

Respiratory Symptoms and Associated Factors among Cement Factory Workers and Civil Servants in North Shoa, Oromia Regional State, North West Ethiopia: Comparative Cross Sectional Study

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Abstract

Background: In Ethiopia, workers are not well informed about the health effects of their work environment and occupational related respiratory symptoms are extensively high especially, in cement factories.

Objective: This study was designed to determine prevalence of respiratory symptoms and associated factors among Cement Factories Workers and Civil Servants.

Methods: An organization based comparative cross sectional study were done on 266 cement factories and 269 civil servant workers, using pre-tested questionnaire. Simple random sampling method was used to select participants from Civil Servants, while working section stratification with simple random was applied to select participant Cement Factories Workers. The data were entered to Epi-info version 7 and exported to SPSS version 20 for analysis. In the bivariate logistic regression variables with $p \leq 0.2$ were fitted to multivariate logistic regression and finally, variables with $p < 0.05$ was considered as significantly associated.

Result: The prevalence of respiratory symptoms was 66.2% in cement factories workers and 31.2% in Civil Servants with a significant difference ($p < 0.001$). The odds of developing respiratory symptoms were higher among exposed groups (AOR=7.60, 95% CI: 4.93-11.89). Respiratory symptoms were higher in ≥ 45 years old workers (AOR=4.67, 95% CI: 1.16-18.74) than < 25 years old workers. Night shift workers were more likely to develop respiratory symptoms (AOR=2.07, 95% CI: 1.02-4.18) than their counterpart. Having trained in occupational health and safety (AOR=0.18, 95% CI: 0.09- 0.36) and education above secondary school (AOR= 0.15, 95% CI: 0.03-0.78) were protective for respiratory symptoms in the exposed groups. Smoking was positively associated with respiratory symptoms in both cement factories workers (AOR=11.7, 95% CI: 1.6- 85.76) and unexposed groups (AOR=3.4, 95% CI: 1.19-9.05).

Conclusion: Respiratory symptoms were higher among cement factories workers than civil servants, so engineering and administrative control measures are needed to reduce the exposure of workers to cement dust.

Keywords: Cement dust, Ethiopia, Respiratory symptoms

Background

World health organization (WHO) 2010 reported that non-communicable diseases (NCD) were the leading cause of death resulting in loss of life of about 57 million people globally in 2008. From this, 36 million (63%) were due to cardiovascular diseases, cancer, respiratory diseases and diabetes [1]. From those non communicable diseases, respiratory diseases, including asthma and chronic obstructive pulmonary disease (COPD), contributed 4.2 million deaths. These problems always come after different respiratory symptoms. From those respiratory diseases occupation related respiratory diseases account 10 - 20%. Those occupational respiratory diseases accounts up to 30% of all registered work-related diseases with up to 50% prevalence among workers in high risk sectors such as mining, construction and dust generating works. Respiratory

symptoms are preceding those occupational related respiratory disease and they are among the major causes of consultation at primary health care centers [1-4]. In low and middle income country, including Africa, occupational respiratory symptoms and diseases are huge burden due to the expansion of investments, high unemployment rate; workers are probably more likely to continue working even when having poor health status and outdated machine that are producing excessive dust to work environment are still used for production purpose [1,4]. Ethiopia is one of the low income countries, occupational related respiratory symptoms are extensively abundant and the expansion of investment, especially in cement product in Ethiopia exposes workers for dusty environment and workers are not well informed about health effect their work environment [1,4].

Cement is produced typically through a series of processes that includes quarrying, crushing, raw milling, blending, kiln burning to form clinker and homogenous blend of limestone and clay, which is

then adjusted to a suitable content of Calcium, Silicon, Aluminum and Iron in a kiln [5,6]. During its heating clinker is formed, the clinker contains Calcium Silicates, Calcium Aluminates and Calcium Ferrites. Clinker is subsequently ground with gypsum and other additives, resulting in a fine particulate powder called Cement [2]. Substantial dust is emitted during these processes, exposing workers to dust [2,6]. In contact with water, clinker partly dissolves and forms an aqueous slurry of high alkalinity, giving clinker and cement strong irritant properties and cause respiratory symptoms and disease [2,7]. Dust with aero diameter of less 100 μ m is inhalable. In cement factories, dust is produced during crushing and grinding of raw materials, blending and kiln burning to form clinker, cement milling and packaging [7,8].

The main route of entry of cement dust particles in the body is the respiratory tract and/ or the gastrointestinal tract by inhalation or swallowing respectively. Both routes, especially the respiratory tract are exposed numerous to potentially harmful substances in the cement environment. Cement dust contains limestone, clay, calcium, silica-quartz, aluminum and iron. Some of those are irritants and fibrosis that can cause acute or chronic respiratory tract inflammation and scarring lung tissue, which is the overproduction of mucus, and lead to cough, dyspnea and others respiratory symptoms. Quartz (the common form of free crystalline silica) is highly insoluble compound, the toxicity of which is completely dependent on its penetration to the alveolar portion of the lungs that reach alveoli when enough small in size but most of time it deposited in the nose, throat, bronchi, or larger bronchiole to cause respiratory symptoms and disease Occupational lung diseases are preceded by different symptoms such as shortness of breath, cough, sputum, dyspnea, and wheeze. The existence of respiratory symptoms could indicate that there is a mild cold or a life threatening condition and show the chronic respiratory disorders [7,9,10].

Many researchers have found that the dust exposed workers in cement factory were significantly associated with high prevalence of cough, sputum, dyspnea and wheezing than the control group [6,8,11,12]. Several researchers from United Arab Emirate(UAE), Iran, Tanzania, and India show that chronic occupational exposure to dust in cement factories leads to a greater prevalence of respiratory symptoms such as Chest Tightness, Cough, Sputum, Wheezing and Dyspnea among exposed than unexposed [6,8,11,12]. However, there was a study that showed no significant difference of between exposed and unexposed workers on respiratory symptoms [13]. The expansions of labor intensive investments in developing country, especially in cement product create dusty work environment for workers and those workers are from low socioeconomic group and need special safety concern [1,4]. In Ethiopia even though the cement industry are extensively increasing, the study of respiratory symptoms and illness is limited. Studies from Dire Dawa and from two cement factories around Addis Ababa were the only existing study [5,14]. The aims of this study were to determine prevalence of respiratory symptoms in cement factories workers and civil servants and associated factors. The findings could help to policy makers and management of the organizations to develop appropriate workplace intervention measures to protect the health of their workforces.

Methods

Study area

The study was conducted in North Shoa Administrative Zone, Oromia Regional State which is one of the largest zones and well

known for investment as there are rich natural resources and located 100km from Addis Ababa to Northwest of Ethiopia. Currently above 7,000 employees were employed in different private economic activities in this zone. Manufacturing contains a large percent, including three cement factories. The three cement factories have about 1011 workers and the Civil Service had 831 civil servants in the study area [15]. Currently there are three cement factories with two of them are functional and one is stopped production due to devastating accident at the workplace. Jema cement factory Share Company is one that found at Wucale district and has 437 workers out of which 77 are administrative, 112 raw material processing sections, 65 burner section, 87 clinker section and 96 cement mill and packing section. The other factory is an East cement Share Company, which found in Degem district and has 574 workers out of which 93 are administrative, 153 raw material processing sections, 47 burner section, 103 clinker section and 178 are cement mill and packing section. The study was conducted on factory workers in two cement factories and civil servants from North Shoa administrative zone from March 22 to April 19, 2014.

Sample size determination

Stat Calc module of Epi InfoTM 7 software was used to compute the sample size with an assumption of 95% level of confidence, 90% power, 1:1 ratio of exposed (cement factories workers) to unexposed (civil servant workers) and prevalence of cough among exposed 26.2% and among unexposed 14.1% from previous study [6]. A total of 544 (272 in each group) were the planned sample size, but during the actual data collection, a total of 535 participants (266 exposed and 269 unexposed) were included in the study.

Sampling procedure

Stratified sampling technique was used to select the study subjects in the exposed group. The workers in cement factories were stratified into Raw Mill section, Burner Section, Clinker Section, Cement Mill and Packing Section and the sample size was proportionally allocated to these sections finally, using simple random sampling method workers were selected from each working section of the factories. The simple random sampling technique was used to select 272 participants for the unexposed group (civil servants) from 831 civil servants.

Operational definitions

Respiratory symptoms: Respiratory symptoms were defined workers who developed one or more symptom of cough, phlegm, wheezing, dyspnea, and chest pain and chest tightness.

Cough: Cough was defined as cough as much as 4–6 times per day occurring for most days of the week (≥ 4 days) for at least three months in a year and for at least two consecutive years.

Phlegm: Phlegm was classified as sputum expectoration as much as twice a day for most days of the week (≥ 4 days) for at least three months in a year and for at least two consecutive years.

Wheeze: Chest sound whistling on expiration when have cold or occasionally apart from colds or most days or night for at least three months in a year.

Chest pain: In past two year's chest pain that kept off work of the workers with phlegm.

Chest tightness: Tightness or constriction of the chest, occurring any time during the work shift and on any work day.

Dyspnea: Dyspnea was divided into 5 grades with the following definitions:- Grade 0: No breathlessness except with strenuous exercise; Grade 1: Breathlessness when hurrying on the level or walking up a slight hill; Grade 2: Walking slower than people of the same age on the level because of breathlessness or has to stop for breath when walking at own pace or level; Grade 3: Stopping for breath after walking about 100 yards (96 meter) or a few minutes on the level; Grade 4: Too breathless to leave the house or breathless when dressing or undressing. So, that the study was report dyspnea grade 2 or more as outcome American thoracic society [16].

Data collection tool

Interviewer administered modified standard questionnaire from American Thoracic Society [16] was used. The questionnaire was used with epidemiological studies of all respondent 13 or more age and have two part that the first part was recommended as minimal question to be asked in every survey and followed by optional question that are left for discretion individual investigators to consider for inclusion at the end of the appropriate section of the questionnaire. The questionnaire was prepared in English then translated to Afaan Oromo (local language) and back to English to keep the consistence. Four trained nurses' data collectors and two supervisors were assigned for data collection and practice of dust control mechanism and personal protective equipment (PPE) uses were observed in the workplace using an observational checklist.

Statistical analysis

The data were checked, coded and entered to Epi-info version 7 and exported to SPSS version 20 for analysis. Proportion, mean and standard deviation between parameters were analyzed. Pearson's X² test was used to compare both dependent and independent variable among exposed (cement factories workers) and unexposed group (civil servants). Variables that have p<0.02 in the bivariate logistic regression analysis were fitted to multivariate logistic regression analysis and finally, variables having p<0.05 was considered as significantly associated in the multivariate logistic regression analysis.

Ethical consideration

The research protocol was approved by the University of Gondar Ethical Review Board and permission letter was obtained from North Shoa Labor and Social Affairs. Verbal and written consent were obtained from all participants. Privacy and confidentiality of information given by each respondent was kept properly and personal identifiers were removed. Participants who had severe respiratory symptoms were referred to health centers for further treatment and health education was provided for other participants.

Results

Demographic characteristics

The study was conducted among 266 (49.7%) cement factories workers and 269 (50.3%) civil servants and, about 61.1% of respondents were male. The mean age of the study population was 35.6±9.87 years, ranged from 19 to 68 years and the cement factories workers were significantly younger (33.5±9.06years) than the civil

servants (37.7±10.21years) with p<0.001. Age, education, and service year were significantly different among the two groups (p<0.05) while, sex, smoking status and history of respiratory diseases were not (Table 2).

Respiratory symptoms

The prevalence of respiratory symptoms in cement factories workers was 66.2% and 31.2% in civil servants with significant difference (p< 0.001). Cement factories workers reported high prevalence of cough, phlegm, dyspnea, wheezing, and chest pain and chest tightness than civil servants with significant difference for all symptoms (p < 0.05) (Table 1). About 12% of cement factories workers had grade III dyspnea when compared with 2.2% of civil servants similarly, 7.2% of cement factories workers had grade IV dyspnea unlike that of 1.1% civil servants and the difference is statistically significant for both grade III and IV dyspnea with p<0.05.

Respiratory symptoms	Cement factories (n=266) n (%)	Civil servants (n=269) n (%)	P-value
Cough	85(32)	37(13.8)	<0.001*
Phlegm	81(30.5)	45(16.7)	<0.001*
Wheezing	101(38)	28(10.4)	<0.001*
Dyspnea grade II or more	117(44)	36(13.4)	<0.001*
Chest pain	54(20.3)	4(1.5)	<0.001*
Chest tightness	112(42.1)	7(2.6)	<0.001*
*Chi-square test significant			

Table 1: Prevalence of respiratory symptoms in cement factories workers and civil servants in North Shoa, Oromia Regional State, North West Ethiopia

Variable	Exposed (n=266) n (%)	Unexposed (n=269) n (%)	p-value
Sex			0.128*
Male	154(57.9)	173(64.3)	
Female	112(42.1)	96(35.7)	
Age (in year)			
<25	31(11.7)	16(5.9)	
25-34	134(50.3)	95(35.3)	
35-44	68(25.6)	81(30.1)	
≥45	33(12.4)	77(28.6)	
Mean(±SD)	33.5(±9)	37.7(±10.2)	< 0.001**
Educational status			<0.001*
Illiterate	123(46.2)	0(0)	
Primary school	85(31.9)	0(0)	

Secondary school	47(17.7)	1(0.4)	
Above secondary school	11(4.1)	268(99.6)	
Year of service (in year)			
< 5	86(32.3)	124(46.1)	
≥5	180(67.7)	145(53.9)	
Mean(±SD)	5.2(±1.3)	8(±6.2)	<0.001**
Smoking habit			
Never smoked	243(91.4)	252(93.7)	
Ever smoked	23(8.6)	17(6.3)	
One or more respiratory disease			
No	246(92.5)	238(88.5)	
Yes	20(7.5)	33(12.3)	
*: X ² - test. **: mean comparison			

Table 2: Selected demographic characteristic of cement factory workers (exposed group) and civil servant workers (unexposed group) in North Shoa, Oromia Regional State, North West Ethiopia

Factors associated with respiratory symptoms

Sex was significant in both cement factories workers and civil servant. In cement factories workers, males were more likely to develop respiratory symptoms (AOR= 5.46 95% CI: 2.22-13.44) than females (Table 3) similarly, in civil servant workers males were more likely to develop respiratory symptoms (AOR=3.65 95% CI: 1.88-7.08) than females (Table 5). Cement factories workers aged 25-34years and ≥45years old were more likely to develop respiratory symptoms than <25years old workers with (AOR= 5.95 95% CI: 1.94-18.23), (AOR= 4.6795% CI: 1.16-18.74) respectively (Table 3).

Variable	Respiratory symptoms		COR (95% CI)	AOR (95%CI)
	Yes	No		
Sex				
Male	109	45	1.67(0.97,2.71)	5.46(2.22, 13.44)**
Female	67	45	1.00	1.00
Age (in years)				
<25	13	17	1.00	1.00
25-34	95	40	3.1(1.38,6.98)	5.95(1.94,18.23)*
35-44	42	26	2.11(0.88,5.05)	3.19(0.92,11.03)
≥45	26	7	4.85(1.6,14.64)	4.67(1.16,18.74)*
Educational status				
No education	83	40	1.00	1.00
Primary education	58	27	1.03(0.57,1.87)	2.05(0.91,4.62)
Secondary education	30	17	0.85(0.42,1.72)	1.74(0.64,4.68)

Above secondary	5	6	0.4(0.11,1.39)	0.15(0.03,0.78)*
Evening shift work				
No	25	23	1.00	
Yes	151	67	2.07(1.09,3.91)	
Night shift work				
No	42	45	1.00	1.00
Yes	134	45	3.19(1.86,5.47)	2.07(1.02,4.18)*
Working department				
Raw mill	55	30	1.48(0.8,2.74)	5.07(1.77,14.48)*
Burner	27	9	2.42(1.02,5.77)	4.59(1.33,15.88)*
Clinker	47	13	2.92(1.38,6.17)	8.46(2.52,28.39)*
Cement mill and packing	47	38	1.00	1.00
Personal protective equipment use				
No	147	61	2.41(1.33,4.37)	
Yes	29	29	1.00	
Smoking status				
Never smokers	155	88	1.00	1.00
Ever smokers	21	2	5.96(1.36,26)	11.7(1.6,85.76)*
Home used energy source				
Electric	6	6	1.00	
Biomass	170	84	2.02(0.63,6.46)	
Occupational health and safety training				
No	137	41	1.00	1.00
Yes	39	49	0.24(0.14,0.41)	0.18(0.09,0.36)**
1.00: reference. *: p<0.05. **: p<0.001. CI: Confidence Interval. COR: Crude Odd Ratio. AOR: Adjusted Odd Ratio				

Table 3: Association of variable and respiratory symptoms among cement factory workers (Bivariate and Multivariate analysis) in North Shoa, Oromia Regional State, North West Ethiopia

Higher education status was protective for respiratory symptoms among cement factory workers (AOR= 0.15 95% CI: 0.03-0.78), compared to those had no education (Table 3). Both smokers in cement factories workers and civil servants smokers were more likely to develop respiratory symptoms. For cement factories workers, the odds of experiencing respiratory symptoms among smoker were almost 12 times compared with than that, never smokers (AOR; 11.7 95% CI: 1.6- 85.76) (Table 3) and among civil servant workers, smokers were 3.4 times to develop respiratory symptoms (AOR=3.4 95% CI: 1.19-9.05) than never smokers (Table 5).

Shift work was another factor that was statically significant among cement factory workers. Those were working in night shift were two times more likely to develop respiratory symptoms (AOR=2.07 95%

CI: 1.02-4.18) than do not work the night shift. Dyspnea and chest pain were significantly associated with both evening and night shift work, while cough was more likely to develop among evening shift workers. Night shift workers were also more likely to develop wheezing than their counterpart. Among cement factories workers, training on occupational health and safety related to dust health effect was reduced respiratory symptoms by 82% (AOR=0.18 95% CI: 0.09-0.36) (Table 3). Specially those not trained workers were had Cough (39.4%vs.19.2%), Wheezing (47.7%vs.18.2%), Dyspnea(54.5%vs.22.7%), Phlegm(79%vs.21%), Chest Pain (81.5%vs. 18.5%) and Chest Tightness (81.2%vs.18.8%) than those trained. But the difference was significant only for wheezing, cough and Dyspnea. In case of working section in the cement factory workers, those working in Clinker section (AOR= 8.46 95% CI: 2.52-28.39), Burner section (AOR= 4.59 95% CI: 1.33-15.88) and Raw Mill section (AOR= 5.07 95% CI: 1.77-14.48) were more likely to develop respiratory symptoms when compared with workers who work in Cement Mill and Packing section (Table 3).

The work environment was the leading cause of difference for respiratory symptoms in the cement factories workers and civil servants. The odds of developing respiratory symptoms among cement factories workers were 7.6 times more (AOR=7.6 95% CI: 4.93-11.89) than civil servants when adjusted for major confounders age, smoking status, history of respiratory disease and home used energy source (Table 4).

Variable	Respiratory symptoms		COR(95%CI)	AOR(95%CI)
	Yes	No		
Sex				
Male	179	148	1.89(1.33,2.7)	Male
Female	81	127	1.00	Female
Age(in years)				
<25	13	33	1.00	<25
25-34	113	117	2.45(1.22,4.89)	25-34
35-44	64	85	1.91(0.93,3.92)	35-44
≥45	70	40	4.44(2.09,9.4)	≥45
Exposure to dust				
No	84	185	1.00	No
Yes	176	90	4.3(2.99,6.18)	Yes
Smoking status				
Never smokers	235	267	1.00	Never smokers
Ever smokers	25	8	3.55(1.57,8.02)	Ever smokers
Home Energy source				
Electric	22	39	1.00	Electric
Biomass	238	236	1.78(1.02,3.1)	Biomass
History of Respiratory disease				
No	223	259	1.00	No

Yes	37	16	2.68(1.45,4.95)	Yes
Occupational history of dust exposure				
No	244	269	1.00	No
Yes	16	6	2.94(1.13,7.63)	Yes
1.00: reference. *: p<0.05. **: p<0.001. CI: Confidence Interval. COR: Crude Odd Ratio. AOR: Adjusted Odd Ratio				

Table 4: Association of variable and respiratory symptoms among cement factory workers and civil servant workers together (Bivariate and Multivariate analysis) in North Shoa, Oromia Regional State, North West Ethiopia

Variable	Respiratory symptoms		COR(95%CI)	AOR(95%CI)
	Yes	No		
Sex				
Male	70	103	3.98(2.09,7.57)	3.65(1.88,7.08)*
Female	14	82	1.00	1.00
Smoking status				
Never smokers	74	178	1.00	1.00
Ever smokers	10	7	3.43(1.26,9.37)	3.4(1.19,9.05)*
Home used energy source				
Electric	16	33	1.00	
Biomass	68	152	0.92(0.47,1.78)	
History of respiratory disease				
No	66	170	1.00	1.00
Yes	18	15	3.09(1.47,6.49)	2.34(1.09,5.01)*
Service years				
≤5	45	102	1.00	
>5	39	83	1.06(0.63,1.78)	
1.00: reference. *: p<0.05. **: p<0.001. CI: Confidence Interval. COR: Crude Odd Ratio. AOR: Adjusted Odd Ratio				

Table 5: Association of variable and respiratory symptoms among civil servant workers (Bivariate and Multivariate analysis) in North Shoa, Oromia Regional State, North West Ethiopia

Discussion

In this study, the prevalence of respiratory symptom was 66.2% among cement factories workers and 31.2% among civil servant workers. Cough (32% vs.13.8%), Phlegm (30.5% vs.16.7%), Wheezing (38% vs.10.4), Dyspnea (44% vs.13.4%), Chest Pain (20.3% vs.1.5%) and Chest Tightness (42.1% vs.2.6%) among cement factories and civil servant workers respectively with significant differences.

Male, those age ≥45 years old, higher educational status, working section, history of respiratory disease, smoking, night shift work, and

safety training on respiratory health were significant association with respiratory symptoms. The prevalence of respiratory symptoms, among exposed group (cement factories workers) in current study (66.2%) is much higher than the study done in United Kingdom with upper respiratory symptoms, 38.1% and lower respiratory symptoms 45.2% among organic dust exposed [17]. The difference might be due to the concern given for workplace safety between developed and developing country. The previous study also conducted among textile and agro-processing industries that not produce dust as cement plants.

The prevalence of Cough (32% vs. 13.8%) and Phlegm (30.5% vs. 16.7%) in current study were lower than survey done on cleaners in other cement factory in Ethiopia with Cough (57.9% vs. 10%) and Phlegm (73.7% vs. 15%) in exposed and unexposed group respectively but, almost similar for Chest tightness (44.7% vs. 5%) in exposed and unexposed groups [5]. The difference of Cough and Phlegm might be due to study participants of former study only cleaners that they were extremely exposed for dust due to cleaning activity. The prevalence of Cough (32% vs. 13.8%) and Phlegm (30.5% vs. 16.7%) were in agreement with study done in Tanzania with Cough (25.8% vs. 12.1%) and Phlegm (34.2% vs. 10.3%) among exposed and unexposed group respectively [6]. The prevalence of Cough, Wheezing and Chest pain among exposed in current study were lower than study done in cement factories in India with Cough (87% to 90%), Chest pains (50% to 59%) and Wheezing (89%-93%) in workers exposed to cement dust [9]. The difference with Indian study might be due to that the definition of those symptoms. The Indian study used one year length period to said cough presence or absence while this study used minimum two year to say cough and wheezing. Also for chest pain this study consider the presence of sputum with chest pain that kept off the workers from work but the Indian study consider only the presence of pain on chest.

In the current study, there was significant difference of all respiratory symptoms between exposed and unexposed group which is in agreement with studies other cement factories in Ethiopia and Iran [5,11]. The prevalence of Cough and Phlegm in Shiraz, Iran were also similar with prevalence in our study. Unlikely, study conducted in cement factory in United Arab Emirate (UAE) only Cough, Phlegm and Dyspnea were significantly varies among exposed and control group [8]. The difference with study in the UAE might be that the UAE used the control group from same organization (administrative workers) and these administrative workers had some exposure to dust due to the working environment and work activities. Also in contrast to current study, study from Ghean, Iran shows that prevalence of respiratory symptoms between exposed and unexposed was not significant different and prevalence of symptoms in that study is also higher than current study when we compare each symptoms with Cough (60.7% vs. 42.9%), Sputum (37.5% vs. 25.7%), Dyspnea (44.6% vs. 32.4%), Wheezing (41.1% vs. 25.7%) among exposed and control group respectively [13]. The difference with current study might be also related to selection of the control group and small sample size.

The current study show that dust exposure was the main factor for respiratory symptoms. There were no significant difference of major confounding factors sex, history of respiratory disease and smoking status between those exposed and unexposed then the difference of respiratory symptom between them is only due to cement dust exposure. This is consistent with studies from Ethiopia, Tanzania, UAE, Iran, and India [6,8,11,12,14]. Result from work place observational with checklist show that neither of the two factories was trying to apply engineering mechanism such as Cyclones, Wet

scrubber's methods, Electrostatic precipitation and Local Exhaust ventilation to collect particulate matter from the workplace and separate the clean air and dust in separate setting or dilute the concentration of dust in the air.

This study demonstrates that for the exposed group socio-demographic factors as age, sex and education were significant association with respiratory symptoms, but for those of unexposed only sex was significant association. The difference with age and education factors among two groups may that there was not a variation between educations among the unexposed group, but the exposed groups varied vary from no education to above secondary school. In case of age in the exposed group respiratory symptoms varies with age, because as age increase ability to remove dust decrease, but among unexposed they had no dust exposure.

In this study there was a higher risk of respiratory symptoms among males than females. Male were dominant in the current study and they were smokers than female in both cement factories workers and civil servants. As the men were dominant, it was possible that these workers might be exposed to dust with a greater level of large amount particles than their female counterparts working on the processes. There might be also that negligence was more observed in males and females were at least use their own cloth if personal protective equipment (PPE) was not available. Our finding was in agreement with WHO report 2006 on COPD that respiratory symptoms were main determinants of COPD [18].

The prevalence of respiratory symptoms among cement factories workers was increase with age and this was in line with study done in southern industry of Tehran, Iran and Pakistan [19,20]. As age increase the ability of immunity to compact the foreign body is decreased. In contrast to the current study, study in other cement factories of Ethiopia show that even though cleaners where younger than production workers, the prevalence of respiratory symptoms were higher among cleaners [14]. The difference with this study might be that cleaners were exposed to the high concentrations of dust in the working environment due to their working activities of cleaning.

Working section was also the main factor that influences the prevalence of respiratory symptoms among exposed group. Raw Mill, Clinker and Burner section were higher respiratory symptom than other. Finding by workplace observation shows that in one factory, Cement Mill and packing section were more automated and packing machinery were used. Workers were controlling those machines automatically without manual interfere and dust produced in this section was less and workers are less likely exposed to dust. But in other's section, especially Clinker section the Clinker drops from a height on the level ground and workers were manually controlled the outlet valves and exposed to excessive dust, but in the other factory Clinker is transported with conveyer belts and workers were only exposed when they were feeding milling machine. High prevalence respiratory symptoms among Raw mill, Clinker and Burner section in the present study were also probably due to open flow lines, leakages from machines, lack of enclosure, lack of maintenance, poor general mechanical ventilation and inefficient natural ventilation in the work area, and a lack of local exhaust ventilation from those working sections which was approved by observation. Similarly, study from other cement factory in Ethiopia also showed that highest dust exposure among cleaners of cement dust was detected in Raw Mill department [5].

In current study, smokers were higher prevalence of respiratory symptoms than nonsmokers in both exposed and unexposed groups. Cough, Phlegm, Chest Pain and Chest Tightness was higher among smokers than nonsmokers. This finding was in line with studies from UAE, Tanzania, Pakistan and India [6,8,12,20] that smoking is an important contributing factor for the development of respiratory symptoms. The chemical compositions of Cigarette destroy the Cilia that the lungs use for the removal of particles and alter the ability of the lungs to clear themselves. In contrast, a study from southern industry of Tehran, Iran was found that there was no significant difference of respiratory symptoms between smokers and nonsmokers. This might be due to small frequency of smokers in previous study.

The current study also shows that administration of training on occupational health and safety related to dust significantly reduces respiratory symptoms. This result is consistent with follow up study done in Tanzania that was after follow up of exposed cement workers with administration of health and safety training; significant reduction of respiratory symptoms was recorded among exposed but no difference among control group [21]. Only 21.8% of exposed group were used personal protective equipment (PPE) during their work activities and other use their own cloth. Workplace observation also shows that the filtering face mask was observed at one factory. This finding is similar with study from Ethiopia (21%) and UAE (19.5%) [4,8]. Proper utilization of PPE at work place reduce amount of dust inhaled per working time. The result of this study shows that even though, respiratory symptoms as general was not significant, for Cough and Phlegm use of PPE was protective and for other symptoms no significant difference was found. Similar finding were reported from Tanzania and UAE [8,21]. Unlike this, another study from Tanzania shows that exposed group those use face mask was significantly higher prevalence of Cough than non-user of facemask [6]. This difference might be that in previous study the respondents might use the face mask after development of cough to reduce the aggravation of this symptom. Another explanation might be that the exposed group used poor quality and not effective PPE and continue to work without additional measure taken to reduce dust exposure.

Conclusion

This finding concludes that the prevalence of respiratory symptoms was higher among cement factories workers than civil servants. This was related to cement dust exposure among cement factories workers. Respiratory symptom found to be more common, among older ages, male, smokers, those with a previous history of respiratory diseases and, those work night shifts among cement factories workers, whereas, male, smokers and those had a history of respiratory diseases had more respiratory symptoms among civil servants. Administration of health and safety training on respiratory health effect of dust and higher educational level above secondary school were protective for the respiratory symptoms among cement factories workers.

Authors' contributions

KS contributed in the planning of the project, study design development, literature review, objective development, data collection, statistical analysis, and in the drafting of the manuscript. KA and MK contributed in the study design development, literature review, objective development, statistical analysis, and the drafting of the manuscript. All authors gave approval of the manuscript to be published.

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