

FOOD ALLERGY IN BRONCHIAL ASTHMA

Experiences from the years 1946-1957.

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Allergy to food in asthma has long been a subject of discussion. The varying results of examinations underline the difficulties of obtaining reliable criteria of the relationship between asthma and the relevant food. Food allergy is known, of course, to be quite common during childhood, but at more advanced ages the condition may be obscure and there is a tendency to consider only sensitivity to shellfish, nuts, egg, strawberry, spices and condiments, etc. The reason is doubtless that so many different factors play a role in the pathogenesis of asthma.

OUTLINE OF THE LITERATURE

Some investigators, including Tuft (1), consider that food allergy is present in 5-10 per cent, but others, as for instance Rowe and Vaughan (2), have found the incidence of sensitivity to food in allergic persons to be as high as 40-60 per cent.

In sensitivity to food the hereditary influence—predisposition—is equally important as in other types of allergy. However, acquired hypersensitivity, as pointed out by Tuft (1), among others, may already have its onset during intrauterine life. Some particular food eaten by the mother during pregnancy may, via the blood, produce sensitivity *in utero* if the mother is sensitive to the food in question. This explains why eczema and asthma may occur in newborn infants. Sensitivity

may even arise in infants by transmission of minimal amounts of allergens in the mother's breast milk. Tuft (1) says, further, that although the hereditary disposition may be great in many patients with food allergy, it can be slight in others in whom transient clinical manifestations such as urticaria occur after a surfeit of some particular food, as for example shell-fish or strawberries. This type is more common in adults and, according to Tuft (1), constitutes acquired sensitivity, often in the absence of predisposition. Summarizing, he writes that this form of sensitivity soon disappears and leaves little or no trace of clinical allergy.

Ratner (3) (1951) similarly points out that hypersensitivity in the newborn may have been acquired *in utero*. He calls it "congenital allergy". Many authors are inclined to attribute it to constitutional factors—heredity. Ratner (3) has also demonstrated in guinea-pig experiments this acquired sensitivity during intrauterine life. In his opinion, therefore, a careful distinction must be made between this "congenital allergy" and "chromosomal inheritance". He showed that the guinea-pig fetus could be sensitized both actively and passively, first by injection of antigen into the mother during pregnancy, then by feeding with proteins foreign to the animals' diet. He reported, too, that the human fetus could be sensitized to protein-containing food ingested by a healthy mother during pregnancy, and that the fetus might then be passively sensitized *in utero* by antibodies present in the blood of an allergic mother. This may explain why some infants present allergic symptoms the first time they eat some particular food. Yet Ratner (3) does not claim that this is invariably the case. My own views are fairly selfevident: If an expectant mother knows that she is suffering from asthma, eczema, hay fever, polyps, headache or gastrointestinal symptoms, she should seek medical advice in order to establish whether she has food allergy.

Sensitivity to food may affect anyone, regardless of hereditary disposition. Nearly all foods are capable of producing allergic reactions in any part of the body. The foods usually

coming into question are those that are eaten often. Frequently they are rich in proteins. The commonest are milk, egg, wheat, fish, potatoes, tomatoes, beans, peas, and chocolate. Great importance attaches, of course, to the food customs in different countries. Spain (4) (1955) says that inhalation of odor from spices and cooking food, from fish and some cereals, may provoke asthma. Horesh (5) (1942) reports nine cases of dermatitis provoked by inhalation of vapors or odors from fruits. The patients, he found, were clinically sensitive to those foods. He also observed that inhalation of odor from eggs, peas, beans, wheat, rye, soy-bean meal, etc. could produce allergic symptoms. Spain (4) reports that mere contact with egg, milk, fish, shellfish, chocolate, and nuts may give rise to asthma. According to him, incidentally, these foods are the most important ones in allergic diseases. In about one-half of the cases of food allergy the symptoms develop immediately; in the other half later on, usually within an hour but sometimes perhaps 12 to 40 hours later. Withers and Hale (6) (1956) write that different conceptions of food allergy seem to result in the perpetuation of numerous errors. In the first place, food allergy is not confined to childhood; it is equally common in adults. Secondly, the patients are not aware of the existence of sensitivity to some particular food; a person may know full well that he cannot tolerate some special food, but will rarely suspect a food that is eaten quite often. Thirdly, mistakes are often made in skin tests. There are both pseudo-positive and pseudonegative responses, and they occur with such frequency that these tests cannot be relied upon in the case of food allergy associated with asthma. Skin tests provide some indication of the cutaneous sensitivity, but not always that of the lungs.

In the opinion of Rowe, Alexander, Vaughan (2) and others, skin tests are negative in approximately 50–60 per cent of food allergy cases. Hill (7) and Unger (8) consider that positive intracutaneous tests are to a large extent of no significance. Of 3,920 skin tests on 70 patients (34 children and 36 adults) with respiratory allergy, 1,732 (44.2 per cent)

were positive. Fish and nuts gave the largest number of negative skin reactions.—Tuft, Heck and Gregory (9) (1955), among others, have shown changes in skin reactions with age. The cutaneous activity decreases with counting age. The tendency to positive skin reactions is greatest during the first ten years of life, but the cutaneous sensitivity then gradually decreases up to the age of fifty. After that age, and especially after 60 years, there is a pronounced reduction, particularly in relation to the first ten years of life. Here, therefore, major errors may be made at advanced ages.—Hill (7) (1948) found that in 218 positive skin tests on 100 asthmatic children, the corresponding food could be ingested without producing symptoms, on testing of 158 foods. Neither asthma nor urticaria nor eczema arose, even though many of the children had pronounced cutaneous sensitivity. It emerged that some of the foods producing positive reactions had to be taken into account as earlier etiologic factors. There was a marked tendency, Hill found, for the allergic children to become accustomed to foods to which they had been sensitive. Many of those who had severe symptoms after ingesting egg white at the age of one year were able to eat eggs at the age of six without distress. Yet the positive skin reactions to egg white persisted.

Peshkin (10) (1955) holds the view that skin tests are of greater value in children than in adults. According to Matheson (11) (1939) they are more serviceable in atopic dermatitis, urticaria and gastrointestinal disturbances than in other allergic conditions. McGee (12) (1943) reported 21 cases of fetal hiccoughs. In 17 cases the mothers were allergic, and in ten had allergic symptoms in the gastrointestinal tract. The 21 infants early presented clinical symptoms of allergy; ten of them did not tolerate milk. The most interesting finding was that the hiccoughs could be duplicated by giving the mothers the particular food to which they were sensitive, as chocolate, milk, tomatoes, grapefruit, nuts, and water melon.—Mundall (13) (1954) reports another interesting observation: In a series of 1,500 pregnant women, he claims to have found a

relationship between spontaneous abortions and sensitivity to one or more foods.

Squier (14) (1950) writes that positive skin tests must be considered together with other allergic symptoms, and that cutaneous reactions in food allergy are very difficult to evaluate; they provide nothing more than a clue. According to Squier, there is a correlation between positive skin tests and clinical symptoms in the case of inhaled allergens, as in hay fever and asthma, but not in the case of food allergy. It is almost impossible, for instance, to detect sensitivity to strawberries by skin testing with strawberry extract. The reason for this is not known; evidently the allergen is destroyed in preparation of the extract. Tuft (1), it may be added here, has shown that extracts of fruit and leafy vegetables are unstable; they undergo deterioration from enzyme action with 1 to 2 days and may therefore be unsuitable for testing.

Sensitivity to horse meat calls for greater attention than it is in fact receiving. Horse meat is eaten on a fairly wide scale in such countries as the Netherlands, the Soviet Union and Sweden. According to Kolle and Hetsch (15), mare's milk is commonly drunk by Tartar children in Russia. These children react faster and more strongly than others to injections containing horse serum.—In the Netherlands positive reactions to horse are common in asthmatics. Vaughan (15) writes that some asthmatics who are sensitive to horse odor may tolerate horse serum, but others may not. The explanation lies in the presence of two antigens in horse hair: the dander antigen and the serum antigen. A person sensitive to both should not be given injections of horse serum.—Gillette (16) (1908) and Weaver (16) (1909) already called attention to the discovery of Rosenau and Anderson, in 1906, that guinea-pigs fed on fresh and dried horse meat became sensitized to horse serum. They assumed, moreover, that in some fatal reactions to horse serum the persons in question had eaten sausages containing horse meat.—Billard (16) (1912) described the case of a girl who had received diphtheria antitoxin and immediately developed severe general symptoms of serum sickness.

Some time before, she had eaten horse meat. Urbach (17) reported some deaths in anaphylactic shock. Brusa, according to Urbach (17), had shown that if a mother received serum during pregnancy, the first injection of the same serum produced an allergic reaction in her child.

Hård (18) (1950) reported a case of severe serum sickness in a 31-year-old man. Of interest from the allergic standpoint is that this patient developed urticaria from phenacetin at the age of 19 and became sensitive to egg when 23 years old. Six days before falling ill he had received an intramuscular injection of antidiphtheric serum. After six days there were pain, vomiting, diarrhea, dyspnea, tachycardia and loss of consciousness. On recording of the history it emerged that he had been treated, since the age of 24, with anticatarrh vaccine from the State Bacteriological Laboratory in Stockholm. Since that time he had been distressed by sudden diarrhea after some meals, although he had excluded all foods containing eggs. After discharge from hospital he also excluded horse meat from his diet following positive skin tests for horse. (Incidentally, the patient, while still quite unaware of his sensitivity to horse, had observed an urticarial eruption on his chin after shaving. The shaving brush had horse-hair bristles). His general condition improved but he could still have attacks of diarrhea if he happened to eat horse meat. The investigations were continued. Hård writes: "Through the courtesy of the State Bacteriological Laboratory the composition and manufacture of the anticatarrh vaccine was studied. The vaccine is made in two strengths: Strength I, for persons over the age of 10, contains about 700 million bacteria per millilitre, and strength II, for children under the age of 10, about 230 million bacteria per millilitre. The vaccine consists of several of the bacterial species that may cause infections in the upper respiratory passages. The bacteria are killed by heating and then suspended in normal saline solution, and in the final solution they occur in the following percentages:

<i>Haemophilus influenzae</i>	30 %
<i>Pneumococcus pneumoniae</i>	40 %
<i>Neisseria catarrhalis</i>	10 %
Friedländer's bacillus	10 %
Beta-hemolyzing streptococci	10 %

"Of the above, only the three first-named are cultivated in media containing horse albumin, and they comprise 80 per cent of the bacterial content of the vaccine. *Pneumococcus pneumoniae* is cultivated in a liquid medium-bouillon containing 10 per cent horse serum. The bacteria are separated and washed once. Thus the possibility of horse allergen from the culture medium being present in the finished product would seem to be minimal. *Haemophilus influenzae*, on the other hand, is cultivated on a solid medium containing 10 per cent non-denatured horse blood. The bacteria are washed off with normal saline solution, filtered through gauze, and are not washed before suspension in the final saline solution. The same applies to *Neisseria catarrhalis*, which is cultivated on a solid medium containing 10 per cent horse serum. Thus the possibility is not ruled out that small quantities of horse albumin may accompany the bacteria when they are washed off the solid medium containing horse blood or horse serum."

It was now worthwhile finding out whether guinea-pigs that had been sensitized with anticatarrh vaccine reacted with anaphylactic shock after injection of horse serum. Anticatarrh vaccine was injected subcutaneously in nine guinea-pigs, five with a single dose and four with two injections, one five days after the other. Following cardiac injection of horse serum, four animals died. Nine controls that received injections of horse serum were not affected. The investigation showed that the anticatarrh vaccine contained horse serum.—Notwithstanding every precaution during the preparation of anticatarrh vaccine, minute amounts of horse serum are present, though they suffice to produce a dangerous state of shock. It would be interesting to know the procedure employed in the preparation of anticatarrh vaccine at other laboratories. The question

also arises as to the advisability of prescribing a diet free of horse meat for all persons inoculated with anticatarrh vaccine. Many of these patients are already allergic before the treatment is instituted.

Sheldon (19) (1951) writes, with regard to food allergy, that the person sensitive to food may have no symptoms when he eats only small quantities of the relevant food, but develop symptoms on consuming large amounts. Hence we have to take into account a quantitative factor. The cumulative factor is also substantial. Patients who occasionally eat some particular food without reacting, may develop allergic symptoms when they ingest it frequently. Rinkel, Randolph and Zeller (20) (1951) described cyclic types of food allergy. Immediately after an allergic reaction to some food there is a brief refractory period during which further ingestion of the allergen does not provoke allergic symptoms. Following this there may be a longer period of decreased or subclinical sensitivity. —Sheldon (19) emphasizes that food allergy is often multiple, and this adds to the difficulties of elucidating the foods to which a person is sensitive. Hansel (21) (1953) reports that when some food seems to be an etiologic factor, there is often sensitivity also to other foods in the same group. For instance, a person sensitive to wheat is often allergic to other cereals, such as corn, rye or barley. In general the sensitivity is greatest to foods containing a high percentage of germinating proteins, such as egg, beans, peas, nuts and cereals.—Alvarez, Hinshaw and Frank (22) mention some symptoms which in their opinion point to allergy associated with sensitivity to food, such as gastrointestinal disturbances, meteorism, vomiting, diarrhea, nausea, insomnia, and nervousness. The criteria of allergic symptoms vary, and hence the results of examinations too.

Randolph (23) recommends elucidation of the degree of intolerance to a particular food. In the case of children, it should also be ascertained whether nausea occurs at mealtimes and what amounts of foods have been eaten. Those most frequently ingested should be specially investigated.—Loveless

(24) finds it surprising that so little information is available concerning the minimal provocative dose of an allergen. Such determinations would seem to be possible by means of standardized food extracts. Skin tests are of course unsuitable, for they often give clinically false positive or negative reactions. Loveless adds that the leukopenic index is apparently unreliable, since it is influenced by psychogenic factors.—Ancona and Schumacher (25) (1950) showed that the number of positive skin tests is greater with extracts of fresh fruits. Tuft and Blomstein (26) (1944) demonstrated that berries and some other fruits were easily destroyed in the preparation of extracts for cutaneous tests. Randolph (27) called attention to the necessity of bearing in mind that precisely in the case of foods, contaminants may produce allergic reactions. Peshkin (10) (1955) demonstrated pitfalls in skin testing. In his view great importance attaches to the history, since the skin tests may yield negative results. On the other hand, pseudopositive reactions do occur. The apparatus must be absolutely free of contaminants. We know from Walker, Peshkin and Rost, Sidlick and Knowles, Shannon and Vaughan (28) that delayed positive reactions occur in skin tests. Vaughan considers that "the delayed positive reaction constituted in logical type of response in those cases in which allergenic contact was chronic or more or less constant, as with foods eaten daily. The delayed positive reaction is a mild clinical counterpart of the well-known Arthus phenomenon, a slowly developing reaction following frequent local injections of horse serum.—The intracutaneous delayed reaction is of little or no diagnostic significance, because with a number of allergens there are nonspecific irritating substances which cannot be removed entirely from the test extract and are responsible for delayed irritative lesions. They are not specific."

In delayed clinical symptoms due to ingestion of a food, the onset may occur several hours up to a few days afterwards. It will then be extremely difficult to demonstrate the relationship. In the subsequent hypersensitivity it has to be taken into account that the allergen cannot directly be the rele-

vant food, but must be its breakdown products formed during digestion.

In the elucidation of food allergy, extensive use has been made of both elimination and provocative diets. Rowe (29) employed an alimination diet for the first time in 1928. He based his observations on negative and positive skin tests.—Incidentally a number of elimination diets have been proposed which I cannot go into here.—The diet used by Andresen (30) is precisely the opposite. It opens with eggs, milk, potatoes, meat, oranges and salt for one week. He described this diet in 1942 (31), and it was later modified by Black (32) (1948), then by Lee and Squier (33) (1950). The above-mentioned foods are considered to be the commonest. If sensitivity to any of them is present, the symptoms will increase during the course of the week. Failing this, the foods are of no significance. The examination is more difficult to carry out when pollen or other inhalation allergens occur at the same time; but repeated examinations later on may give a satisfactory response. In the opinion of Walzer (34) the food survey is of greater value than skin testing.

Collins-Williams (35) (1956) considers the demonstration of milk allergy in children to be of exceptional importance, for instance, in colic. Swinny (36) (1956) reported a case of sensitivity to milk in which there was blood eosinophilia of 97 per cent. After a milk-free diet for two weeks the eosinophil count fell to 18 per cent, and 1½ years later it was 6 per cent. In 1948 Nance (37) advocated examination of the feces for eosinophils in children with gastrointestinal symptoms. As early as 1924, he pointed out, Haughwout (38) had called attention to the increased number of eosinophils in the feces of patients with diarrhea.

Food allergy may of course produce many types of symptoms. A few morbid conditions, in addition to bronchial asthma, will be mentioned briefly: Eczema, dermatitis, urticaria, vasomotor rhinitis, gastrointestinal disturbances, some types of headache and some disease of the joints.

Ackroyd (39) (1953) reported a series of 74 cases of

Henoch-Schönlein syndrome due to sensitivity to foods.—Lupton (40) described cheilitis due to sensitivity to coffee.—Wiseman and Moore (41) (1954) reported a case of glaucoma associated with sensitivity to orange and peas; the patient was symptom-free after elimination of those two foods. They also mentioned an earlier case, not examined in detail, in which the patient had attacks of glaucoma after consuming wine. He knew that he was sensitive to grapes.

Stevenson and Alvord (42) (1947) communicated a case of sensitivity to pig in which retrobulbar neuritis accompanies other allergic symptoms.—Dean, Dean and McCutcham (43) reported six cases of interstitial keratitis associated with food allergy.—Theodore (44) established that hyperemia and edema of the conjunctiva might occur in food allergy.—Rowe (45) (1948) found that sensitivity to food might be one of the causes of unexplained fever.

Davidson (46) analyzed 5,000 allergic cases and found 428 with possible cerebral allergy. Food allergy was present in 50 patients. The commonest types of sensitivity were those to milk, chocolate, egg, pork, shellfish, tomato, nuts, apple, onion and cabbage.

Organic nervous disturbances due to food allergy were observed by Staffieri, Bentolila and Levi (47) (1952).

If we consider the various foods that are relevant in this connection, it is milk that comes first. Loveless (48) (1950) found that 1½ per cent of 245,000 patients were allergic to milk. Of 180,000 who were tested intracutaneously, 2.3 per cent showed positive skin reactions. This finding is in striking contrast to a report by Rowe (29), in whose opinion allergy to cow milk is present in 20–30 per cent of all persons with food allergy. He found that 5.5 per cent of 234 patients with asthma were allergic to milk. Vaughan (32) reported positive cutaneous reactions to milk in 14 per cent. Hansel (21) observed that 13 per cent were positive when tested intracutaneously, and 11 per cent in cutaneous tests. Vaughan (32) referred to Bayleat's finding of 47 per cent positive skin reactions to milk in atopic eczema, and O'Keefe and Rackemann's

finding of 26 per cent. He himself estimated the incidence of allergy to milk in a normal population, adults and children, at 1-1½ per cent.—Collins-Williams (35) (1956) calls attention to the various confusing reports, but considers that the variations are dependent on the diagnostic criteria. Brain (49) (1941) held that cow milk was the commonest cause of eczema in children, which conclusion had already been reached by Hill (50) in 1938. Davidson (51) (1942) found that milk produced allergic symptoms in 40 of 100 allergic children over the age of six, and in up to 55 per cent of children up to the age of four years. Rosenblum and Rosenblum (52), investigating 60 infants with gastrointestinal disturbances and eosinophils in the feces, found that the most frequent cause was sensitivity to cow milk. Wessel *et al.* (53) (1954) examined 48 children with colic and found allergy to cow milk in 12 per cent. Clein (54) stated that approximately 7 per cent of children were sensitive to cow milk.

As regards allergy to milk, it must be borne in mind that other allergens may be present in the milk. Vaughan (32), for instance, mentioned that Donally in 1930 had reported cases of protein allergens in mother's milk. In allergy to milk the possibility of sensitivity to cream, cheese and butter must be considered too.

According to Vaughan (32) (1954) sensitivity to meat is present in 2 per cent on cutaneous testing. Rowe (29) also reports a figure of 2 per cent, but Hansel (21) has 6.4 per cent positive reactions to intracutaneous tests. Rowe states that a patient may be sensitive to beef liver but not to beef itself. Sensitivity to liver extract has been described by Vaughan and Pipes (32) as well as by Crip (32), Krantz (32) and others. The skin tests are usually positive.

Allergy to egg may be present without sensitivity to chicken meat. Egg is the commonest allergen in atopic eczema. Rowe (29) (1928) found that of 175 persons with food allergy, 57 were sensitive to wheat, 35 to egg, and 31 to milk. Vaughan (32) observed positive skin reactions to wheat in 24 per cent, to egg in 9.5 per cent and to milk in 14 per cent. Ratner and

Untracht (55) (1932), on studying 322 selected non-allergic children, found positive cutaneous reactions to egg white in 0.3 per cent; in 500 allergic children the corresponding figure was 20.4 per cent, but only 5.6 per cent had clinical symptoms of sensitivity to egg white. It should be kept in mind that sensitivity to egg white is less pronounced if the egg has been boiled. Boiling of foods either destroys or reduces the antigenic activity; frying, in my experience, does not serve to reduce the sensitivity; and all asthmatics are sensitive to the emanations from fried food.

Vaughan (32) found positive skin reactions to wheat in 24 per cent of patients with food allergy. He mentions that Rowe observed positive reactions to wheat in 30 per cent of 175 patients, but to other cereals in not more than 4 per cent.

Sensitivity to potatoes does occur though, according to Rowe (29), on a smaller scale than that to cereals. Sensitivity to potatoes and tomatoes may coexist.

With regard to fish, some persons with this type of allergy pinpoint certain kinds of fish. Great importance doubtless attaches to the mode of cooking. The antigen is stable in the case of boiling. Since minimal quantities are potent, circumspection is advisable. Hansen (56) (1957) points out that persons allergic to fish should be careful not to inhale the odor. Contact with fish glue, liver oil, and fabric dressing containing isinglass, may produce asthmatic symptoms. According to Hansen, incidentally, isinglass is used in the production of wine for clarifying it. Occasionally, therefore, allergic symptoms following consumption of wine may be manifestations of allergy to fish.—Fish meal is often used for fattening pigs and poultry. The meat from these animals, as well as the eggs, contain fish antigen, and if eaten by a person sensitive to fish may produce allergic reactions.

According to Vaughan (32), sensitivity to cane sugar was already reported by Duke in 1925 and by Urbach and Willheim in 1932. Randolph and Rollins assume that it is an allergen, but Rinkel, Randolph and Zeller (20 (1951) report having observed only four cases. Zindler and Colovos (57) should

be mentioned in this connection, for they made the interesting observation that 26 of 28 patients with anthocyaninuria were sensitive to sugar beet and two were apparently allergic to other foods. Normal persons do not demonstrably absorb anthocyanin (betanin) from the intestinal tract. Betanin is a pigment found in sugar and red beet that can be demonstrated spectrographometrically. It colors the urine slightly red.

Lastly, a few words on sensitivity to alcoholic beverages. Dees (58) reports the occurrence of sensitivity to grapes; this might be kept in mind, therefore, in cases of allergy to wine. Persons with allergic reactions to whisky may be sensitive to barley; by the same token, reactions to liquor produced from potatoes may imply sensitivity to the latter. In addition, there may be sensitivity to any spices contained in the beverage, and that to juices, tomatoes, oranges, etc. used in various cocktails.

The foregoing is but a brief outline of the copious literature. If the works of some allergy specialists have been omitted, I would ask for their indulgence; due to my isolated position I have not been able to produce all papers available.

PERSONAL INVESTIGATIONS

Food surveys have been in progress for more than ten years at the Board of Pensions Hospital at Åre, and we have been able gradually to improve the method.

In recording the history, considerable importance is attached to the patient's own observations of sensitivity to any particular foods.

Each patient is tested intracutaneously with the use of a no. 20 injection needle, i.e., the same caliber as that employed in Mantoux tests. The needles, after use, are first washed in a soap and ethyl alcohol solution, then with 70 per cent disinfecting spirit, and finally with ether, after which they are blown dry. Following this procedure they are sterilized for 20 minutes in a thermostat at 180° C.

The following foods have been investigated: Turnip, carrot, potato, semolina, cocoa, boiled peas, red beans, wheat, oats, rye, maize, rice, fish (mixture of cod, Baltic herring, pike and perch), beef, veal, pork, boiled egg yolk, boiled egg white, fresh unboiled milk, and orange. In addition, testing has been done with extracts of horse dander and cow dander, always in a dilution of 1:1,000. The sensitivity to histamine has been tested, too, with a dilution of 1:10,000. The control test has been done with the extraction fluid, Coca's solution. The extracts as well as histamine and control fluid have been prepared by the Vitrum Company.

An amount sufficient to produce a wheal of up to 2–3 mm in diameter is used in testing. A normal person usually reacts with a wheal 10–20 mm in diameter. If only a slight reaction occurs to histamine, this must be taken into account in weak reactions to other substances. The reaction is read after 20 minutes. If the patient is not allergic, the wheal has usually subsided after this time. Positive reactions are manifested in a wheal surrounded by a red zone. The intensity is recorded in plus signs, each plus denoting 5 millimeters. In testing a substance, the reaction must be stronger than the control test if it is to be classed as positive.

In the continued food tests the following general rules have been observed.

1. Infections of varying type and localization must be eliminated as far as possible.

2. On testing of the food the asthmatic must be subjectively free of symptoms and must not have ingested anything for 6–7 hours before the examination. No adrenalin or hormone preparations must have been administered before the test. The patient should have slept soundly, without asthma distress, during the night.

3. The examination must be performed in a quiet environment, and the patient must not be restless or nervous.

4. Everything that may conceivably have an unfavorable influence on the examination must be eliminated from the room. The bed clothes must not be woolen or contain feathers,

down or horsehair. No cosmetics, brushes, flowers or flower pots must be allowed in the examination room.

5. The examination should be conducted in a private room, with no reading, no radio, and no visitors.

6. Duplicate tests are required in doubtful cases.

7. The examining staff must be well trained and absolutely reliable. They must be on the alert for any symptoms that may point to allergy.

8. The examination should be performed early in the morning, and the patient must remain in bed.

In the food test I have employed a modified leukopenic index, in the full knowledge of all the criticism that has been levelled at leukopenia tests. The procedure is based on Widal's observation (1920) of the hemoclastic crisis; in allergic conditions blood changes are found, such as a decreased number of leukocytes (leukopenia) and thrombocytopenia. Widal's discovery gave Vaughan (60) (1934) the idea that a reduced leukocyte count might be utilized for diagnostic purposes in food allergy. Vaughan advocated testing early in the morning. He himself makes two leukocyte counts with an interval of 30 minutes and with the patient with an empty stomach; the relevant food is then ingested and two further leukocyte counts are made, the first after 1 hour and the second 30 minutes later. In Vaughan's opinion, a decrease of more than 1,000 leukocytes per cubic millimeter is conclusive. Joltrain (60) considers a fall of 2,000 leukocytes per cubic millimeter to be a criterion of leukopenia. The phenomenon is attributed to a peripheral reflex with accumulation of leukocytes in the gastrointestinal tract. It is adversely affected by mental unrest and body movements as well as pruritus and dyspnea. The simplified method is based on the observations of Lindeberg-Lindvet (59). Since a total white cell count will manifestly give unreliable results (lymphocytes do not conform to the laws valid for leukocytes), I have made leukocyte counts alone. This consideration does not seem to have received proper attention, for much of the criticism has come from authors who have employed wrong methods. Hence not all of papers

in this field are referred to here. It will assuredly be possible further to improve the method when a simple and practical means has been found of eliminating the eosinophilic leukocytes, since those to do not conform to the laws governing other leukocytes with respect to the hemoclastic crisis. (Hedström (61) (1957)). The leukopenic index, nevertheless, serves only as a framework for the food tests; the regimen itself is the most important. Both patient and hospital staff have a scheme to follow. The patient observes that something is really being done to help him, and therefore adheres more readily to his instructions.

The examination opens at 7 a.m. a good night's sleep. A blood sample is taken for leukocyte and lymphocyte counts. Immediately after this the relevant food is ingested. (In my investigation all food tested were either boiled or uncooked; none were fried). During the next hour the patient remains in bed in as quiet an atmosphere as possible, whereafter further leukocyte and lymphocyte counts are made. A simplified leukopenic index is accordingly employed. Any subjective symptoms are annotated, such as asthma, cough, nasal obstruction, profuse nasal secretion, pruritis, urticaria, Quincke's oedema, nausea or other gastrointestinal disturbances, and headache. A fall in the leukocyte count exceeding 1,000 for each cubic millimeter points strongly to hypersensitivity; but if the symptoms are severe the blood picture will be distorted. In conjunction with the food tests, intracutaneous testing is done at an appropriate juncture.

In recording the history, it is advisable to find out if the patient has been ill during any of the chief public holidays. In Sweden we have to bear in mind sensitivity at Christmas time: cod, pork, veal, oranges, nuts, apples, chocolate, and raisins; at Easter, sensitivity to eggs; during the midsummer holiday, salmon and strawberries.

In the last 200 asthmatics examined, whose condition permitted of food tests and who underwent concurrent intracutaneous testing, the distribution is as follows:

In the "negative intracutaneous tests" group, 46 patients

(29 per cent) showed no hypersensitiveness and 114 (71 per cent) sensitivity to food, including 101 (63 per cent) reacting with asthma and 13 (8 per cent) with other allergic symptoms. (Tables 1 and 2).

TABLE 1

Negative intracutaneous tests.

Special food-tests according to method Hedström.

No symptoms: 46 patients:

0-9	10-19	20-29	30-39	40-49	50-59	60-69 years
7	9	6	4	9	11	patients

TABLE 2

Negative intracutaneous tests.

Hypersensitiveness to foodstuffs according to method Hedström.

Bronchial asthma: 101 patients.

Vasom. rhinitis: 4 patients, oedema Quincke: 2 patients, pruritus: 1 patient, hacking cough 5 patients and headache: 1 patient.

0-9	10-19	20-29	30-39	40-49	50-59	60-69 years
2	9	11	15	37	35	5 patients

In the "positive intracutaneous tests" group, 10 patients (25 per cent) presented no food allergy and 30 (75 per cent) demonstrable sensitivity to food. Of the last-named patients, 25 (62.5 per cent) reacted with asthma and 5 (12.5 per cent) with other allergic symptoms. (Table 3).

TABLE 3

Positive intracutaneous tests.

Special food-tests to method Hedström.

Bronchial asthma: 25 patients.

Vasom. rhinitis: 2 patients, oedema Quincke: 1 patient, feeling of sickness: 1 patient, vomiting: 1 patient.

0-9	10-19	20-29	30-39	40-49	50-59	60-69 years
3	8	2	2	8	7	0 patients

No symptoms: 10 patients:

0-9	10-19	20-29	30-39	40-49	50-59	60-69 years
1	5	1	1	0	2	0 patients

In this series of 200 patients, 56 (28 per cent) did not show, and 144 (72 per cent) did show, sensitivity to food. Of

the latter group, 126 (63 per cent) reacted with asthma and 18 (9 per cent) with other symptoms that could be regarded as allergic. (Table 4).

TABLE 4

Two hundred patients, suffering from Bronchial Asthma.

Negative intracutaneous food-tests

Special food-tests according to method Hedström:

No symptoms: 46 patients.

Negative intracutaneous food-tests

Special food-tests according to method Hedström:

Symptoms:

Bronchial Asthma:

101 patients

Other allergic symptoms:

13 patients

(5 hacking cough

4 vasom. rhinitis

2 oedema Quincke

1 pruritus

1 headache)

Positive intracutaneous food-tests.

Special food-tests according to method Hedström:

Symptoms:

Bronchial Asthma:

25 patients

Other allergic symptoms:

5 patients

(2 vasom. rhinitis

2 vomiting and

indisposition

1 oedema Quincke)

No symptoms:

10 patients

Sum:

Symptoms: Bronchial Asthma: 126 patients = 63 per cent.

Other allergic symptoms: 18 patients = 9 per cent.

No symptoms: 56 patients = 28 per cent.

Only subjectively asymptomatic cases, as mentioned above, could be examined by this method; no bedridden patients or those with asthma or infective asthmatic bronchitis were investigated in this connection, so that the values obtained are probably too high.

During the period from December 3, 1954 to March 8, 1957, to which the above asthmatic cases were referable, a total of 600 asthmatic patients were admitted to the hospital.

Only 27 (13.5 per cent) of the 200 asthmatic patients in-

vestigated were able to name foods to which they were sensitive. These foods totalled forty-seven. Seven patients reported sensitivity to egg, seven to fish, four to milk, four to chocolate, and three to sweetstuffs, among other things (table 5).

TABLE 5 a

In only 27 (13.5 per cent) from the 200 investigated asthma patients or some of their relative noticed hypersensitivity to special food.

From these only 7 (3.5 per cent) were children up to the age of 12 years.

0-9	10-19	20-29	30-39	40-49	50-59	60-69 years
5	7	0	2	9	4	0 patients

TABLE 5 b

Egg, milk, chocolate, fish and sweets dominated on the 27 patients who themselves or their relatives noticed hypersensitivity to foods.

Egg: 7 patients	Seasoning: 1 patient
Fresh milk: 4 patients	Common beet: 1 patient
Sour milk: 1 patient	White cabbage: 1 patient
Chocolate: 4 patients	Oats: 1 patient
Fish: 3 patients	Cheese: 1 patient
Sweetmeats: 3 patients	Tomato: 1 patient
Currants: 2 patients	Bananas: 1 patient
Peas: 2 patients	Apple: 1 patient
Salt food: 1 patient	Rice: 1 patient
Fat: 1 patient	Flour: 1 patient
Sausage: 1 patient	Wheat: 1 patient
Fruit juice: 1 patient	Beans: 1 patient

In the 144 asthmatics who showed food allergy, fish predominated: 36 had asthma, two cough, two vasomotor rhinitis, one Quincke's edema and one pruritus.—After beef, 26 had asthma, three cough, one vomiting and two throat symptoms; after milk, 21 showed asthma and one cough; egg white produced asthma in 17, nausea in two, vasomotor rhinitis in one; sugar was followed by asthma in 18 and cough in four. Fifteen were sensitive to apples, 17 to potatoes. (Table 6).

These figures lend strong support to the view that the most frequently eaten foods usually have to be suspected as allergens.

Of special interest was to find out what relationship existed between sensitivity to cow dander and to foods deriving from

the same animal, since there is every reason to assume that cow dander, to, contains a serum antigen, as is the case with horse hair.

TABLE 6 a
Positive intracutaneous tests.
Special food-tests according to method Hedström.

	Asthma	Other allergic symptoms
Beef	5 patients	1 indisposition
Veal		1 indisposition
		1 vomiting
Ox-liver	2 "	
Sausage	2 "	
Egg white (boiled)	4 "	1 vasom. rhinitis
		1 indisposition
Yolk (boiled)	0 "	0
Fresh milk	3 "	
Cream	3 "	1 hacking cough
Cheese	3 "	1 pruritus
Whey-cheese	3 "	
Butter	1 "	
Fish	3 "	1 pruritus
Sugar	3 "	
Carrot	3 "	
White cabbage	3 "	1 vasom. rhinitis
Orange	3 "	
Onion	3 "	
Tomato	2 "	1 vasom. rhinitis
Potato	2 "	
Red beans	2 "	1 indisposition
Apple	2 "	
Wheat	2 "	
Rye	2 "	
Rice	1 "	
Oats	2 "	
Margarine (vegetable)	1 "	1 sore on the lips
Cucumber	1 "	1 vasom. rhinitis
Grapes	1 "	
Macaroni	1 "	
Banana	2 "	
Plum	1 "	
Dog-rose	1 "	
Semolina		1 urticaria

TABLE 6 b
Negative intracutaneous food-tests.
 Special food-tests according to method Hedström.

	Bronchial asthma	
Fish	33 patients	2 hacking cough 2 vasom. rhinitis 1 oedema Quincke
Beef	10 "	2 hacking cough
Veal	12 "	1 hacking cough
Ox-liver	9 "	2 vasom. rhinitis
Calf-liver	1 "	
Fresh milk	18 "	1 hacking cough
Cream	8 "	1 hacking cough 1 indisposition 2 headache
Cheese from cow-milk	8 "	2 hacking cough 1 itching
Whey-cheese	5 "	2 hacking cough
Egg white (boiled)	13 "	1 hacking cough 1 indisposition
Yolk (boiled)	10 "	1 vasom. rhinitis 1 indisposition
Sugar	15 "	4 hacking cough
Apple	13 "	2 hacking cough 1 vasom. rhinitis
Potato (boiled)	14 "	2 hacking cough 2 vasom. rhinitis
Potato (raw)	1 "	
White cabbage	10 "	2 vasom. rhinitis
Oats	11 "	
Wheat	6 "	2 vasom. rhinitis
Macaroni	6 "	
Rye	6 "	1 indisposition 1 hacking cough
Rice	3 "	
Semolina	5 "	1 vasom. rhinitis
Peas	10 "	2 indisposition 1 hacking cough
Red Beans	2 "	
Dog-rose	10 "	
Orange	6 "	1 diarrhoea
Carrot	1 "	1 hacking cough 1 itching

TABLE 6 b (continued)
Bronchial
asthma

Banana	6	„	
Plum	5	„	1 hoarseness
Margarine (vegetable)	10	„	1 hacking cough
Pork	8	„	
Sausage	14	„	2 hacking cough
			1 indisposition
Onion	6	„	1 itching
Artichoke			1 vasom. rhinitis
Sugar-beet	1	„	
Cucumber	2	„	1 hacking cough
Common beet	4	„	1 hacking cough
			2 vasom. rhinitis
Cauliflower	9	„	1 headache
Swedish turnip	3	„	
Spinach	6	„	2 hacking cough
			1 vasom. rhinitis
Tomato	6	„	
Lingonberries	5	„	
Grapes	2	„	
Pear	3	„	1 hacking cough
			1 indisposition
Coffee	6	„	
Cacao	1	„	
Tea	1	„	1 hacking cough

TABLE 6
Asthma

Fish	36 patients		Other allergic symptoms
			1 pruritus
			2 hacking cough
			2 vasom. rhinitis
			1 oedema Quincke
Fresh milk	21	„	1 hacking cough
Cream	11	„	1 pruritus
			2 hacking cough
			2 headache
			1 indisposition
Cheese	11	„	2 pruritus
			2 hacking cough
Whey-cheese	8	„	2 hacking cough

TABLE 6 (continued)

	Asthma	Other allergic symptoms
Butter	1 "	
Beef	15 "	2 hacking cough
		1 indisposition
Veal	12 "	1 hacking cough
		1 indisposition
		1 vomiting
		2 vasom. rhinitis
Ox-liver	11 "	
Calf-liver	1 "	
Pork	8 "	
Sausage	16 "	2 hacking cough
		1 indisposition
Egg white (boiled)	17 "	1 hacking cough
		1 vasom. rhinitis
		2 indisposition
Yolk (boiled)	10 "	1 indisposition
		1 vasom. rhinitis
Sugar	18 "	4 hacking cough
Potato (boiled)	16 "	2 vasom. rhinitis
Potato (raw)	1 "	
Tomato	8 "	1 vasom. rhinitis
Apple	15 "	2 hacking cough
		1 vasom. rhinitis
Carrot	10 "	1 pruritus
		1 hacking cough
White cabbage	13 "	2 vasom. rhinitis
Margarine (vegetable)	10 "	1 sore on the lips
Peas	10 "	2 indisposition
		1 hacking cough
Dog-rose	11 "	
Onion	9 "	1 itching
Wheat	8 "	
Macaroni	7 "	
Manna groats	5 "	1 urticaria
		1 vasom. rhinitis
		1 hacking cough
Rye	8 "	
Oats	13 "	
Red beans	4 "	1 indisposition
Banana	8 "	
Plum	6 "	1 hoarseness
Pear	3 "	
Grapes	3 "	
Lingon berries	5 "	

TABLE 6 (continued)

	Asthma		Other allergic symptoms
Cauliflower	9	„	1 headache
Swedish turnip	3	„	
Cucumber	1	„	1 vasom. rhinitis
Spinach	6	„	2 hacking cough
			1 vasom. rhinitis
Common beet	4	„	1 hacking cough
			2 vasom. rhinitis
Sugar beet	1	„	
Artichoke			1 vasom. rhinitis
Coffee	6	„	
Cocoa	1	„	
Tea	1	„	

TABLE 7 a

From the 200 patients 29 (14.5 per cent) in all reacted with positive intracutaneous tests to cow dander. 21 patients were hypersensitive to separate or some of the following foodstuffs:

Asthma	Other allergic symptoms
Fresh milk: 6 patients	
Sour milk: 2 patients	1 hacking cough
Cream: 3 patients	2 hacking cough
Cheese (from cow milk): 0 patient	0 patient
Whey-cheese (from cow milk): 1 patient	
Beef: 4 patients	1 hacking cough
Veal: 0 patient	1 hacking cough
	2 vomiting or feeling of sickness
Ox-liver: 2 patients	

Of the 200 asthmatics investigated here, 29 (14.5 per cent) showed positive intracutaneous reactions to cow dander, and 18 of these (9 per cent) presented symptoms of sensitivity to foods from the same animal. (Table 7).

The investigation demonstrates that food allergy is common in bronchial asthma but that a great deal of patience and work is required for its elucidation.

The literature of recent years nevertheless reflects mounting interests in the subject, for there is a growing understanding

of the major significance of foods in bronchial asthma and other allergic diseases.

TABLE 7 b

Positive intracutaneous test to cow dander.
Special food-test accordingly to method Hedström.

394/55 ♂ 13	Beef	<u>4700</u> 3400	<u>3600</u> 3400	= leucocytes lymphocytes	No symptoms
	Fresh milk	<u>4100</u> 3300	<u>4000</u> 3000		" "
	Butter	<u>4400</u> 4000	<u>2900</u> 3500		" "
427/55 ♂ 9	Beef	<u>3600</u> 3100	<u>2800</u> 2500		No symptoms
	Veal	<u>3000</u> 3800	<u>2700</u> 3400		" "
	Milk	<u>3000</u> 3500	<u>2600</u> 3500		" "
	Cheese half-fat from cowmilk	<u>3400</u> 4000	<u>2600</u> 3100		" "
459/55 ♀ 28	Beef	<u>2400</u> 2500	<u>2700</u> 3500		Asthma
	Veal	<u>3900</u> 1700	<u>2600</u> 1300		No symptoms
	Fresh milk	<u>2500</u> 1600	<u>3500</u> 1300		" "
633/55 ♂ 54	Milk	<u>2800</u> 2500	<u>1600</u> 3500		Asthma
638/55 ♂ 22	Beef	<u>1600</u> 1700	<u>1700</u> 1100		Hacking cough
	Veal	<u>1800</u> 900	<u>1900</u> 1100		" "
	Cream	<u>2200</u> 1500	<u>1300</u> 1200		" "

TABLE 7 b (continued)

653/55 ♀ 16	Beef	<u>3300</u> <u>2700</u> 1900 2600	No symptoms
	Milk	<u>2800</u> <u>2100</u> 2600 1800	" "
	Cheese	<u>3500</u> <u>2400</u> 3700 2800	Asthma
	Ox-liver	<u>4700</u> <u>3100</u> 2100 1900	"
667/55 ♀ 19	Beef	<u>2300</u> <u>3500</u> 3400 2400	No symptoms
	Fresh milk	<u>4000</u> <u>3700</u> 3200 3100	" "
	Sour milk	<u>4200</u> <u>3000</u> 1700 1600	" "
	Cream	<u>4200</u> <u>3200</u> 2800 2000	" "
668/55 ♀ 36	Cream	<u>4500</u> <u>3300</u> 2700 2900	Hacking cough
	Fresh milk	<u>3200</u> <u>2500</u> 2900 2200	No symptoms
	Beef	<u>4800</u> <u>3500</u> 3400 3900	" "
682/55 ♂ 7	Beef	<u>2800</u> <u>1600</u> 3100 2800	Asthma
128/56 ♀ 56	Beef	<u>2600</u> <u>1100</u> 3700 3100	No symptoms
	Veal	<u>2700</u> <u>2800</u> 2800 2600	" "
	Ox-liver	<u>3600</u> <u>2800</u> 2000 2800	" "

TABLE 7 b (continued)

160/56 ♀ 19	Beef	<u>2600</u> 3700	<u>1100</u> 3100	No symptoms	
	Veal	<u>2700</u> 2800	<u>2800</u> 2600	"	"
	Ox-liver	<u>3600</u> 2000	<u>2900</u> 2800	"	"
	Fresh milk	<u>3100</u> 1800	<u>3200</u> 1900	"	"
176/56 ♂ 51	Veal	<u>4300</u> 3100	<u>4900</u> 2100	No symptoms	
	Ox-liver	<u>3400</u> 3000	<u>2200</u> 1700	"	"
	Fresh milk	<u>2800</u> 3600	<u>2500</u> 1800	"	"
177/56 ♂ 29	Beef	<u>4200</u> 2800	<u>3700</u> 2700	No symptoms	
	Veal	<u>3100</u> 2700	<u>2100</u> 2300	"	"
	Fresh milk	<u>4000</u> 3000	<u>3000</u> 2300	"	"
	Ox-liver	<u>4400</u> 3000	<u>2900</u> 1900	"	"
263/56 ♂ 48	Fresh milk	<u>3300</u> 2600	<u>2200</u> 2000	Asthma	
	Cream	<u>3600</u> 3000	<u>2400</u> 1800	No symptoms	
	Butter	<u>2900</u> 3200	<u>2300</u> 1900	"	"
	Ox-liver	<u>3100</u> 3000	<u>3700</u> 2800	"	"
269/56 ♂ 9	Fresh milk	<u>6100</u> 5300	<u>4700</u> 3900	Asthma	
	Whey-cheese	<u>4400</u> 3100	<u>3100</u> 2400	"	

TABLE 7 b (continued)

313/56 ♂ 10	Fresh milk	<u>5000</u> <u>3800</u> 3700 4000	Asthma
	Boiled milk	<u>4900</u> <u>4400</u> 4200 4200	No symptoms
	Cheese	<u>5000</u> <u>3700</u> 3800 3800	Asthma
	Veal	<u>3500</u> <u>2000</u> 3800 3900	No symptoms
	Beef	<u>4300</u> <u>3900</u> 3600 3900	" "
	Ox-liver	<u>5400</u> <u>4300</u> 4300 5100	" "
314/56 ♂ 52	Beef	<u>3700</u> <u>2600</u> 1300 2000	No symptoms
	Fresh milk	<u>3700</u> <u>3800</u> 2500 2000	" "
	Cheese	<u>6300</u> <u>4100</u> 3500 3000	Asthma
355/56 ♀ 22	Beef	<u>2900</u> <u>2600</u> 2200 1400	No symptoms
	Fresh milk	<u>2500</u> <u>1400</u> 1000 2600	" "
	Cheese	<u>3700</u> <u>3200</u> 2600 1300	" "
383/56 ♂ 16	Beef	<u>4200</u> <u>2600</u> 3200 3200	Asthma
392/56 ♂ 19	Sour milk	<u>3100</u> <u>2800</u> 2000 2700	Asthma
	Fresh milk	<u>2300</u> <u>2700</u> 3100 2600	No symptoms
	Beef	<u>3300</u> <u>2300</u> 3000 2800	" "
	Veal	<u>4900</u> <u>3600</u> 1600 2000	" "

TABLE 7 b (continued)

396/56 ♂ 43	Cream	<u>2600</u> <u>2100</u> 2900 2800	Asthma
	Beef	<u>2900</u> <u>2200</u> 3200 2700	
440/56 ♀ 51	Fresh milk	<u>2200</u> <u>1200</u> 2500 2000	Asthma
	Cheese	<u>3000</u> <u>1800</u> 4200 4000	No symptoms
	Beef	<u>2400</u> <u>2200</u> 3100 3100	" "
454/56 ♂ 51	Veal	<u>5300</u> <u>4700</u> 2600 2700	Vomiting
	Beef	<u>3600</u> <u>2500</u> 3500 3500	Feeling of sickness
	Ox-liver	<u>3900</u> <u>2600</u> 2400 3100	No symptoms
488/56 ♂ 46	Veal	<u>5300</u> <u>4700</u> 2600 2700	Vomiting
	Beef	<u>5900</u> <u>4700</u> 2100 3000	No symptoms
	Fresh milk	<u>4700</u> <u>4300</u> 2800 2600	" "
553/56 ♀ 31	Beef	<u>2200</u> <u>1000</u> 2800 2800	Asthma
	Cream	<u>3700</u> <u>2100</u> 3900 3800	"
585/56 ♂ 59	Cream	<u>3700</u> <u>2100</u> 3900 3800	Asthma
	Fresh milk	<u>3900</u> <u>2400</u> 2300 3100	No symptoms
	Veal	<u>3600</u> <u>2000</u> 3500 3100	" "
	Beef	<u>3600</u> <u>3400</u> 3400 4000	" "

TABLE 7 b (continued)

622/56 ♀ 51	Fresh milk	<u>3500</u> <u>3200</u> 2900 3000	Asthma
	Sour milk	<u>3100</u> <u>3000</u> 3100 2500	Hacking cough
723/56 ♀ 48	Butter	<u>3800</u> <u>2300</u> 2800 2200	Asthma
143/57 ♀ 44	Fresh milk	<u>3400</u> <u>2300</u> 2400 2400	Asthma
	Sour milk	<u>3600</u> <u>2800</u> 2000 3500	"
	Ox-liver	<u>2600</u> <u>1300</u> 3300 2400	"

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