MedCrave
Step into the World of Research

MOJ Public Health

Research Article

Open Access

CrossMark

Dust exposure and byssinosis among cotton textile workers in Dar es salaam, Tanzania

Abstract

Background: Cotton dust exposure increases the risk of developing lung diseases including Byssinosis. The prevalence of byssinosis is more in developing countries compare to developed countries. For the past forty years there are little information known about the prevalence of byssinosis and its associated risk factors among textile workers in Tanzania.

Objective: The study aimed to assess dust exposure and associated risk factors among textile workers, in Dar es Salaam, Tanzania.

Material and methods: The study design was descriptive cross sectional study conducted from March to August 2019. Stratified sampling technique was used to obtain 325 participants (exposed 164 and control 161) respectively. A modified British Medical Research Council (BMRC) questionnaire and Side Kick Casella Pump were used for data collection. Data were analyzed using Statistical Package for Social Science software 23 versions. Chi square test and Binary logistic regression were performed to check for association. A 95% confidence Interval with a significance expressed in $P<0.05$ was used.

Results: Prevalence of byssinosis in the exposed group was 18.9% and 6.2% in the control group. Respiratory symptoms such as Coughing more days in three consecutive months ($P<0.001$), wheezing ($P<0.02$), dyspnoea I ($P<0.03$), dyspnoea II ($P<0.007$), and dyspnoea III ($P<0.002$), were higher among exposed group compare to control group and the differences were statistically significant. The department of weaving had higher dust level of arithmetic mean of 2.20 mg/m^3 (SD =0.32). Working experience ($P<0.02$), previously respiratory symptoms ($P<0.001$), were significant risk factors for byssinosis.

Conclusion: In conclusion, our study shows that workers who are exposed cotton dust have higher prevalence of byssinosis and other respiratory symptoms. Awareness of the byssinosis disease, and necessary preventive measure need to be highlighted among stakeholders.

Keywords: cotton textiles workers, byssinosis, respiratory symptoms, inhalable dust, tanzania

Volume 9 Issue 6 - 2020

Luco P Mwelange, Simon Mamuya, Gloria Sakwari, Witness John Axwesso
Department of Environmental and Occupational Health, Muhimbili University of Health and Allied Sciences, Tanzania

Correspondence: Luco P Mwelange, Muhimbili University of Health and Allied Sciences, Tanzania, Tel+255655049524, Email mwelnge@gmail.com

Received: October 29, 2020 | **Published:** November 30, 2020

Abbreviations: BMRC, british medical research council; ACGIH, american conference of governmental industrial hygienists; TLV, threshold limit values; PVC, polyvinyl chloride; SKC, side kick casella

Introduction

The textile industry is among the industries that employ many workers. It is estimated that more than 60 million people globally work in the cotton textile industry.[1] Tanzania is among the country in Africa which manufactures textile products and employ a lot of workers. Report on textile industries status of 2004 shows that 50 textile industries were established by the year 2002.[2] Cotton dust exposure has a significant contribution to the increase in the occupational burden of diseases globally.[3]

Byssinosis is a respiratory disease associated with exposure to cotton dust. Some of its symptoms are chest tightness that is worst for being out of work for 48 hours and on the first day of the working week. Although it improves when you are on holiday, this differentiates byssinosis from occupational asthma.[3,4]

Factors influencing byssinosis have been investigated in several studies. A study done in Turkey indicated that age, sex, smoking status, working history in a dusty place, working in divisions with the high risk of dust exposure were not associated with byssinosis.[5] A study by Ismail et al showed that education level is associated with byssinosis,[3,6] however a study done by Mansouri et al.,[7] showed that education level is not associated with byssinosis.

Processing of cotton generate a lot of dust, the concentration of respirable cotton dust differ from section to section. The section with high dust exposure concentration is associated with high byssinosis prevalence.[5,8]

In Tanzania, little is known about the prevalence of byssinosis and it is not clear which risk factors are associated with byssinosis because the last study in Tanzania was done almost 40 years ago 1979.[9]

In order to develop effective control measures, it is important to understand the magnitude of the problem and risk factors associated with byssinosis among textile workers. Therefore the aim of this study was to assess the cotton dust exposure, prevalence of byssinosis and associated factors so as to portray the clear health status of workers in textile industry in Dar es Salaam.

Material and methods

This was a cross sectional study conducted in Dar es Salaam, Tanzania among cotton textile workers between March and August 2019. The study participants were workers from the cotton textiles industry who have worked for at least 1 year and above and the control were the workers from pure drinking water industry.

Sample size estimation and sampling procedure

Simple random sampling technique was used to select the textile industry from the list obtain from Tanzania Board's Textile sector development unit. Stratified sampling technique was used to select participants from each department of the textile industry. This sample procedure was used to obtain sample size for assessment of reported respiratory health systems. Participants for personal total dust assessment were selected from three department of the textile industry by using NIOSH guideline.[10] The similar exposure group from a job section was made based on similarity of task performed.

Data collection

A standardized British medical research council (BMRC) questionnaire modified to suit the Tanzanian environment was used to asses respiratory health symptoms.[11] Interviews were conducted and observation checklists were used to assess the use of personal respiratory protective equipment at each industry.

Personal sampler used were 35mm diameter ,0.8µm pore size PVC filters places on SKC three piece cassette with 0.4mm orifice mounted on SKC pumps which were operated at a flow rate of 2l/ min. Before pre and post weighing of the filters, they were placed in a desiccator for 72 hours to remove humidity. During these processes, the temperatures were maintained between 24^{0}C to 25^{0}C and relative humidity maintained between 50 to 51%. The pre-weighed filters were inserted into the cassettes, given identification code ready to be taken to the field.

Calibration of the flow rate was done prior to and post sampling. A deviation of more than ±5% between pre and post-calibration was the criterion to discard the sample. Personal samples were taken under normal work conditions from the breathing zone of the participants. Gravimetric analyses of the filter was done at MUHAS laboratory using micro balance (Mettle Toledo xp 205, capacity of 0.01mg-220g)

Data analysis

The data were cleaned, coded, entered and analyzed using SPSS version 23. The continuous variables were checked for normality in order to determine the suitable statistical test to be used. The significance level was set to $p < 0.05$. Data were presented in tables, frequencies, and percentages. Continuous variables were compared by using Mean and standard deviation. Categorical responses were tested by using Chi-square test; for an expected number less than 5 Fisher's exact test was used. Univariable and multivariable binary logistics regression analyses were done to examine factors associated with byssinosis. All independent variables and other variables with P value < 0.25 at bivariate analysis, were taken into the binary logistics regression analysis. The measure of statistical association was the odds ratio, and the measure of statistical significance was 95% confidence level expressed in P-value < 0.05.

Ethical clearance

Ethical clearance was provided by the Muhimbili University of Health and Allied Sciences (MUHAS) Ethical Committee, with reference number Ref.No.DA.287/298/01A,issued on March 2019. Informed consents were obtained from the participants after clear explanation on the aim of the study and their confidentiality was ensured at all stages of the study.

Results

Demographic and social characteristics of the study population

The study involved 325 participants, 164 were exposed group and 161 were control. Most of the study participants were males 103 (62.8%) among exposed and 130 (80.7%) among control.

The overall prevalence of byssinosis in the study population was 18.9% in the exposed group and 6.2% in the control group. Among the exposed group, it was observed that the prevalence of byssinosis was higher in Finishing department (26.2%) than those in spinning and weaving departments in which their prevalence was 19.5% and 14.8% respectively (Table 1).

Table 1 Demographic and social characteristics of the study participants (N=325)

Variables	Exposed n (%)	Control n (%)	Total n (%)
Sex			
Male	103 (62.8)	130 (80.7)	233 (71.7)
Female	61 (37.2)	31 (19.3)	92 (28.3)
Age (years)			
18 - 27	8 (4.9)	98 (60.9)	106 (32.6)
28 - 37	15 (9.1)	47 (29.2)	62 (19.1)
38 - 47	22 (13.4)	12 (7.5)	34 (10.5)
48 - 57	73 (44.5)	3 (1.9)	76 (23.4)
Above 58	46 (28.0)	1 (0.6)	47 (14.5)
Education level			
Informal education	0 (0.0)	4 (2.5)	4 (1.2)
Primary school	142 (86.6)	51 (31.7)	193 (59.4)
Secondary school	21 (12.8)	92 (57.1)	113 (34.8)
Diploma College	0 (0.0)	7 (4.3)	7 (2.2)
University	1 (0.6)	7 (4.3)	8 (2.5)

Citation: Mwelange LP, Mamuya S, Sakwari G, et al. Dust exposure and byssinosis among cotton textile workers in Dar es salaam, Tanzania. *MOJ Public Health.* 2020;9(6):217–221. DOI: 10.15406/mojph.2020.09.00349

Table Continued...

Variables	Exposed n (%)	Control n (%)	Total n (%)
Marital status			
Single	27 (16.5)	106 (65.8)	133 (40.9)
Married	119 (72.6)	49 (30.4)	168 (51.7)
Cohabiting	5 (3.0)	4 (2.5)	9 (2.8)
Separated	7 (4.3)	2 (1.2)	9 (2.8)
Widowed	6 (3.7)	0 (0.0)	6 (1.8)
Work experience (years)			
Below 5	20 (12.2)	131 (81.4)	151 (46.5)
5 - 10	7 (4.3)	27 (16.8)	34 (10.5)
11- 20	11 (6.7)	1 (0.6)	12 (3.7)
Above 20	126 (76.8)	2 (1.2)	128 (39.4)

Respiratory health symptoms

The cotton textile workers had higher prevalence of respiratory symptoms than the Control group. The following reported respiratory health symptoms cough more days in 3 months, wheezing and all type of dyspnoea were higher among exposed group compare to control group and the differences were statistically significant ($P<0.05$) (Table 2).

Table 2 Prevalence of respiratory symptoms among study participants

Respiratory Symptoms	Exposed n (%)	Control n (%)	P-value
Cough	41 (25.0)	31 (19.3)	0.23
Morning cough	22 (53.7)	14 (45.2)	0.63
Cough day and night	30 (73.2)	26 (83.9)	0.39
Cough 4-6 days a week	25 (61.0)	20 (64.5)	0.8
Cough more days in 3 months	19 (46.3)	2 (6.3)	0.001*
Cough with Sputum	40 (24.4)	38 (23.6)	0.48
Morning cough with sputum	24 (61.5)	22 (59.5)	0.85
Cough day and night with sputum	27 (69.2)	28 (75.7)	0.61
Cough 4-6 day a week with sputum	19 (48.7)	13 (38.2)	0.47
Cough more days in 3 months with sputum	11 (28.2)	7 (18.9)	0.42
Wheezing	39 (23.8)	22 (13.7)	0.02*
Breathlessness			
Dyspnoea I	26 (96.3)	21 (75.0)	0.03*
Dyspnoea II	22 (81.5)	13 (46.4)	0.007*
Dyspnoea III	17 (63.0)	6 (21.4)	0.002*

Cotton dust exposure

Dust samples were collected from three departments which are spinning, weaving and finishing. The department of weaving had higher dust level of arithmetic mean of 2.20 mg/m^3 (SD =0.32) and geometric mean 2.14 mg/m^3 (GSD=0.25) (mg/m^3) (Table 3).

Factors associated with byssinosis

The finding shows that those workers with previous respiratory symptoms had 4.83 times higher odds of developing byssinosis compared to those respondents with no previous respiratory symptoms (AOR=4.83, 95%CI:1.95, 11.98).

After controlling for outliers, working experience was statistically significant (AOR=1.07, 95% CI: 1.01, 1.13), with p-value < 0.02. This shows that for every unit increase in working year experience there is 7% increase in odds of byssinosis holding other factors constant (Table 4).

Citation: Mwelange LP, Mamuya S, Sakwari G, et al. Dust exposure and byssinosis among cotton textile workers in Dar es salaam, Tanzania. *MOJ Public Health.* 2020;9(6):217–221. DOI: 10.15406/mojph.2020.09.00349

Table 3 Dust level in the textile industry by department

Department	Total Dust levels (mg/m^3)		
	GM (GSD)	AM(SD)	95% CI
Spinning	1.92(0.18)	2.03(0.13)	1.99 -2.07
Weaving	2.14(0.32)	2.20(0.25)	2.15-2.26
Finishing	1.36(0.09)	1.64(0.05)	1.63 -1.66

GM - geometric mean, GSD - geometric standard deviation, AM - arithmetic mean, mg/m3 - milligram per cubic meter

Table 4 Multivariable binary logistic analysis of factors associated with byssinosis (N=164)

Variables		Byssinosis		COR (95%CI)	AOR (95%CI)	p-value
		No	Yes			
Departments						
Finishing		31 (81.1)	11 (26.2)	1.00	1.00	
Weaving		69 (85.2)	12 (14.8)	0.49 (0.95, 1.06)	0.40 (0.15, 1.06)	0.67
Spinning		33 (80.0)	8 (19.8)	0.68 (0.24, 1.92)	0.58 (0.15, 1.62)	0.25
Work experience (years)				1.06 (1.01, 1.11)	1.07 (1.01, 1.13)	0.02
Gender						
Female		84 (81.6)	19 (18.4)	1.00	1.00	
Male		49 (80.3)	12 (19.7)	0.9 (0.41, 2.06)	1.5(0.72, 3.118)	0.24
Age(years)						
18 – 38		20 (76.9)	6 (23.1)	1.00	1.00	
39 – 59		93 (82.3)	20 (17.7)	1.20 (0.31, 4.57)	1.21 (0.29, 4.97)	0.79
Above 60		20 (80.0)	5 (20.0)	0.79 (0.21, 2.34)	0.88 (0.26, 2.90)	0.82
Smoking	No	114 (82.0)	25 (18.0)	1.00	1.00	
	Yes	19 (76.0)	6 (24.0)	1.44 (0.55, 3.97)	1.4(0.44, 4.06)	0.60
Previous respiratory symptoms	No	118 (86.1)	19 (13.9)	1.00	1.00	
Yes		15 (55.6)	12 (44.4)	4.97 (2.01, 12.22)	4.83 (1.95, 11.98)	0.001

COR=crude odds ratio, AOR=Adjusted Odds ratio. Controlled for Age, gender; smoking previous respiratory symptoms

Discussion

In this study we assessed dust exposure, and factors associated with byssinosis, among cotton textile workers in Dar es Salaam, Tanzania. In this study, the prevalence of byssinosis was higher among exposed group, compare to control group. The results of this study are similar to other studies done in Benin, Pakistan, and Ethiopia.[4,6,12,13] This justify that exposure to cotton dust is a risk factor for byssinosis.

The findings of this study show a higher prevalence of byssinosis in the finishing department which had more than 25% prevalence of byssinosis. The finding differs with what was reported by other studies which found the prevalence of byssinosis is higher in the spinning department.[4,13] This difference can be due to the fact that workers who have problem in other department are shifted to the finishing department.

The study revealed that workers were exposed to a high level of cotton dust compare to the permissible threshold limit value (TLV, 0.2 mg/m^3).[14] This finding is in contrary with other studies,[15] where they found higher dust in sections of the spinning department. The variation in types of cotton and environmental prevails in the working place can justify the differences in dust level.

The study found that workers who previously had respiratory symptoms had higher odds of having byssinosis. (AOR = 4.83, 95% CI: 1.95, 11.98). This finding shows that, previously respiratory problem significant increase the chance of developing byssinosis.

This study shows that, for every unit year increase in working experience there is 7% increase in odds of developing byssinosis holding other factors constant. The finding is consistent to other studies done in Ethiopia, Benin, and Pakistan[12,13,16] which found that working duration is associated with byssinosis.

Our study did not show clear association between smoking and byssinosis. This finding is similar to what reported by other studies[4,17] which also found that smoking was insignificantly associated with byssinosis. However, there are other research that has shown smoking is associated with byssinosis.[6]

Conclusion

In conclusion, our study shows that workers who are exposed cotton dust have higher prevalence of byssinosis and other respiratory symptoms. Awareness of the byssinosis disease, and necessary preventive measure need to be highlighted among stakeholders.

Citation: Mwelange LP, Mamuya S, Sakwari G, et al. Dust exposure and byssinosis among cotton textile workers in Dar es salaam, Tanzania. *MOJ Public Health.* 2020;9(6):217–221. DOI: 10.15406/mojph.2020.09.00349

Further study, to determine the level of endotoxin in cotton dust and its association to byssinosis is required.

Acknowledgments

My special thanks to NORHED for their financial support which enables the study to be completed. My gratitude to all cotton textiles industry workers participated in this study.

Conflicts of interest

The authors declare that there was no conflict of interest.

References

1. Lai PS, Christiani DC. Long-term respiratory health effects in textile workers. *Curr Opin Pulm Med*. 2013;19(2):152–157.
2. Keregero MC. A study on the performance of textile sector in Tanzania-challenges and ways forward. *International academic research*. 2016;4(5):1–14.
3. Nafees AA, Fatmi Z, Kadir MM, et al. Pattern and predictors for respiratory illnesses and symptoms and lung function among textile workers in Karachi, Pakistan. *Occup Environ Med*. 2013;70(2):99–107.
4. Alemu K, Kumie A, Davey G. Byssinosis and other respiratory symptoms among factory workers in Akaki textile factory, Ethiopia. *Ethiop J Heal Dev*. 2010;24(2):133–139.
5. Altin R, Ozkurt S, Fisekci F, et al. Prevalence of byssinosis and respiratory symptoms among cotton mill workers. *Respiration*. 2002;69(1):52–56.
6. Memon I, Panhwar A, Rohra DK, et al. Prevalence of byssinosis in spinning and textile workers of Karachi, Pakistan. *Arch Environ Occup Heal*. 2008;63(3):137–142.
7. Mansouri F, Pili JP, Abbasi A, et al. Respiratory problems among cotton textile workers. *Lung India*. 2016;33(2):163–166.
8. GhasemKhani M, Kumashiro M, Rezaei M, et al. Prevalence of respiratory symptoms among workers in industries of south Tehran, Iran. *Ind Health*. 2006;44(2):218–224.
9. Mustafa KY, Bos W, Lakha AS. Byssinosis in Tanzanian textile workers. *Lung*. 1979;157(1):39–44.
10. Leidel NA, Busch KA, Lynch jeremiah R. Occupational Exposure Sampling Strategy Manual. *U.S. Department of Health, Education, and Welfare*. 1977;1–132.
11. Cotes JE. Medical research council questionnaire on respiratory symptoms (1986). *Lancet*. 1987;330(8566):1028.
12. Wami SD, Chercos DH, Dessie A, et al. Cotton dust exposure and self-reported respiratory symptoms among textile factory workers in Northwest Ethiopia: a comparative cross-sectional study. *J Occup Med Toxicol*. 2018;13(1):13.
13. Hinson AV, Schlünssen V, Agodokpessi G, et al. The prevalence of byssinosis among cotton workers in the North of Benin. *Int J Occup Environ Med*. 2014;5(4):194–200.
14. Sturgeon DH, Sziklai AT. Integrated hazardous substance tracking and compliance. *Google Patents*. 1998.
15. Sopan I, Dube KJ, Ingale LT, et al. Respiratory Impairment in Cotton-Ginning Workers Exposed to Cotton Dust Respiratory Impairment in Cotton-Ginning Workers Exposed to Cotton Dust. *International Journal of Occupational Safety and Ergonomics*. 2015;19:3–12.
16. Memon I, Panhwar A, Rohra DK, et al. Prevalence of byssinosis in spinning and textile workers of Karachi, Pakistan. *Arch Environ Occup Health*. 2008;63(3):137–142.
17. Sibel Ö, Beyza A, Murat K, et al. Respiratory symptoms and pulmonary function of workers employed in textile dyeing factory in Turkey. Med J Malaysia. 2012;67(4):375–378.