA + beta APN showed a maximal decrease (40%) at 10 days; more moderate depression of SSAO was seen in lung and bone, LyO changes were most marked in aorta, where activities were consistently and markedly depressed in all rats receiving beta APN (either alone or in combined treatment). Similarly, the lung and bone LyO activity was depressed at all time points in rats receiving beta APN, but to an apparently lesser degree than in aorta. The most striking changes in in vivo enzyme activities were seen in the aorta, the major target organ in this model. No synergistic effect of the two toxins was seen in the depression of LyO enzyme activity, since there was no difference in the degree of enzyme inhibition present between rats given beta APN alone or AA + beta APN, indicating that inhibition of this enzyme is mainly due to the effect of beta APN. We suggest that AA is the primary toxin in this synergistic vasculotoxic effect. It is likely that some effect of beta APN on AA metabolism or detoxification mechanisms results in synergism. [References: 26].

Source: Copyright Current Contents

Semicarbazide-sensitive amine oxidase/ Lysyl oxidase/ Allylamine/ Beta-aminopropionitrile/ Aorta/ Vascular toxicity/ Smooth-muscle cells Benzylamine oxidase/ Lysyl oxidase/ Allylamine cardiotoxicity/ Beta-aminopropionitrile/ Rat/ Toxicity Lathyrism/ Acrolein/ Invitro.

Tylleskär, T.; Rwiza, H. T.; Banea, M.; Howlett, W. P.; Aquilonius, S.-M.; Persson, L.-A., and Rosling, H. (1994). **Similarities between Konzo and lathyrism suggest a common pathogenetic mechanism.** In: Abegaz, B. M.; Tekle Haimanot, R.; Palmer, V. S., and Spencer, P. S. (Eds). **The grass pea and lathyrism. Proceedings of the second international Lathyrus/lathyrism conference in Ethiopia**, New York: Third World Medical Research Foundation, pp. 26-32. (author affiliation: International Child Health Unit, Department of Neurology, University Hospital, Uppsala, Sweden).

Source: reprintDE

Lathyrism chronic Cassava toxicity/ Lathyrus/ Lathyrism/ Konzo/ Pathogenic mechanism/ Cassava toxicity lathyrism similarities/ Neurology Cassava toxicity/ Child/ Ethiopia/ Lathyrism Ethiopia/ Lathyrism mechanisms/ Lathyrus toxicity/ Humans/ Manihot esculenta/ Cassava Mechanisms toxicity/ Sweden/ Toxicity/ Uppsala/ reprint.

Urga, K.; Fite, A., and Gebre Tsadik, M. (1994). **Influence of processing methods on cooking time and nutritional quality of grass pea.** In: Abegaz, B. M.; Tekle Haimanot, R.; Palmer, V. S., and Spencer, P. S. (Eds). **The grass pea and lathyrism. Proceedings of the second international Lathyrus/lathyrism conference in Ethiopia**, New York: Third World Medical Research Foundation, pp. 105-118.

A simple and convenient procedure has been developed for the preparation of quick-cooking grass pea seeds. When cooked in boiling water, salt solution and wood ash filtrate, pre-soaked grass pea seeds tenderised within 20 and 40 min, respectively. This corresponds to a reduction of 96 % and 84%, respectively, of the time required to cook untreated grass pea seeds. The process also resulted in leaching of solids to the soaking solutions; these increased with the hydration time. During cooking, leaching of solids to the cooking water decreased with the drop in cooking time. Hydration of grass pea seeds prior to cooking also gave a higher drained weight than without hydration. The process also resulted in loss of minerals, protein, phytate and ODAP. The cooked, quick-cooking seeds, however, had a smooth uniform texture, excellent whole-seed appearance, and a pleasing and acceptable flavour. The quick-cooking process thus should find applications in

parts of Ethiopia which are usually fuel-deficient and where dry grass pea seeds are produced as a stable and high protein food commodity.

Source: reprintDE

Lathyrus sativus processing/ Lathyrus sativus cooking/ ODAP/ Lathyrus sativus/ Ash/ Cookery/ Ethiopia/ Flavour/ Food/ Food processing Food processing L. sativus/ Fuel/ Lathyrism/ Lathyrism Ethiopia/ Mineral/ Phytates/ Processing/ Processing methods L. sativus/ Protein/ Quality Seed/ Soaking/ Water/ reprint.

Willis, C. L.; Meldrum, B. S.; Nunn, P. B.; Anderton, B. H., and Leigh, P. N. (1994). **Neuroprotective effect of free radical scavengers on beta-n-oxalylamino-L-alanine (BOAA)-induced neuronal damage in rat hippocampus.** *Neuroscience Letters* **182** (2):159-162 (author affiliation: Willis CI Inst Psychiat Dept Neurol De Crespigny Pk London Se5 8af EnglandInst Psychiat Dept Neurosci London Se5 8af EnglandUniv London Kings Coll Div Biomed Sci London Wc2r 2ls England)

The neurotoxin beta-N-oxalylamino-L-alanine (BOAA), found in *Lathyrus sativus* seeds, is thought to be the causative agent of *neurolethyrism*. We have investigated the neuroprotective effects of free radical scavengers on BOAA-induced toxicity following focal injection (1  $\mu$ l) of BOAA and comparing the pathological outcome with the effects of injections of alpha-amino-3-hydroxy-5-methyl-isoxazole-4-propionate (AMPA), kainate (KA) or N-methyl-D-aspartate (NMDA) into the dorsal hippocampus of male Wistar rats. Cellular damage was assessed histologically. BOAA (50 nmol) induced a highly selective pattern of hippocampal damage identical with that seen with AMPA (1 nmol). BOAA-induced neurotoxicity, but not AMPA, KA (0.5 nmol) or NMDA (25 nmol)-induced neurotoxicity, was prevented in a dose-dependent manner by focal co-injection of four potential free radical scavengers; dimethyl sulphoxide (DMSO) (1750-7000 nmol), dimethylthiourea (DMTU) (8000 nmol), dimethylformamide (DMF) (7000 nmol) and mannitol(1000 nmol). These findings suggest that hippocampal damage induced by BOAA involves an interaction between AMPA receptors and free radicals. [References: 28].

Source: Reprinted with permission (1994) Elsevier Science Ireland Ltd.

ODAP/ DMSO/ Free Radical/ Neurotoxicity/ Neurolethyrism/ Motor neuron disorder/ Excitatory Amino Acid/ Hippocampus/ ODAP toxicity mechanism/ Toxicity ODAP/ Free radical scavengers/ Lathyrism/ Neurology/ Biochemistry/ Lathyrus sativus/ Beta Alanine analogs and derivatives/ Amino acids/ Amino acids toxicity/ AMPA receptors/ Aspartic acid/ England/ Injections/ Kainic acid/ Lathyrism Biochemistry Lathyrism hippocampus/ Lathyrism mechanisms/ Lathyrism ODAP toxicity/ Lathyrism rats/ Lathyrus toxicity/ Males/ Mechanisms toxicity Motor neurons/ Neurons/ Neurotoxins/ NMDA/ Prevention lathyrism/ Lathyrism prevention/ Rats/ Receptors/ Rodents/ Seed/ Toxicity L. sativus/ Toxicity L. sativus mechanisms/ Toxicity mechanism ODAP/ Toxicity/ UK.

Wuhib, E.; Tekle Haimanot, R.; Kassina, A.; Kidane, Y., and Alemu, T. (1994). **Survey of grass pea preparation and general dietary intake in rural communities.** Abegaz, B. M.; Tekle Haimanot, R.; Palmer, V. S., and Spencer, P. S. The grass pea and lathyrism. Proceedings of the second international Lathyrus/lathyrism conference in Ethiopia, in Addis Ababa, Ethiopia. Published in New York: Third World Medical Research Foundation, pp. 119-126. ISBN: 0-9617775-3-2.

Ethiopian Nutrition Institute, Addis Ababa, Ethiopia; and Faculty of Medicine, Addis Ababa University Addis Ababa, Ethiopia (RTH & TA)Grass pea is a leguminous crop widely consumed in the central highlands of Ethiopia. It is known to have a toxic effect that can manifest as a medico-social problem in a large number of the population. A comprehensive study under the title of 'The Improvement of *Lathyrus sativus* and the Eradication of Lathyrism' has been conducted by the medico-nutrition group. As part of this study, a household survey on grass pea preparation and general dietary study has been conducted in Dembia and Fogera sub-districts in Gondar administrative region in 1989. The main purpose of the survey was to study methods used in preparation of grass pea for consumption and at the same time, to assess feeding patterns and food intake of the communities. Two farmers associations were selected, namely Shina (grass pea growing) and Muntura (non-grass pea producing). Random samples of 110 and 114 households from Shina and Muntura Farmers' Associations were respectively selected. Information was collected using a pre-tested questionnaire. Standard dietary survey procedure was followed for the dietary study. Information was collected by 10 trained female enumerators under close supervision. Processed data indicate that grass pea is prepared into shiro, nifro, kollo and kitta for consumption. The grass pea is washed whole or split and heat treated in one way or another before preparing into the desired dish. Approximately 80% of the households surveyed have two main meals during the day. The main dishes are thin leavened bread, injera, and sauce, wot. The injera is prepared from finger millet alone or mixed with teff, corn and sorghum. The sauce is prepared from grass pea alone or grass pea mixed with chickpeas.

Source: Lambein\_95\_5; reprintDE

Lathyrism/ Lathyrism Ethiopia Survey/ Lathyrus sativus preparation/ Lathyrus sativus recipes/ Homeeconomics/ Socioeconomics/ Ethiopia Lathyrus food/ Dietary intake L. sativus Ethiopia/ Human consumption L. sativus Ethiopia/ Economic botany L. sativus/ Culinary aspects INILSEL/ Lathyrus sativus/ Agriculture/ Bread/ Cicer arietinum/ Diet/ Dietary intake/ Economic botany/ Ethiopia/ Feeding/ Female/ Food Heat/ Household/ Human consumption/ Dietary/ Intake/ Lathyrism Ethiopia/ Lathyrism nutrition/ Lathyrus toxicity/ Humans/ Mixtures Nutrition/ Nutrition surveys/ Population/ Rural/ Sorghum/ Surveys/ Toxicity L. sativus/ Toxicity/ reprint.

Ahmad, K. and Jahan, K. (1995). **The role of vitamin C in the prevention of neurolathyrism and detoxification of Lathyrus sativus.** In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, p. 278.

Source: reprintDE

Bangladesh/ Bangladesh L. sativus/ Bangladesh lathyrism/ Bangladesh nutrition/ Vitamin C/ Vitamin C lathyrism/ Vitamin C neurolathyrism Vitamins/ Lathyrus sativus/ reprint.

Amruth, R. P. and Bhat, R. V. (1995). **Lathyrism in Bidar and Medak districts of South India.** In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, pp. 239-242.

Source: reprintDE

Lathyrism/ Neurolathyrism/ India/ Andhra Pradesh/ Surveys/ Lathyrism epidemiology/ Epidemiology lathyrism/ Lathyrus sativus/ reprint.

Azzi, G.; Safars, M.; Viljanentarifa, E.; Voros, E., and Robert, A. M. (1995). **Effect of the benzquercin treatment on the connective tissue of lathyritic mice - a study by optical and transmission electron microscopy [french].** *Pathologie Et Biologie* **43** (5):448-460 (author affiliation: Azzi G Univ Paris 07 Fac Sci Equipe Tissu Conjonctif Biol Cellulaire Lab 2 Pl Jussieu F-75251 Paris 05 France)

Vascular pathology is characterized by important alterations of some vessel macromolecular constituents, such as fibrous proteins, collagens and elastin. The purpose of our study was to establish the activity of benzquercin treatment on such alterations of the vascular wall. As experimental model we used lathyrism induced in mice by chronic administration of beta-amino-propionitril (beta-APN). This compound prevents crosslink-formation in elastin and collagen and provokes a disorganisation of the structure and an alteration of the physiological functions of the vascular wall. The connective tissue of the skin is also impaired simultaneously with that of the blood vessels. We compared by optical and transmission electron microscopy the morphological structure of the aorta and the skin of 3 groups of mice : a normal control group, an other which only received the beta-APN alone and a third one which received the beta-APN and the benzquercin treatment. The second group, injected with beta-APN without treatment, showed important alterations of the structure of the aorta as well as of the skin. Both fibrous proteins, collagen and elastin were concerned by these alterations, the consequence of which was an increase of the permeability of the aorta wall demonstrated with the horse-radish peroxydase as a tracer. The third group, injected with beta-APN and treated with the benzquercin, showed much less morphological disorders than the untreated group and the vascular permeability was also close to normal controls. These results are in favour of a corrective effect of benzquercin treatment on fibrous proteins of connective tissue and may represent one of the components of the therapeutic effects observed in the clinical trials of this drug. [References: 19].

Source: Copyright Current Contents

Benzquercin/ Beta-apn/ Lathyrism/ Crosslinks/ Reticulation of collagen/ Reticulation of elastin/ Vascular permeability/ Procyanidolic oligomers.

Bell, E. A. (1995). **Complementary approaches to the improvement of Lathyrus sativus and the elimination of lathyrism.** In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, pp. 249-253.

Source: reprintDE

Poverty/ Genetics/ Malnutrition/ ODAP/ Lathyrus sativus/ Neurolathyrism/ Australia/ Canada/ Lathyrus sativus low ODAP/ Outcrossing Biochemistry/ reprint.

Briggs, C. J.; Campbell, C. G., and Castell, A. G. (1995). **Analysis of grass pea, Lathyrus sativus, and its evaluation as a component of animal feed.** In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, pp. 81-84.

Use of Lathyrus sativus (L) seed as a component of pig feed was evaluated. Effects on growth, carcass quality and major organs were assessed. There was some reduction in rate of weight gain, but results with up to 20% lathyrus in feed were acceptable for commercial use.

Source: reprintDE

Pigs/ ODAP analysis/ Carcass quality/ Nutrition animal/ Feed/ Lathyrus sativus feed/ Lathyrus sativus/ Canada/ reprint.

Campbell, C. G. and Deshpande, S. S. (1995). **Breeding grass pea (Lathyrus sativus) for increased nutritive value.** In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, pp. 167-172.

Source: reprintDE

Phenols/ Polyphenols/ Protease inhibitor/ Protease inhibitors L sativus/ Tannins/ Trypsin inhibitor/ Amylase inhibitor/ Chymotrypsin inhibitor ODAP/ Nutrition/ Nutritive value/ Lathyrus sativus/ Canada/ Breeding/ Lathyrus sativus low ODAP/ reprint.

Chowdhury, B.; Hussain, M., and Wouters, G. (1995). **Comparative study of the OPT method for the neurotoxin ODAP as modified by various laboratories.** In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, p. 284.  
Source: reprintDE  
ODAP/ O Phthalaldehyde/ ODAP analysis/ ODAP chemistry/ Analysis ODAP/ Lathyrus sativus/ reprint.

Chowdhury, S. D. (1995). **Lathyrus in poultry feeding - some recent findings.** In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, pp. 235-238.  
Source: reprintDE  
Poultry/ Lathyrus sativus/ Feed/ Lathyrus pusillus/ Lathyrus odoratus/ Lathyrus hirsutus/ BAPN/ Beta aminopropionitrile/ ODAP/ Review reprint.

Cohn, D. F. (1995). **Are other systems apart from the nervous system involved in human lathyrism?** In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, pp. 101-102.  
Twenty five years of following lathyrism patients, who were exposed in 1942 to the grass pea ( Lathyrus sativus), point to the fact that not only the central nervous system is involved, but the skeleton, the peripheral nerves and the cornea may also be affected in some patients. It is therefore suggested that the term Human Lathyrism Syndrome (HULAS) be coined for the condition in man.  
Source: reprintDE  
Osteolathyrism/ Neurolathyrism/ Skeleton/ Ukraine/ Israel/ Lathyrism/ Cornea/ Peripheral nervous system/ Human Lathyrism Syndrome Lathyrus sativus/ reprint.

Datta, A. (1995). **Strategy to develop transgenic Lathyrus with low level neurotoxin by recombinant DNA technology.** In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, pp. 173-176.  
Source: reprintDE  
Molecular biology/ Lathyrus sativus/ Lathyrus sativus genetics/ Lathyrus sativus low ODAP/ India/ Oxalate decarboxylase/ reprint.

De Bruyn A. and Nunn, P. B. (1995). **Involvement of an imidazolidine derivative during the rearrangement of the neurotoxin beta-ODAP.** In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, pp. 25-30.  
Source: reprintDE  
Isomerism/ Chemistry/ ODAP/ Alpha-ODAP/ ODAP chemistry/ Chemistry ODAP/ NMR/ Imidazolidine/ Lathyrus sativus/ reprint.

De Bruyn A.; Van Haver, D.; Nunn, P. B., and Abegaz, B. M. (1995). **Comparison of the experimental and calculated conformations of beta-ODAP.** In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, p. 281.  
Source: reprintDE  
ODAP/ ODAP chemistry/ ODAP structure/ NMR/ NMR characteristics ODAP compounds/ Lathyrus sativus/ reprint.

Dibabe, A. (1995). **Grain yield and ODAP content of some grass pea cultivars in Ethiopia.** In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, pp. 139-143.  
Source: reprintDE  
ODAP screening/ Ethiopia/ Lathyrus sativus/ Ethiopia L. sativus/ Ethiopia L sativus improvement/ Ethiopia L. sativus genetic resources Lathyrus sativus Genetic resources screening/ Yield/ Yield L. sativus/ Genetic resources/ Genetic resources evaluation/ reprint.

Düsünceli, F. (1995). **Prospects for production of Lathyrus sativus and L. cicera in Southeast Anatolia in Turkey.** In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, pp. 131-137.  
Source: reprintDE  
Lathyrus sativus/ Lathyrus cicera/ Turkey/ Anatolia/ Forage/ Seed yield/ Agronomy/ Genetic resources evaluation/ ODAP screening/ Yield Yield fodder/ Yield L. sativus/ Yield L. cicera/ Genetic resources/ reprint.

Dwivedi, M. P. (1995). **Legal aspects of cultivation and consumption of Lathyrus sativus in India.** In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, pp. 51-54.  
Source: reprintDE  
Legislation/ Lathyrus sativus ban India/ India/ Lathyrus sativus/ reprint.

Enneking, D. (1995). **Post-harvest detoxification: the key to alternative Vicia grain legumes?** In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, pp. 85-92.

*Vicia sativa*, *V. narbonensis*, *V. ervilia* and *V. articulata* (syn. *V. monantha*) are well suited for Mediterranean dryland agriculture. The use of these species as grain legumes has been largely restricted to the supplemental feeding of ruminants and draft animals, and in times of famine, this use has sometimes been extended to human consumption. We have studied the unpalatability of *V. villosa* and *V. narbonensis* grain, using a porcine feed-intake bioassay. Two different antifeedant principles were isolated. The seed of *V. villosa* contains the toxic arginine analogue, canavanine<sup>1</sup> and that of *V. narbonensis* the dipeptide gamma glutamyl S-ethenyl-cysteine<sup>2</sup>, which incidentally is analogous to the flavour precursor, gamma glutamyl S-prop-1-enyl-cysteine present in chives (*Allium schoenoprasum*)<sup>3</sup>. *V. villosa* is not a grain legume, but a forage crop. Other species, such as *V. articulata* and *V. ervilia* which do also contain canavanine in their seeds are used as grain legumes for supplemental feeding of ruminants. Their use as food for monogastric animals and humans is limited by the presence of canavanine. *V. sativa* contains the favism toxin, vicine, as well as the neurotoxic and antinutritional cyanoamino acids,  $\beta$ -cyanoalanine and gamma glutamyl  $\beta$ -cyanoalanine. The antinutritional non-protein amino acids in *V. sativa* and *V. narbonensis* can be inactivated by mild acid hydrolysis<sup>2</sup>. Under alkaline conditions, canavanine degrades to deamino-canavanine which is inactive in the bioassay<sup>1</sup>. Thus, in principle, the major undesirable non protein amino acids in *Vicia* spp. seeds, can be inactivated by either acidic or alkaline chemical processes. In view of the biological functions for these factors in the ecology of *Vicia* spp., it appears that post-harvest detoxification could well be the best long-term option for the sustainable development of these crops. Traditional utilisation practices and preparative methods for *Vicia* grain should now be assessed in detail for their effectiveness in minimising the ingestion of these factors whilst preserving their nutritive properties. Innovative application of this knowledge can reasonably be expected to provide the basis for the wider utilisation of *Vicia* spp. as grain legumes. 1.

Enneking, D. Giles, L. C., Tate, M. E., Davies, R. L. (1993). L-canavanine: a natural feed-intake inhibitor for pigs (isolation, identification and significance) *J. Sci. Food Agric.* 61, 315-325 2. Enneking, D. 1994, The toxicity of *Vicia* species and their utilisation as grain legumes. PhD thesis. University of Adelaide, South Australia 3. Mattikala, E. J. & Virtanen, A. I. (1962). A new g-glutamylpeptide, g-L-glutamyl-S-(prop-1-enyl)-L-cysteine, in the seeds of chives (*Allium schoenoprasum*). *Acta Chem. Scand.* 16, 2461-2462.

Source: reprintDE

*Vicia* spp toxicity/ Postharvest detoxification/ *Vicia sativa*/ *Vicia narbonensis*/ *Vicia villosa*/ Canavanine/ gamma glutamyl S-ethenyl-cysteine South Australia/ Famine foods/ Famine/ Malnutrition/ Antinutritional factors/ Forage/ *Lathyrus sativus*/ Bioassay/ NPAA gamma glutamyl peptides/ Agriculture/ Beta cyanoalanine/ *Allium*/ Amino acids/ Arginine/ Australia/ Chemistry/ Cysteine/ Detoxification/ Dissertations Distribution plants/ Dryland/ Ecology/ Favism/ Feed/ Feeding/ Feed ruminants/ Feed *Vicia sativa*/ Feed *Lathyrus sativus*/ Feed *Lathyrus ochrus* Flavour/ Food/ Gamma glutamyl peptides/ Gamma glutamyl beta cyanoalanine/ Grain legumes/ Pulses/ Human consumption/ Intake/ Isolation Lathyrism animals/ Lathyrism Bioassay/ *Lathyrus ochrus*/ *Lathyrus toxicity*/ Humans/ Mediterranean/ Monogastric/ Neurotoxins/ NPAA NPAA chemistry/ Peptides/ Pigs/ Postharvest/ Protein/ Ruminants/ Ruminant feed/ Ruminants *L. sativus*/ Seed/ Sulfur amino acids/ Toxicity *L. sativus*/ Toxicity/ Toxin/ Utilisation/ *Vicia* spp/ *Vicia*/ *Vicia ervilia*/ *Vicia articulata*/ *Vicia monantha*/ Vicine/ reprint.

Geda, A. K.; Pandey, R. L., and Agrawal, R. K. (1995). **Environmental influence on ODAP content in *Lathyrus***. In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, pp. 221-223.

Source: reprintDE

ODAP/ ODAP environmental variation/ India/ India *L. sativus*/ *Lathyrus sativus*/ *Lathyrus sativus* India/ Rabi/ IARI/ *Lathyrus sativus* low ODAP/ Environmental effects/ Environment x genotype/ reprint.

Gutierrez, J. F. and Vences, F. J. (1995). **Genetic and physiological studies in *Lathyrus sativus***. In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, pp. 189-199.

Source: reprintDE

Genetics/ Physiology/ *Lathyrus sativus*/ Spain/ RAPD/ Isozymes/ HPLC/ ODAP/ Linkage analysis/ *Lathyrus sativus* low ODAP/ reprint.

Haque, A. and Hossain, M. (1995). **Role of tolperisone in lathyrism**. In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, pp. 119-126.

Source: reprintDE

Neurotoxicity/ Muscle relaxant lathyrism treatment/ Muscles/ Tolperisone lathyrism treatment/ *Lathyrus sativus*/ reprint.

Haque, A.; Hossain, M.; Lambein, F., and Bell, E. A. (1995). **Occurrence of osteolathyrism among neurotoxic patients in Bangladesh**. In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, p. 273.

60 of 500 neurolathyrism patients complained of bone pain and showed skeletal deformities. 2 of these were found to have skeletal damage (failure of fusion in both vertebral and iliac epiphyses). Of the 60, all were familiar with the consumption of seeds and green parts of *Lathyrus sativus*, the latter of which contain 2-cyanoethyl-isoxazolin-5-one, a compound that chemically and metabolically can osteolathyrigen beta-aminopropionitrile.

Source: reprintDE

Osteolathyrism/ Neurolathyrism/ Bangladesh/ BAPN/ Isoxazolin-5-one/ Isoxazolin-5-one toxicity/ Beta aminopropionitrile/ Beta aminopropionitrile toxicity/ *Lathyrus sativus*/ reprint/ 2 Cyanoethylisoxazolin 5 one/ NPAA 2-(2-cyanoethyl)-3-isoxazolin-5-one.

Haque, A.; Hossain, M.; Wouters, G.; Kuo, Y. H., and Lambein, F. (1995). **Study on some socio-economic aspects of lathyrism patients in two North-Western districts of Bangladesh.** In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, pp. 63-68.

Source: reprintDE

Bangladesh economics/ Bangladesh/ Bangladesh L. sativus/ Bangladesh lathyrism/ Bangladesh nutrition/ Bangladesh poverty/ Bangladesh socioeconomics/ Socieconomics Bangladesh/ Socieconomics L. sativus/ Socioeconomic constraints/ Socioeconomic Factors/ Socioeconomics Socioeconomics Bangladesh/ Socioeconomics L. sativus/ *Lathyrus sativus*/ reprint.

Haque, A.; Kebede, N.; Kuo, Y. H.; Hussain, M., and Lambein, F. (1995). **Effect of nutrient elements and environmental factors on ODAP and other amino acids content in *Lathyrus sativus*.** In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, p. 276.

Source: reprintDE

ODAP/ ODAP environmental variation/ ODAP Zinc/ ODAP drought stress/ Drought/ Drought stress/ Drought stress effect on ODAP/ Drought stress L. sativus/ Salinity/ Nutrient manipulation Zinc/ Nutrients/ Nutrition plant/ *Lathyrus sativus*/ reprint.

Haque, A.; Khan, J. K.; Wouters, G.; Hossain, M., and Lambein, F. (1995). **Low frequency of HTLV-1 antibodies in neurolathyrism patients in Bangladesh.** In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, p. 283.

Source: reprintDE

Neurolathyrism/ HTLV/ HTLV 1/ HTLV-1 lathyrism/ Bangladesh/ Bangladesh lathyrism/ *Lathyrus sativus*/ reprint.

Haque, A.; Khan, J. K.; Wouters, G.; Hossain, M., and Lambein, F. (1995). **Study of HTLV-I antibodies in CSF and serum of neurolathyrism patients in Bangladesh.** Annales De La Societe Belge De Medecine Tropicale **75** (2):131-134

Neurolathyrism is a form of human spastic paraparesis related to the overconsumption of the legume *Lathyrus sativus* or grass pea (Khesari in Bangladesh) containing the neurotoxin 3-N-oxalyl-2,3-diaminopropanoic acid (beta-ODAP). The clinical symptoms of neurolathyrism are similar to those of Tropical Spastic Paraparesis, In order to eliminate the proposed causative agent of TSP (HTLV-I) as a potential cause of the symptoms ascribed to neurolathyrism, a total of 444 diagnosed lathyrism patients were screened for HTLV-I antibodies. 50 CSF and 394 serum samples were collected from male (415) and female (29) patients. Only 4 serum samples were found sere-positive for HTLV-I. This agrees with the assumption that overconsumption of beta-ODAP containing *Lathyrus* seeds, and not HTLV infection, is the causative agent for neurolathyrism.

Source: Reprinted with permission of the authors

Neurolathyrism/ Tropical Spastic Paraparesis/ HTLV 1/ Cerebrospinal Fluid/ ODAP/ Bangladesh lathyrism/ Neurology/ *Lathyrus sativus* Lathyrism symptoms/ Antibodies/ Bangladesh/ Female/ Belgium/ HTLV/ Immunology/ Infection/ Khesari/ Lathyrism/ Lathyrism Bangladesh Lathyrism cerebrospinal fluid/ Lathyrism serum/ Lathyrism viral infection/ Males/ Humans/ Neurotoxins/ Seed/ Spasticity/ Spastic paraparesis Symptoms lathyrism/ Tropics.

Haque, R.; Kuo, Y. H., and Lambein, F. (1995). **Effect of zinc and iron on the biosynthesis of ODAP in callus tissue of *Lathyrus sativus*.** In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, p. 282.

Fe 2+ and Zn 2+ ions can modulate the biosynthesis of ODAP.

Source: reprintDE

ODAP/ ODAP Zinc/ Tissue culture/ Callus/ Callus culture/ Zinc/ Iron/ *Lathyrus sativus*/ *Lathyrus sativus* biochemistry/ Biochemistry Biosynthesis ODAP/ Biosynthesis/ ODAP biosynthesis/ reprint.

Hussain, M. and Chowdhury, B. (1995). **Agro-ecological factors affecting the concentration of beta-N-oxalyl-alpha,beta-diaminopropionic acid (ODAP) in *Lathyrus sativus* seed.** In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, pp. 201-209.

Source: reprintDE

Environmental effects/ Environment x genotype/ Salinity/ Water stress/ ODAP/ ODAP environmental variation/ Fertiliser/ Micronutrients Trace elements/ Water/ Water relations/ Lathyrus sativus/ reprint.

Ikegami, F.; Kuo, Y. H.; Lambein, F., and Murakoshi, I. (1995). **Biosynthesis in vitro of some Lathyrus toxins**. In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, pp. 1-13.

Source: reprintDE

Lathyrus sativus/ NPAA biosynthesis/ In vitro/ Biosynthesis/ Isoxazolin-5-one/ Biochemistry L. sativus/ Toxin/ Toxin biosynthesis/ reprint.

Junaid, M. A.; Jain, R. K., and Rao, S. L. N. (1995). **Binding of ODAP to chick synaptic membranes**. In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, pp. 31-40.

Source: reprintDE

Synapses/ Synaptic Membranes metabolism/ ODAP receptors/ Neurology/ Biochemistry/ Lathyrus sativus/ reprint.

Kaul, A. (1995). **Concluding remarks and recommendations**. In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, pp. 269-271.

Source: reprintDE

Strategy/ Recommendations/ Lathyrus sativus/ reprint.

Kebede, N.; Kuo, Y. H.; Khan, J. K., and Lambein, F. (1995). **Influence of nutrient status for cultivation of Lathyrus sativus and level of the neurotoxin ODAP: A link between environment and toxicity?** In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, pp. 211-214.

Source: reprintDE

Environmental effects/ Environment x genotype/ Sulfur/ Cysteine Synthase/ ODAP environmental variation/ Belgium/ Lathyrus sativus Toxicity L. sativus/ Toxicity ODAP/ Toxicity/ reprint.

Khan, J. K.; Kebede, N.; Kuo, Y. H., and Lambein, F. (1995). **High-performance liquid chromatographic separation of the toxins and some non-protein amino acids in Lathyrus sativus**. In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, pp. 69-72.

Source: reprintDE

NPAA analysis/ NPAA chemistry/ Isoxazolin-5-one/ HPLC/ ODAP/ Lathyrus sativus chemistry/ Chemistry/ Toxin/ Lathyrus sativus/ reprint.

Khan, J. K.; Kuo, Y.-H.; Haque, A., and Lambein, F. (1995). **Inhibitory and excitatory amino acids in cerebrospinal fluid of neurolathyrism patients, a highly prevalent motorneuron disease**. Acta Neurologica Scandinavica **91**:506-510.

Data are presented which suggest a disturbance of amino acid metabolism caused through the consumption of L. sativus/ and associated factors. Glu, Tau, Gly were higher in lathyrism patients.

Source: reprintDE; reprinted with permission Copyright 1995 Munksgaard Publishers, Copenhagen

Cerebrospinal fluid amino acid analysis/ Lathyrism CSF aa profile/ Lathyrism patients/ Neurology/ Lathyrus sativus/ Amino acids/ Amino acids analysis/ Cerebrospinal fluid/ Excitatory amino acid/ Lathyrism/ Lathyrism cerebrospinal fluid/ Metabolism plant/ Motor neurons Neurolathyrism/ Neurons/ Prevalence/ reprint.

Khan, J. K.; Kuo, Y. H.; Haque, A., and Lambein, F. (1995). **Neurotransmitters in the cerebrospinal fluid and serum of neurolathyrism patients**. In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, pp. 111-117.

Source: reprintDE

Cerebrospinal fluid/ Cerebrospinal fluid amino acid analysis/ Human consumption L. sativus/ Neurolathyrism/ Neurologic Examination Neurology/ Neurotoxins/ Neurotoxins analysis/ Glutamates/ Glycine/ Lathyrus sativus/ reprint.

Khawaja, I.; Khawaja, H. I. T.; Ullah, I.; Raja, N. U., and Khushk, A. M. (1995). **Lathyrism in Pakistan: A preliminary survey**. In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, pp. 55-62.

Source: reprintDE

Pakistan/ Pakistan L. sativus/ Lathyrism epidemiology/ Lathyrism Pakistan/ Lathyrus sativus production/ ODAP/ Surveys/ Socioeconomics Lathyrus sativus/ reprint.

Kuo, Y. H.; Bau, H.-M.; Khan, J. K., and Lambein, F. (1995). **Detoxification of Lathyrus sativus meal by fermentation without loss of nutritive value**. In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, pp. 231-234.

Source: reprintDE

Fermentation/ Fermentation L. sativus/ Fermentation L. sativus detoxification/ Aspergillus oryzae/ Rhizopus oligosporus/ SDS PAGE/ Protein Protein electrophoresis/ ODAP/ ODAP analysis/ Nutrition/ Nutritive value/ Processing/ Processing L. sativus/ Processing methods L. sativus Tempeh/ Post harvest processing L. sativus/ Postharvest detoxification/ Detoxification/ Detoxification L. sativus/ Detoxification L. sativus fermentation/ Lathyrus sativus/ reprint.

Kuo, Y. H.; Khan, J. K., and Lambein, F. (1995). **Biosynthesis in vivo of the neurotoxin beta-ODAP in Lathyrus sativus.** In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, pp. 15-20.

Source: reprintDE

Lathyrus sativus/ NPAA biosynthesis/ In vivo/ Biosynthesis/ ODAP biosynthesis/ Biochemistry L. sativus/ Biosynthesis ODAP/ ODAP Biochemistry/ reprint.

Kuo, Y. H.; Lambein, F.; Mellor, L. C.; Adlington, R. M., and Baldwin, J. E. (1995). **Biosynthesis of the neurotoxin beta-ODAP in callus tissue of Lathyrus sativus: Incorporation of [N] - and [C] - precursors.** In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, pp. 21-24.

Source: reprintDE

Lathyrus sativus/ ODAP biosynthesis/ Biosynthesis ODAP/ Biochemistry/ reprint.

Lambein, F. (1995). **Collaborative projects on Lathyrus and human lathyrism coordinated by the University of Ghent, Belgium: Prospects for further research.** In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, pp. 261-267.

Source: reprintDE

BIA/ ODAP/ Lathyrus sativus low ODAP/ NATO/ EEC/ Isoxazolin-5-one/ Bangladesh/ Belgium/ ODAP/ Biosynthesis/ Biochemistry Lathyrus sativus/ reprint.

Mehra, R. B.; Raju, D. B., and Hima Bindu, K. (1995). **Breeding work on Lathyrus sativus L. at I.A.R.I., New Delhi.** In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, pp. 127-130.

Source: reprintDE

Genetic resources/ Genetics/ Genetics flower colour/ Polymorphism L. sativus/ Polymorphisms/ Flower colour polymorphism/ Flower colour ODAP/ ODAP L. sativus/ ODAP screening/ India/ Genetic resources L. sativus/ Lathyrus sativus/ reprint.

Mehta, S. L. (1995). **Strategies for toxin removal from Lathyrus sativus.** In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, p. 275.

Source: reprintDE

Somaclones/ Somaclones L. sativus/ ODAP/ Lathyrus sativus low ODAP/ India/ Lathyrus sativus/ reprint.

Moges, G.; Johansson, G., and Solomon, T. (1995). **Determination of the neurotoxic amino acid ODAP using a redox enzyme, glutamate oxidase, in batch-wise or flow injection mode.** In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, pp. 73-79.

Source: reprintDE

ODAP analysis/ Analysis ODAP/ Glutamate oxidase/ Lathyrus sativus/ Biochemistry/ reprint.

Narayan, R. K. J.; Getachew, A., and Jadhav, A. (1995). **Genetic manipulation of the biosynthesis of beta-N-oxalyl-L-alpha, beta-diaminopropionic acid ( beta-ODAP) in Lathyrus sativus: Problems and prospects.** In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, pp. 177-187.

Source: reprintDE

ODAP/ Molecular biology/ Genetics/ Lathyrus sativus/ ODAP biosynthesis/ Phenology/ Tissue culture/ Callus culture/ reprint.

Nunn, P. B.; Perera, K. P. W. C., and Bell, E. A. (1995). **Blood and urine analyses following the consumption of Lathyrus sativus seed by human volunteers.** In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, pp. 103-110.

Source: reprintDE

Human consumption L. sativus/ Human metabolism ODAP/ ODAP/ ODAP bioassay/ ODAP metabolism/ Volunteers/ Lathyrus sativus/ reprint.

Pandey, R. L. and Kashyap, O. P. (1995). **Studies on socio-economic strata and Lathyrus consumption in Rural Madhya Pradesh.** In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, pp. 47-50.

Source: reprintDE

Madhya Pradesh/ India/ Rural/ Socioeconomics/ Socioeconomics L. sativus/ Socioeconomics lathyrism/ Nutrition/ Nutrition L. sativus  
Nutrition surveys/ Dhal/ Surveys/ Lathyrus sativus/ reprint.

Pooder, A. K. (1995). **Studies on the growth and physiology of Lathyrus nodule bacteria.** In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, p. 277.

Source: reprintDE

Bangladesh/ Bangladesh L. sativus/ Bangladesh L. sativus Rhizobium/ Lathyrus sativus/ Lathyrus sativus Rhizobium/ Rhizobium/ Rhizobium leguminosarum/ Rhizobium L. sativus/ reprint.

Rahman, M. K.; Sarker, M. A. H.; Uddin, M. A., and Naved, A. F. (1995). **Effect of Lathyrus sativus and vitamin C on the activities of aromatic L-amino acid decarboxylase and dipeptidyl aminopeptidase-IV in the central and peripheral tissues and serum of guinea pigs.** In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, pp. 243-247.

Source: reprintDE

Vitamin C/ Aromatic amino acid decarboxylase/ Amino acids metabolism/ Guinea Pigs/ Peripheral/ Peripheral nervous system/ Serum  
Dipeptidyl aminopeptidase/ Aminopeptidase/ Lathyrus sativus/ ODAP toxicity/ Toxicity L. sativus/ Toxicity ODAP/ Toxicity/ Vitamins/ reprint.

Rahman, M. M.; Quader, M.; Rahman, A.; Sarker, A.; Kumar, J.; Yusuf, H. K. M., and Malek, M. A. (1995). **Recent advances in breeding glow toxin khesari lines at BARI.** In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, pp. 153-160.

Source: reprintDE

BARI/ Bangladesh L. sativus/ Bangladesh L. sativus genetic resources/ Breeding/ Breeding L. sativus/ Breeding ODAP/ ODAP/ ODAP  
screening/ Genetic resources evaluation/ Lathyrus sativus low ODAP/ Toxin/ Genetic resources/ Lathyrus sativus/ reprint.

Roy, B. C.; Yusuf, H. K. M.; Khan, L. A.; Wouters, G.; Khan, J. K., and Lambein, F. (1995). **BIA toxicity in day-old chicks.** In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, p. 280.

Source: reprintDE

BIA/ Beta (Isoxazolin 5 on 2 yl) L Alanine/ BIA toxicity/ Bioassay/ Bioassay chicks/ Poultry/ Poultry bioassay/ Lathyrus sativus/ reprint.

Sarwar, C. D. M.; Sarker, A.; Murshed, A. N. M. M., and Malek, M. A. (1995). **Variation in natural population of grass pea.** In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, pp. 161-164.

Source: reprintDE

Lathyrus sativus Bangladesh/ Lathyrus sativus genetic resources/ Lathyrus sativus genetic variation/ Bangladesh/ Bangladesh L. sativus  
Bangladesh L. sativus genetic resources/ Bangladesh ODAP/ ODAP/ Flower colour/ Genetic resources collecting/ Genetic resources/ Genetic  
resources L. sativus/ Genetic resources evaluation/ Lathyrus sativus/ reprint.

Shaikh, M. A. Q.; Majid, M. A., and Lahiri, B. P. (1995). **Mutant derivative low neurotoxin lines of grass pea (Lathyrus sativus).** In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, pp. 165-166.

Source: reprintDE

Bangladesh/ Bangladesh L. sativus/ Bangladesh ODAP/ Mutagenesis/ Mutagenesis breeding L. sativus/ Mutants/ Lathyrus sativus/ reprint.

Swarup, I. and Lal, M. S. (1995). **Reaction of Lathyrus genotypes to powdery mildew (Erysiphe polygoni DC) under 'Upland conditions'.** In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, p. 286.

Source: reprintDE

Powdery mildew/ Erysiphe polygoni/ Erysiphe/ India/ Phytopathology L. sativus/ Phytopathology/ Mycology/ Diseases plant/ Diseases L.  
sativus/ Lathyrus sativus/ reprint.

Tate, M. E.; Enneking, D.; Delaere, I.; Malaterre, C., and Glatz, P. C. (1995). **Towards the detoxification of Vicia sativa L.** In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, pp. 93-100.

Cultivars of Vicia sativa L. contain the favism toxin vicine, as well as gamma-glutamyl-beta cyanoalanine and in some cases the cyanogenic glycoside vicianine. Reports of the rising human consumption of Vicia sativa: cultivars with orange coloured cotyledons, such as the Vicia sativa cultivar Blanche Fleur, which mimics the colour and size of red lentils (Lens culinaris Medik) have stimulated the search for low toxin lines and detoxification procedures. Diffuse Reflectance Using Infrared Dispersion (DRUID) spectroscopy of the

absorbance of the nitrile group (-CN) near 2250 cm<sup>-1</sup> provides a useful method for monitoring its presence in food or feed samples and also its loss during in situ acid catalysed hydrolysis of the seeds. It will also be important for screening germplasm.

Source: reprintDE

Vicia spp toxicity/ Postharvest detoxification/ Vicia sativa/ Poultry bioassay/ Layers/ Feed intake/ Egg production/ Poultry bioassay/ Lathyrus sativus/ Bioassay/ NPAA gamma glutamyl peptides/ Agriculture/ Genetic resources/ Beta cyanoalanine/ Beta Alanine analogs and derivatives Colour/ Cotyledons/ Cultivars/ Detoxification/ Dietary intake/ Dispersion/ Eggs/ Favism/ Feed/ Feed Vicia sativa/ Feed Lathyrus sativus/ Food Gamma glutamyl beta cyanoalanine/ Gamma glutamyl peptides/ Glycosides/ HCN/ Human consumption/ Hydrolysis/ Diet/ Dietary/ Intake Lathyrism Bioassay/ Lathyrus toxicity/ Layers/ Lens culinaris/ Humans/ Nitriles/ NPAA/ Peptides/ Postharvest/ Poultry/ Reports/ Screening Seed/ Toxicity L. sativus/ Toxicity/ Toxin/ Vicia spp/ Vicia/ Vicine/ reprint.

Tekle Haimanot, R.; Abegaz, B. M.; Wuhib, E.; Kassina, A.; Kidane, Y.; Kebede, N.; Alemu, T., and Spencer, P. S. (1995). **Nutritional and neuro-toxicological surveys of Lathyrus sativus consumption in Northern Ethiopia.** In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, pp. 41-45.

Source: reprintDE

Socioeconomics/ Socioeconomics L. sativus/ Processing/ Processing methods L. sativus/ Production L. sativus/ Ethiopia/ Ethiopia L. sativus Ethiopia lathyrism/ Ethiopia Lathyrus food/ Ethiopia nutrition/ Ethiopia nutritional survey/ Lathyrus sativus/ reprint.

Willis, C. L.; Meldrum, B. S.; Nunn, P. B.; Anderton, B. H., and Leigh, P. N. (1995). **Neuronal damage, induced by beta-ODAP in rat hippocampus, can be prevented by the non-NMDA antagonist 2,3-dihydroxy-6-nitro-7-sulphamoyl-benzo(F)quinoxaline (NBQX).** In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, p. 285.

Results indicate that the acute in vivo hippocampal toxicity of beta-ODAP in the rat is mediated by AMPA receptors, rather than by KA or NMDA receptors. Neurones in the rat hippocampus did not die immediately on exposure to beta-ODAP, but via a process involving sustained AMPA receptor activation. It is proposed that excitotoxic processes acting via AMPA receptors may play a role in the loss of upper motor neurones that occurs in neurolathyrism.

Source: reprintDE

ODAP/ ODAP toxicity mechanism/ NMDA/ NMDA receptors/ AMPA receptors/ KA receptors/ Neurology/ Neurons/ Neurotoxicity/ Rats Rodents/ Neurolathyrism/ NBQX/ Lathyrus sativus/ reprint.

Wouters, G.; Lambein, F.; Haque, A.; Hussain, M., and Yusuf, H. K. M. (1995). **Progress and prospects in the Bangladesh/Belgium Inter-University project.** In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, pp. 255-260.

Source: reprintDE

Lathyrus sativus/ Bangladesh/ Belgium/ HTLV-1/ Osteolathyrism/ Epidemiology lathyrism/ Lathyrism epidemiology/ Demography Socioeconomics/ ODAP analysis/ Poultry bioassay/ Zinc/ Environmental effects/ Trace elements/ reprint.

Yadav, C. R. and Neupane, R. K. (1995). **Genetic evaluation and breeding program of grass pea in Nepal.** In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, p. 274.

Source: reprintDE

Lathyrus sativus/ Lathyrus sativus breeding/ Nepal/ Nepal L. sativus/ reprint.

Yu, Jing-Zhong (1995). **Cultivation of grass pea and selection of lower toxin varieties and species of Lathyrus in China.** In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, pp. 145-151. (author affiliation: The Soil and Fertilizer Institute, Academy of Agricultural Sciences Yangling, Shaanxi 712100, P.R. of China).

Our results show that the grass pea (*Lathyrus sativus* L.) is tolerant to drought and barren land, and that it is resistant to pea weevil. About 20,000 ha of grass pea were grown in North Shaanxi in recent years, with a stable yield 20% higher than pea (*Pisum sativum* L.). Human lathyrism was a serious problem in the Chinese province of Gansu in the seventies. The same varieties grown in different localities produced seeds with the same content of ODAP. From 50 varieties of *L. sativus* (with 0.03 to 0.87% ODAP) we selected six varieties with toxin content of 10.2%, giving virtually no visible symptoms in young chicks. One species of *Lathyrus* was found to be free of ODAP. Different varieties of grass pea or different species of *Lathyrus* have different compositions of esterase isozymes. This variability may be useful as a method to identify grass pea varieties, to select the parents for cross-breeding as a strategy for developing lower toxin varieties of *Lathyrus sativus*.

Source: reprintDE

Lathyrus sativus/ Lathyrus cicera/ Lathyrus latifolius/ Lathyrus odoratus/ Lathyrus sativus China/ Lathyrus sativus low ODAP/ Lathyrus sativus ODAP/ Lathyrus sativus ODAP screening/ Lathyrus sylvestris/ China/ China Shaanxi/ China Gansu/ Shaanxi/ Gansu/ China L. sativus

China L. sativus chemical analysis/ China L. tingitanus/ Toxin/ Varieties/ Varieties L. sativus/ Lathyrus sativus varieties/ Yield/ Yield L. sativus  
Yield L. cicera/ reprint.

Yusuf, H. K. M.; Haque, K.; Uddin, A.; Roy, B. C., and Lambein, F. (1995). **Homoarginine antagonises the toxicity of Lathyrus toxin in 1-day-old chicks.** Bangladesh Journal of Physiology and Pharmacology **10** (2):74-75 (author affiliation: Biochemistry (Human Nutrition Lab.) University of Dhaka, Dhaka 1000, Bangladesh; and Laboratory of Physiological Chemistry, University of Ghent, B-9000 Ghent, Belgium)  
Meeting abstract.

Source: Lambein\_95\_5; reprintDE

Lathyrus sativus toxicity/ Lathyrism/ Chick bioassay-ODAP antagonism/ Antagonism ODAP-homoarginine/ ODAP-homoarginine antagonism  
ODAP toxicity/ Biochemistry/ Lathyrus sativus/ Bioassay/ Bioassay L. sativus/ Lathyrus sativus bioassay/ Antagonism amino acids  
Bangladesh/ Chemistry/ Chickens/ Belgium/ Homoarginine/ Lathyrism Bangladesh/ Lathyrism Bioassay/ Lathyrism Biochemistry/ Lathyrism  
nutrition/ Lathyrism ODAP toxicity/ Lathyrus toxicity/ Humans/ Nutrition/ ODAP/ Physiology not plant/ Phytochemistry/ Poultry/ Toxicity  
ODAP/ Toxicity L. sativus/ Toxicity L. sativus poultry/ Toxicity/ Toxin/ reprint.

Yusuf, H. K. M.; Roy, B. C.; Khan, L. A.; Al-Monsoor, M. M.; Sarker, S.; Mohiduzzaman, M., and Quazi, S. (1995). **Studies on a toxin-free Lathyrus protein concentrate.** In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, pp. 225-230.

Source: reprintDE

Post harvest processing L. sativus/ Protein isolates/ Protein L. sativus/ Protein quality L. sativus/ Protein quality/ Digestibility/ Amino acid  
composition/ Nutritive value/ Lathyrus sativus/ Bangladesh/ Toxin/ reprint.

Yusuf, H. K. M.; Roy, B. C.; Sarkar, S.; Wouters, G., and Lambein, F. (1995). **ODAP toxicity in chicks: zinc appears to have a protective role.** In : Yusuf, H. K. M. and Lambein, F. (Eds). **Lathyrus sativus and Human Lathyrism: Progress and Prospects**, Dhaka: University of Dhaka, p. 279.

Source: reprintDE

ODAP/ ODAP toxicity ions/ ODAP Zinc/ Zinc/ Zinc lathyrism/ Poultry/ Chick bioassay/ Chickens/ Bangladesh/ Bangladesh lathyrism  
Bangladesh nutrition/ Lathyrus sativus/ reprint.

Haque, A.; Hossain, M.; Wouters, G., and Lambein, F. (1996). **Epidemiological study of lathyrism in Northwestern districts of Bangladesh.** Neuroepidemiology **15** (2):83-91 (author affiliation: Lambein F State Univ Ghent Physiol Chem Lab K1 Ledeganckstr 35 B-9000 Ghent Belgium State Univ Ghent Physiol Chem Lab B-9000 Ghent Belgium Inst Postgrad Med & Res Dept Neurol Dhaka Bangladesh)

Two northwestern districts of Bangladesh with a population of 629,752 were surveyed from June 1991 to March 1993 to detect and follow up lathyrism patients. Out of 2,567 neurological patients, 882 were diagnosed as having lathyrism, giving a prevalence rate of 14.0/10,000. This prevalence was higher among young males: only 12.9% of the patients were female, and only 19.3% of the patients were over 30 years of age at onset of the disease. The average family size was 4.6 members. In the surveyed area, 730 families were evaluated: 622 families had only 1 affected member, and 108 families had 2-8 affected members. Most of the patients were working, while only 4% were not. The majority of the patients had a very low intake of animal protein. A few cases of human T-lymphotropic virus infection and osteolathyrism were found during this study. [References: 28].

Source: reprintDE

Animal Protein Intake/ Bangladesh lathyrism/ Lathyrism Epidemiology/ Human nutrition animal protein/ HTLV/ Osteolathyrism Bangladesh  
Osteolathyrism human/ Virology/ Osteolathyrism/ Age/ Bangladesh/ Epidemiology lathyrism/ Female/ Belgium/ Infection/ Intake/ Lathyrism  
Lathyrism animals/ Lathyrism Bangladesh/ Lathyrism nutrition/ Lathyrism viral infection/ Males/ Humans/ Nutrition animal/ Nutrition  
Population/ Prevalence/ Protein/ Reprint.

Ikonomidou, C.; Qin, Y. Q.; Labruyere, J., and Olney, J. W. (1996). **Motor neuron degeneration induced by excitotoxin agonists has features in common with those seen in the sod-1 transgenic mouse model of amyotrophic lateral sclerosis.** Journal of Neuropathology and Experimental Neurology **55** (2):211-224 (author affiliation: Olney Jw Washington Univ Sch Med Dept Psychiat 4940 Childrens Pl St Louis, Mo 63110 Usa)

A superoxide dismutase 1 (SOD-I) genetic defect has been identified in familial amyotrophic lateral sclerosis (ALS) and motor neuron degeneration has been described in SOD-1 transgenic mice. Because an excitotoxic mechanism has been implicated in ALS, we undertook studies to provide a description of excitotoxic degeneration of spinal motor neurons for comparison with the degenerative process observed in SOD-I transgenic mice. Excitotoxin agonists selective for each of the three major types of ionotropic glutamate receptors were applied directly onto the lumbar spinal cord of 21-day-old rats following posterior laminectomy. N-methyl-D-aspartate (NMDA) preferentially affected dorsal horn neurons, whereas the non-NMDA agonist, kainic acid, preferentially affected motor neurons. Cytopathological changes in motor neurons closely resembled those described in SOD-1 mice. These changes consist of massively swollen

dendritic processes in the presence of well-preserved presynaptic axon terminals; cell bodies of motor neurons filled with vacuoles that originate both from endoplasmic reticulum and mitochondria; pleomorphic changes in mitochondria; axons of motor neurons becoming swollen proximally with accumulation of vacuoles, organelles, filaments, and degeneration products in the swollen segment. The observed changes in motor axons resemble changes described in the spinal cord of ALS patients. These findings are consistent with the proposal that motor neuron degeneration in ALS may be mediated by an excitotoxic process involving hyperactivation of non-NMDA glutamate receptors. [References: 55].

Source: Copyright Current Contents

AMPA/ Amyotrophic lateral sclerosis/ DL-homocysteic acid/ Excitotoxicity/ Kainic acid/ Nmda/ Sod-1/ Rat spinal-cord/ Abnormal glutamate metabolism/ Amino-acids Parkinsonism-dementia/ Axonal swellings/ Cell-culture/ Kainic acid Brain/ Neurotoxicity/ Lathyrism.

**Kusamaeguchi, K.; Ikegami, F.; Kusama, T.; Lambein, F., and Watanabe, K. (1996). Effects of beta-ODAP and its biosynthetic precursor on the electrophysiological activity of cloned glutamate receptors.**

Environmental Toxicology and Pharmacology 2 (4):339-342

3-N-Oxalyl-L-2,3-diaminopropanoic acid (beta-ODAP) induces neurolathyrism, a motor neuron disease. To elucidate the pathogenic mechanism of this process, the action of beta-ODAP on the excitatory amino acid (EAA) receptor-mediated currents was examined using cloned EAA receptors expressed in *Xenopus* oocytes. On the voltage-clamp recordings of an AMPA receptor(alpha(1)/alpha(2) heterooligomer), beta-ODAP was a strong agonist on this receptor, the potency being almost the same as L-glutamate. On the other hand, beta-ODAP had little effect on the glutamate-evoked currents through the expressed NMDA receptor (NR1(A) NR2A), but showed a weak inhibitory effect on the glycine-modulatory site. beta-ODAP may cause the neurodegenerative disease, neurolathyrism, mainly through the excitotoxic interaction with AMPA receptors. [References: 16].

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AMPA receptor/ NMDA receptors/ Neurology/ ODAP/ *Xenopus* oocyte/ Neurolathyrism/ *Lathyrus sativus* toxicity/ *Lathyrus sativus*/ Toxicity Lathyrism.

Ludolph, A. C. and Spencer, P. S. (1996). **Toxic models of upper motor neuron disease.** Journal of the Neurological Sciences 139 (Suppl S):53-59 (author affiliation: Ludolph Ac Humboldt Univ Berlin Dept Neurol Schumannstr 20-21 D-10098 Berlin Germany Oregon Hlth Sci Univ Dept Neurol Portland, Or 97201 Usa Oregon Hlth Sci Univ Ctr Res Occupat & Environm Toxicol Portland, Or 97201 Usa)

Although neurotoxic models for progressive degeneration of both the anterior horn cell and the Betz cell do not exist, (neuro)lathyrism and neurocassavism (konzo) are examples of self-limiting neurotoxic disorders that predominantly target the Betz cell. Both disorders are caused by the continuous intake of neurotoxic plant products (*Lathyrus sativus* and *Manihot esculenta*, respectively) which result in a virtually identical clinical picture of spastic paraparesis. A neurotoxic excitatory amino acid and AMPA agonist (beta-N-oxalylamino-L-alanine, BOAA) is held largely responsible for lathyrism. Epidemics of konzo are strongly associated with increased intake of the cyanide-liberating glycoside linamarin by protein-poor subjects. Whereas an animal model for neurocassavism does not exist, macaques fed *Lathyrus sativus* or BOAA develop central motor deficits with corticospinal tract involvement. Estimated dosages of *Lathyrus sativus* used to induce beginning lathyrism in well-nourished primates are 10-20 fold greater than those associated with irreversible human neurolathyrism. Major unexplained aspects of both diseases are the factors which allow the suspected toxins to target Betsz cells (blood-brain barrier, receptor distribution, cellular energy metabolism), the latency to onset in both diseases, and how two separate etiologic factors trigger clinically similar disorders. [References: 58].

Source: Copyright Current Contents

Motor neuron disease/ Neurolathyrism/ Neurocassavism/ Konzo/ Free Radical/ ODAP/ Neurology/ Antinutritional factors/ *Lathyrus sativus* Beta Alanine analogs and derivatives/ Amino acids/ AMPA receptors/ Anterior horn/ Blood brain barrier/ Blood/ Brain/ Cyanides/ Energy Energy metabolism/ Excitatory amino acid/ Glycosides/ HCN/ Intake/ Lathyrism/ Lathyrism animal models/ Lathyrism animals/ Lathyrism chronic Cassava toxicity/ Lathyrism motor neurons/ *Lathyrus toxicity*/ Primates/ Humans/ *Manihot esculenta*/ Cassava/ Metabolism/ Models Motor neurons/ Neurons/ Neurotoxins/ Protein/ Receptors/ Spasticity/ Spastic paraparesis/ Toxicity ODAP/ Toxicity *L. sativus*/ Toxicity/ Toxin USA.

Reed, P. J.; Dickens, J. S. W., and Oneill, T. M. (1996). **Occurrence of anthracnose (*Colletotrichum acutatum*) on ornamental lupin in the united kingdom.** Plant Pathology 45 (2):245-248 (author affiliation: Reed Pj Maff Cent Sci Lab Hatching Green Harpenden AL5 2bd Herts England Adas Hort Cambridge CB2 2bl England)

The first recorded outbreak of anthracnose (*Colletotrichum acutatum*) on ornamental lupin in the United Kingdom occurred in 1989. Seedborne infection by *Colletotrichum acutatum* was investigated after seed was implicated in the origin of the outbreaks and infection was found on seed of three of 14 cultivars tested. In pathogenicity tests, typical anthracnose symptoms developed only on plants of *Lupinus* spp; there were slight

symptoms on *Pisum sativum*, *Vicia sativa* and *Lathyrus odoratus*, but none on *Vicia faba*, *Phaseolus coccineus*, *P. vulgaris* and *Onobrychis viciaefolia*. [References: 9].

Source: Copyright Current Contents

*Lathyrus odoratus*/ Anthracnose *L. odoratus*/ *Colletotrichum acutatum* host range/ *Lathyrus odoratus*/ Lathyrism symptoms/ Anthracnose/ *Colletotrichum*/ Cultivars/ England/ Fungi/ Mycology/ Hatching/ Horticulture/ Horticulture *L. odoratus*/ Hosts/ Host range/ Infection/ Lathyrism/ *Lupinus*/ Microbiology/ *Onobrychis viciaefolia*/ Ornamentals/ Ornamentals *L. odoratus*/ Pathogenicity/ *Phaseolus*/ *Pisum sativum*/ Seed/ Seed borne/ Symptoms lathyrism/ UK/ *Vicia*/ *Vicia faba*/ *Vicia sativa*.

Robertson, L. D.; Singh, K. B.; Erskine, W., and Abd El Moneim, A. M. (1996). **Useful genetic diversity in germplasm collections of food and forage legumes from West Asia and North Africa.** Genetic Resources and Crop Evolution **43** (5):447-460

The germplasm collections at ICARDA of faba bean, chickpea, lentil and forage legumes have been exploited by breeding programmes in the West Asia and North Africa region for production of improved cultivars. The first lines distributed were taken directly from the germplasm collections after initial evaluation. This formed the first flush of releases by national programmes, with 56 of 105 cultivars emanating from germplasm. A systematic evaluation of the food legumes for a wide range of morpho-agronomic characters based on the IBPGR/ICARDA descriptors has led to publication and widespread distribution of catalogues which, in turn, have led to an extensive use of the germplasm by national breeding programmes. In the period of 1990-1994, more than 5000 accessions of food legumes and more than 1900 accessions of forage legumes have been distributed per year. The most important use made of the germplasm collections has been their exploitation as a source for resistances and tolerances to biotic and abiotic stresses. These legumes often suffer severe yield loss due to disease and environmental stress; consequently, screening procedures were developed for the major biotic and abiotic stresses and were successfully applied in selecting sources of resistances and tolerances. The germplasm collections have also been used to improve the nutritional quality of these crops, both for human and animal consumption. Most of the food legume collections have been screened for protein content. The *Lathyrus* spp. collections have yielded lines with low levels of the neurotoxin ODAP (beta-N-Oxalyl-L-alpha,beta-Diaminopropionic Acid), which causes Lathyrism in humans and animals. These lines are being used extensively in the breeding programme. In addition to maintaining collections of the cultigens, ICARDA has also assembled large collections of wild relatives and progenitors of lentil and chickpea; and wild and weedy forms of the forage legume species. In the past five years the wild *Lens* and *Cicer* collections have been evaluated for resistances to biotic and abiotic stresses. These have been useful in providing sources of new, improved or multiple-stress resistance. They have also been useful in increasing yield potential and adaptation of the cultigens. [References: 71].

Source: reprintDE

*Cicer arietinum*/ Genetic resources collection/ *Lathyrus* spp Genetic resources/ *Lens culinaris*/ *Vicia faba*/ *Vicia* spp Genetic resources/ Genetic resources *Lathyrus* spp/ ODAP/ Forage/ Adaptation/ ICARDA/ Agriculture/ Genetic resources/ Africa/ Asia/ Cultivars/ Descriptors Distribution plants/ Environment/ Evaluation genetic resources/ Evolution/ Food/ Forage Syria/ Genetic diversity/ Genetic resources collecting Grain legumes/ Pulses/ Grain legumes evolution/ Grain legumes genetic resources/ Lathyrism animals/ *Lathyrus* spp/ Humans/ Neurotoxins North Africa/ Africa North/ Protein/ Protein content/ Quality/ Resistance/ Screening/ Stress/ Syria/ Syria genetic resources/ *Vicia* spp/ *Vicia* Weed/ Wild relatives/ Wild/ Yield/ Yield fodder/ Genetic resources evaluation/ Reprint.

Tiwari, K. R. and Campbell, C. G. (1996). **Inheritance of neurotoxin (ODAP) content, flower and seed coat colour in grass pea (*Lathyrus sativus* L).** Euphytica **91** (2):195-203 (author affiliation: Tiwari Kr Natl Grain Legume Res Program Rampur Chitawan NepalAgrifood Diversificat Res Ctr Morden Mb R6m 1y5 Canada)

A strong epidemiological association is known to exist between the consumption of grass pea and lathyrism. A neurotoxin, beta-N-Oxalyl-L-alpha, beta-diaminopropanoic acid (ODAP) has been identified as the causative principle. This study was undertaken to investigate the mode of inheritance of the neurotoxin ODAP, flower and seed coat colour in grass pea. Five grass pea lines with low to high ODAP concentration were inter-crossed in all possible combinations to study the inheritance of the neurotoxin. Parents, F-1 and F-2 progenies were evaluated under field condition and ODAP analyzed by an o-phthalaldehyde spectrophotometric method. Many of the progenies of low x low ODAP crosses were found to be low in ODAP concentration indicating the low ODAP lines shared some genes in common for seed ODAP content. The F-1 progenies of the low ODAP x high ODAP crosses were intermediate in ODAP concentration and the F-2 progenies segregated covering the entire parental range. This continuous variation, together with very close to normal distribution of the F-2 population both of low x low and low x high ODAP crosses indicated that ODAP content was quantitatively inherited. Reciprocal crosses, in some cases, produced different results indicating a maternal effect on ODAP concentration. Blue and white flower coloured lines of grass pea were inter-crossed to study the inheritance of flower colour. Blue flower colour was dominant over the white. The F-2 progenies segregated in a 13:3 ratio indicating involvement of two genes with inhibiting gene

interactions. The gene symbol LB for blue flower colour and LW for white flower colour is proposed. [References: 33].

Source: Reprinted with permission Copyright 1996 Kluwer Academic Publishers, Netherlands  
Flower Colour/ ODAP inheritance/ Lathyrus sativus genetics/ Genetics L. sativus/ Breeding/ ODAP genetics/ Breeding ODAP/ ODAP inheritance/ Genetics ODAP/ Genetics L. sativus/ Lathyrus sativus genetics/ Genetics cytoplasmic factors/ ODAP biosynthesis cytoplasm Lathyrus sativus/ Biosynthesis/ Colour/ Flower colour genetics/ Flowers/ Genes/ Genetics/ Genetics flower colour/ Grain legumes/ Pulses Maternal/ Neurotoxins/ O phthalaldehyde/ ODAP/ ODAP biosynthesis/ Population/ Seed/ Seed coats.

Haque, A.; Hossain, M.; Lambein, F., and Bell, E. A. (1997). **Evidence of osteolathyrism among patients suffering from neurolathyrism in Bangladesh.** *Natural Toxins* **5** (1):43-46.

In a study of 500 patients suffering from neurolathyrism in Bangladesh it was found that 60 (all male) complained of bone pain and showed skeletal deformities suggestive of osteolathyrism. On X-ray examination a failure of fusion in both vertebral and iliac epiphyses was found in two patients. At the age of these patients (30 and 37 years) such failure was considered a clear evidence of osteolathyrism. All 60 patients were accustomed to eating the green parts of *Lathyrus sativus*, which contain 2-cyanoethyl-isoxazolin-5-one, a compound that chemically and metabolically can produce the osteolathrogen beta-aminopropionitrile (BAPN), as well as foods made from the seeds of the same plant which contain the neurotoxin 3-N-oxalyl-2,3-diaminopropanoic acid (beta-ODAP).

Source: reprintDE

Lathyrus sativus/ Osteolathyrism/ Lathyrism/ Neurolathyrism/ Isoxazolin-5-one/ BAPN/ ODAP/ 2 Cyanoethylisoxazolin 5 one/ Isoxazolin-5-one toxicity/ NPAA 2-(2-cyanoethyl)-3-isoxazolin-5-one/ Bangladesh/ reprint.

Kusamaeguchi, K.; Kusama, T.; Ikegami, F.; Lambein, F., and Watanabe, K. (1997). **Inhibitory activity of a naturally occurring heterocyclic beta-substituted alanine, beta-(isoxazolin-5-on-4-yl)-l-alanine, on the l-glutamate/l-aspartate transporter (glast) expressed in xenopus oocytes.** *Molecular Brain Research* **52** (1):166-169 (author affiliation: Nihon Univ Coll Pharm Biol Lab Funabashi Chiba 274 Japan)

Excitatory amino acid (EAA) transporters are of physiological importance in the regulation of the extracellular concentration of excitatory amino acids and the neuroexcitation in CNS. Among four identified transporters, the Na<sup>+</sup>-dependent high-affinity L-glutamate/L-aspartate transporter (GLAST) is highly expressed in glial cells. Here, we report a naturally occurring inhibitor of GLAST, derived from bovine retina, using the *Xenopus* oocyte expression system. beta-(Isoxazolin-5-on-4-yl)-L-alanine (TAN), an antifungal antibiotic, inhibited [C-14]L-glutamate (L-Glu) transport into GLAST-expressing oocytes. TAN also served as a substrate for this transporter in voltage-clamp experiments measuring the current coupled to the EAA transport. The maximum current of TAN itself was approximate to 1/3 of that of L-glutamate, and its apparent affinity was almost the same as L-Glu. In combination with L-Glu, TAN antagonized L-glutamate transport. In radioisotope experiments, the inhibitory potency of this compound against [C-14]L-Glu uptake into oocytes was approximate to 1/6 of that of L-(-)-threo-3-hydroxyaspartate (THA). The glucoside of TAN (TANG), occurring in seedlings of the garden pea, the lentil and some *Lathyrus* species, did not show any electrophysiological activity nor was it transported into oocytes. It is proposed that TAN is a novel type antagonist of natural origin on GLAST. By affecting such transport system, naturally occurring compounds may affect the regulation of the extracellular level of endogenous EAA. (C) 1997 Elsevier Science B.V.

[References: 18].

Glast/ Sodium-dependent transporter/ Oocyte/ Xenopus/ Neurolathyrism/ Lathyrus toxin/ Beta-(isoxazolin-5-on-4-yl)-l-alanine/ Beta-odap Rat-brain/ Functional-analysis/ Lathyrism/ Receptors Acid.

Melka, A.; Tekle Haimanot, R., and Lambein, F. (1997). **Symptomatic treatment of neurolathyrism with tolperizone HCl (mydocalm) - a randomized double blind and placebo controlled drug trial.** *Ethiopian Medical Journal* **35** (2):77-91

The efficacy and safety of oral Tolperisone HCL was evaluated in double blind, placebo-controlled, randomized trial in 72 patients with neurolathyrism in stages I, II, and III of the disease at Kolla Duba Health Centre of Dembia District of North Gondar between January and April 1995. Taken orally daily for 12 weeks, tolperisone: HCL (Mydocalm) in a dose of 150 milligrams (mgs) twice daily significantly improved subjective complaints such as muscle cramps, heaviness of the legs, startle attacks, flexor spasms and repeated falls; An overall subjective improvement was observed in 75% of the patients on tolperisone HCL and 39% of the placebo group (P=0.002). When-objectively assessed spastic muscle tone in the abductors, stiffness of Achilles and spontaneous ankle clonus were significantly reduced in tolperisone HCL group (P values = 0.001 0.04, and 0.0001, respectively). Walking ability and speed of walking was also significantly improved. The drug is most effective in relieving symptoms of stage I and stage II disease. Some adverse effects like muscle pain, generalized body-weakness and, dizziness were recorded in patients taking the drug but all were minor and self limited, none requiring discontinuation of treatment. It is concluded that tolperisone is a well tolerated and efficacious drug for symptomatic treatment of neurolathyrism. [References: 17].

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Lathyrism/ Tolperisone/ Ethiopia/ Symptomatic treatment.

Padmajaprasad, V.; Kaladhar, M., and Bhat, R. V. (1997). **Thermal isomerisation of beta-n-oxalyl-l-alpha, beta-diaminopropionic acid, the neurotoxin in Lathyrus sativus, during cooking.** Food Chemistry **59** (1):77-80 (author affiliation: Indian Council Med Res Natl Inst Nutr Po Jamai Osmania Hyderabad 500007 Andhra Pradesh India Indian Council Med Res Natl Inst Nutr Hyderabad 500007 Andhra Pradesh India) The naturally occurring beta-form of N-oxalyldiaminopropionic acid (beta-ODAP) present in Lathyrus sativus is the main neurotoxic principle implicated in neuro-lathyrism. The alpha-form of ODAP has been shown to be less toxic to experimental animals. Therefore, the extent of isomerisation of the toxin from the beta-form to the alpha-form during cooking might determine the toxicity of L. sativus seed. The results of the present study reveal that there is a temperature- and time-dependent isomerisation of the beta-form to the alpha-form. The extent of conversion of beta-ODAP to its alpha-form was determined in some common Indian cooking preparations and was found not to exceed 40%. It seems likely that the toxicity of L. sativus seed due to beta-ODAP is only partially removed during cooking and that a significant proportion of the toxin (about 60%) remains as the toxic beta-form. (C) 1997 Elsevier Science Ltd. All rights reserved. [References: 21]. ODAP isomerism/ Isomerism ODAP/ Lathyrus sativus processing/ Processing L. sativus.

Tekle Haimanot, R. and Lambein, F. (Eds) (1997). Lathyrus and Lathyrism. A decade of progress, in Addis Ababa, Ethiopia. Published in Ghent, Belgium: University of Ghent 139 pp. ISBN: 90-803685-1-2. Lathyrus sativus/ Lathyrus sativus review/ Review L. sativus/ Lathyrism/ Lathyrism review/ Review lathyrism.

Awasthi, S. and Boor, P. J. (1998). **Allylamine and beta-aminopropionitrile-induced vascular injury - enhanced expression of high-molecular-weight proteins.** Journal of Toxicology and Environmental Health **53** (1):61-76 (author affiliation: Boor Pj Univ Texas Med Branch Dept Pathol Chem Pathol Div Galveston, Tx 77555 Usa)

In the present study we describe changes in aorta at the protein level associated with allylamine (AA) and beta-aminopropionitrile (beta APN) induced vascular toxicity in a rat model. This model represents a remarkable synergistic, necrotizing toxic effect of these combined toxins, and our rationale was to examine protein expression in order to shed light on the mechanisms underlying this synergism. Rats were given AA (100 mg/kg body weight/day) and beta APN (1 g/kg body weight/day) by gavage for 10 d; this protocol has been shown to result in smooth-muscle necrosis, but no visible connective tissue changes. Soluble and insoluble fractions from AA + beta APN-or from beta APN-treated aorta showed enhanced expression of three high-molecular-weight protein bands (ranges between approximately 120 and 95 kD). The time course of induction of proteins showed the appearance of AA + beta APN-induced specific proteins at d 3 of AA + beta APN treatment. Partial purification and characterization suggested that AA + beta APN specific proteins are likely to be collagen proteins (type I). Thus, the data presented in this article help in understanding the vascular toxicity induced by AA + beta APN or by beta APN, in that we have described an altered phenotypic expression of collagenous proteins indicative of selective medial vascular toxicity. [References: 28].

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Smooth-muscle cells/ Sensitive amine oxidase/ Gel-electrophoresis Toxicity/ Collagen/ Rat/ Lathyrism/ Coronary/ Disease Invitro.

Bruel, A.; Ortoft, G., and Oxlund, H. (1998). **Inhibition of cross-links in collagen is associated with reduced stiffness of the aorta in young rats.** Atherosclerosis **140** (1):135-145 (author affiliation: Aarhus Univ Inst Anat Dept Connect Tissue Biol Dk-8000 Aarhus C Denmark)

Collagen and elastin fibres are of major importance in providing the aorta with tensile strength and elasticity. The presence of cross-links in collagen and elastin is essential for the mechanical stability of collagen and elastin fibres. beta-aminopropionitrile (BAPN) reduces the formation of cross-links by inhibiting the enzyme lysyloxidase. Young rats were injected with BAPN to inhibit the formation of cross-links, and the changes in the biomechanical and biochemical properties of the thoracic aorta were studied. The biomechanical analyses of aortic samples from BAPN-treated rats showed a significantly increased diameter (1.64 +/- 0.02 mm), a significantly reduced maximum load (1.08 +/- 0.08: N), and a significantly reduced maximum stiffness (3.34 +/- 0.10 N) compared with controls (1.57 +/- 0.02 mm, 1.55 +/- 0.04 N and 4.49 +/- 0.14 N, respectively). No changes in the concentrations of collagen and elastin were found. The content of pyridinoline? a mature collagen cross-link, was significantly decreased by 49% in the BAPN-treated group compared with controls. No changes in the concentration of desmosine+ isodesmosine, the major cross-links of elastin, were found. The present study shows that cross-links are essential in providing mechanical stability of the aorta. Even a partial inhibition of the cross-linking processes results in a destabilisation of the aortic wall with increased diameter and reduced strength and stiffness. (C) 1998 Elsevier Science Ireland Ltd. All rights reserved. [References: 60].

Rat/ Lathyrisim/ Aorta/ Biomechanics/ Collagen/ Elastin/ Pyridinoline/ Desmosines/ Performance liquid-chromatography  
Beta-aminopropionitrile/ Biomechanical properties/ Hydroxypyridinium crosslinks/ Mechanical-properties/ Coronary angioplasty/ Balloon  
angioplasty/ Hypertensive rats/ Marfan-syndrome Blood-pressure.

Getahun, H. and Tekle Haimanot, R. (1998). **Psychosocial assessment of lathyrisim patients in rural Estie district of South Gondar, northern Ethiopia.** Ethiopian Medical Journal **36** (1):9-18 (author affiliation: Getahun H S Gondar Hlth Dept Pob 67 Debre Tabor Ethiopia)

Three hundred and thirty three patients in the lathyrisim endemic rural Estie district of Northern Ethiopia were interviewed and examined to assess the psychosocial impacts of neurolathyrisim. The majority of the affected were in the age group of 11-20 years (43%) followed by 21-30 years (29%). Males were more affected than females (4.8:1). Peak 1 occurrences of neurolathyrisim was observed at time of mobilization of the population in villagization and land diversification schemes. Females were affected to lesser extent and at an earlier age than males. Neurolathyrisim affected matrimony among the rural farming population where marriage is considered as the most significant social achievement of any young member of the society. Divorce rate due to paralysis was 28%. It also influenced the choice of occupation among the afflicted rural people. Many males went into ecclesiastical professions. A significant number of males also took up occupations which traditionally were considered to be exclusively for women like basketry and embroidery. More females, not withstanding their age, were engaged in cattle-keeping. During the study, the rural communities were made aware of the association of neurolathyrisim and consumptions of grass pea seed. It is believed that this step will enable communities to use home-based detoxifying methods and resort to alternate crops during times of food shortage. [References: 11].

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Lathyrisim/ Ethiopia/ Epidemiology.