

Phytohaemagglutinin

1. Name of the Toxin:

Phytohaemagglutinin (Kidney Bean Lectin)

This compound, a [lectin](#) or [hemagglutinin](#), has been used by immunologists for years to trigger DNA synthesis in T lymphocytes, and more recently, to activate latent human immunodeficiency virus type 1 (HIV-1, AIDS virus) from human peripheral lymphocytes. Besides inducing mitosis, [lectins](#) are known for their ability to agglutinate many mammalian red blood cell types, alter cell membrane transport systems, alter cell permeability to proteins, and generally interfere with cellular metabolism.

2. Name of the Acute Disease:

Red Kidney Bean (*Phaseolus vulgaris*) Poisoning, Kinkoti Bean Poisoning, and possibly other names.

3. Nature of the Acute Disease:

The onset time from consumption of raw or undercooked kidney beans to symptoms varies from between 1 to 3 hours. Onset is usually marked by extreme nausea, followed by vomiting, which may be very severe. Diarrhea develops somewhat later (from one to a few hours), and some persons report abdominal pain. Some persons have been hospitalized, but recovery is usually rapid (3 - 4 h after onset of symptoms) and spontaneous.

4. Diagnosis of Human Illness:

Diagnosis is made on the basis of symptoms, food history, and the exclusion of other rapid onset food poisoning agents (e.g., *Bacillus cereus*, *Staphylococcus aureus*, arsenic, mercury, lead, and cyanide).

5. Foods in Which It Occurs:

Phytohaemagglutinin, the presumed toxic agent, is found in many species of beans, but it is in highest concentration in red kidney beans (*Phaseolus vulgaris*). The unit of toxin measure is the hemagglutinating unit (hau). Raw kidney beans contain from 20,000 to 70,000 hau, while fully cooked beans contain from 200 to 400 hau. White kidney beans, another variety of *Phaseolus vulgaris*, contain about one-third the amount of toxin as the red variety; broad beans (*Vicia faba*) contain 5 to 10% the amount that red kidney beans contain.

The syndrome is usually caused by the ingestion of raw, soaked kidney beans, either alone or in salads or casseroles. As few as four or five raw beans can trigger symptoms. Several outbreaks have been associated with "slow cookers" or crock pots, or in casseroles which had not reached a high enough internal temperature to destroy the glycoprotein lectin. It has been shown that heating to 80°C may potentiate the toxicity five-fold, so that these beans are more toxic than if eaten raw. In studies of casseroles cooked in slow cookers, internal temperatures often did not exceed 75°C.

6. Frequency of the Disease:

This syndrome has occurred in the United Kingdom with some regularity. Seven outbreaks occurred in the U.K. between 1976 and 1979 and were reviewed (Noah et al. 1980. Br. Med. J. 19 July, 236-7). Two more incidents were reported by Public Health Laboratory Services (PHLS), Colindale, U.K. in the summer of 1988. Reports of this syndrome in the United States are anecdotal and have not been formally published.

7. Usual Course of the Disease and Some Complications:

The disease course is rapid. All symptoms usually resolve within several hours of onset. Vomiting is usually described as profuse, and the severity of symptoms is directly related to the dose of toxin (number of raw beans ingested). Hospitalization has occasionally resulted, and intravenous fluids may have to be administered. Although of short duration, the symptoms are extremely debilitating.

8. Target Populations:

All persons, regardless of age or gender, appear to be equally susceptible; the severity is related only to the dose ingested. In the seven outbreaks mentioned above, the attack rate was 100%.

9. Analysis of Food:

The difficulty in food analysis is that this syndrome is not well known in the medical community. Other possible causes must be eliminated, such as *Bacillus cereus*, *staphylococcal* food poisoning, or chemical toxicity. If beans are a component of the suspected meal, analysis is quite simple, and based on

10. Selected Outbreaks:

hemagglutination of red blood cells (hau).

As previously stated, no major outbreaks have occurred in the U.S. Outbreaks in the U.K. are far more common. The syndrome is probably sporadic, affecting small numbers of persons or individuals, and is easily misdiagnosed or never reported due to the short duration of symptoms. Differences in reporting between the U.S. and U.K. may be attributed to greater use of dried kidney beans in the U.K., or better physician awareness. The U.K. has established a reference laboratory for the quantitation of hemagglutinins from suspected foods.

For more information on recent outbreaks see the [Morbidity and Mortality Weekly Reports](#) from CDC.

11. Education:

NOTE: The following procedure has been recommended by the PHLS to render kidney, and other, beans safe for consumption:

Soak in water for at least 5 hours.
Pour away the water.
Boil briskly in fresh water for at least 10 minutes.

Undercooked beans may be more toxic than raw beans.

CDC/MMWR

The CDC/MMWR link will provide a list of Morbidity and Mortality Weekly Reports at CDC relating to this organism or toxin. The date shown is the date the item was posted on the Web, not the date of the MMWR. The summary statement shown are the initial words of the overall document. The specific article of interest may be just one article or item within the overall report.

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