Occupational Allergic Diseases among Workers of the State Company of Fertilizers/ Basrah/Iraq

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Summary

A cross - sectional comparative study was carried out in the state company of fertilizers / southern region, which is one of the important companies in Iraq. The aim was to study the relationship between exposure to gases and dust in the workplace and allergic diseases.

The exposed groups (workers in ammonia , urea, water refinery, and packing units) were compared to non exposed comparison group (workers in administrative units).

The results showed that the prevalence of work - related allergic conditions as reported by workers and diagnosed by the investigator was significantly higher among the exposed groups than the comparison group.

Similarly, the total serum immunoglobulin E (IgE) levels were significantly higher in the exposed groups than that in comparison group. A clear significant association between the degree of exposure to hazardous gases and dust & the total level of serum IgE was observed.

These findings suggest that the risk of work - related allergic diseases among workers exposed to irritant gases and dust was high compared to their control.

Introduction

As manufacturing techniques improved, machine became speedier and more dangerous.

Toxic hazards were also increased because of the prolonged exposure to a wider range of new chemicals which were introduced without considering their possible effect on workers.[1]

Each day in the United States an average of 9000 workers sustain disabling injuries in the job, 16 workers die from work place injuries, and 137 workers die from work related diseases.2

In developing countries, occupational injury and illness rates are believed to be much higher than that in developed countries. However the numbers of occupational diseases and injuries reported in these countries are much lower than the real number.[2]

To effectively prevent occupational diseases, health care providers must know how to recognize work related conditions, not only in workers who present with symptoms but also in those who are pre symptomatic.[3,4]

Thus, the present study was carried out in the state company of fertilizers/ southern region to determine the impact of exposures to hazardous agents in the work place on worker's health with special reference to the development or exacerbation of allergic diseases.

Setting

State company of fertilizers / southern region is one of the important companies in Iraq.

The company employs a total of 2336 workers, working in eighteen units, however, only workers in the production units (Ammonia, Urea, and Water Refinery), and in the packing unit, are exposed to hazardous gases (including ammonia, carbon dioxide, chlorine gas), and to urea dust.

Subjects & Methods

A cross sectional comparative study involving workers who were exposed to gases and dusts in the work place and those who were not exposed to any hazardous agents was carried out.

The study group (exposed) included workers from the productive units (ammonia, urea, water refinery) & workers from the packing unit.

Workers in the ammonia & urea units were exposed to ammonia & carbon dioxide gases, those in the water refinery unit were exposed to ammonia & chlorine gases, while workers in the packing unit were exposed to urea dust only.

The comparison group (none exposed) included workers from several administrative departments. Workers included in the study were chosen from each unit randomly using the systematic random sampling technique by choosing every third person in the name list of the company workers which was obtained from the computer unit.

All workers in the three productive units & the majority of those in the packing unit were males, so that males only were included in this study.

The comparison group was chosen randomly by using the same above technique.

A special questionnaire form was developed for the purpose of the study & was filled for each worker included in the study by direct interview by one of the researchers.

It covered the following aspects: personal characteristics; occupational history (years of service, previous jobs, average number of daily working hours); present medical history; history of respiratory symptoms (like cough, sputum, haemoptysis, chest pain, dyspnoea, & wheeze); dermatological symptoms (redness, itching, scales, & lichnifaction); nasal symptoms (like sneezing, and runny nose); eye symptoms (red eyes, itching, & discharge). The questionnaire also included questions on the relation of symptoms to exposure to the workplace environment, presence of symptoms

on the weekends & on holidays, relation of symptoms to certain process, work task, or work exposure; history of drug allergy; family history of allergic diseases; &smoking history.

After completing the interview each worker was fully examined looking for any sign of allergy and then 5 mls of venous blood was obtained from each worker two hours after starting the working day for doing both differential white blood cells count (eosinophil percentage), and total serum immunoglobin E (IgE).

Results

Characteristics of the study and comparison groups

No significant differences were found in the sociodemographic characteristics between the study (exposed) and the comparison (none exposed) groups. The majority of the workers in both groups were below 40 years of age.

Similarly, no difference between the two groups with respect to smoking habits or the presence of family history of allergic diseases was found.

Prevalence of allergic conditions

The prevalence of allergic symptoms ranged between 38.7-53.3% among the study groups as compared to 20% among the comparison group. Table (1).

The allergic symptoms included irritant cough, dyspnoea, runny nose burning and redness of the eyes, itching & wheal of the skin.

Similarly, the percentage of workers in the study groups who showed abnormal or positive physical signs were significantly higher than that of the comparison group. Table (2).

The physical signs of allergic conditions included ronchi, redness of the conjunctiva, congestion of the nose, and skin changes (redness, swelling, scales).

The proportions of workers who showed abnormal physical signs among the three study groups & the control group were 12.5 %, 32.3 %, 25.8 %, & 3.8 % respectively.

In addition, 3.8 % of workers in the study groups showed an eosinophil percent of >5 as compared to none of workers in the comparison group, the difference was statistically significant.

The percentage of workers who showed total serum IgE levels of more than 100 IU was markedly higher among the study groups compared to that of the comparison group. Table (3)

There was no significant association between the total serum IGE & age, duration of service, smoking habit, and presence or absence of family history of atopy. Tables (4, 5, 6, &7)

While there was a significant association between total serum IgE level and the degree of exposure to hazardous gases and dust.

The percentage of workers who showed high total serum IgE levels (>100 IU) had increased with the increase in the level of exposure. Table (8)

In order to determine the relative effect of various independent variables on total serum IgE, a logistic regression analysis was carried out, Table (9).

The results indicate that the level of total serum IgE was significantly & independently affected by the degree of exposure to hazardous gases and dust.

Table 1: Distribution of the study and comparison groups according to Symptoms of allergy

Symptoms of allergy	Study groups						Comparison group	
	Ammonia and urea	units	Water refinery	unit	packing	unit	Administrative	departments
	No.	%	No.	%	No.	%	No.	%
Present	64	53.3	15	48.4	12	38.7	26	20.0
Absent	56	46.7	16	51.6	19	61.3	104	80.0
Total	120	100.0	31	100.0	31	100.0	130	100.0
P-value	<0.01		<0.01		<0.05			

Table 2: Distribution of the study and comparison groups according to the presence or absence of physical sign

Physical sign	Study groups						Comparison group	
	Ammonia and urea	units	Water refinery	unit	packing	unit	Administrative	departments
	No.	%	No.	%	No.	%	No.	%
+ ve	15	12.5	10	32.3	8	25.8	5	3.8
- ve	105	87.5	21	67.7	23	74.2	125	97.2
Total	120	100.0	31	100.0	31	100.0	130	100.0
P-value	<0.05		<0.01		<0.01			

Table 3: The results of total serum IgE levels of study and comparison groups

IgE	Study groups						Comparison group	
	Ammonia and urea	units	Water refinery	Units	packing	units	administrative	departments
	No.	%	No.	%	No.	%	No.	%
(<20 I.U) Allergy not probable	9	7.5	1*	3.2	3	9.7	67	51.5
(20- 100 I.U) Allergy questionable	35	29.2	9	29.0	9	29.0	52	40.0
(> 100 I.U) Allergy very probable	76	63.3	21	67.7	19	61.3	11	8.5
Total	120	100.0	31	100.0	31	100.0	130	100.0
P-value	< 0.01		<0.01		<0.01			

Table 4: The results of total serum IgE according to age

Age (years)	IgE							
	<20 I.U		20-100 I.U		>100 I.U		Total	
	No.	%	No.	%	No.	%	No.	%
< 30	8	22.2	8	22.2	20	55.6	36	100.0
30-39	33	32.7	29	28.7	39	38.6	101	100.0
40-49	24	24.7	35	36.1	38	39.2	97	100.0
50+	15	19.2	33	42.3	30	38.5	78	100.0
Total	80	25.6	105	33.7	127	40.7	312	100.0

$\chi^2 = 9.64$ d.f= 6 P-Value NS

Table 5: The results of total serum IgE according to Years of service

Years of service	Total serum IgE						Total	
	<20 I.U.		20-100 I.U		>100 I.U			
	No.	%	No.	%	No.	%	No.	%
< 10	36	31	34	29.3	46	39.7	116	100.0
10-19	21	31.8	20	30.3	25	37.9	66	100.0
20+	32	17.7	51	39.2	56	34.1	130	100.0
Total	80	25.6	105	33.7	127	40.7	312	100.0

$\chi^2 = 7.914$ d.f= 4 P-Value NS

Table 6: The results of total serum IgE in relation to smoking habit

Smoking habit	Total serum IgE						Total	
	< 20 I.U		20 -100 I.U		>100 I.U			
	No.	%	No.	%	No.	%	No.	%
Smoker	23	25.0	24	26.1	45	48.9	92	100.0
Non- smoker	57	25.9	81	36.8	82	37.3	220	100.0
Total	80	25.6	105	33.7	127	40.7	312	100.0

$\chi^2 = 4.4$ d.f = 2 P-Value NS

Table 7: The results of total serum IgE in relation to family history of allergic diseases

Family history of allergic diseases	Total serum IgE						Total	
	<20 I.U.		20-100 I.U.		>100 I.U			
	No.	%	No.	%	No.	%	No.	%
Present	30	28.6	35	33.3	40	38.1	105	100.0
Absent	50	24.2	70	33.8	87	42.0	207	100.0
Total	80	25.6	105	33.7	127	40.7	312	100.0

$\chi^2 = 0.8$ d.f=2 P-Value NS

Table 8: The results of total serum IgE according to the degree of exposure to hazardous gases and dust

Degree of exposure	Total serum IgE							
	<20 I.U.		20 – 100 I.U.		> 100 I.U.		Total	
	No.	%	No.	%	No.	%	No.	%
Minimum	67	51.5	52	40.0	11	8.5	130	100.0
Medium	3	5.9	15	29.4	33	64.7	51	100.0
Maximum	10	7.6	38	29.0	83	63.4	131	100.0
Total	80	25.6	105	33.7	127	40.7	312	100.0

$\chi^2 = 117.9$ d.f = 4 P. Value < 0.01

Table 9: logistic regression for total serum IgE

Independent variable	B	Direction of effect	Exp (B)	P-Value
Degree of exposure	0.8620	+	2.3679	<0.01
All others (non of them showed significant effect)				
Age	0.0210			NS
Address	0.2482			
Education	0.1451			
Family history	0.0325			
Protective device	0.5252			
Smoking	0.1422			
Unit	0.0816			
Years of service	0.0166			

Discussion:

In this study, three occupational groups (exposed to hazardous chemical agents and dust) were compared with a comparison group (none exposed).

All the study occupational groups showed a significantly higher prevalence of several allergic symptoms than the comparison group.

The symptoms were obvious few hours after exposure to the workplace environment on working days or nights with improvement at weekends or holidays which strongly suggests that they were workplace induced conditions.

These symptoms were considered by the exposed workers as a normal response to the exposure to irritant gases and dust at the workplace. They did not seek medical advice and these symptoms were not brought to physician's attention. Furthermore, a significantly and markedly higher proportion of the study groups as compared to the comparison group showed physical signs of allergic conditions, however, the absence of signs of allergy may not exclude the presence of allergic diseases.

The association between workplace exposure to chemical agents and the risk of allergic diseases was further strengthened by the significantly higher prevalence of eosinophilia among the exposed workers as compared to their controls.

However, depending on self–reported symptoms, the presence of physical signs of allergy, and eosinophilia for the diagnosis of allergic disorders may not be reliable.

Eosinophilia is neither specific nor sensitive enough for the diagnosis of allergic disorders. Therefore, the total serum IgE level was used for further assessment of allergic disorders among the exposed and the comparison groups.

Total serum IgE level is considered to be an important epidemiological parameter in evaluating the prevalence of allergic conditions.[5]

In the present study, IgE levels were significantly higher in the exposed groups than that in the comparison group.

This suggests that the risk of work–related allergic diseases was higher among workers exposed to irritant gases and dust than among their controls.

Many previous studies in Iraq and elsewhere showed that the total IgE was significantly elevated in patients with allergic conditions.[5,6,7]

When the effect of age years of service & smoking, on IgE level was assessed, none of them showed a significant effect on the IgE level of both exposed and non exposed workers.

Age was not expected to affect the levels of total serum IgE because in the non allergic subject, the total serum IgE levels increase up to puberty, then they decrease up until the age of 30 when they reach a plateau.[8] Years of service did not show a significant effect on IgE levels in this study may be due to the fact that these years of service may not reflect the actual duration of exposure to work place hazards.

This is because there were many interruptions in the production activities of the factory which took place during the wars.

The lack of an effect of smoking habit on IgE levels agrees with various other studies.[6]

Another important point need to be considered, which is the confounding effect of parasitic (particularly helminthes infestation) on total IgE levels.

Generally it is well known that parasitic infestation is associated with an elevation of both eosinophils & total IgE levels.[5]

However, omission of stool examination in the present study should not greatly affect the results of this study, since there is no reason to believe that the prevalence of parasitic infestations was different among exposed & non exposed groups.

There was a clear significant effect of the degree of exposure to hazardous gases and dusts on IgE level.

The effect was significant even after the control of other variables such as years of service & age which are likely to confound the relationship.

This may support further the relationship between workplace exposure to irritant gases and dusts and the development or exacerbation of allergic conditions among exposed workers (dose–response relationship).

These findings agree with those found in a study which was done in two chemical fertilizer producing factories in Saudi Arabia.

The Saudi study found that exposure to ammonia gas in the workplace was significantly associated with an increase in allergic symptoms of respiratory system.[9]

To conclude, from the above results it seems that exposure to irritant gases (ammonia and chlorine gases) and urea dust at the workplace was harmful.

This exposure caused allergic manifestations and may cause chronic damage to pulmonary function and this harmful effect could be discovered early by simple tests to prevent this unwanted harmful effect.

These results also indicate the presence of a defect in the occupational health program in the factory.

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