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Sick Building Syndrome and Its Relationship With Work Stress as a Psychosocial Risk: A Shopping Mall Example

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ABSTRACT

Recently, buildings, residences, plazas, shopping malls, skyscrapers and towers that have been rising all over the world have begun to form our living spaces as smart structures where private, social and business lives are carried out. The fact that these closed spaces threaten the health of people living and working in them and cause diseases, has led to these buildings being called "sick building syndrome (SBS)". Sick building syndrome results in the health of people who spend time and work in these buildings being affected both physically and psychologically. The aim of this study is to reveal the symptoms of sick building syndrome and its effects on stress, which is a psycho-social risk at workplace. A cross-sectional study conducted in two randomly selected shopping malls in Turkey involved 268 employees. Research findings indicate that employees suffer from symptoms like dry throat, runny nose, eye irritation, headaches, muscle-joint pain and fatigue. Additionally, it has been observed that these symptoms intensify during peak weekend traffic Moreover, the sick buildings phenomenon increases the stress levels of employees' due to the conditions associated with enclosed spaces.

Keywords: Sick building syndrome, Psycho-social risk, Shopping mall, Symptoms

INTRODUCTION

The building design process can be seen as a system consisting of subsystems that appropriately incorporate the elements of a bio-climatic perspective. Constructing buildings in a manner that has minimal impact on the environment, making them eco-friendly, focusing on human health, comfort, and safety, and ensuring efficiency, making buildings energy-friendly for energy savings, are design processes that have recently attracted significant attention (Guy and Farmer, 2001).

For a building to be defined as human-friendly, both physical and environmental (thermal, auditory, visual, chemical, etc.) characteristics must be designed to suit humans, prioritizing the health and safety of building users (Abidin and Powmya, 2014). Buildings that are designed with consideration for factors such as physical and environmental attributes, architectural features, spatial design, physiological and demographic indicators, as well

as safety elements incorporated into the space, are those that prioritize eco-friendly strategies (Zr and Mochtar, 2013; Bougdah, 2010).

Buildings surrounding modern urban life; residences, shopping malls, plazas, skyscrapers, and towers, sometimes as private, sometimes societal, and sometimes as smart structures where business life is sustained, continue to rapidly fill and transform urban living spaces (Aytaç and Tüfekçi, 2018).

A study conducted by the United Nations shows that people spend 88% of their daily time in indoor environments. Considering that almost all of daily actions, movements, and lives occur in indoor spaces, it is an undeniable fact how important these indoor spaces are in the social process.

These buildings, designed to help people keep up with the fast pace of life and live more comfortably, safely, and conveniently through modern technology, also emerge as the main elements threatening human health, preventing quality and efficient living, and reducing productivity in working life (Demirarslan and Başak 2018). For these reasons, these buildings have become topics that need to be carefully researched as indicators of negative lifestyles. The emergence of physical and psychological health problems and diseases in individuals living and working in these spaces has led to these buildings being referred to as Sick Building. Therefore, it can be said that Sick Building Syndrome (SBS) is an important and noteworthy issue in terms of occupational health and safety. SBS adversely impacts the physical and psychological well-being of individuals who inhabit or work in these environments, necessitating an examination of its symptoms and their correlation with workplace stress.

The purpose of this study is to reveal the relationship between physical symptoms that may be seen in employees working indoor shopping malls and stress, which is one of the psychosocial risks.

SICK BUILDING SYNDROME AND SYMPTOMS

Sick Building Syndrome will primarily result in the health of individuals working in these buildings being affected both physically and psychologically (Gomzi and Bobic, 2009). Symptoms that appear while living or working in a specific building but disappear upon leaving the environment are referred to as "SBS symptoms." Complaints can be observed in a specific room, section, or throughout a large area of the building. Symptoms are directly related to the time spent in the building but often cannot be attributed to a specific cause. In this syndrome, symptoms decrease or completely disappear after leaving the workplace and recur upon returning to the space (Otlu. 2012).

Sick Building Syndrome is defined by Spurgeon and colleagues using the biopsychosocial model, which states that the symptoms of SBS have three interactive pathways (Gomzi et al., 2007). These are, respectively:

1. **Somatic (related to body cells)**: bodily interactions such as allergic (atopy), mucous secretion (mucosal), and attention deficit, hyperactivity (hyperactivity).
2. **Environmental factors**: physical, biological, and chemical hazards, heating and ventilation systems, excessive electrical load, paint, moisture

flooring, noise, cleaning products, office supplies and machines, etc., which are air pollutants.

3. **Psychosocial factors (individual and sociological factors such as personality and behavior)**: Some psychosocial factors related to the work environment, such as stress, burnout, anxiety, position in the job hierarchy and emotional stability, excessive workload, stress, lack of cooperation, support among employees, and various conflict situations in the workplace.

Studies have shown that SBS affects psychological health as well as its effects on the body (Mendelson et al., 2000; Miskulin et al., 2014; Barmark, 2015). Particularly, the presence of stress among the significant determinants of SBS poses a threat not only to employee health but also to job safety. It is clear that issues such as inattention and loss of concentration caused by stress will endanger safety. Therefore, it can be said that SBS is an important issue in terms of occupational health and safety.

When examining first studies on SBS, the study by Nordström and colleagues (1995) in a hospital in Sweden, which measured the impact of air quality and personal factors on SBS, found that a large portion of the 225 hospital employees exhibited symptoms consistent with SBS. The most commonly observed symptoms were dry or flushed facial skin, throat dryness, fatigue, headache, and eye irritation.

In the study by Tarcan and colleagues (2000) investigating the impact of building quality and health enterprises on performance, hospitals were grouped according to their ownership, and information was collected regarding indoor air quality, lighting, ergonomics, noise levels, health complaints related to the work environment, and the overall adequacy of the buildings. The study found a relationship between health complaints arising from the workplace and the overall adequacy of the building and that there were differences in the overall adequacy of the buildings among hospitals. Furthermore, based on the analysis results regarding comfort, health complaints arising from the work environment, and overall adequacy levels, it was determined that, starting from the best, private hospitals were followed by state and university hospitals, respectively (Tarcan et al., 2000).

According to the results of a study conducted on 3507 people in Denmark, 27% of employees experienced nose, eye, or throat irritation, and 36% exhibited general symptoms associated with SBS such as fatigue, exhaustion, and headaches (Ağca, 2005). In a study conducted on 469 office workers in the Hong Kong and Shenzhen regions, it was found that more than half of the participants showed symptoms of Sick Building Syndrome (Gou and Lau, 2012).

Dhungana and Chalise (2020) conducted a study among 234 commercial bank employees in Nepal to assess the prevalence of SBS symptoms and associated factors among bank employees. The study found that the prevalence of respiratory and dermal (skin) disease symptoms was 47.6%, 11.9%, 11.9%, and 8.1%, respectively. The perceived physical indoor environment was considered a significant predictor of SBS symptoms. Additionally, age, discomfort with temperature, and job pressure were

significantly associated with general symptoms, highlighting the importance of maintaining appropriate room temperature, noise control, good ventilation systems, and promoting a supportive psychosocial working environment in banks to prevent and control employees from suffering from SBS symptoms (Dhungana, Chalise, 2020).

In a study conducted by Akalp and colleagues (2021) to draw attention to symptoms that may be seen in people who have stayed indoors for a long time due to the COVID-19 pandemic, it was found that the symptoms that may arise from long-term indoor living during the global quarantine initiated by the World Health Organization with the slogan "stay home" due to the COVID-19 pandemic increased stress alongside the global fear and anxiety affecting on all individuals.

As a result of a study conducted on 966 students to evaluate the relationship between the prevalence of SBS and indoor air quality in primary schools in rural and urban regions in the west of Turkey; The prevalence of SBS was found to be 10.2%. The most common SBS symptoms were listed as fatigue, nasal congestion and runny nose, cough and headache. Additionally, there was a relationship between SBS and discomfort with indoor air quality and increased CO2 and PM values (Tekin and Arıkan, 2023).

METHODS

In this study, a survey method consisting of questions prepared by the researchers and associated with the relevant literature was used. A total of 50 questions were included in the survey form. Following the university's Ethics Committee approval (2023-02/7), survey forms were distributed in sealed envelopes to 300 store employees across two shopping malls in our city via random sampling. The researchers collected these within one week. A total of 268 usable data (response rate of 89%) from the collected survey forms were statistically analyzed using the SPSS 23 software package.

Descriptive statistics, frequency, and percentage distributions related to demographic characteristics (gender, age, education level) and items in the data collection tools were examined in the study. Correlation analysis was conducted to reveal the relationship between two variables, and regression analysis was performed to measure the impact of SBS on stress.

51% of the participants were women (138 people), and 49% were men (130 people). 37% of the participants were between the ages of 18-25. Only 12% of the employees were over 40 years old (min.18- max.50), and 58% were single. 47% of the participants had high school level education, while 24% had higher education. 38% had been working for 1–5 years. 84% of the participants had been working in the current indoor shopping mall for 1–5 years, and most of participants were full-time employees (92%).

To the question, "Have you ever been diagnosed with allergic rhinitis, pharyngitis, or asthma?" 15% stated that they had been diagnosed with asthma, and it is noteworthy that 40% of those had received this diagnosis after starting to work in this workplace. 59% stated that their working environment was quite stressful. To the question, "Do you have any illnesses

that are not work-related and require doctor supervision?" 82% of the participants answered No, and 18% answered Yes.

In the study, the following measurement tools were used:

- A personal information form to measure demographic information such as age, gender, education level, and duration of work.
- A 12-item SBS symptom questionnaire developed by the London Hazards Centre, Interchanges Studios, to detect physical symptoms such as watery eyes and headaches. These questions were measured with a 4-point scale for each item: 1: None, 2: Rarely (once a week), 3: Often (at least 2–4 times a week), 4: Constantly (5 times a week). Additionally, each question asked if the symptoms decreased and disappeared after leaving the work environment and whether the symptoms increased more on weekends. The internal consistency for this section was calculated as 0.90.
- The 7-item Job Stress Scale developed by House and Rizzo (1972) and adapted to Turkish by Efeoğlu (2006). This scale was measured with a 5-point Likert type assessment (1: strongly disagree, 2: disagree, 3: neutral, 4: agree, 5: strongly agree). (Cronbach's alpha = 0.89).
- The 12-item Psychical Symptoms Inventory (PSI) developed by Spector and Steve M. Jex (1997) to measure stress-related physical symptoms. (Cronbach's alpha = 0.90).

The current research has a two-dimensional structure. In the first stage, the research aims to describe the symptoms in the context of SBS, determine the changes in symptoms in the work environment, and identify the differentiation of symptoms during high-intensity times such as weekends, making it descriptive in this context.

Subsequently, the study aims to determine the relationship between Symptoms and stress and impact of SBS symptoms on stress, which is one of the psychosocial risks. In this context, based on the literature, the following hypotheses were proposed (Mendelson et al., 2000; Yücel et al., 2011; Miskulin et al., 2014; Barmark, 2015):

- H_1: There is a relationship between Sick Building Syndrome symptoms and stress-related symptoms.
- H_2: Sick Building Syndrome symptoms increase an individual's stress level.

RESULTS

After the analysis performed on the scales to be used in the research, it was observed that the skewness and kurtosis values met the normal distribution criteria (Tabachnick and Fidell, 2013). Therefore, parametric analyses were used in the analysis of the variables.

Following the evaluation of the findings, the general evaluation workplace condition of the participants are as follows:

Table 1. Participants' general evaluations about workplace conditions.

Personal Assessment of the Workplace	Always		Often		Occasionally		Never	
	N	%	N	%	N	%	N	%
1. The air inlet is very few	33	**28,8**	15	12,6	30	26.1	37	32,4
2. Excessive ventilation	20	17,9	20	17,9	28	25,5	42	38,7
3. too dry	19	16,5	26	22,9	34	30,3	34	30,3
4. Excess moisture	9	7,5	10	8,5	16	14,2	75	69,8
5. Very hot	11	9,3	33	29,6	42	38,0	26	23,1
6. Very cold	9	7,5	5	3,8	35	32,1	61	56,6
7. **Very bright**	50	**44.1**	36	31.5	12	9.9	17	14.4
8. More dim	8	6.5	3	1.9	15	13.0	86	78,7

As seen in Table 1, participants emphasized the excessive brightness of their workplace (44%).

In the research, participants were asked about the frequency of symptoms that had bothered them in the last 3 months and whether these symptoms decreased after leaving the workplace or increased on weekends. The percentage distributions of the responses are shown in Table 2.

Table 2. Frequency of symptoms that bothered the participants in the last three (3) months (%).

Symptoms	None	Rarely (Once a week)	Frequently (At least 2–4 times a week)	Continuously (5 times a week)	Do the symptoms decrease or disappear when you leave the work environment?		Do symptoms worsen on the weekend?	
					No	Yes	No	Yes
1. Burning-stinging, watering, redness in the eyes	43	34	16	7	36	64	41	59
2. Dry throat, sore throat, dry cough	37	22	22	19	25	**75**	23	**77**
3. Runny nose, nosebleeds, congestion	15	58	9	18	23	**77**	25	**75**
4.Unpleasant odor sensation	52	26	14	8	37	63	34	66
5. Shortness of breath	71	11	9	9	45	53	54	46
6.Fatigue-exhaustion, weakness	16	21	21	42	4	**96**	18	**82**
7. Restlessness	19	70	7	4	45	55	44	56
8. Headache	16	19	31	34	6	**94**	15	**85**
9. Dizziness	78	11	8	3	46	54	50	50
10. General muscle-joint pain	29	23	15	33	18	**82**	23	**77**
11. Dry skin, skin redness, skin itching	9	59	8	24	22	**78**	27	**73**
12.Concentration problem	67	17	7	9	41	59	60	40

As seen in Table 2, the most common complaints among participants were fatigue, exhaustion, and weakness (96%), followed by headache complaints (94%), and general muscle, joint, and muscle pain (82%). It was noteworthy that 85% of those who reported complaints said their headache symptoms and 82% said their fatigue and weakness symptoms increased on weekends at crowded days when working at high tempo. Another important point is that they stated that these symptoms decreased or disappeared when they moved away from where they worked.

Table 3. t-Test for decrease or disappearance of SBS symptoms when leaving the work environment.

Symptoms of sick building syndrome	The decrease or disappearance of symptoms when leaving the work environment		t	p
	No	Yes		
1.Burning-stinging, watering, redness in the eyes	2.44±1.05	2.75±0.999	−1.77	0.08
2.Dry throat, sore throat, dry cough	*1.91±0.84*	*2.81±0.84*	*−5.13*	***0.00***
3.Runny nose, nosebleeds, congestion	*2.09±0.64*	*2.80±1.11*	*−3.76*	***0.00***
4.Unpleasant odor sensation	2.94±0.57	3.20±0.93	−1.09	0.27
5.Shortness of breath	3.48±0.75	3.39±0.81	0.433	0.66
6.Fatigue-exhaustion, weakness	*1.97±0.98*	*2.66±1.16*	*−2.748*	***0.00***
7. Restlessness	2.56±1.14	2.99±0.98	−1.69	0.09
8.Headache	*2.24±1.05*	*3.00±1.15*	*−2.855*	***0.00***
9.Dizziness	2.35±0.98	2.73±0.97	−1.51	0.13
10.General muscle-joint pain	*2.23±0.71*	*3.25±1.04*	*−4.56*	***0.00***
11. Dry skin, skin redness, skin itching	*1.93±1.12*	*2.53±1.08*	*−2.62*	***0.01***
12.Concentration problem	2.16±1.13	2.63±1.30	−1.66	0.10

According to Table 3, it was observed that 6 out of 12 symptoms (dry throat, runny nose, fatigue, headache, general muscle-joint pain and skin dryness) increased when leaving the work environment.

When the participants were asked about the frequency of the symptoms they observed in the last month, 45% stated constant fatigue almost every day, 32% stated headache most of the time, and 26% stated eye fatigue.

To investigate whether there is a relationship between participants' stress levels and stress-related physical symptoms, correlation analysis was conducted to measure the relationship between stress and symptom variables.

Table 4. Correlation analysis between stress and physical stress symptoms.

	Physical Stress Symptoms
Stress	,632**

**. Correlation is significant at the 0.01 level (2-tailed).

As seen in Table 4, the findings indicate a positive and significant relationship between stress and stress-related physical symptoms ($r = 0.632^{**}$, $p<0.01$). According to this result, the H_1 hypothesis is accepted.

Table 5. Regression analysis on the effect of sick building syndrome symptoms on stress.

Stress	B_i	Standard error	t	p
Constant term	1.803	0.191	9.34	**0.00**
Sick building syndrome symptoms	0.648	0.086	7.46	**0.00**

R^2: 0.19 F: 55.878 p: 0.00

The analysis results regarding the impact of Sick Building Syndrome on stress are presented in Table 5. After performing the regression analysis, it was found that the established model is significant. Accordingly, the symptoms of SBS observed in shopping malls increase the stress levels of employees (F: 55.878, p: 0.00). When the model is closely examined, it was found that a one-unit change in SBS symptoms results in a 0.648-unit increase in stress levels, and 19% of the change in stress is explained by SBS symptoms. Therefore, the proposed H_2 hypothesis is also accepted.

CONCLUSION

Sick Building Syndrome (SBS) usually occurs in the form of physiological health problems that have long worried doctors and health professionals. The complaints of those living in these buildings about air conditioners, air systems, chemicals, physical environment and biological factors show that environmental and psychosocial factors are effective in addition to psychological complaints. In other words, SBS symptoms are related to personal characteristics, physical factors and stress (Mendelson et al., 2000; Kubo et al., 2006; Miskulin et al., 2014).

As a result of this study on sick building syndrome symptoms, first of all, participants drew attention to excessive brightness and inadequate ventilation in terms of workplace conditions. In work environments, both insufficient and excessive lighting can cause various discomforts in people, having serious physical and psychological effects. Studies also corroborate this situation. These studies indicate that light (of different types and intensities) has different effects depending on gender and age, leading to reduced cognition, weakened problem-solving abilities, emotional problems, and causing cataracts and glaucoma (Devlin et al., 2003; Knez, 2001).

Another notable point is that 66% of employees with sensitivity to unpleasant odors reported that this sensitivity increased on weekends, considering the crowded nature of shopping malls on weekends. The main reasons for this discomfort are the insufficient increase in ventilation capacity, the increased amount of CO2, CO, and the intensity of sweat odor despite the increase in the number of people entering the malls on weekends.

A study conducted on shopping malls in Hong Kong, one of the countries with the largest shopping malls in the world, also confirms the findings obtained in this study. According to this study, the amount of CO2 and bacteria in shopping malls on weekends was significantly higher than the evening rates during the week, attributed to the high human density and insufficient ventilation (Wai-Ming et al., 2000). Undoubtedly, poor indoor air quality significantly reduces the perceived comfort conditions of employees and customers in shopping malls. CO2 levels above 1000 ppm have been found to increase symptoms related to SBS, such as headaches, eye strain, and respiratory issues (Demiraslan and Basak, 2018; Molhave et al., 1999; Liao et al., 1991).

In this study, as in similar studies, common symptoms such as dry throat, runny nose, eye irritation, fatigue emerged, general muscle-joint pain and cough, and that these symptoms severity increased during weekends when shopping malls are more crowded, thus increasing stress levels (Mendelson et al., 2000; Gomzi et al., 2007; Runeson et al., 2013; Yücel, 2011; Zeybek, 2014; Rashid and Zımrıng, 2008; Özgürbüz, 2019; Akalp et al., 2021).

Another important finding is that as a result of this study, one of the determinants of SBS is work stress, which is one of the psychosocial risks in terms of occupational health and safety, and that working in closed areas for long periods of time increases stress levels, especially on weekends.

Studies show that work and occupation-related factors, perception of indoor environment and psychological tendencies are also determinants of health complaints and work stress (Brasche et al., 2001; Barmark, 2015). Although SBS symptoms are thought to be primarily physical in origin, the results show that stress and physical environmental conditions play an indirect role. In this study, it can be said that stress is associated with SBS symptoms and that evaluations regarding its individual effects, especially headache, fatigue and muscle pain, are the basis of the physical discomfort experienced by the employees.

Another smilar studies at the psychosocial level found that work-related stress is an important determinant of SBS, while job satisfaction reduces the risk of reporting SBS related to the workplace (Barmark, 2015). According to this result, it can be said that staying in closed spaces for a long time significantly affects not only physical health but also mental health and triggers more risks. Smilar research shows that work and job-related factors, perception of the enclosed environment, and psychological tendencies are also determinants of health complaints (Brasche et al., 2001; Aytac and Tufekci, 2018; Akalp et al., 2021). Although the symptoms of SBS are primarily thought to be physically sourced, the results indicate that stress and physical environmental conditions play an indirect role. Similar results were obtained in this study as in other studies, and it can be said that stress is associated with SBS symptoms and that evaluations regarding its individual effects, especially headache, fatigue and muscle pain, are the basis of the physical discomfort experienced by employees.

As can be understood, the emergence of SBS symptoms causes psychosocial risk factors such as anxiety and stress in addition to ergonomic risk factors. (Kukec and Dovjak, 2014).

In order to prevent the negative effects of SBS and to take the necessary precautions in terms of occupational health and safety, ergonomic layout planning should be carried out in workplaces first, and noise levels should be controlled. In addition, adjustments should be made regarding lighting and ventilation. For example, it is important to maintain a suitable room temperature (thermal comfort), prevent glare and provide appropriate lighting, provide appropriate ventilation and continuous fresh air supply, regularly clean pollutant sources, control carpet and flooring contamination, use stone, ceramic or parquet floors, and properly position ventilation ducts, windows and open passages. Attention should be paid to the cleanliness of the working environment, and working conditions aimed at health and performance that prevent physiological stress should be provided. In addition, adjustments should be made regarding ergonomic design: For example, providing updated and strategically placed workstation equipment, having comfortable and easily adjustable office chairs, taking risks into account in equipment selection and placement, and providing protection against dangerous machine parts (Kukec and Dovjak, 2014). The sensitivity of occupational health and safety specialists and occupational physicians to this issue will show that SBS can be prevented, its negativity, and its potential undesirable risks to human health will be eliminated.

In conclusion; this cross-sectional study, which was conducted in two shopping malls in Turkey and included 268 employees, is limited by the fact that it was conducted in a single city and only in two shopping malls. Therefore, it would be appropriate to repeat this research with more people in more shopping malls.The sensitivity of occupational health and safety specialists and occupational physicians to this issue will show that SBS is preventable, its negativity, and its potential undesirable risks to human health will be eliminated.

REFERENCES

Abidin, N. Z., and Powmya, A. (2014). Drivers for green construction in Oman and its future prospects. Middle-East Journal of Scientific Research, 21(6), 929–935.

Akalp, G., Başol, O., & Aytaç, S. (2021). Covid-19, Sick Building Syndrome and Stress, International Journal of Social Inquiry, 14 (2), 357–382.

Aytaç, S.; Tufekçi, U. (2018). The Importance of Ergonomic Measures in Reducing Sick Building Syndrome. Journal of Engineering Sciences and Design, (SP: Ergonomi 2017) 6, 137–142

Barmark, M., (2015). Social Determinants of the Sick Building Syndrome: Exploring the Interrelated Effects of Social Position and Psychosocial Situation. International Journal of Environmental Health Research, 25, (5) 490–507.

Bougdah, Hocine dan Sharples. (2010). Environmental technology and sustainability. New York: Taylor & Francis.

Brasche, S., Bulinger, M., Morfeld, M., Gebhardt, H. J., Bischof, W., (2001). Why do Women Suffer from Sick Building Syndrome more often than Men? – Subjective Higher Sensitivity versus Objective Causes. Indoor Air, 11, 217–222.

Demiraslan, K. O., Başak, S., (2018). Sick Building Syndrome Concept Literature Research and Comparison of Indoor Air Quality of Various Spaces, Journal of Engineering Sciences and Design, 6(2), 190–201.

Devlin A. S., Arneill A. B., (2003). Health care environments and patient outcomes: A review of the literature. Environment and Behavior, 35, 655.

Dhungana, P.; Chalise, M. (2020). Prevelence of Sick Building Syndrome Symptoms and its Associated Factors among Benk Employees in Pokhara Metropolitan, Nepal. International Journal of Indoor Environment and Health, 30(2), https: //doi.org/10.1111/ina.12635 Epub

Gomzi, M., Bobic, J., (2009). Sick Building Syndrome: Do We Live And Work İn Unhealty Environment? Perıodicum Biologorum, Udc, 111 (1) 79–84.

Gomzi, M., Bobic, J., Radosevic-Vidacek, B., Macan, J., Varnai, V. M., Milkovic-Kraus, S., Kanceljak-Macan, B., (2007). Sick Building Syndrome: Psychological, Somatic, and Environmental Determinants. Archives of Environmental & Occupational Health, 62, (3.) 57:61

Gou, Z.; Lau, S. S. Y. (2012). A Survey of Sick Building Syndrome: Workplace Design Elements and Perceived Indoor Environmental Quality. Journal of Facilities Management, 10(4), 256–265.

Guy, S.; Farmer, G. (2001). Reinterpreting sustainable architecture: The place of technology. Journal of Architectural Education, 54(3), 140–148.

Knez, I. (2001). Effects of colour of light on nonvisual psychological processes. Journal of environmental psychology 21, 201–208.

Kubo, T., Mizoue, T., Ide, R., Tokuı, N., Fujino, Y., Minh, P. T., Shirane, K., Matsumoto, T., Yoshimura, T., (2006). Visual Display Terminal Work and Sick Building Syndrome – The Role of Psychosocial -Distress in the Relationship. Journal of Occupational Health, 107–112.

Kukec, A., Dovjak, M., (2014). Prevention and Control of Sick Building Syndrome (SBS). International Journal of Sanitary Engineering Research, 8 (1), 16–40.

Liao SST, Bacon SJ, Yoon SK (1991). Factors influencing indoor air quality in Hong Kong: measurements in offices and shops. Environ. Technology 12: 737–745.

Mendelson M. B., Catano, V. M., Kelloway, K., (2000). The Role of Stress and Social Support in Sick Building Syndrome. Work & Stress, 14, (2), 137–155.

Miskulin, M., Matic, M., Benes, M., Vlahovic, J., (2014). The Significance of Psychosocial Factors of the Working Environment in the Development of Sick Building Syndrome. Journal of Health Sciences, 4(3), 136-142.

Molhave L, Hempl-Jorgensen A, Kjaergaard SK, Hudnell KH. (1999). Sensory eye irritation in humans exposed to mixtures of volatile organic compounds. Arch Environ Health. 54:416_424.

Nordström, K.; Norbäck, D.; Akselsson, R. (1995). Influence of Indoor Air Quality and Personal Factors on the Sick Building Syndrome (SBS) in Swedish Geriatric Hospitals. Occupational and Environmental Medicine, 52(3), 170–176.

Otlu M., (2012). Prevalence of Sick Building Syndrome in Turgut Özal Medical Center Employees and Affecting Factors, Specialist Thesis, İnönü University Faculty of Medicine, Malatya. Turkey

Runeson-Broberg, R.; Norback, D. (2013). Sick Building Syndrome (SBS) and Sick House Syndrome (SHS) in Relation to Psychosocial Stress at Work in the Swedish Workforce. International Archives of Occupational and Environmental Health, 86, 915–922.

Tabachnick, B. G.; Fidell, L. S. (2013). Using multivariate statistics (6th ed.). Boston: Pearson.

Tarcan, E.; Varol, E.; Ateş, M. (2000). Building Quality and Its Effects on the Performance of Healthcare Facilities. Hacettepe Health Administration Journal, 5(4), 95–121.

Tekin ÖF, Arıkan İ. (2023). Evaluation of the Relationship between Sick Building Syndrome Prevalence and Indoor Air Quality in Schools. ESTUDAM Public Health Journal.8(1):42-53

Wai-Ming L., Shun C. L., Lo Y. C. (2001). Indoor air quality at nine shopping malls in Hong Kong. The Science of the Total Environment 273 -17-40

Yücel, A., Aycan, S., Özkan, S., Vaizoğlu, S., (2011). Sick Building Syndrome in Employees of a Public Building. Health and Society. 21 (3) 19-27.

Zr, D. L., and Mochtar, S. (2013). Application of bioclimatic parameter as sustainability approach on multi-story building design in tropical area. Procedia Environmental Sciences, 17, 822–830.