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Acute Symptoms Following Exposure to Grain Dust in Farming

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History of acute symptoms (cough, wheezing, shortness of breath, fever, stuffy nose, and skin itching/rash) following exposure to grain dust was obtained from 661 male and 535 female current and former farmers. These symptoms were relatively common: 60% of male and 25% of female farmers reported at least one such symptom on exposure to grain dust. Association of cough, wheezing, shortness of breath, and stuffy nose with skin reactivity and capacity to form IgE is consistent with an allergic nature of these symptoms. Barley and oats dust were perceived as dust most often producing symptoms. On the other hand, grain fever showed a different pattern, i.e., it was not associated with either skin reactivity or total IgE. Smoking might modify the susceptibility to react to grain dust with symptoms. Only those who reported wheezing on exposure to grain dust may have an increased risk to develop chronic airflow obstruction.

Introduction

Over 250 years ago Ramazzini reported that sifters and measurers of grain developed acute symptoms when exposed to grain dust (*1*). More recently acute effects of grain dust exposure have been described in several studies (*2–11*). The respiratory system, which seems to be the primary target of grain dust, reacts with a variety of symptoms such as cough, wheezing, tightness of chest, and dyspnea. Wheezing and shortness of breath could be due to reversible airways obstruction since an asthmatic reaction has been both observed clinically (*12,14*) and provoked in challenge studies (*15–22*). Conjunctivitis (*2,3*), skin itching and rash (*3,6,10*) have also been reported as well as grain fever which is characterized by malaise, headache, muscle ache, tiredness, feverish feeling and chills accompanied by rise in body temperatures and white cell count (*2,6,7,23,24*). Acute symptoms on exposure to grain dust have been most often studied in workers in grain elevators. There is a disagreement how frequently these symptoms, especially grain fever, occur in grain elevator workers (*3,5*).

The purpose of our study was to determine the proportion of farmers who had a history of acute symptoms on grain exposure, which personal and exposure characteristics were associated with these symptoms, and if the history of symptoms was associated with chronic airflow obstruction

We studied grain farmers who participated in a respiratory survey of a rural community. In order to identify characteristics and determinants of symptoms, farmers who had experienced symptoms were compared with farmers who had not.

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Materials and Methods

Subjects

Subjects of this analysis are participants in a study which was conducted in a rural town (Carman) and two adjacent municipalities (Dufferin and Roland) in Southern Manitoba, Canada, between February 1978 and February 1979. Manitoba Health Services Population Registry and electoral rolls were used to identify permanent residents between the ages of 20 and 65 years; these were then invited to attend for an examination consisting of administration of a questionnaire by a trained interviewer, skin testing with allergens, measurements of total immunoglobulin E (IgE), hematology, and spirometry.

Of the 1902 individuals who responded to the invitation to participate in the survey, 927 (48.7%) were men and 975 (51.2%) were women representing 82% of those invited. At the time of the survey 51% of male and 46% of female participants were residing in town and the remainder on farms scattered over an area of approximately 40 × 40 km.

With respect to farming, participants in the study were divided into three groups. Current farmers (424 males and 335 females) derived at least some of their income from farming. Former farmers (237 males and 200 females) used to farm in the past but depended on

nonfarming jobs for income at the time of the survey. Individuals who had never worked on farms even if they had lived on farms at some time were classified as nonfarmers. Only current and former farmers (661 males and 535 females) representing 62.9% of all subjects surveyed are included in this analysis.

Symptoms

The presence of chronic respiratory symptoms such as cough, sputum production, shortness of breath (SOB), and wheezing and of chest diseases were obtained by a respiratory questionnaire (National Heart, Lung and Blood Institute modified version) (*25*). In addition, the questionnaire inquired about the history of the following acute symptoms following exposure to grain dust:

- Cough (Is cough brought on or made worse by exposure to grain dust?);
- Wheezing (Is wheezing brought on or made worse by exposure to grain dust?);
- SOB (Do you get short of breath during or after exposure to grain dust?);
- Grain fever (Have you ever had fever and/or flulike symptoms during exposure or after being exposed to grain dust?);
- Stuffy nose (Do you get stuffy nose, sneezing by exposure to grain dust?);
- Skin rash/itching (Have you ever had skin itching or rash after exposure to grain dust?).

Farming and Grain Exposure

With the questionnaire, the information was obtained on duration of farming, main farm produce and crops, particularly if grain, as well as history of exposure to different varieties of grain. Each individual was asked to estimate the average number of days per year spent in grain seed cleaning, seeding, swathing, combining, and delivering grain to the elevators.

Smoking

For the purpose of this study, nonsmokers were those who never smoked as much as 1 cigarette or 1 pipe or 1 cigar a day for a year. Smokers smoked an amount equal or more than this and ex-smokers had stopped smoking at least one month before the survey.

Skin Testing

Subjects were tested for sensitization with 11 allergens thought to be common in the area: major and minor grasses, prairie trees, prairie weeds, giant ragweed, house dust, aspergillus mix, penicillium mix, molds common to crops, grain dust, and grain storage mite (*Lepidoglyphus destructor*) that is frequent in crop storage sites on local farms. The method for obtaining allergen from grain and grain storage mite was described in an earlier paper (*26,27*). All other commercially available preparations in single batches were supplied by Hollister-Stier Laboratories, Mississauga, Ontario. In addition, subjects were also tested with a control preparation containing solvent.

One technician performed all prick testing as described by Pepys (*28*). Bottles with allergen were coded and rearranged every 250 tests in order to keep the technician ignorant of the allergen being used. The maximum diameter of the wheal produced at the site of the prick was measured after 15 min.

According to the size and number of reactions, subjects were divided into three groups of skin reactivity. Those with no skin reaction greater than the control reaction were assigned to the "none" group. The subjects who had one or more wheals whose diameter totalled less than 5 mm were considered the "mild" group. A subject with a skin reaction of 5 mm or larger or with several wheals whose diameters totalled 5 mm or more was assigned to the "strong" reactivity group.

Total IgE

Venous blood was collected from each subject at the time of examination. The serum was separated within 1 hr and stored at -20°C. The total serum IgE was measured by a solid-phase radioimmunoassay employing Phadebas IgE PRIST kits (Pharmacia, Canada, Ltd.).

Lung Function

Spirometry was performed as recommended for epidemiologic studies by the Division of Lung Diseases of the National Heart, Lung and Blood Institute (*25*).

Volume and flow were measured using a dry rolling seal spirometer (Cardiopulmonary Instruments, Houston, TX). Analog signals of volume and flow were recorded simultaneously on an XYY plotter and on magnetic tape. The magnetic tape signals were later processed and analyzed by a Hewlett-Packard 2100 computer (Hewlett-Packard, Copertino, CA). Flow and volume signals were sampled from each acceptable FVC (forced vital capacity) curve and digitized at the rate of 33.3 Hz/sec.

The FVC maneuver was performed until three comparable acceptable curves were obtained from a maximum of five attempts. Acceptability required the FVC to be within 10% and peak expiratory flow within 15% of the maximum value achieved. For each subject, the best FVC, FEV_1 (forced expiratory volume in 1 sec) and FEV_1/FVC ratio were determined.

Lung function parameters were also expressed as percent predicted values. The prediction equations of the lung function parameter were derived from asymptomatic nonsmoking men and women in the study by multiple regression on height and age.

Statistical Analysis

Standard statistical methods were used. Farmers with and without symptoms were compared with a *t*-

test or chi-square test depending on whether the variable was continuous or discrete. The level of significance was set at 5% and no correction for multiple comparisons was done.

In addition, skin reactions to 11 allergens and symptoms were separately examined by the Boolean factor analysis (*29,30*) and cluster analysis (*31*) in order to determine which skin reactions and symptoms, respectively, were highly correlated forming distinguishable factors or clusters.

Although the values of total IgE were transformed to logarithmic scale (log IgE), the antilog values of the mean log IgE (i.e., the geometric mean) are reported (*27*).

Results

We have studied 800 current (445 or 56% males and 355 or 44% females) and 450 former farmers (242 or 54% males and 208 or 46% females). Their characteristics are shown in Table 1. Males and females were of similar age although in both sexes former farmers were, on the average, 8 to 10 years older than current farmers. It can be further seen in Table 1, that farms of men and women were similar in size, although those belonging to former farmers tended to be somewhat smaller. Duration of farming was also similar for current and former farmers of both sexes. Virtually all farmers were exposed to grain. Over 95% of current and former farmers of both sexes reported that they had grown grain in the past. In the year prior to the survey, grain was grown on 80% of the farms and in the preceding 5 years, it was grown on 90% of farms. Over 90% of farmers were engaged in seeding, swathing, combining, and delivery of grain to grain elevators. However, on the average, former farmers tended to spend fewer days per year in these grain-handling activities than current farmers and females less than males. While virtually all males used to shovel grain, only about two-thirds of females did it.

There was a significant difference in smoking habits between males and females since over 70% of females never smoked in comparison with 29 to 43% of males. In addition, there was a difference between current and former male farmers. The proportion of those who never smoked was higher in current (43%) than in former (29%) male farmers.

The distribution of skin reactivity in males and females was also significantly different because there were on the average 5% more males than females with strong skin reactivity. In both sexes, there was no difference between current and former farmers.

Table 2 shows how many farmers had history of acute symptoms. A larger proportion of males than of females had experienced symptoms. While in males current farmers reported symptoms more frequently than former farmers, there was no such difference in females.

In current and in former farmers of both sexes, shortness of breath was the most commonly reported symptom (16 to 41%). It developed within 1 hr of exposure in 84% of instances and lasted up to 4 hr in 78%. Other symptoms ranged from 8 to 24% in males and 1 to 12% in females.

Grain fever was the least frequently reported symptom. Half of the subjects reporting this symptom had only one episode. The fever was accompanied by shortness of breath in 42%.

Table 3 shows that there were many grain-exposed farmers who had not experienced any of the six symptoms on exposure to grain dust. The smallest proportion of such farmers was in male current farmers (31%) followed by male former farmers (50%), while about two-thirds of females had no history of acute symptoms. The proportion of individuals who had history of two or more symptoms was large, particularly among current male farmers (41%).

The common factor loading of symptoms in individuals

Table 1. Personal, smoking, and grain exposure characteristics.

	Male farmers		Female farmers	
	Current	Former	Current	Former
Number	445	242	355	208
Age, yr[a]	42 ± 13	50 ± 13	41 ± 11	52 ± 11
Farming characteristics				
Size of farm, acres[a]	653 ± 562	443 ± 485	565 ± 519	370 ± 315
Duration of farming, yr[a]	22 ± 14	19 ± 15	17 ± 13	24 ± 13
Ever grown grain[b]	438 (98%)	224 (97%)	343 (97%)	196 (96%)
Days working with grain[a]	60 ± 41	26 ± 47	7 ± 13	6 ± 15
Shovelling grain[b]	432 (97%)	225 (97%)	210 (62%)	138 (73%)
Smoking habits[b]				
Smokers	129 (29%)	89 (37%)	57 (16%)	40 (19%)
Ex-smokers	104 (23%)	77 (31%)	36 (10%)	21 (10%)
Cigar	20 (5%)	7 (3%)	—	—
Never	193 (43%)	71 (29%)	262 (74%)	149 (71%)
Skin reactivity[b]				
None	227 (51%)	125 (52%)	170 (48%)	111 (54%)
Mild	123 (28%)	73 (30%)	128 (36%)	66 (32%)
Strong	93 (21%)	44 (18%)	54 (15%)	30 (15%)

[a] Mean ± standard deviation.
[b] Number and % of subjects with the characteristic.

Table 2. History of acute symptoms on exposure to grain dust.

	Male farmers				Female farmers			
	Current		Former		Current		Former	
	No.	%	No.	%	No.	%	No.	%
All subjects	445	100	242	100	355	100	208	100
Symptoms								
Cough	97	22	33	14	26	7	9	4
Wheezing	103	23	30	12	30	9	10	5
SOB	183	41	65	27	75	21	33	16
Grain fever	66	15	20	8	17	5	2	1
Stuffy nose	78	18	24	10	44	12	22	11
Skin itching	106	26	40	16	40	11	18	9

was studied by the Boolean factor analysis. The purpose was to reduce six binary variables describing the presence or absence of a symptom into a smaller set of factors. In males, only one factor loaded with more than one symptom was identified: wheezing and shortness of breath on exposure. This reflects high correlation between these two symptoms and no correlation between other symptoms (cough, stuffy nose, grain fever, skin itching/rash). In females, two factors were recognized. One consisted of wheezing, shortness of breath and stuffy nose, and the other of cough and shortness of breath.

Since there were differences in personal characteristics such as age, exposure to grain, and in the frequency of the occurrence of symptoms between current and former male and female farmers, all subsequent analyses were carried out separately for each sex-farmer group.

In further analysis, farmers with a symptom were compared with farmers without the symptom in order to identify characteristics associated with the development of this symptom. Farmers with history of a symptom, for instance cough, were similar to those without this symptom with respect to age, duration of farming and grain exposure. They were therefore not different from the averages for sex-farmer groups in Table 1. This is true for all symptoms except skin itching/rash in male current farmers. Those with this symptom were significantly younger and farmed for a shorter period than those without it.

Smoking was associated with cough on exposure to grain dust in current farmers of both sexes and with shortness of breath in male current farmers (Table 4). In former male farmers, the history of stuffy nose was associated with nonsmoking in males. Similarly, individuals who had experienced grain fever were more likely to be never smokers in both current and past farmers but this was significant only when data for current and past farmers were pooled.

Table 3. Proportion of individuals reporting several symptoms.

	Male farmers				Female farmers			
Number of symptoms	Current		Former		Current		Former	
	No.	%	No.	%	No.	%	No.	%
0	137	31	130	53	255	63	144	70
1	128	29	62	26	70	20	42	20
2	86	19	22	9	31	9	15	7
3	61	14	13	5	20	6	6	3
4	18	4	9	3	5	1	1	–
5	11	2	5	2	4	1	–	–
6	4	1	1	–	–	–	–	–
Total	445	100	242	100	355	100	208	100

Table 4. Proportion (%) of farmers who ever smoked (smokers and ex-smokers).

		Current farmer[a]		Former farmer[a]	
Symptom	Sex	+	–	+	–
Cough	M	66	54*	73	71
	F	50	24*	33	29
Wheezing	M	61	55	70	71
	F	33	26	10	30
SOB	M	63	52*	71	71
	F	28	26	24	30
Grain fever	M	47	58	60	72
	F	12	27	—[b]	—[b]
Stuffy nose	M	55	57	46	74*
	F	22	27	19	31
Skin itching	M	54	57	69	71
	F	20	27	33	29

*$p < 0.05$.
[a] Farmers with (+) and without (–) history of a symptom.
[b] % not calculated because of small number.

Different grain dusts vary in their capacity to provoke symptoms. Table 5 shows which dust was perceived as most likely to provoke a symptom in our study. Obviously, in most people, a symptom was provoked by several types of grain dust. However, it seems that most respondents considered barley dust (70–90%) and oats dust (35–53%) as the most irritating grain dust.

Tables 6 and 7 show the relationship between the history of acute symptoms and skin reactivity to specific allergens in males and females, respectively. The proportion of those with positive skin reactivity varied by allergens and by symptoms. House dust and grain mite allergens were most likely to cause a positive skin reaction. History of any symptom was not associated with more than 60% of positive skin test to any of the 11 allergens. It can be seen that those with stuffy nose, skin rash, and wheezing were sensitized to most allergens, indicating that this association was not very specific. In males, allergens associated with grain (asper-

Table 5. Which dust is most likely to bring on a symptom or make it worse?

	Symptom			
	Cough	Wheezing	SOB	Skin itching
Number with history	97	103	183	106
Proportion (%) reacting to				
Durum wheat	10	14	15	6
Spring wheat	20	31	34	12
Rye	17	10	10	4
Oats	53	52	50	35
Barley	70	77	71	91
Corn	3	4	4	2

Table 6. Relationship between skin reactivity and history of acute symptoms in males.[a]

		Symptoms[a]											
		Cough		Wheezing		SOB		Grain fever		Stuffy nose		Skin itching	
Skin reactivity	Farmer	+	−	+	−	+	−	+	−	+	−	+	−
Grass, major	C	17	12	19	11*	13	12	15	13	28	10*	22	11*
	F	21	10*	30	9*	22	7*	10	11	42	8	24	8*
Grass, minor	C	21	9*	20	9*	17	7*	12	11	30	7*	18	9*
	F	12	9	27	7*	14	8	10	9	30	7*	17	8
Ragweed	C	9	12	18	9*	14	8*	11	11	24	8*	16	9*
	F	16	9*	27	7*	15	7*	10	9	29	7*	14	8
Weeds	C	13	10	14	9	13	8*	8	10	22	7*	19	7*
	F	12	11	27	8*	19	8	10	11	33	8*	17	9
Trees	C	14	8*	17	8*	13	7*	12	9	24	6*	17	7*
	F	9	7	17	6*	8	7	5	7	21	6*	10	6
House dust	C	23	22	23	22	24	21	26	22	32	20*	36	18*
	F	33	18*	43	16*	28	17	20	20	42	17*	31	17*
Aspergillus	C	10	8	16	7*	13	5*	11	8	17	7*	13	7*
	F	3	8	10	7	11	6	10	7	17	6	14	6
Penicillium	C	10	10	14	9	12	8	18	8*	18	9*	13	7
	F	0	6	0	6	2	6	5	5	0	6	5	5
Molds	C	13	13	10	14	23	13	20	12	14	13	16	12
	F	18	14	20	15	12	16	15	15	21	15	14	15
Grain mite	C	25	22	20	23	24	22	28	22	29	22	33	19*
	F	17	20	39	17*	25	19	7	21	36	18*	24	19
Grain dust	C	13	7	11	8	11	7	5	9	18	7*	13	7
	F	3	5	4	4	6	4	0	5	10	4	6	5

[a] History of symptoms: positive (+), negative (−).
[b] Farmer: C (current) and F (former).
*$p < 0.05$.

gillus, crop molds, grain mite, and grain dust) discriminated less well than common allergens between those with and without symptoms. Data in males and females were similar, except that in females the history of symptoms such as cough, wheezing, shortness of breath, and stuffy nose were more frequently associated with positive skin reactivity to grain mites and grain dust than in males.

Table 7. Relationship between skin reactivity and history of acute symptoms in females.[a]

		Symptoms[a]											
		Cough		Wheezing		SOB		Grain fever		Stuffy nose		Skin itching	
Skin reactivity	Farmer	+	−	+	−	+	−	+	−	+	−	+	−
Grass, major	C	19	10	20	9*	14	9	24	10	14	10	15	10
	F	0	8	10	7	13	6	—[c]	—[c]	27	5*	6	7
Grass, minor	C	19	6*	30	5*	18	4*	24	6	23	5*	18	6
	F	0	8	20	7	16	6*	—	—	27	5*	6	8
Ragweed	C	4	8	17	7*	8	7	6	8	16	6*	5	8
	F	1	9	0	10	16	8	—	—	23	8*	17	9
Weeds	C	19	7*	27	6*	21	4*	18	7	26	6*	20	6
	F	0	6	10	5	9	5	—	—	18	4*	6	5
Trees	C	18	9*	38	7*	24	6*	29	9	26	8*	15	9
	F	0	9	10	9	16	7	—	—	23	7*	6	9
House dust	C	27	24	40	22*	34	21	18	24	44	21*	15	25
	F	1	19	30	19	25	18	—	—	41	17*	22	19
Aspergillus	C	23	7*	30	8*	26	5*	6	10	30	7*	10	10
	F	0	9	0	9	9	8	—	—	18	7*	7	9
Penicillium	C	19	11	33	10	25	8*	12	12	28	9*	15	11
	F	0	6	0	5	6	5	—	—	14	4*	6	5
Molds	C	23	18	37	17*	27	17	6	19	33	17*	35	17*
	F	33	20	20	21	28	19	—	—	46	18*	22	21
Grain mite	C	39	16*	48	14*	31	13*	8	18	53	12*	19	17
	F	11	18	60	16*	8	19	—	—	24	17	13	18
Grain dust	C	31	9*	30	9*	25	7*	31	10	24	9*	12	11
	F	25	6*	0	7	0	7	—	—	31	5*	20	6*

[a] History of symptoms: positive (+), negative (−).
[b] Farmer: C (current) and F (former).
[c] % not calculated because of small numbers.
*$p < 0.05$.

Table 8. Total IgE (geometric mean in units/liter) in farmers with (+) and without (−) history of symptoms.

		Total IgE, units/L			
		Current farmers		Former farmers	
Symptoms	Sex	+	−	+	−
Cough	M	28.1	20.7*	41.0	23.4*
	F	26.2	18.0	16.0	15.8
Wheezing	M	25.3	21.2	52.4	22.3*
	F	40.8	17.2*	17.6	17.2
SOB	M	26.5	19.5*	31.8	22.7*
	F	24.0	17.3	18.2	17.1
Grain fever	M	23.9	21.8	21.7	25.1
	F	21.4	18.4	—	—
Stuffy nose	M	24.5	20.1*	36.8	23.8
	F	34.5	17.0*	19.2	17.1
Skin itching	M	24.5	21.4	28.8	24.1
	F	20.0	18.6	13.6	17.6

[a]$p < 0.05$ (one-sided test).

It should be noted that there was no difference in sensitization between those who did and those who did not experience grain fever in either males or females.

The Boolean factor analysis and cluster analysis showed clusters of positive skin reactivity. There were different clusterings occurring for males and for females. For males, two clusters were identified: the first consisted of skin reactions to major and minor grasses, weeds, trees, and ragweeds while the second consisted of reactions to house dust and grain mite allergens. While in females the reaction to house dust and grain mite also tended to occur together, the cluster of both grasses, trees, weeds, also contained grain dust, aspergillus, penicillium, and molds.

The relationship between history of symptoms and total IgE is presented in Table 8. It can be seen that higher levels of total IgE were associated with history of cough and shortness of breath on grain exposure in both current and former male farmers. Wheezing was associated with total IgE only in former male and current female farmers and stuffy nose/sneezing in current farmers of both sexes. On the other hand, there was no association between history of grain fever and of skin itching/rash and total IgE.

Table 9 shows the percent predicted values of FVC, FEV_1, and FEV_1/FVC ratio for current male farmers with and without history of symptoms. It can be seen that only history of wheezing was associated with lower values of FEV_1 in all three smoking categories, i.e., nonsmokers, ex-smokers, and smokers. The same pattern was observed in former male farmers as well as in both groups of female farmers.

Discussion

Our study shows that acute symptoms on exposure to grain dust (cough, wheezing, dyspnea, grain fever, skin itching/rash and stuffy nose) are relatively common. More than half of male and about one third of female farmers reported at least one of these symptoms. Among males symptoms were more frequently reported by current than by former farmers (69% vs. 47%, respectively).

Study of acute symptoms in population studies is methodologically difficult. It should be pointed out that our study was a cross-sectional one, a respiratory survey. The limitation of the study is that we could not directly observe the development of acute symptoms. We had to rely on obtaining histories of symptoms which had been experienced in the past by subjects in the study. These histories might have been biased by selective recollection. Another limitation is that while symptoms occurred in the past, hematological, skin sensitivity, IgE, and lung function measurements were made at the time of the survey. It is therefore difficult to establish a temporal relationship between the symptom and an independent variable such as total IgE level.

On the other hand, the advantage of doing a survey was the possibility to obtain the information on symptoms from a large number of individuals, in our case from a total rural community including those who have withdrawn from the exposure to grain dust and from farming sometime prior to the survey.

Studies of farming environments are particularly difficult since it is very difficult, if not impossible, to obtain adequate estimates of exposure. In absence of these, we had to depend on rather crude indices of duration and of intensity of exposure such as average duration of handling grain.

In our study, females reported fewer symptoms than males. This could be due to the fact that although females lived and worked on grain growing farms, they were exposed less to grain dust than males. The difference in the frequency of symptoms between current and former male farmers could be due to heavier exposure in current farmers or to worse recollection of symptoms in former farmers.

It was reported by several authors that grain dust provokes cough in up to 75% (*2,3*), wheezing in 14 to 42% (*2,4,11*), and shortness of breath in 25 to 45% (*2,10,24*) of exposed workers in grain elevators. Our results are on the lower side of this range. This could be due to some differences in the questionnaire or to differences in exposure to grain dust between farmers and workers in grain elevators. Such exposure differences have been documented (*32*). Not only grain dust varies between the farming and the grain elevator environment but also the farmer's exposure is intermittent and in most instances does not exceed 2 to 3 months a year.

Our results are consistent with reports by others that barley and oats dust are more irritating than other grain dusts, for instance durum and spring wheat. It is interesting that this effect of barley and oats dust is not limited to the respiratory system as it includes skin. This effect could be due to finer particle size and/or shape of barley and oats dust (*33*), composition of allergens (since more barley dust particles are derived from husks) (*34*), or variability of contaminants between different grain dust.

In searching for components of grain dust responsible

Table 9. Relationship between history of acute symptoms and lung function (percent predicted) by smoking habits in male current farmers.

		Nonsmokers[a]		Ex-smokers[a]		Smokers[a]	
Symptom	Lung function	−	+	−	+	−	+
Cough	FVC	100	100	100	105	100	96
	FEV_1	94	97	96	104	94	90
	FEV_1/FVC	99	97	97	98	94	94
Wheezing	FVC	101	97	102	93*	100	97
	FEV_1	100	93*	99	87*	94	89*
	FEV_1/FVC	100	97*	97	94	95	92
SOB	FVC	100	100	101	100	100	98
	FEV_1	100	98	97	97	93	92
	FEV_1/FVC	100	97	97	97	94	94
Grain fever	FVC	100	102	100	103	98	104
	FEV_1	99	101	96	105	92	96
	FEV_1/FVC	99	99	96	101	94	93
Stuffy nose	FVC	100	103	101	97	99	98
	FEV_1	99	100	98	94	92	95
	FEV_1/FVC	99	98	97	96	93	97
Skin itching	FVC	100	102	101	100	100	95
	FEV_1	100	97	97	97	93	91
	FEV_1/FVC	100	96*	97	98	93	96

[a] History of symptoms: positive (+), negative (−).
*$p < 0.05$.

for acute symptoms, it might be useful to determine why oats and barley dust are perceived as more irritating than other grain dusts.

Symptoms of cough and shortness of breath were associated with smoking. Although this relationship was not consistent in both sexes and in both current and former farmers, it raises the possibility of an interaction between smoking and grain dust exposure. Smoking might increase the susceptibility of an individual to react to dust exposure.

Association of cough, wheezing, shortness of breath and stuffy nose and skin rash with skin reactivity to several allergens and to some degree with the capacity to produce IgE is consistent with the allergic nature of some of these symptoms. The results of the multivariate analysis is also consistent with a common pathogenesis of several symptoms.

Published reports vary about how frequently grain fever occurs in exposed populations (*2,3,5,6,23,24*). To a degree, this might be due to differences in the definition of grain fever. History of grain fever was reported by nobody or very few grain elevator workers in some studies to 33% of grain scoopers in another study (*3,5,6*). Our findings are somewhere in the middle.

In our study, grain fever showed a different pattern from wheezing, cough, shortness of breath with respect to smoking, skin reactivity, and total IgE. There was no association between grain fever and skin reactivity or total IgE levels. Grain fever was more common in nonsmokers. Although this association was not very strong, it might indicate a different relationship between grain fever and smoking than between smoking and other respiratory symptoms. The cluster analysis showed that grain fever symptoms did not correlate with other acute symptoms. Although about half of people with grain fever also develop shortness of breath, this is coincidental. About half of the individuals who reported grain fever reported more than one episode of grain fever. There was no difference between both groups of individuals and there was no evidence that history of grain fever was associated with a permanent disability. Grain fever is likely a systematic response of the organism to the exposure to grain dusts without residual disability.

In previous studies it was shown that wheezing and shortness of breath on exposure were associated with a reversible airflow obstruction (*17*). However, the relationship between acute and short-term changes in lung function and chronic airflow obstruction is not known. Our study shows that those who reacted to grain dust exposure with wheezing might be at an increased risk to develop airflow obstruction.

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