East African Scholars Journal of Medical Sciences
Abbreviated Key Title: East African Scholars J Med Sci
ISSN: 2617-4421 (Print) & ISSN: 2617-7188 (Online)
Published By East African Scholars Publisher, Kenya

Volume-7 | Issue-4 | Apr-2024 | DOI: 10.36349/easms.2024.v07i04.003

OPEN ACCESS

Original Research Article

The Health Effects of Workers Practice in Biological Hazards

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Article History
Received: 03.03.2024
Accepted: 08.04.2024
Published: 13.04.2024

Journal homepage:
https://www.easpublisher.com

Quick Response Code

Abstract: ***Background*:** Exposure to microorganisms could be caused infectious diseases but some exposures were not caused disease in normal situation. Objective of this study was to determine the health effects of biological hazards in low to moderate concentration. ***Methods*:** It was a study. The people who were employed in different industries were participated in this study. Groups were followed for infections in skin, respiratory, mucous membranes, gastrointestinal, urinary and etc. symptoms and signs. These groups were exposed to biological hazards; according to working sections, 3 groups were participated: working section A, working section B and working section C. Symptoms and signs were determined. Data were analyzed with SPSS 16. ANOVA, Chi-2, Exact test and relative risks with considering P<0.05 as significant level. ***Results*:** Working section B, had the most microorganisms; in air: 5.01±0.01 CFU on surface: 10.15±0.01 CFU. Infection in skin, respiratory, mucous membranes, gastrointestinal, urinary and etc symptoms and sign were determined. Skin, gastrointestinal, urinary and etc were the most in group B and relative risks were shown significant risks. Relative risks for skin infection were 1.80(1.12-3.15). ***Conclusions*:** Even in normal situation microorganism in workplace could be caused many infection diseases and prevention was necessary.

Keywords: Biological hazards, Infection, Occupational exposure.

INTRODUCTION

Exposure to microorganisms could be caused infectious diseases but some exposures were not caused disease in normal situation.

Occupational exposures with microorganism could be controlled and occupational health centers in factories, health and medical centers tried to find the best way for decreasing this agent [1]. One of the most harmful occupational exposures was biological factors [1]. One of the known microorganism was bacteria [1, 2].

The main etiology for many of disorders symptoms and signs in the environment and workplaces was biological exposures [1]. But the air pollution was an important exposure in the environment also surface pollution was important. The health system tried to control it in all places [3, 4]. If it was more than standards,0-1,000 number of colony forming units in cubic meters or cfu/m3, they had controlled [5-7]. But in recent years researchers showed symptoms and signs in lower counts in susceptible persons [8, 9].

Exposure to high concentrations of this hazard could be caused an acute infection with acute symptoms and signs for skin, respiratory, mucous membranes, gastrointestinal, urinary and etc [10]. But in lower exposure, might be seen some mild ones [11-14].

Carducci A and coworkers showed the quantitative microbial risk assessment in occupational settings [1]. Fritschi L and coworkers demonstrated the estimated prevalence of exposure to asthmagens in the workforce [2]. Brauner P and coworker worked on automated image analysis for determination of antibody titers against occupational bacterial antigens [3]. Gutarowska B and coworkers studied on microbial contamination within working environments of different types of composting plants [4]. Schantora AL and coworkers showed the prevalence of work-related rhino-conjunctivitis and respiratory symptoms among domestic waste collectors [5].

Van Kampen V and coworkers calculated the concentration of bioaerosols in composting plants [6]. Gołofit-Szymczak M and coworkers demonstrated the exposure of ventilation system cleaning workers to harmful microbiological agents [7]. Duquenne P and coworkers worked on exposure to airborne endotoxins among exposed workers [8, 9]. Ławniczek-Wałczyk A and coworkers showed the exposure to harmful

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microbiological agents during the handling of biomass for power production purposes [10]. Su WC and coworkers showed the evaluation of physical sampling efficiency for cyclone-based personal bioaerosol samplers in moving air environments [11]. Coggins MA and coworkers demonstrated the workplace exposure to bioaerosols in podiatry clinics [12]. Eduard W and coworkers studied about bioaerosol exposure assessment in the workplace [13]. Cho KJ and coworkers showed the comparison of workplace protection factors for different biological contaminants [14]. Danyluk Q and coworkers worked on health care workers and respiratory protection [15]. Fallschissel K and coworkes showed the direct detection of salmonella cells in the air of livestock stables by real-time PCR [16]. Cyprowski M and coworkers had an assessment of occupational exposure to fungal aerosols in wastewater treatment plants [17]. Liebers V and coworkers showed the health effects due to endotoxin inhalation [18].

Leggat PA and coworkersstudied about occupational health problems in modern dentistry [19].

Gioffrè A and coworkers had an evaluation of occupational exposure to biological agents, endotoxins and PNOC in a sewage treatment plant [20].

Anderson ME and coworker studies about environments, indoor air quality, and children [21].

Chew GL and coworkers showed the mold and endotoxin levels in the aftermath of Hurricane Katrina: a pilot project of homes undergoing renovation [22]. Researchers worked on measurement of risks in the workplaces. There were some studies about the preventive methods from occupational exposures in this situations. Health programs for workers were necessary and assessing and measuring the biological hazards were important subject in this situation [23-25].

Objective of this study was to determine the health effects of biological hazards in low to moderate concentration.

METHODS

Study Setting; different industries.

Study design and Study population; it was a study with follow up. The people who were employed in different industries were participated in this study. Groups were followed for infections in skin, respiratory, mucous membranes, gastrointestinal, urinary and etc. symptoms and signs. These groups were exposed to biological hazards; according to working sections, 3 groups were participated: working section A, working section B and working section C. Symptoms and signs were determined. Data were analyzed with SPSS 16. ANOVA, Chi-2, Exact test and relative risks with considering $P<0.05$ as significant level.

Simple random sampling method was used with $\alpha= 0.05$, power= 80, P1=32% and P2= 42%. These groups were exposed to low to moderate microorganisms count; according to working section the population was divided to three groups. Symptoms and signs were determined by using questionnaire and clinical examinations.

Symptoms and sign were related to infections of skin, respiratory, mucous membranes, gastrointestinal, urinary, etc.

The Inclusion criteria were people who worked in different industries with at least 2 years work experience in the same work. The exclusion criteria were having the related diseases in Symptoms and sign were related to infections of skin, respiratory, mucous membranes, gastrointestinal and urinary, before beginning this job and having the positive family history of skin, respiratory, mucous membranes, gastrointestinal, urinary, etc.

Exposure assessment; all exposures assessed and calculated the risks. Other work exposures were kept in the standard levels. Microorganism count measured and calculated according to standards of occupational safety and health administration and committee on bioaerosols guidelines for assessment and sampling of saprophytic bioaerosols in the indoor environment in applied industrial hygiene 2(5): RIO to R16 and rationale for monitoring viable microorganisms in the office environment in applied industrial hygiene 1: R19-R23 by using viable biological samplers.

The validity and reliability of questionnaire were checked with specialists' opinions and also with performing a pilot study with correlation coefficient 94%. The participants were examined by author using a questionnaire, physical exams.

For statistical analysis, data were analyzed with SPSS 16. Chi-2, Exact test, ANOVA, P value less than 0.05 was considered for significant levels and relative risks were calculated with confidence interval 95%.

Ethical consideration; the study was implemented with the consent that was obtained from all the participants.

RESULTS

The study participants were divided into 3 groups based on psychological stresses; group 1: n= 1000, group 2: n=1000 and group 3: n=1000.

Working section B, had the most microorganisms; in air: 5.01±0.01 CFU on surface: 10.15±0.01 CFU. Infection in skin, respiratory, mucous membranes, gastrointestinal, urinary and etc symptoms and sign were determined. Skin, gastrointestinal, urinary and etc were the most in group B and relative risks were

shown significant risks. Relative risks for skin infection were 1.80(1.12-3.15).

Table 1 showed the minimum, maximum and means of microorganism count in three groups. Group B had the highest concentration, group A and C had the lowest concentration of microorganism count. There were significant differences between three groups (P<0.05).

The highest number of symptoms and signs of related infections were in group B: skin, respiratory, mucous membranes, gastrointestinal, urinary and etc. The lowest number of symptoms and signs was from group A. There were significant differences. These items were demonstrated in table 2 (P<0.05).

The relative risks for symptoms and signs were determined, group B had the highest risks. Relative risk in group B for gastrointestinal infection was 1.08(1.01-2.75) and for urinary infection was 1.05(1.10-2.81). Relative risk in group A and C for skin infection were 1.55(0.06-3.54), 1.65(0.05-4.15) and for respiratory infection were 1.60(0.04-3.74), 1.45(0.02-2.90). Table 3 shows the relative risks in different groups. By using the logistic regression, these were had significant differences. Staph coagulase (+) and klebsiella were positive.

Table 1: Means of microorganisms count in CFU and comparison between working sections (P<0.05)

Group Variable	working section A Air Surface	working section B Air Surface	working section C Air Surface
Concentration Minimum	3.25±0.10 2.24±0.10	4.01±0.01 10.10±0.10	3.20±0.05 5.75±0.01
Concentration Maximum	5.30±0.01 10.22±0.06	6.02±0.02 10.20±0.50	3.20±0.10 10.25±0.03
Concentration Mean±SD	4.25±0.12 6.20±0.05	5.01±0.01 10.15±0.01	3.02±0.02 7.50±0.02
P value	0.001		

Table 2: Frequencies of symptoms and signs and comparison between working sections.(P<0.05)

Groups Symptoms and signs	working section A N(%)	working section B N(%)	working section C N(%)	P value
skin infection	10(1.0)	20(2.0)	15(1.5)	0.001
respiratory infection	15(1.5)	15(1.5)	12(1.2)	0.03
mucous infection	15(1.5)	15(1.5)	13(1.3)	0.001
gastrointestinal infection	5(0. 5)	12(1.2)	6(0. 6)	0.03
urinary infection	4(0. 4)	11(1.1)	5(0.5)	0.03
other infection	2(0. 2)	5(0.5)	3(0.3)	0.001

Table 3: Relative risk of symptoms and signs between working sections (P<0.05)

Groups Symptoms and signs	working section A RR(CI)	working section B RR(CI)	working section C RR(CI)
skin infection	1.55(0.06-3.54)	1.90(1.12-1.25)	1.65(0.05-4.15)
respiratory infection	1.60(0.04-3.74)	1.18(1.13-1.26)	1.45(0.02-2.90)
mucous infection	1.57(0.05-3.70)	1.09(1.02-1.29)	1.55(0.05-3.64)
gastrointestinal infection	1.07(0.12-3.52)	1.08(1.01-2.75)	1.14(0.07-3.10)
urinary infection	1.02(0.12-2.32)	1.05(1.10-2.81)	1.09(0.01-2.70)
other infection	1.01(0.01-2.30)	1.04(1.05-2.57)	1.03(0.02-2.50)

DISCUSSION

According to our findings, Working section B, had the most microorganisms; in air: 5.01±0.01 CFU on surface: 10.15±0.01 CFU. Infection in skin, respiratory, mucous membranes, gastrointestinal, urinary and etc symptoms and sign were determined. Skin, gastrointestinal, urinary and etc were the most in group B and relative risks were shown significant risks. Relative risks for skin infection were 1.90(1.12-1.25).

According to the finding; group C had the highest number of symptoms and signs for infections in skin, respiratory, mucous membranes, gastrointestinal, urinary and etc. The lowest number of symptoms and signs was from group A and B. Group A had the lowest concentration of microorganism in the surfaces and group C had the lowest in air of workplaces. There were significant differences.

The relative risks for symptoms and signs were calculated, group B had the highest relative risks. Relative risk in group B for gastrointestinal infection was 1.08(1.01-2.75) and for urinary infection was 1.05(1.10-2.81). Relative risk in group A and C for skin infection were 1.55(0.06-3.54), 1.65(0.05-4.15) and for

respiratory infection were 1.60(0.04-3.74), 1.45(0.02-2.90). Staph coagulase (+) and klebsiella were positive.

There were significant too. By using the logistic regression, these were had significant differences. It mean symptoms and signs were not related to body mass index, age, other occupational exposure and environmental exposures.

Other studies showed the same as these results and demonstrated the special effects of microorganisms on skin, respiratory, mucous membranes, gastrointestinal, urinary [23, 24]. Microorganisms had effects on different part of the body, we thought it affected on all of them from skin to respiratory system [20].

It seems that microorganisms that was emphasized on vital and other organ systems [2, 3]. These were more prominent on skin and respiratory. In this study researcher showed that group B had the most frequency infection in skin, respiratory, mucous membranes, gastrointestinal and urinary. This group had the highest level of microorganisms such as Staph coagolase (+) and klebsiella were positive. Other studies had demonstrated the harmful effects of biological hazards [1, 2].

After deleting the effects of age, body mass index and other exposures the risk of diseases had significant difference. The risk of respiratory infection symptoms and related diseases was demonstrated in other studies too [2, 3]. Skin and mucous membranes infections symptoms could be caused by exposure to microorganisms [2, 3]. This study showed the effects of low concentration of this hazards on infection symptoms and signs in these organ systems.

The physician must not ignore this important item in occupational health system. Modifying the workplace specially from biological hazards; normal floar was necessary and then employee could be worked very well [20, 21].

According to the results of this study, researcher thought that specific job analysis must be done for all workers and must be measured all of risk hazards in the work place. In other studies were worked on determination of risk factors by emphasized on gases in related industries [21, 22].

Frequency of symptoms and signs were important and were gathered by reliable and valid questionnaires. Some studies used questionnaires as the same as this study [21, 22].

Author found that the microorganism was an important risk factor for skin, respiratory, mucous membranes, gastrointestinal and urinary infections even in low to moderate concentrations. Low to moderate concentration in long time might be followed by these infections symptoms and signs [2, 3].

Examination in occupational had an important situation. Infectious disorders could be prevented by periodic examinations and assessments of pollutants. The author of this article recommended to the occupational physicians and occupational health team, must be assessed the risk factors in the workplaces specially biological factors and tried to modified the workplaces, they should be examined personnel in periodic examinations and assessed the exposures.

Biological hazards exposure could be resulted from environmental exposures and air pollution, occupational health team might be paid attention.

CONCLUSIONS:

Even in normal situation microorganism in workplace could be caused many infection diseases and prevention was necessary.

Acknowledgement

The author would like to thank the Vice Chancellor for Research of Mashhad University of Medical Sciences for supporting the research project (950773).

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Cite This Article: Seyedeh Negar Assadi (2024). The Health Effects of Workers Practice in Biological Hazards. *East African Scholars J Med Sci*, *7*(4), 129-133.