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Investigation of Bacterial and Fungal Load of Five Printing House in Kahramanmaraş City

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Abstract: Employee health is one of the mos portant issues in the printing sector as well as in all sectors. In addition to the chemical stances in printing, some of the pathogenic bacteria and fungi that are formed in the e ment m reaten the working health if factors such as the printing materials used, humidit m ure in the environment can not be controlled. In our study, it was aim to determ cterial and fungal load in the internal environment of the printing ho ing in different regions in Kahramanmaraş Province. In the scope of the study, petri p me used for indoor sampling. Rose Bengal Streptomycin Agar (RSBA) was used for s lin ampling, incubation was performed at 27^{0}C for 7 days. After incubation, morpholog acteristics of fungal colonies were examined and pure cultures were transf ctive n Fungus colonies were identified as genus and species level with morpho al acteris According to the results of the study, it was determined that the prin ouse re exposed to indoor pathogens intensely. The most fungi are *Penicillium* and were found to be followed by *Cladosporium* and *Alternaria* species. ng t ecies, species known as allergy sources have been identified. In such environ , it is nec to take preventive measures for these microorganisms.

Key ing house, fungus, bacteria, allergy

hramanm taki Beş Matbaanın Bakteri ve Mantar Yükünün İncelenmesi

Çalış sağlığı tüm sektörlerde olduğu gibi matbaacılık sektöründe de en önemli ko n bi . Matbaacılıkta kullanılan kimyasal maddelerin yanı sıra kullanılan baskı altı malz tamdaki nem, sıcaklık gibi etkenlerin kontrol altında tutulamaması durumunda rtamda an bazı patojen bakteriler ve mantarlar çalışan sağlığını tehdit edebilir. Bu çalışmada Kahramanmaraş ilinde bulunan farklı mahallelerde faaliyet gösteren matbaaların iç ortamında bakteri ve mantar yükünün belirlenmesi amaçlanmıştır. Çalışma kapsamında iç ortamdan petri plak yöntemi ile örnekleme yapılmıştır. Örnekleme için Rose Bengal Streptomisin Agar (RSBA) kullanılmıştır. Örnekleme sonrası laboratuarda 7 gün süre ile bırakılmıştır. İnkübasyon sonrası fungal koloniler morfolojik özellikleri incelenerek seçici besiyerlerine saf kültürleri elde edilmiştir. Fungus kolonileri morfolojik kriterler doğrultusunda cins ve tür düzeyinde tanımlamaları yapılmıştır. Çalışma sonuçlarına göre matbaalarda birçok fungus türüne maruziyet olduğu belirlenmiştir. Bu fungus türlerinin başında *Penicillium* ve *Aspergillus* türlerinin yer aldığı, bunları *Cladosporium* ve *Alternaria* türlerinin takip ettiği belirlenmiştir. Bu türler içerisinde alerji kaynağı olarak bilinen türler tespit edilmiştir. Bu gibi ortamlarda bu mikroorganizmaları önleyici tedbirler alınması gerekliliği ortaya konulmuştur.

Anahtar kelimeler: Matbaa, mantar, bakteri, alerji

Introduction

With the developing industrialization in the world, the number of diseases caused by industrial working environments has increased. For this reason, studies are carried out to determine occupational diseases originating from the working environment. With the development of technology, the printing industry has become connected with almost all sectors (Yavuz, 2016). According to social security Institution statistics, Turkey in the printing industry in 2012 395 cases of occupational diseases were observed. 395 occupational disease cases were seen in the printing sector in 2012. 173 employees have become permanently incapacitated as a result of occupational disease. The causes of these diseases are the pathogen and allergen bacteria and fungi that are constantly growing in the printing house as well as the hazardous chemicals used in the facility environment. There are many studies examining the bacterial and fungal concentrations for the determination of indoor air quality (Adams et al 2014; Jafari et al, 2015; Adams et al,2015; Hanson et al, 2016; Nevalainen et al, 2015; Güneş Et al, 2016; Weikl et al, 2016; Ogbu et al, 2016; Benammar et al, 2017; Pokhum et al, 2018).Bacterial infections a fungal allergens constitute a significant expense countries' health expenditures.

The purpose of this study determine the bacterial an fungal load in different printing houses. D ion of indoor air fungal and bacterial load imp nt in determining the microorganisms tha be of disease and taking necessary ecau

Material and metod

Sampling was ma he working hours of the staff in 5 different pri ng ho erating intensively in Kahramanmara center.

Prepara of m ia: Rose-bengal-Streptomycin Agar (RBA) sed irst medium for the isolation and diagnosis of nali , 2011a). The isolates obtain fter i e inoculated into flat agar tub -term on special media (Malt Extract , Cza Dox Aga) for diagnosis (Biyik et al. 2005). CA) was used to determine bacterial lo

ling from the station: In the samples, Gravity sed Petri Plate Method was used. Simultaneously at all stations, it is taken from a height of 1.5 meters above the ground. Five (5) petri plates containing the appropriate medium were provided to contact with air by leaving the lid open for 15 minutes. The closed plates were wrapped with stretch film and brought to the laboratory for incubation. Incubation was performed for 48 hours at 37 °C for growth of bacteria and 7-10 days at 27 °C for growth of fungi (Sarıca et al, 2002).

Identification: The total number of microfungi was determined according to the macroscopic appearance obtained at the end of incubation. The follo ources were used for identification of microfun glu (1991), Samson and Pitt (2000), Ca and J n (2013) and Walsh et al. (2018). Base se so s, identification of genus and spe leve ex ed under light microscope and oscopic an copic structures.

Results

The numb bacteria indoor air of the printing hou the genera d species level of microfungi ntifi re made. The following Table 1 shows the percentag acteria and microfungi.

T 1. Percentage of bacteria and microfungi mined in study

Sta	Bacteria (%)	Microfungi (%)
1	35,90	7,14
2	14,53	39,29
3	5,98	0,00
4	39,32	53,57
5	4,27	0,00

When Table 1 was examined, it was seen that the highest bacterial load was in station number 4 and the least bacterial load was in station number 5. At the same time, microfungi were not found in stations 3. and 5. while fungal diversity was determined to be the highest in station 4. When the table was examined, it was determined that the bacteria rate was the highest (39.32%) and the microfungus percentage was the highest (53.57%) in the 4th station.It was determined that the stations with the lowest bacterial density are stations 3 and 5. The majority of bacteria and microfungus organisms were found to be in the paper stack area in the printing house. It should be noted that the higher the bacterial flora in the indoor air of the studied facility, the higher the number of microfungi. Therefore, ventilation systems should be developed and widespread use in working environments.

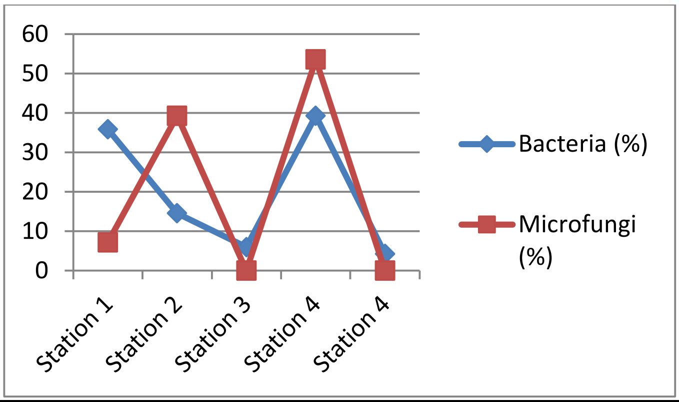

Figure 1. Graphical representation of bacteria and fungi

Table 2 below shows the microfungus species identified in the study.

Table 2. Microfungus species identified in the study

Mikrofungi genus and species	
***Aspergillus* P. Micheli ex Haller** *Aspergillus niger* Tiegh. *Aspergillus flavus* Link *Aspergillus fumigatus* Fresen.	Samson and Pitt, (2000) Campbell and Johnson, (2013)
***Alternaria* Nees** *Alternaria alternata* (Fr.) Keissl. *Alternaria brassicicola* (Schwein.) Wiltshire	Hasenekoğlu, (1991)
***Penicillium* Link** *Penicillium* sp. *Penicillium chrysogenum* Thom *Penicillium brevicompactum* Dierckx *Penicillium commune* [illegible] *Penicillium thomi* M[illegible]re	Sa[illegible]nd Pitt, [illegible] Pitt, (2[illegible])
***Mucor* Fresen.** *Mucor hiema*[illegible]*ehm*[illegible]	Hasenekoğlu, (1991)
***Clados*[illegible] Lin[illegible]** *Cla*[illegible]*m cl*[illegible]*es* [illegible] A. de V[illegible] [illegible]*dos*[illegible]*sporum* [illegible] *C*[illegible]*rium oxysporum* Berk.[illegible] Curtis	Hasenekoğlu, (1991)

In our country, many studies have been conducted to determine the indoor air fungal and bacterial load (Imali et al, 2011a; Sarıca et al, 2002; Aydogdu et al, 2005;). The determination of indoor air fungal and bacterial concentration is important for the prevention of parameters affecting human health in different workin[illegible]ments. Demirel et al. (2017) reported that [illegible]vus fungus is a thermotelorant and may b[illegible]nfectiou[illegible]nt. In our study, *Aspergillus* species w[illegible]ntified [illegible]e sampling area. *Aspergillus* s[illegible]spor[illegible]ich[illegible]se allergen sources and other d[illegible]ses, wer[illegible]tified (Sugeçti et al. 2018) [Tabl[illegible] *Asp*[illegible]*llus* sp[illegible], which is a dominant species [illegible]tu[illegible] intensively by many scientist Pitt and Taylor ([illegible]amso[illegible] Pitt (2000), İmalı et al.(2011b)[illegible]ng e[illegible]16[illegible] Nascimento et al. (2019).

Alabbasy (20[illegible]ted that *Pe*[illegible]*ium* spp.,*Aspergillus* spp.,*Altern*[illegible]sp[illegible] *Cladosporium* spp. were found in his study on [illegible]aper m[illegible] *Penicillium* species were found to be [illegible]ost comm[illegible]cies in the printing facilities wh[illegible]pling is taken w[illegible]hin the scope of the study. This w[illegible]ollowed by *Aspergillus*, *Alternaria, Cladosporium* and [illegible]*or* respe[illegible]y. Some species belonging to these g[illegible] are fo[illegible]o be common in the air and spores have al[illegible]es (Imalı et al, 2011b)[Fig. 1]. It can also be c[illegible] that the paper origin used also contributes [illegible] the reproductive environment of the microfungi. The [illegible]ng Figure 1, shows the images of the microfungi [illegible]ed in the study.

Routine health screening of working people is important as an indicator of immune system parameters, early detection and prevention of bacteria and fungal infections. In addition, improvement of working conditions (air filtration (Burrell, 1991) removal of biological resources (Nevalainen et al, 2015) etc.) is necessary to protect employee health. It is possible to develop immunoprotective antifungal strategies (prophylaxis, empirical and preventive).

Conclusion

Identifying and identifying microfungi in the workplace is important for eliminating employee exposure. *Penicilium*,*Aspergillus*, *Alternaria*, *Cladosporium* and *Mucor* species which are commonly found in airborne microfungi have been reported to be allergen. It has been demonstrated that the necessary controls of the personel working in closed environments should be made and that they should be included in the diseases list such as COPD, asthma and allergy..

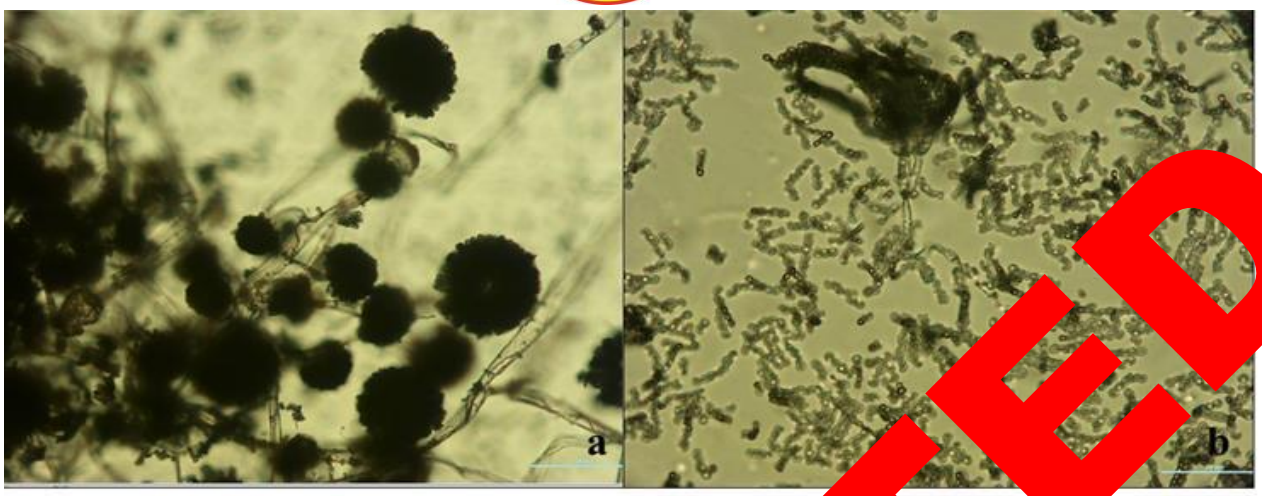

Figure 2. Images of microfungi obtained in the study [a: *As* ... b: *Penicill* ... (40x)

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