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POTATO SENSITIVITY, AN OCCUPATIONAL ALLERGY IN HOUSEWIVES

By

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Asthmatic patients not uncommonly complain that scraping new potatoes for cooking causes them to sneeze or wheeze. A question relating to this was therefore included in a routine questionnaire which all asthmatics seen in the Out-patient Departments of two hospitals have been asked to fill in on their first attendance. Twenty nine cases (2.34 per cent) out of 1,227 asserted that within a few minutes of starting to scrape new potatoes in preparation for boiling, they would sneeze or wheeze. One patient only, stated that peeling old potatoes also caused symptoms. The symptoms diminished in each case within a few minutes of stopping this form of activity.

AGE AND SEX INCIDENCE

As might be expected symptoms were almost exclusively limited to females (Table 1). The age incidence between the age of 20 and 40 reached a level of between 6 and 7 per cent and fell slightly thereafter.

The onset of symptoms was noticed for the first time in sixteen out of nineteen patients between the ages of 12 and 39.

SYMPTOMS

Of the twenty nine cases 14 stated that scraping potatoes caused wheezing, eight wheezing and sneezing, one wheezing, sneezing and urticaria, one wheezing and urticaria, one sneez-

ing and urticaria and four sneezing only. Sneezing was in most cases accompanied by rhinorrhoea.

In four of these, symptoms also followed eating cooked potatoes which caused asthma in all four and generalised urticaria in one.

TABLE 1
Symptoms Caused by Scraping new Potatoes According to Age and Sex.

Age in Years	Sex	0-9	10-19	20-29	30-39	40-49	50-59	60+
All cases seen	♀	40	143	116	127	120	73	37
	♂	67	84	94	80	67	64	15
Cases sensitive to new potatoes	♀	0	1	.8	8	5	4	1
	♂	0	0	0	0	2	0	0
Percentage sensitive	♀	0	0.7	6.9	6.3	4.2	5.5	2.7
	♂	0	0	0	0	3	0	0
Age of Onset (19 cases)	♀	0	4	7	5	1	1	1

All patients also had attacks of asthma unrelated to contact with potatoes. In twenty three, other allergic precipitating factors were identified, in sixteen infection of the upper respiratory tract played some part and in eleven there was some obvious emotional factor.

REPRODUCTION OF SYMPTOMS UNDER EXPERIMENTAL CONDITIONS

Ten housewives who stated that wheezing occurred when scraping potatoes were asked to attend in order to confirm the history they had given.

The forced expiratory volume (FEV) was in each case recorded on a revolving drum. Two recordings were made at five minute intervals on three occasions, and the F.E.V. and F.E.V.₁ were measured. There was good agreement between these preliminary recordings, the higher of which was taken on each occasion.

Each patient was provided with 1-2lbs of potatoes. These had been scrubbed lightly in water so as rid the skins of any

dirt that might have been adhering to them. The patient was then asked to scrape the potatoes as they would do in their own homes. The act of scraping took 5-7 minutes.

The F.E.V. was recorded on two occasions at one, six, eleven and sixteen minutes after the operation had finished. In four cases no effect was observed but in the remaining six there was a reduction of F.E.V. between 13 and 67 per cent, and of F.E.V.₁ between 21 and 71 per cent (Table 2) from 5-10 minutes later. The higher of the two readings was recorded on each occasion. Two of the four cases who showed no change in the F.E.V. or F.E.V.₁ complained of itching in the nose and throat (Table 2).

TABLE 2
Effect of Scraping Potatoes on F.E.V. and F.E.V.₁ in Potato Sensitive Housewives.

Case No.	Percentage reduction of		Month of Test	Skin test to fresh potato juice	Symptoms
F.E.V.	F.E.V. ₁				
1	0	0	May	0	Nose & throat itched
2*	16	24	July	0	Wheezing
3	60	71	August	+++	Wheezing
4	0	0	March	0	None
5	13	17	June	0	Nose itched
6	27	36	May	+++	Wheezing
7	0	0	March	—	None
8	0	0	June	0	Nose itched
9	18	21	June	+	Itching face, nose blocked, wheeze
10*	67	68	August	+++	Wheezing

* Eating potatoes causes asthma.

Cases 5 and 9 were also asked to repeat the test with old potatoes in October in each case with negative response. Case 4 was tested for a second time in August and again failed to show any change in respiratory function.

Twenty two patients were questioned some years after their first attendance: twelve of these were still affected, eight stated that they were now able to scrape potatoes without ill effect, and two refused to carry out a test to see whether they were still sensitive or not.

Details of case histories are given in cases 3, 6, 9 and 10.

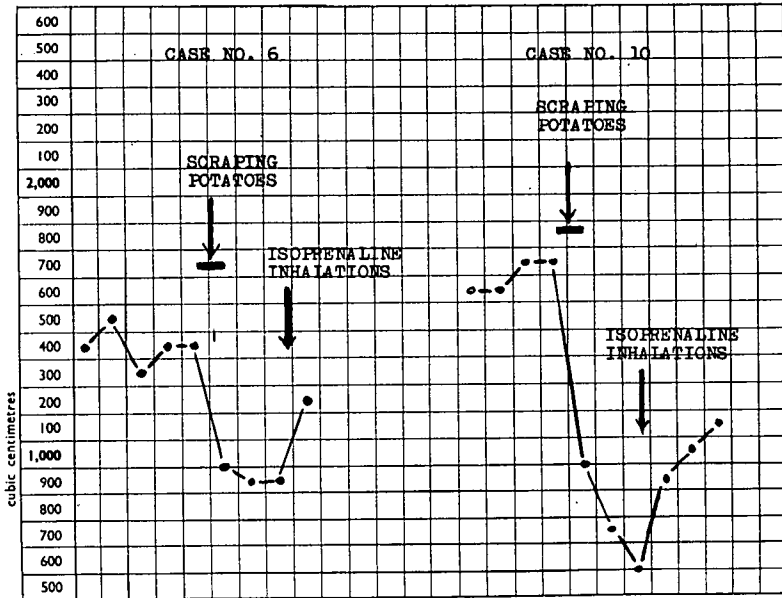
CASE HISTORIES

Case 3 (E.B.) a housewife of 39. Her asthma began at 24, and she had severe attacks on 3 or 4 occasions annually, with minor attacks weekly. She knew that wheezing was brought on by contact with house dust and by scraping new potatoes. Eating potatoes had no effect. Positive skin reactions were obtained with extract of house dust, feathers, grass pollen, some animal hairs and potato extract. Subsequent observation confirmed that she was clinically sensitive to grass pollens. Desensitisation with house dust, animal hairs and feathers brought about considerable improvement. Scraping potatoes under experimental conditions caused wheezing and sneezing, the F.E.V. falling from 2,400 to 1,600 ml (60 per cent), and the F.E.V.₁ from 2,100 ml. to 1,200 ml. (71 per cent). Six years later she had maintained her improvement but attacks were still caused by contact with cats, grass pollen and scraping new potatoes.

Case 6 (E.C.) housewife of 54. She had had hay fever for many years and when employed in a bakery developed eczema from contact with flour. She also had nickel dermatitis. She had had asthma for 1 year and had noticed that scraping new potatoes caused sneezing and wheezing; her symptoms were also related to contact with tree and grass pollens. Positive skin reactions were given to grass pollens, various tree pollens, horse dander, feathers and potato juice. She was able to eat potatoes without ill effect. Scraping potatoes caused wheezing and itching of the nose with a reduction of F.E.V. from 2,200 ml. to 1,600 ml. (27 per cent) and the F.E.V.₁ from 1,400 to 900 ml. (36 per cent).

Case 9 (E.F.) a housewife of 35 years. She had had asthma from the age of 18 years and recognised that attacks might be produced by contact with house dust and scraping new potatoes. Eating potatoes had no effect but wheezing following consumption of raw pears, grapes and eggs. Positive skin tests were given to house dust and animal hairs but not to potato extract or fresh potato juice. Scraping new potatoes caused itching in throat and nose, and a dry cough. The F.E.V. fell from 2,800 to 2,300 (18 per cent) and F.E.V.₁ from 1,700 to 1,350 ml. (21 per cent). When the test was repeated with old potatoes in October there was no response.

Case 10 (J.C.) a housewife of 21. Seven years previously she had noticed that she developed urticaria and angio-neurotic oedema of the face after eating



SF. 3

Fig. 1.

Effect of Scraping Raw Potato on F.E.V.

Ordinates in cubic centimeters: abscissae represent time, each space being equivalent to five minutes. In both cases four preliminary readings at 5 minute intervals precede exposure to potato juice spray.

potatoes. Scraping potatoes at that time caused her hands to swell. Six years previously she began to wheeze if she was present in the kitchen when new potatoes were being scraped or even peeled. At this time asthma occurred only as the result of scraping or eating potatoes. Five years ago her asthma became more severe and occurred most nights. No cause for this has been detected but upper respiratory tract infection made her worse. Positive skin reactions were given by house dust, potato extract and potato juice. A positive Prausnitz Kustner response was obtained when raw potato juice was pricked into an area passively sensitised with 0.5 ml., of her serum in a control subject but not elsewhere.

Experimental scraping of potatoes caused a fall of F.E.V. from 2,000 ml. to 650 ml. (67 per cent) and of F.E.V.₁ from 1,700 ml. to 550 ml. (68 per cent). There was marked wheezing and the nose became blocked. The attack became so severe that isoprenaline was given by inhalation after 10 minutes and was repeated on two subsequent occasions in the next half hour. (See Fig. 1).

NATURE OF ALLERGEN

The nature of the allergenic material in potatoes has not been determined. Since most individuals who show symptoms of sensitivity as previously described, can eat potatoes without ill effect, the material appears to be destroyed or reduced in potency by digestion.

Recent publications (*Freedman & Siddiqi* 1962, *Siddiqi & Freedman* 1963) have shown that chlorogenic acid, a simple phenolic compound widely distributed throughout the vegetable kingdom, may be capable of acting as an antigen which is the effective agent in allergy to castor bean and oranges and also to the inhaled dust of green coffee. Chlorogenic acid loses its allergenicity in the gastrointestinal tract (*Freedman, Shulman, & Krupey* 1964). *Layton & Greene* (1965) were unable to confirm the allergenicity of chlorogenic acid in monkeys sensitised primarily to coffee bean extract with serum from coffee sensitive patients.

Chlorogenic acid has been shown to be present in potato tubers (*Zucker & Levy* 1959. *Sondheimer* 1964). *Baruah & Swain* (1959) estimated the content of chlorogenic acid in potato and give the following figures—Peel 140 mg./100 g., Flesh 72 mgm./100 g. and freeze dried whole tissue 97.4 mgm./100 g., dry weight. Others (*Wolfgang, Schrodter & Hoffman* 1959) have found considerable variation in the chlorogenic acid content of potatoes and observed that the quantity in the peel rises considerably three days after sunshine.

Since chlorogenic acid is evidently present in potatoes and especially in that part directly under the skin it seemed worth while to carry out skin tests with chlorogenic acid and to compare these with raw potato juice. A commercial preparation of chlorogenic acid¹ was dissolved in phosphate solution buffered at a pH of 7.0 in a strength of 1 mgm. of chlorogenic acid per ml. It was sterilised by passing through a 'millipore' filter. Tests were carried out in five patients as follows:

¹ Obtained from L. Light & Co., Ltd., Colnbrook, Bucks.

TABLE 3

	Fresh raw potato juice Prick test	Commercial potato extract	Chlorogenic acid 1 mgm/ml. Prick test	Chlorogenic acid 1 mgm/ml. Intradermal 0.05 ml./ 0.05 ml.
Case 3	+++	+++ (Prick)	+	o
Case 10	+++	—	o	+
Case 11	++	++ (Intradermal)	o	±
Case 12	+	—	o	o
Case 13	+++	+++ (Prick)	o	o

Although small reactions were given in three cases to chlorogenic acid by prick (1) or intradermal (2) test these were insignificant compared with raw potato juice or commercial potato extract. In one patient chlorogenic acid (1 mgm per ml) was inserted into the patient's right nostril without any effect. It was considered unlikely that chlorogenic acid was the factor responsible for allergic symptoms in these cases. *Freedman et al* (1962) have however pointed out that commercially prepared chlorogenic acid may contain three isomeric forms, and that not all these are allergically active.

DISCUSSION

Raw potatoes contain an allergen which may cause asthma or rhinorrhoea in those who repeatedly come into contact with it. Cooking or digestive processes appear to denature the active material so that the majority of patients can eat potatoes without ill effect. A small proportion (four out of 29) were however unable to tolerate it as a food. All patients stated that new potatoes only caused symptoms: in two patients this was confirmed, no reduction in F.E.V. or F.E.V.₁ taking place when they were asked to scrape old potatoes during the autumn

months. Only new potatoes are normally scraped, old potatoes which have thicker skins are peeled: this may partly explain the ability of patients to handle old potatoes without ill effect. It is possible that storage causes some loss of activity in the allergic factor responsible. There is no doubt that the act of scraping the skin from potatoes liberates a fine spray of liquid from the ruptured potato cells: this settles as a fine starchy deposit over a wide area, and is certainly inhaled by anyone carrying out the operation and those near by.

Though this particular sensitivity is not uncommon, it is easily avoided by getting some other member of the family to prepare the potatoes or perhaps by peeling them instead of scraping. There is no evidence that the allergic sensitivity is related to the presence of chlorogenic acid in the potatoes.

SUMMARY

1) In over 1,200 patients with asthma, 29 (2.3 per cent) developed allergic symptoms when scraping new potatoes.

2) Twenty seven of the patients were females, and two males.

3) In women between 20 and 40 years the incidence rose to between 6 and 7 per cent.

4) Attacks of asthma were reproduced under experimental conditions in 6 out of 10 cases giving this history.

5) The majority of the patients affected (25 out of 29) could eat cooked potatoes without ill effect.

6) No confirmation was obtained for believing that chlorogenic acid was the active principle responsible for symptoms.

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