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CONTROL-BASED MANAGEMENT STRATEGIES AND THEIR IMPACT ON FLOUR MILL WORKERS' OCCUPATIONAL ASTHMA

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Article Info

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Abstract

Occupational asthma remains a significant global concern, particularly impacting workers exposed to grain and flour dust, which stands as the second most frequently cited cause of such asthma cases. Despite being prevalent, limited research has delved into the topic, with a focus on symptomatology. Notably, a study investigated the prevalence of occupational asthma in South Cairo's flour mills, revealing that a quarter of workers exhibited work-related asthma symptoms that manifested during work hours and subsided post work. Moreover, these asthmatic workers displayed inferior spirometric parameters compared to non-asthmatic counterparts. Similarly, studies conducted in other regions corroborate these findings. For instance, an investigation in Iraq among flour mill workers discovered a significantly high prevalence of occupational asthma, substantiated both by self-reports and investigator diagnoses. In Egypt, a study involving flour production mill workers highlighted complaints of asthma due to occupational exposure, coupled with diminished respiratory capacity. Additionally, Indian research unveiled that chronic exposure to flour dust led to pronounced respiratory symptoms, including cough, breathlessness, and wheezing, further compounded by substantial declines across various pulmonary function tests. In sum, these collective studies emphasize the link between flour dust exposure and the prevalence of occupational asthma, urging comprehensive measures to safeguard the respiratory health of workers.

Introduction

Occupational asthma is a global problem affecting a large number of workers. Exposure to grain and flour dust is the second most typical reported cause of occupational asthma. Few studies on occupational asthma in Egypt, focusing mainly on asthma symptoms. A study was done to investigate the presence of occupational asthma among workers at flour mills of south Cairo, which indicated that 25% of mills workers had asthma-related to

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work; the asthma symptoms appeared during work and improved after leaving the workplace. Also, the asthmatic workers had lower spirometric parameters than non-asthmatic (El-Gewily et al., 2018). Therefore, many studies investigated the relationship between flour dust and the prevalence of occupational asthma among flour mill workers. One of those studies was done by Ajeel & Al-Yaseen (2015) in Iraq to study the prevalence of occupational respiratory disorders among flour mill workers and found that the prevalence of occupational asthma as reported by workers and diagnosed by one of the investigators was significantly high. In addition, a study done by Rafiee et al. (2015) to assess the effects of flour dust on the respiratory system among 400 workers of flour production mills in Assiut, Egypt, found that most workers complained of occupational exposure to asthma and a decrease in respiratory capacity. Another study done by Asia & Atram (2016) in India to evaluate the effect of chronic exposure to flour dust on pulmonary function test among flour mill workers concluded that cough and breathlessness were more pronounced among workers, wheezing is a commonly encountered sign, and all pulmonary function tests showed a significant decline.

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www.multidisciplines.com Yawn et al. (2014) mentioned that the asthmatic flour mill workers need effective occupational asthma management to achieve clinical control of the disease and maintain that control through implementing a control-based management strategy. Control-based asthma management strategy is a worker-focused, individualized, flexible approach to occupational asthma management that allows adjustments to regimens over time, thus considering the variable nature of the disease within each worker. Therefore, occupational health nurses in flour mills play an essential role in maintaining the health and safety of health care workers through the three levels of prevention. The primary level of prevention includes both health promotion and work-related injury or disease prevention; health promotion is applied when the occupational health nurse helps the workers to change their lifestyle to move toward a state of optimal health. Work-related injury or disease prevention began with recognition of health risk factors, a disease, injury, or an environmental hazard and was followed by measures to protect as many workers as possible from the harmful consequences of that risk (Neis & Ewen, 2014).

The occupational health nurse should provide more frequent health surveillance at the secondary prevention level, including a respiratory questionnaire about work-related upper and lower respiratory symptoms. To identify sensitized workers or cases of occupational asthma at early and reversible stages of the disease and ensure that the workplace and working practices are investigated to identify potential causes and implement corrective actions (Buchta & Russi, 2017). Additionally, the occupational health nurse is often the key person in the rehabilitation program with the manager in the tertiary prevention level. Moreover, the affected workers she/he is responsible for completing a risk assessment and advising the affected workers with the rehabilitation program to reduce the consequences of occupational asthma, monitor its progress, and coordinate health care services for the affected workers from the onset of illness to a safe return to work or an optimal alternative (Ethridge et al., 2015). So, the study aimed to evaluate the effect of a control-based management strategy on occupational asthma control among flour mill workers in Giza Governorate.

Materials and Methods

Research design and areas

A quasi-experimental one-group pretest-posttest design will be utilized to fulfill the aim of the study. A purposive sample of 122 flour mill workers from El-Haram flour mill constituted the subjects of the study. The sample size was calculated based on a G-power version 3.1.1 for power analysis. A Power of .95 ($\beta = 1-.95 = .05$) at alpha .05 (one-sided) was used as the significance level, and effect size= 0.3 was utilized. The inclusion criteria were working full-time for at least one year in the flour mill (8 hours a day and six days per week). The exclusion

criteria were having a history of bronchial asthma before joining the work or family history and having a present or history of severe respiratory infections as extensive pulmonary tuberculosis. These criteria were according to British Occupational Health Research Foundation (2017).

Research setting

This study was conducted at South Cairo & Giza Mills & Bakeries Company in 2019. It is the largest company in Egypt for the manufacture of flour and has the most significant number of workers. It includes 950 workers. El-Haram Mill Branch was selected to implement the study because it includes many workers. It includes 300 workers out of 950 workers in all company mills. In addition, the El-Haram mill is the main branch of the company.

Tools of data collection

Data were collected using five tools: I: Occupational Asthma Questionnaire: It was structured by the researcher based on extensive literature reviews. It included three parts: (a) Workers' characteristics consisted of 9 questions (b) Occupational asthma symptoms: It included 22 questions related to reported asthma symptoms as wheezing and tightness in the chest, cough, and whether these symptoms improved when the worker was away from work. (c) occupational asthma flare-ups symptoms: It consisted of 3 questions related to reported sudden symptoms as coughing, shortness of breath, and wheezing.

II: Worker's Inhaler Adherence and Satisfaction Questionnaire: It was developed by the researcher based on an extensive literature review. It included two parts 1st part. Pre/ post worker's inhaler adherence. This part assessed the worker's adherence to the use of an inhaler, and it included ten questions related to when to use the inhaler, using the inhaler only when feeling breathless, missing out on doses. 2nd part. Pre/ post worker satisfaction with the inhaler. This part assessed the workers' satisfaction regarding inhaler use. It included ten questions about inhaler preparation, using, keeping, carrying.

III: Inhaler Technique Observational Checklist: It is adopted from Basheti et al. (2014). It consisted of ten steps that assessed the worker's inhaler use. This tool was used as a pre/post-test.

IV-Workplace Observational Checklist: It was developed by the researcher based on Stobnika & Gorny (2015). It included five preventive measures available in the workplace to minimize the risks of occupational asthma among workers: a) Flour dust control measures, b) Ventilation measures, c) Personal Protective Equipment, d) First aid facilities, and e) Waste management measures.

V: Spirometry Test Record. Spirometry is a standard test used to measure how well patient lungs are functioning. The test works by measuring airflow into and out of the patient lungs using a spirometer. The patient sits and breathes into a small machine (spirometer) to take a spirometry test. This medical device records the amount of air a patient breathes in and out to measure the Forced Expiratory Volume in one second (FEV1) and the speed of the patient breath. The researcher recorded the readings. Spirometry tests are used to diagnose asthmatic patients.

Ethical consideration

The research proposal and the tools were submitted to the Committee of Research Ethics at the Faculty of Nursing, CairoUniversity. Approval to start the study was obtained on 28 May 2018. Written approval was obtained from the director of the medical sector at South Cairo & Giza Mills & Bakeries Company on 8 July 2018 to collect data from the workers working at the El-Haram flour mill. Also, written informed consents were obtained from the workers working at El-Haram flour mill after explaining the aim of the study, its benefits, and risks, if any, duration of the study, data collection tools, and the procedure of the study. The researcher informed the workers that all data gathered during the study would be confidential. Moreover, they had the right to withdraw without any reason and any pressure from the head of the department. Besides, workers were informed that the obtained data would be used for this study, and it would not be reused in other studies except with their permission.

Results and Discussion

Description of flour mill workers' characteristics

Concerning the personal characteristics of flour mill workers, table (1) shows that 51.6% and 23% of workers aged 45 to less than 55 and from 25 to < 45 years old respectively with a mean of 48.11 ± 8.61 years. In addition, the table reveals that 40.1% of workers had work experience of 20 to less than 30 years while 18% had work experience of 1 - < 10 years with a mean of 17.86 ± 8.69 years. As for smoking history, 17.2% were moderate smokers, and 6.6% were heavy smokers.

Table 1. Percentage distribution of flour mill workers' characteristics (n = 122).

Personal characteristics	**Frequency**	**%**
Age / year		
25 < 35	13	10.7
35 < 45	15	12.3
45 < 55	63	51.6
55 – 60	31	25.4
$\bar{x}$ ± SD	48.11 ± 8.61 years	
Duration of work:		
1 - < 10	22	18
10 - < 20	39	32
20 - < 30	49	40.2
30- 38	12	9.8
$\bar{x}$ ± SD	17.86 ± 8.69 years	
History of smoking:		
No	82	67.2
Yes:	40	32.8
< 10 cigarettes/day (light smoker)	11	9
10-20 cigarettes/day (moderate smoker)	21	17.2
> 20 cigarettes/day (heavy smoker)	8	6.6

Description of occupational asthma and lung function among flour mill workers in pre, post, and follow-up tests.

Regarding the prevalence of occupational asthma, Figure 1-2 reveals that all degrees of asthma percentages changed better. Moderate occupational asthma represented 31.1% of workers in the pre-test, which decreased to 28.7% and 18% in post and follow-up tests, respectively. The percentage of severe asthma workers decreased from 22.1% in the pre-test to 20.5% and 12.3% in the post and follow-up tests, respectively. Also, mild asthma increased from 18.9% in the pre-test to 22.9% and 36.9% in post and follow-up tests. Also, intermittent asthma

increased from 27.9% to 32% in the follow-up. In addition, Table 2-3 shows a significant reduction in occupational asthma degree in the post and follow-up tests (F = 31.16, P = 0.006).

Table 2. Difference between airway obstruction scores in pre and follow-up tests among flour mill workers.

Scores of airway obstruction	Mean	SD	Paired T-Test	P
Pre	2.24	1.04	9.718	0.000*
Follow-up	1.50	0.67		
Note. * Significant at the 0.05 level and n = 122.				

Table 3. Difference between the means of occupational asthma degree in pre, post, and follow-up tests among flour mill workers.

Degree of occupational asthma	Mean (10)	SD	F	P
Pre	6.86	1.74	31.16	0.006*
Post	5.19	1.23		
Follow-up	3.52	1.45		
Note. *Significant at the 0.05 level and n = 122.				

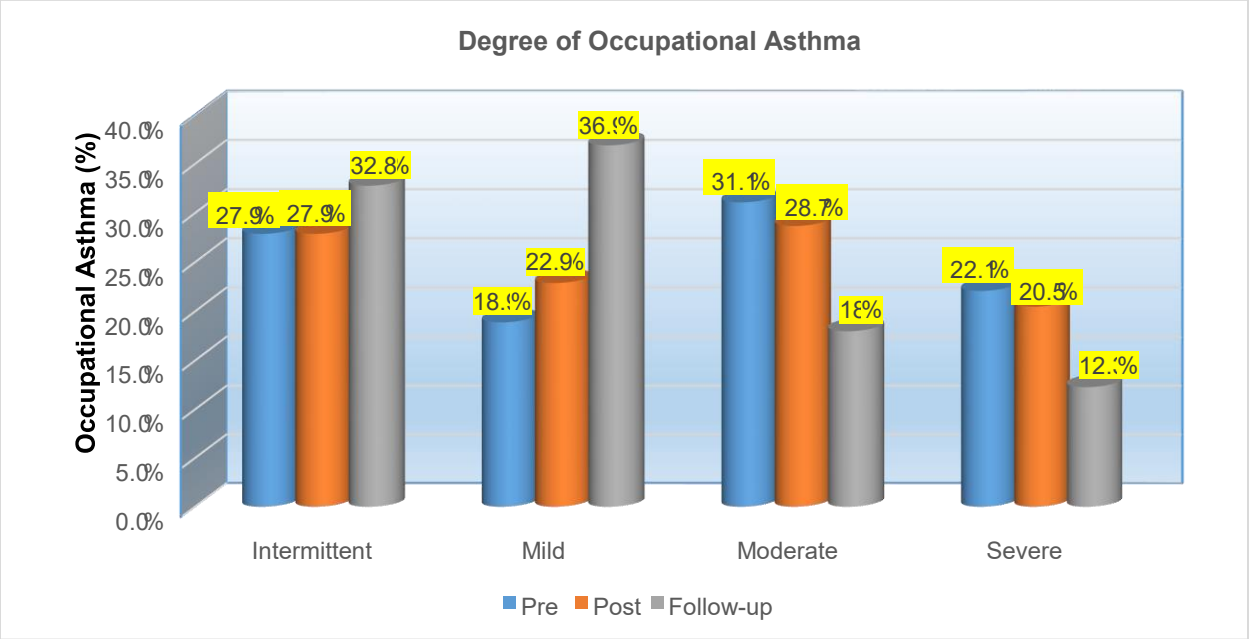

Figure 1. Percentage distribution of pre, post, and follow-up occupational asthma degree among flour mill workers (n = 122).

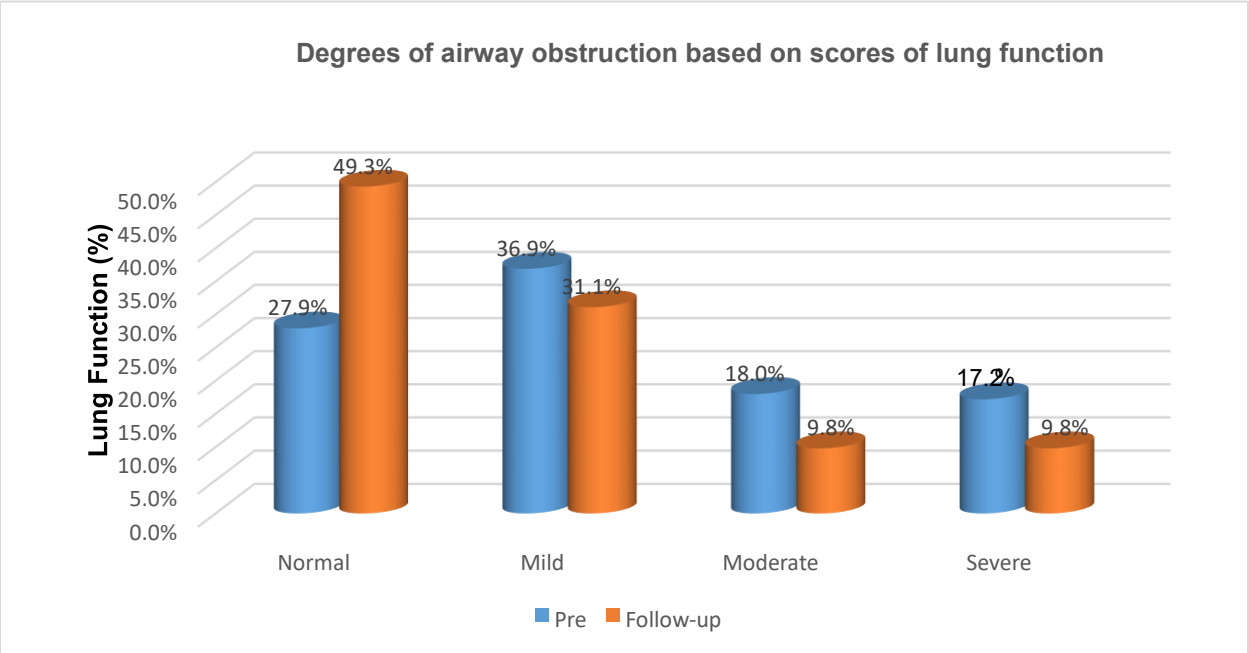

Figure 2. Percentage distribution of airway obstruction in pre, and follow-up tests through Forced Expiratory Volume (FEV1) among flour mill workers (n = 122).

Figure 2 clarifies that the percentage of workers who had normal lung function increased from 27.9% in the pre-test to 49.3% in the in-follow-up test. Moderate and severe airway obstruction represented 18% and 17.2% in the pre-test, respectively decreased to 9.8% in the follow-up test. Table 3 shows a highly statistically significant difference between the means of airway obstruction scores in pre and follow-up tests (T = 9.718, P = 0.000).

Table 4. Correlation between flour mill workers' characteristics and scores of airway obstruction in pre, and followup tests.

The score of airway obstruction				
Flour mill workers' characteristics	Pre		Follow-up	
R		P	R	P
Age	0.105	0.250	0.088	0.3322
Sex	0.211	0.020*	0.082	0.370
Level of education	0.007	0.937	0.028	0.761
Place of residence	0.161	0.076	0.194	0.033*
Duration of work	0.033	0.721	0.119	0.192
Income	0.082	0.370	0.071	0.439
Smoking	-0.055	0.545	0.083	0.364

Note. * Significant at the 0.05 level, R = Pearson correlation, P = Probability, and n = 122.

3.3. Workers' compliance to prescribed management.

As indicated in Figure 3 regarding adherence of workers to inhalers, it shows that 4.9% of them were adherent to inhalers in pre-test increased to 75.4% and 79.5% in post and follow-up tests, respectively. Nonadherence

represented 95.1%, 24.6%, and 20.5% in pre, post, and follow-up tests, respectively. Regarding the worker's satisfaction with an inhaler, figure 4 clarifies that only
4.1% of them were satisfied with using inhalers in pre-test increased to 60.7% and 42.6% in post and follow-up tests, respectively.

Table 5. Percentage distribution of non-pharmacological practice among flour mill workers in pre, post, and follow-up tests.

Non-pharmacological practices	Pre		Post		Follow-up	
	*N	%	*N	%	*N	%
Smoking:						
Light smoker	11	9	10	8.2	8	6.5
Moderate smoker	21	17.2	20	16.3	15	12.2
Heavy smoker	8	6.6	5	4	3	2.4
Physical activity	27	22.1	45	36.8	77	63.1
Breathing exercises	8	6.5	82	67.2	105	86.1
Influenza vaccine	0	0	7	5.7	7	5.7
Weight reduction	15	12.2	50	40.9	50	40.9
Healthy diet	56	45.9	110	90.1	110	90.1
Avoidance of confirmed food allergy	46	37.7	45	36.8	27	22.1
Avoidance of the outdoor allergen	20	16.3	60	50.8	60	50.8
Avoidance of outdoor air pollutants	82	67.2	115	94.2	115	94.2

Note. *Responses are not mutually exclusive, *N = Number, and n = 122.

Regarding non-pharmacological management, Table 5 shows that 17.2% were moderate smokers in pre-test decreased to 16.3% and 12.2% in post and follow-up tests, respectively. Concerning physical activity, 22.1% of flour mill workers did a physical activity in pre-test increased to 36.8% and 63.1% in post and follow-up tests, respectively. For breathing exercises, the table clarifies that only 6.5% did the exercises in pre-test compared to 67.2% and 86.1% in the post and follow-up tests, respectively. Regarding the influenza vaccine, table 5 shows that no one took the influenza vaccine in the pre-test, and only 5.7% took the vaccine in the post and follow-up tests. Also, the table indicates that 45.9% ate a healthy diet in the pre-test, which increased to 90.1% in post and follow-up tests. In the pre-test, the table also shows that 67.2% avoided the outdoor air pollutant while 94.2% avoided the outdoor air pollutant in post and follow-up tests.

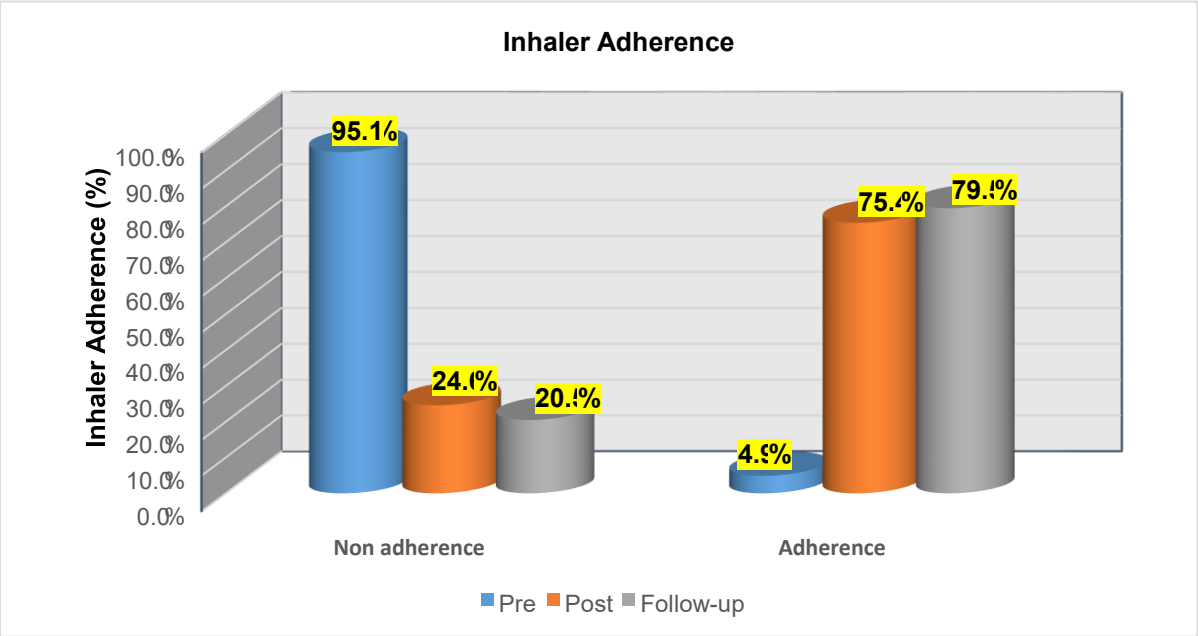

Figure 3. Percentage distribution of pre, post, and follow-up inhaler adherence scores among flour mill workers (n = 122). This figure will cover hypothesis number three.

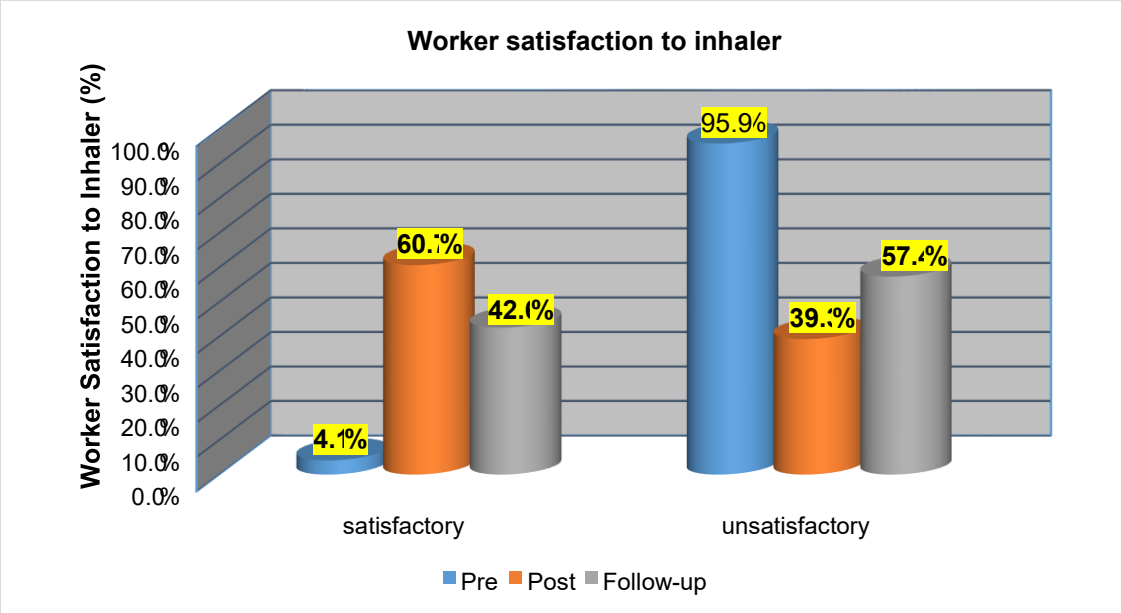

Figure 4. Percentage distribution of pre, post, and follow-up flour mill worker satisfaction to inhaler (n = 122). This figure will cover hypothesis number four.

Preventive measures applied in the flour mill.

Regarding preventive measures applied by flour mill workers, Table 6 shows that the preventive measures to control flour dust remained the same as before the intervention. Table 7 shows no change in ventilation measures in the follow-up test. There were suitable working extraction units, and all equipment was clean and in good repair in pre and follow-up tests. The rest of the preventive measures were not available.

Table 6. Availability of preventive measures toward flour dust control in the flour mill in pre and follow-up tests.

Preventive measures toward flour dust control	Pre	Follow-up
	Available	Available
Fast delivery of flour	Yes	Yes
Short storage time of flour	Yes	Yes
Automatically closing doors	No	No
Restriction of the entrance to areas with high dust levels	No	No
Relevant warning signs displayed	No	No
Washing hands facilities	Yes	Yes
Taking shower facilities	No	No
Storage places of working clothes	Yes	Yes
Avoidance of eating, drinking, or smoking at the mill	Yes	Yes

Table 7. Availability of preventive measures toward ventilation in the flour mill in pre and follow-up tests.

Preventive measures toward ventilation	Pre	Follow-up
	Available	Available
All areas are ventilated sufficiently	No	No
There are extraction units	Yes	Yes
Extraction units are in good working condition	Yes	Yes
The filter screens are free from any buildup of dust	No	No
There are air conditioning units/fans	No	No
All equipment is clean & in good repair	Yes	Yes

Conclusion

This study indicated that all percentages of occupational asthma degrees changed to be better after applying a control-based management strategy. In addition, the percentage of flour mill workers who had normal lung function increased in follow-up tests than in pre-test. There was a significant increase in inhaler adherence mean scores in post and follow-up tests than in pre-test. Also, flour mill workers reported better satisfaction with inhalers in the post-test and follow-up tests than in the pre-test. Moreover, there was a lack of preventive measures in pre and follow-up tests.

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Conflict of interest. The authors declare that there are no conflicts of interest regarding the publication of this paper.

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