

Buckwheat Allergy: Health Food, an Inhalation Health Risk

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Thirteen out of 28 persons (14 men and 14 women) employed in a company which imports, prepares and distributes plant products used in spices and as ingredients in so-called health food, had developed work-related symptoms in the form of rhinitis, conjunctivitis, asthma, itch or urticaria. The symptoms occurred in connection with specific work operations, especially in the grinding and packaging of buckwheat. Seven out of 25 examined persons (28%) had at least one positive allergy test (prick test or RAST) against buckwheat. Furthermore, one person had positive RAST against extract from castor-oil bean. The correlation between positive allergy tests and work-related symptoms is significant. Fourteen persons were also patch tested. All were negative except one person who had a positive patch test against nickel. The nickel allergy was diagnosed before this study was done and had no relation to the work. The levels of airborne dust in the breathing zones of the workers when they performed dust-forming work were around and below 5 mg/m³. When buckwheat flour was packaged, the airborne dust levels were about 1-2 mg/m³. Thus, exposure to comparatively low levels of buckwheat dust may induce a definite risk of rapidly ensuing allergy. It is also obvious that persons without atopic stigmata, such as an earlier history of allergy or the occurrence of allergic diseases in relatives, risk becoming allergic. A conclusion is that health food could be a danger, when it is inhaled.

Key words: Allergy; asthma; buckwheat; dust; inhalation; occupational exposure; rhinitis; vegetable.

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At a routine follow-up of a patient with allergic symptoms, released by vegetable dust when preparing raw materials for so-called health food, it was found that a number of her fellow workers also got reactions when they came in contact with different products at the workplace. The patient was an 18-year old girl who 2-3 months after her employment became hoarse and got sneezing attacks and conjunctivitis when handling products containing buckwheat. All employees preparing and packing these products were examined. The results are accounted for in the following.

MATERIAL AND METHODS

In the company spices and vegetable products used as ingredients in so-called health foods are

ground and packed before distribution. Usually, the imported raw material arrives in sacks, and is re-packed in separate package rooms into smaller packets weighing about 0.25-1 kg. Several products are crushed or ground before re-packaging. Buckwheat (*Fagopyrum esculentum*), the product causing most troubles, is delivered in 25 kg sacks and is ground before re-packaging.

There is a considerable turnover of personnel in the company. Many of the workers are immigrants and, as a rule, they use the employment as a stepping stone to other employment in Sweden. In total 28 persons (14 men and 14 women) were examined from May 1980 to June 1981. Their age ranged from 17 to 65 years. Seven persons were under the age of 20. The period of employment varied from 2

months to 20 years, and eight persons had been employed for shorter than 1 year. Twenty-five of the 28 persons (12 men and 13 women) were smokers. Thus, smoking habits were equally widespread among men and women.

Information was obtained about period of employment, smoking habits, earlier atopic or allergic reactions and whether parents, brothers or sisters had had similar symptoms. Any connections between work factors and occurrence of symptoms were also noted.

Analysis of IgE in blood was performed in 25 persons using Phadebas IgE PRIST (Pharmacia Diagnostics AB) according to the recommendations of the manufacturer. Phadebas RAST (12) was performed on 25 persons against antigens from buckwheat and on 15 persons against antigens from soyabean flour. Fifteen persons were prick tested and 14 were patch tested against the same allergen. The buckwheat extract for prick testing was made from the unfiltered supernatant of a mixture between buckwheat and physiological NaCl solution diluted 1:100. Leukocyte differential counts with calculation of the relative and absolute amounts of eosinophils were performed on 17 persons.

Spirograms were recorded in 17 persons with a Vitalograph. This examination was performed in the morning before the beginning of work. FVC (forced vital capacity), FEV₁ (forced expired volume during 1 sec of expiration), FEV% (FEV₁ in per cent of FVC), FEF_{25-75%} (forced expired flow during mid-expiration) and FMFT (forced mid-expiratory flow time) were calculated from the spiograms. The observed values were compared with reference values corrected for sex, age and body size. The differences between observed values and calculated reference values were statistically analysed.

The level of airborne dust was measured in the breathing zones of the personnel. The dust was collected on Millipore filters placed in monitors on the workers' lapels and connected to personnel monitoring pumps. The filters were weighed after drying to constant weight before and after dust collection. The humidity and

temperature of the air were recorded with an Assman hygrometer.

The statistical analysis was performed with Fisher's exact test for 2 × 2 contingency tables (2) and Mann-Whitney's rank correlation test (8).

RESULTS

The occurrence of work-related rhinitis, asthma, conjunctivitis and skin symptoms are demonstrated in Table 1. The skin symptoms were intense itching except in one worker who had urticaria and rhino-conjunctivitis, sometimes together with a slight fever reaction. All symptoms presented in Table 1 occurred in connection with specific work operations, and, as a rule, they began within 1 h of working. Almost half of the examined persons reported at least one of the symptoms mentioned; the most frequent symptom was rhinitis. Discomfort occurred especially when buckwheat was ground and packed. There are no significant differences between men and women with respect to the frequency of symptoms. Three of the 13 persons with work-related symptoms had been employed for a shorter period than 1 year.

The test results are shown in Table 2. Eight out of 25 examined persons (32%) had at least one positive test. To this is added one person with an already diagnosed nickel allergy, not

Table 1
Reported occurrence of symptoms at work

Symptom	Men (n* = 14)	Women (n* = 14)	Total (n* = 28)
Rhinitis	4	7	11 (39%)
Asthma	3	3	6 (21%)
Skin symptoms	2	3	5 (18%)
Conjunctivitis	2	3	5 (18%)
At least one of the above-mentioned symptoms	6	7	13 (46%)

* n = total number of individuals in the group.

Table 2
Individuals with positive allergy tests

Allergen	Patch test	Prick test	RAST	Minimum one positive test
Buckwheat	0 out of 14	5 out of 15	3 out of 25	7 out of 25
Soya	0 out of 14	—	0 out of 15	0 out of 15
Castor-oil bean	0 out of 14	0 out of 15	1 out of 25	1 out of 25

Table 3

Correlation between work-related symptoms (see Table 1) and positive allergy tests (see Table 2)

		Minimum one positive test	
		No	Yes
Minimum one work-related symptom	No	12	0
	Yes	5	8

Fisher's $P = 0.001$.

Table 4

Correlation between work-related symptoms (see Table 1) and heredity, i.e. the occurrence of allergic disorders in parents, brothers or sisters

		Minimum one symptom	
		No	Yes
Positive heredity	No	13	7
	Yes	2	6

Fisher's $P = 0.07$.

Table 5

Correlation between positive allergy test (see Table 2) and heredity (see Table 4)

		Minimum one positive test	
		No	Yes
Positive heredity	No	14	4
	Yes	3	4

Fisher's $P = 0.12$.

related to work, and with a positive patch test for this substance. The predominant allergen is buckwheat, and seven out of 25 examined persons (28%) had a positive test against this herb. One 37-year old man who got rhinitis when handling buckwheat sacks showed both prick test and RAST positivity. Four cases had only prick-test positivity and two cases only RAST positivity. There were no positive patch tests against these allergens.

Although castor-oil bean was not included in the company's assortment, one of the employees showed a positive RAST against an

Table 6
Airborne dust levels at different work operations

Work place	Work operation	Relative humidity (%)	Sampling time (min)	Dust level (mg/m ³)
Grinding room	Grinding of chick peas	49	160	3.6
	Grinding of coriander	51	149	6.4
Packaging room	Packaging of buckwheat	38	500	1.7
	Packaging of crude rice	35-55	286	0.9
Warehouse	Truck transport	—	110	0.8

extract from this allergen. A possible explanation could be that the burlap sacks in which the products were delivered had formerly contained castor-oil beans and were polluted by remnants of the former contents.

All eight persons with at least one positive test were in the group of 13 persons who had at least one work-related symptom. As appears from Table 3 none of the persons without work-related symptoms showed any positive tests. According to Fisher's test this co-variation is significant. The connections between heredity (allergic symptoms among parents, brothers or sisters) and occurrence of work-related symptoms are less pronounced and the significance is uncertain (Table 4). Corresponding connections between heredity and the occurrence of at least one positive test are even weaker and in this material not significant (Table 5).

There were no demonstrable tendencies to a decrease of spirometric parameters among patients with work-related symptoms as compared with those who had not reported such symptoms. Nor was there any significant co-variation between the IgE-content of blood, heredity (i.e., atopy among parents, brothers or sisters) and occurrence of work-related symptoms or positive allergy tests.

As appears from Table 6 the airborne dust levels in the breathing zones of the workers were, as a rule, lower than or about 5 mg/m^3 . Buckwheat packaging induced airborne dust levels around $1\text{--}2 \text{ mg/m}^3$.

DISCUSSION

It has long been known that some types of organic dust cause considerable risks for sensitization. Among substances which may induce sensitization are proteolytic enzymes (3, 5) and plant products, such as ispaghula powder (4, 6) and dust from tea (11) and coffee (7). Also grain dust has sensitizing properties (10), and respiratory disease among persons occupationally exposed to flour had been described already in 1713 by Ramazzini (9).

Against this background and taken by itself, it could be asserted that this examination confirms

old knowledge. However, the results are of interest because buckwheat dust seems to have an unusually pronounced sensitizing potency when inhaled, and because the high frequency of sensitization has been related to a background of recorded airborne dust levels in the breathing zones of the exposed persons. These dust levels have not been extraordinarily high.

Airborne levels of dust from buckwheat of about $1\text{--}2 \text{ mg/m}^3$ in the breathing zone seem to induce a definite risk of a rapidly ensuing allergy. At this exposure level there will be an obvious sensitization risk also for persons without atopic stigmata, such as a history of earlier allergic symptoms or the occurrence of allergic disorders in relatives. Perhaps the prevalent smoking habits in the exposed group could be a contributory cause to the high frequency of allergy (13). This factor, however, is probably not of crucial importance, because two of the three non-smokers had work-related rhinitis.

Buckwheat is derived from the temperate zones of East Asia and has been cultivated in China for more than a thousand years (1). It was introduced to Scandinavia during the Middle Ages, but during later centuries has totally disappeared from the Scandinavian countries and been replaced by other crops. Nowadays, buckwheat is not included in the ordinary fare of Northern Europe, but during recent years it has experienced a revival as an ingredient in so-called health food. It appears as an irony of fate that evident risks coupled to exposure to buckwheat were disguised because of the superstitious belief of our time in the salubrious properties of some "natural" food products. That health food could be a health risk, at least on inhalation, has been demonstrated by this study on persons who come in contact with the raw materials of such products in their occupational environment.

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