ORIGINAL ARTICLE

Indoor Air Quality and Sick Building Syndrome among Garment Manufacturing Workers in Kota Bharu, Kelantan

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ABSTRACT

Introduction: Sick Building Syndrome (SBS) is an illness that occurs among occupants that linked to time spent in a building. The causes of SBS can be various but it has a significant relation to the Indoor Air Quality (IAQ) of the building itself. This study aimed to investigate the Indoor Air Quality (IAQ) and symptoms of Sick Building Syndrome (SBS) among garment manufacturing workers. **Methods:** The IAQ Parameters (air velocity, temperature, relative humidity, carbon dioxide, carbon monoxide, formaldehyde, PM_{10}, and $PM_{2.5}$) were measured using specified instruments. The SBS symptoms were assessed by a questionnaire adopted from the Industry Code of Practice (ICOP) of Indoor Air Quality (IAQ) 2010 among 173 employees from the production section **Results:** Temperature, $PM_{10,}$ and formaldehyde concentration levels exceeded the threshold values of ICOP IAQ 2010. The prevalence of SBS was high (82.1%). There was a significant association between relative humidity and scalp's itchiness ($\chi 2$ = 5.601, p=0.018) while formaldehyde level with skin's itchiness ($\chi 2$ = 4.425, p=0.039), scalp's itchiness $\chi 2$ = 4.668, p=0.031), and eye irritation ($\chi 2$=9.663, p=0.002). Age, gender, smoking status, and years of employment were predictors for few symptoms of SBS such as fatigue, dizziness, stuffy nose, and eye irritation ($p<0.05$). **Conclusion:** This study showed a significant association between poor IAQ of certain parameters and SBS symptoms. Regular maintenance of ventilation and control measures are important for maintaining good indoor air quality to avoid further health problems to the occupants.

Keywords: Indoor air pollutants, Humidity, Ventilation, Irritation, Itchines

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INTRODUCTION

Indoor Air Quality (IAQ) (IAQ) refers to the air quality status within and around buildings and
closed areas related to the health and comfort of their occupants (1). According to the Department of Occupational Safety and Health Malaysia (DOSH), IAQ discusses how indoor air can affect people's comfort, ability to work as well as their health. Temperature, mould, humidity, exposure to other chemicals, or poor ventilation are among the aspects assessed and monitored in describing IAQ. Poor IAQ may lead to many problems especially discomfort during working time. Asthma and increasing allergic reactions are among chronic effects of poor IAQ that most likely due to exposure of the occupants to indoor pollutants and colds.

Sick Building Syndrome (SBS) symptoms are a common problem associated with IAQ and has recently become the main interest among researchers in Malaysia as there are no apparent causes and the specific medical test to reveal and prove whether there are any individuals so far, suffering from the SBS syndrome or not (2,3). SBS is defined as a term to describe office discomfort and medical symptoms in which the causes may be linked to the characteristics of the building, exposure to pollutants, and unhealthy work activities such as cigarette smoking. Symptoms of SBS are including, but not limited to headaches, difficulty in concentrating, fatigue, lethargy, skin irritation, itching, and complaint of odours (2).

The United States Environmental Protection Agency (EPA) reported that Americans spent approximately

90% of the average of their time indoors, in which the pollutant concentration indoors was 2 to 5 times higher than the concentration of pollutants outdoor (4). Concentrations of some indoor pollutants have elevated in recent decades due to some factors like "energy-efficient building construction" which prevails undesirable aspects such as lack of sufficient mechanical ventilation, furnishing, pesticides, and use of synthetic building materials (4). Occupational hazards that are related to IAQ have become increasingly important as there has been a growing number of health problems reported involving workers that work indoors. Most of the workers spend 90% of their time in indoor facilities (5,6). The deterioration of IAQ level in the textile industry since 1995 was due to the presence of volatile organic compounds (7).

The textile was used to produce garments and clothes. In 2017, more than 90,000 workers were working in the textile and garment industries throughout Malaysia (8). Most of these people did not realize that they were potentially exposed to a poor workplace indoor environment. Their failure to acknowledge such risks was due to the lack of IAQ studies in Malaysia so far, hence leaving the management of the company or factory clueless or being ignorant of the critical importance of such issues to the workers. The garment manufacturing factory generally consists of activities like cutting textile, sewing and finishing the garment. Workers spend most of their work time indoors and this may reduce IAQ among workers due to dust and chemical contaminants from pieces of textiles. For example, formaldehyde released during textile treatment and finishing can affect the worker's health as it is carcinogenic (9).

The detailed data on IAQ, especially the pollutants concentrations and the relationship between SBS and poor IAQ in a Malaysian garment factory is still limited. Therefore, this study investigated the indoor environment which may affect workers' health and comfort as well as highlighting the fact that workers spend most of their working time indoors. Thus, the study variables were the data of IAQ and the symptoms of SBS among garment manufacturing workers.

METHODS AND MATERIALS

Study Design

A cross-sectional study was conducted at a garment factory located in Kota Bharu, Kelantan. The sampling frame was workers from the production section who spend 8 hours every day (except Fridays and 1st Saturday in every month) working in an indoor environment. There were 6 departments in the production section which were cutting, sewing, packing, quality control, research and development, and management. A combination of stratified and random sampling method was used to select respondents whose fulfilled the inclusion criteria including age must at least 18 years old, minimum six months working experience, and ability to understand Malay or English. Those with asthmatic problems, sinusitis, or eczema were excluded from the study. The calculated sample size was 173 participants which comprised of sewing (n=117), cutting (n=8), packing (n=24), quality control (n=16), research and development (n=5), and management (n=3). The sampling fraction formula, n/N was used to determine the sampling unit from each department.

Indoor Air Quality Assessment

The measurements of IAQ parameters were conducted based on the ICOP-IAQ 2010 (3). Following ICOP 2010, the numbers of sampling points were estimated based on the total volume of floor area. This garment factory consisted of one big enclosed building composed of cutting, sewing, and finishing areas with a total area of 3994.61 m^2. The sampling points were determined by considering the position of respondents and source of fresh air intake. The area measurements of IAQ were conducted five days a week continuously from 8 am to 5 pm. Altogether, 8 points were identified for a sampling of the physical measurement that included the cutting area (1 point), the sewing area (6 points), and the finishing area (1 point). The IAQ was measured using instrument; TPI 1010a IAQ Meter to measure the concentration of CO, CO_2, relative humidity (RH) and temperature, Hot Wire Anemometer TES- 1341 to measure air velocity, Portable USB Interface Formaldehyde Thermo-Hygrometer 98170/98171 to measure formaldehyde concentration, and HT 9600 Particle Counter to identify the concentration of $PM_{2.5}$ and PM_{10}. Other parameters were temperature, relative humidity, air velocity, and indoor chemical contaminants; formaldehyde (HCOH), carbon monoxide (CO), carbon dioxide (CO_2), $PM_{2.5,}$ and $PM_{10.}$

A Questionnaire Survey

A set of questionnaires adapted from the Industrial Code of Practice-Indoor Air Quality (ICOP-IAQ) 2010 was used. The purpose of conducting this survey was to get data on demographics, health history, a workplace conditions based on the worker's perspective and to study the SBS symptoms among the building occupants. The questionnaire consists of four parts namely, Part A: General Information (respondent's background information), Part B: Workplace Information, Part C: Environmental Descriptions, Part D: Past and Current Diseases Symptoms. The workers were defined to experience SBS if they had two or more SBS symptoms and it occurred at least once a week for the last four weeks and the reported symptoms had improved or disappeared as they were away from the workplace (10). The questionnaires were distributed concurrently with physical measurements. A walkthrough survey was also conducted by consulting the staff facility to collect information on building conditions that might become a source of poor IAQ. A pilot study was done to ascertain

the reliability of the questionnaire. It was pretested among 17 workers in the same factory and the Cronbach Alpha was 0.733.

Statistical Analysis

All analysis was performed using IBM Statistical Package for Social Sciences (SPSS) version 24. Both descriptive and inferential statistics were used. The significance level was set at $p < 0.05$. Chi-square was used to determine the association between IAQ and SBS symptoms. Multiple Logistic Regression (MLog) was used to identify the predictors of reported SBS symptoms.

Ethical Issue and Clearance

Ethical approval was obtained from the Human Research Ethics Committee of Health Campus Universiti Sains Malaysia with code USM/JEPeM/19110716 dated 16th January 2020. All the information regarding the research including the purpose, method, and outcome was fully understood by the participants. The subjects' and company's information was kept confidential by the researchers.

RESULTS

Indoor Air Quality (IAQ) Assessment and Workplace Condition

Table 1 showed the comparison of IAQ parameters with standards. Only the mean temperature of 30.59 °C had exceeded the Malaysian Standard (ICOP-IAQ 2010) while both Relative Humidity (RH) and air velocity were below the Malaysian Standard with 54.85% and 0.31 m/s respectively. CO_2 was within the acceptable level with 651.25 ppm. $PM_{2.5}$ and PM_{10} were recorded 8 µg/m^3 and 80 µg/m^3 respectively. Even though both PMs were below the Malaysian Standard but PM_{10} was recorded higher than the standard of USEPA (50 µg/m3 for 8 hrs). A high concentration of formaldehyde (HCOH) was recorded with 0.477 ppm, exceeding the limit set by the Malaysian DOSH (ICOP-IAQ 2010). However, the concentration did not exceed the standards set by ASHRAE (11) and OSHA (0.75 ppm). Most of the workers were not satisfied with the ambient temperature and low humidity. Table II showed the workers' responses regarding workplace conditions in the production area. The most common responses were dust and dirt (97.15), varying room temperature (82.7%), and high room temperature (81.5%). Nearly half (46.8%) reported that the SBS symptoms were reduced when as they were distancing themselves from the workplace.

Table I. Comparison of IAQ Parameters with Standards

Variables	Garment Production (Mean)	ICOP IAQ*	USEPA#
Temperature (°C)	30.59	23-26	-
Relative Humidity (RH%)	54.85	40-70	-
Air Velocity (m/s)	0.31	0.15-0.50	-
CO_2(ppm)	651.25	C1000	-
CO (ppm)	0	10	-
$PM_{2.5}$ (mg/m^3)	0.008	0.15	0.012
PM_{10}(mg/m^3)	0.08	-	0.05
Formaldehyde (HCOH) (ppm)	0.47	0.1	-

* Industry Code of Practice on Indoor Air Quality 2010
\# US Environmental Potection Agency
ppm is parts of vapur orgas per million parts of contaminated air by volume
C is the celing limit that shall not exceede at any time. Readings above 1000 ppm are indication of inadequate ventilation

Table II. Worker's Feedback on Workplace Conditions at Production Section

Workplace Condition	Garment Factory N= 173 (100%)	
	Yes	No
Draught	124 (71.7)	49 (28.3)
Room temperature was too high	141 (81.5)	32 (18.5)
Room temperature was too low	95 (54.9)	78 (45.1)
Varying room temperature	143 (82.7)	30 (17.3)
Stuffy bad air	105 (60.7)	68 (39.3)
Dry air	114 (65.9)	59 (34.1)
Unpleasant odour	98 (56.6)	75 (43.4)
Passive smoking	31 (17.9)	141 (81.5)
Dust and dirt	168 (97.1)	5(2.9)

Respondents Characteristics

Out of 178 workers in the production section, they were 173 respondents gave their cooperation for answering the questionnaire (97.2%). Most of them were female (96.0%) and only 4.0% were male. The mean age was 38.81 years old with the majority of them below 40 years old. The mean age of employment was 11.28 with 53.4% have been working for more than 10 years. More than half (75.9%) worked for 8 hours per week.

The Prevalence of Sick Building Syndrome

The prevalence of SBS among workers was 82.1%. The most common reported symptoms were feeling heavy-headed, fatigue, and headaches with 85.0%, 83.3%, and 70.5% respectively. Other reported symptoms were nausea (25.5%), cough (64.7%), stuffy nose (58.4%), sore throat (58.2%), skin rash (54.4%), itchy scalp (35.8%), and eye irritation (19.7%). (Figure 1).

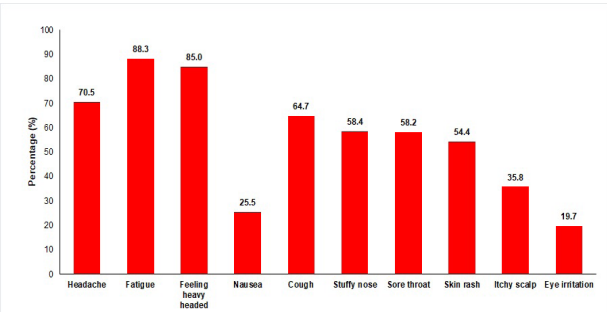

Figure 1: Sick Building Syndrome

The Association of Indoor Air Quality and Sick Building Syndrome Symptoms

The IAQ was categorized into high concentration (High) and low concentration (Low) depending on the median value, either above or below the median (12). Most of the IAQ parameters did not show a significant association with SBS symptoms except relative humidity and formaldehyde parameters. A significant association was found between RH with itchiness of the scalp ($\chi 2$= 5.601, p=0.018) (Table III). No association was found between CO_2 level and SBS symptoms (Table IV). Formaldehyde also showed a positive association with symptoms of skin's itchiness (χ^2=4.4252, p=0.039), itchiness of scalp ($\chi 2$= 4.668, p=0.031), and eyer's irritation ($\chi 2$= 9.663, p=0.002) (Table V).

Table III. Association of SBS Symptoms with Temperature and Relative Humidity

	SBS Symptoms (N=173)		χ2	p- value
	Yes (%)	No (%)		
Temperature	**Headache**			
Low	51(41.5)	19(38.0)	0.177 (1)	0.674
High	72(40.3)	31(62.0)		
Temperature	**Fatigue**			
Low	58(40.3)	12(41.4)	0.012(1)	0.912
High	86(59.7)	17(58.6)		
Temperature	**Feeling heavy headed**			
Low	60(40.8)	10(38.5)	0.051(1)	0.822
High	87(59.2)	16(61.5)		
Temperature	**Nausea**			
Low	21(46.7)	49(38.3)	0.972(1)	0.324
High	24(53.3)	79(61.7)		
Temperature	**Cough**			
Low	45(40.2)	25(41.0)	0.011(1)	0.918
High	67(59.8)	36(59.0)		
Temperature	**Stuffy nose**			
Low	45(44.6)	25(34.7)	1.687(1)	0.194
High	56(55.4)	47(65.3)		
Temperature	**Sore throat**			
Low	43(43.0)	27(37.0)	0.633(1)	0.426
High	57(57.0)	46(63.0)		
Temperature	**Skin Itchiness**			
Low	40(42.6)	30(38.0)	0.374(1)	0.541
High	54(57.4)	49(62.0)		
Temperature	**Itchiness of scalp**			
Low	31(50.0)	39(35.1)	3.649(1)	0.056
High	31(50.0)	72(64.9)		
Temperature	**Eye irritation**			
Low	14(41.2)	56(40.3)	0.009(1)	0.925
High	20(58.8)	83(59.7)		
Relative Humidity	**Headaches**			
Low	61(49.6)	24(48.0)	0.036(1)	0.849
High	62(50.4)	26(52.0)		

CONTINUE

Table III. Association of SBS Symptoms with Temperature and Relative Humidity (CONT.)

	SBS Symptoms (N=173)		χ2	p- value
	Yes (%)	No (%)		
Relative Humidity	**Headaches**			
Low	61(49.6)	24(48.0)	0.036(1)	0.849
High	62(50.4)	26(52.0)		
Relative Humidity	**Fatigue**			
Low	73(50.7)	12(41.4)	0.838(1)	0.360
High	71(49.3)	17(58.6)		
Relative Humidity	**Feeling heavy headed**			
Low	73(49.7)	12(46.2)	0.109(1)	0.742
High	74(50.3)	14(53.8)		
Relative Humidity	**Nausea**			
Low	19(42.2)	66(51.6)	1.162(1)	0.281
High	26(57.8)	62(48.4)		
Relative Humidity	**Cough**			
Low	55(49.1)	30(49.2)	0.000(1)	0.993
High	57(50.9)	31(50.8)		
Relative Humidity	**Stuffy nose**			
Low	44(43.6)	41(56.9)	3.011(1)	0.083
High	57(56.4)	31(43.1)		
Relative Humidity	**Sore throat**			
Low	45(45.0)	40(54.8)	1.620(1)	0.203
High	55(55.0)	33(45.2)		
Relative Humidity	**Skin Itchiness**			
Low	45(47.9)	40(50.6)	0.131(1)	0.718
High	49(52.1)	39(49.4)		
Relative Humidity	**Itchiness of scalp**			
Low	49(55.7)	62(72.9)	5.601(1)	0.018*
High	39(44.3)	23(27.1)		
Relative Humidity	**Eye irritation**			
Low	15(44.1)	70(50.4)	0.426(1)	0.514
High	19(55.9)	69(49.6)		

* Significant at p<0.05

Table IV. Association of SBS Symptoms with CO_2

	SBS Symptoms (N=173)		χ2	p- value
	Yes (n)	No (n)		
CO_2	**Headache**			
Low	72(58.5)	31(62.0)	0.177(1)	0.674
High	51(41.5)	19(38.0)		
CO_2	**Fatigue**			
Low	86(59.7)	17(58.6)	0.012(1)	0.912
High	58(40.3)	12(41.4)		

CONTINUE

Table IV. Association of SBS Symptoms with CO_2 (CONT.)

	SBS Symptoms (N=173)		χ2	p- value
	Yes (n)	No (n)		
CO_2	**Feeling heavy headed**			
Low	87(59.2)	16(61.5)	0.051(1)	0.822
High	60(40.8)	10(38.6)		
CO_2	**Nausea**			
Low	24(53.3)	79(61.7)	0.972(1)	0.324
High	21(46.7)	49(38.3)		
CO_2	**Cough**			
Low	67(59.8)	36(59.0)	0.011(1)	0.918
High	45(40.2)	25(41.0)		
CO_2	**Stuffy nose**			
Low	56(55.4)	47(65.3)	1.687(1)	0.194
High	45(44.5)	25(34.7)		

* Significant at p<0.05

Table V. Association of SBS Symptoms with $PM_{2.5}$, PM 10 and Formaldehyde (HCOH)

	SBS Symptoms (N=173)		χ2	p- value
	Yes (%)	No (%)		
PM 2.5	**Sore throat**			
Low	57(57.0)	46(63.0)	0.633(1)	0.426
High	43(43.0)	27(37.0)		
PM 2.5	**Skin Itchiness**			
Low	54(57.4)	49(62.0)	0.374(1)	0.541
High	40(42.6)	30(38.0)		
PM 2.5	**Itchiness of scalp**			
Low	31(50.0)	72(64.9)	3.649(1)	0.056
High	31(50.0)	39(35.1)		
PM 2.5	**Eye irritation**			
Low	20(58.8)	83(59.7)	0.009(1)	0.925
High	14(41.2)	56(40.3)		
PM 10	**Sore throat**			
Low	42(42.0)	33(45.2)	0.177(1)	0.674
High	58(58.0)	40(54.8)		
PM 10	**Skin Itchiness**			
Low	44(46.8)	31(39.2)	1.001(1)	0.317
High	50(53.2)	48(60.8)		
PM 10	**Itchiness of scalp**			
Low	27(43.5)	48(43.2)	0.002(1)	0.969
High	35(56.5)	63(56.8)		
PM 10	**Eye irritation**			
Low	19(55.9)	56(40.3)	2.705(1)	0.100
High	15(44.1)	83(59.7)		
HCOH	**Sore throat**			
Low	56(56.0)	41(56.2)	0.000(1)	0.983
High	44(44.0)	32(43.8)		

CONTINUE

Table V. Association of SBS Symptoms with $PM_{2.5}$, PM 10 and Formaldehyde (HCOH) (CONT.)

	SBS Symptoms (N=173)		χ2	p- value
	Yes (%)	No (%)		
HCOH	**Skin Itchiness**			
Low	46(48.9)	51(64.6)	4.4252(1)	0.039*
High	48(51.1)	28(35.4)		
HCOH	**Itchiness of scalp**			
Low	28(45.2)	69(62.2)	4.668(1)	0.031*
High	34(54.8)	42(37.8)		
HCOH	**Eye irritation**			
Low	11(32.4)	86(61.9)	9.663(1)	0.002*
High	23 (67.6)	53(38.1)		

* Significant at p<0.05

Predictors of Sick Building Syndrome

Several symptoms showed a significant association with potential factors such as gender, age, years of employment, and smoking status (Table VI). Fatigue symptoms had significant association with gender (*Adj* OR=0.174, 95% CI= 0.032 – 0.940). Dizziness symptoms had a significant association with age (*Adj* OR=0.966 95% CI: 0.939 – 0.933) and years of employment (*Adj* OR=0.966, 95% CI=0.939 – 0.933). The smoking status was also found to be a significant association with the stuffy nose (*Adj* OR=16.174, 95% CI=1.964 –133.28) and eye irritation (*Adj* OR=9.553, 95% CI=1.077 – 84.748).

Table IV. Association of SBS Symptoms with CO_2

	SBS Symptoms (N=173)		χ2	p- value
	Yes (n)	No (n)		
CO_2	**Headache**			
Low	72(58.5)	31(62.0)	0.177(1)	0.674
High	51(41.5)	19(38.0)		
CO_2	**Fatigue**			
Low	86(59.7)	17(58.6)	0.012(1)	0.912
High	58(40.3)	12(41.4)		
CO_2	**Feeling heavy headed**			
Low	87(59.2)	16(61.5)	0.051(1)	0.822
High	60(40.8)	10(38.6)		
CO_2	**Nausea**			
Low	24(53.3)	79(61.7)	0.972(1)	0.324
High	21(46.7)	49(38.3)		
CO_2	**Cough**			
Low	67(59.8)	36(59.0)	0.011(1)	0.918
High	45(40.2)	25(41.0)		
CO_2	**Stuffy nose**			
Low	56(55.4)	47(65.3)	1.687(1)	0.194
High	45(44.5)	25(34.7)		

* Significant at p<0.05

DISCUSSION

The high temperature as claimed by the respondents showed dissatisfaction with the temperature at the workplace. A walkthrough survey during a preliminary visit revealed that the ventilation system in the production area was inadequate. The air conditioning system was insufficient and therefore, the management installed many floor fans in the sewing area and the finishing area. However, the problem arose as the floor fans only circulated air from within an enclosed indoor environment meaning that there was no supply of 'clean' outdoor air and no removal of indoor air. Fortunately, there were few air vents at certain parts of the workplace but still could not improve the overall ventilation. The floor fans also generated additional heat which was trapped in the production area and causing the temperature to increase. Besides, the work activities themselves increased the temperature inside the factory. Production of the shirt collar, the collar stand band, cuff, pockets, and finishing of the garment required steams iron, which generated heat as well.

Exposure to carbon dioxide can cause headaches, fatigue, feeling heavy-headed, nausea, cough, and stuffy nose (13). Pollutants like $PM_{2.5}$, PM_{10}, and HCOH are usually associated with skin, eye, and nose irritation (13,14). The HCOH level was almost 5 times higher than the Malaysian Standard. This was consistent with the previous research by Smith & Bristow (7). They raised concerns on the emerging cases of HCOH's emission by textile materials. A high concentration of HCOH might be emitted by the boxes made up of wood and paper (16). Besides, a wood-based product like wooden tables in the cutting, sewing, and finishing area might contribute to a high level of HCOH. Pressed wood products including plywood, particleboard, and medium-density fibreboard (MDF) were also sources of formaldehyde (16,17). A high concentration of HCOH might also be due to other factors like temperature (13). The temperature inside the factory exceeded the standard. There was a positive correlation between HCOH concentration and temperature (18). High temperature contributed to a high HCOH level.

Half of them also reported having a sore throat, stuffy nose, and skin rash by 2-3 times per week. Headaches and feeling heavy-headed were high (> 60%) due to the high concentration of CO_2 (651.25 ppm). Moreover, a positive correlation was found between the concentration of CO_2 and headaches (19). However, the CO_2 concentration was still below the ceiling limit of Malaysia's standard (C1000). Fatigue (76.9%) and sore throat (50.6%) might also occur due to a high HCOH concentration. Norb∆ck et al. (20) found the association between indoor formaldehyde and fatigue as well as the throat symptoms with 50.3% of respondents suffered stuffy nose symptoms 2-3 times per week. The World Health Organization (14) stated that a high level of formaldehyde could lead to acute non-cancerous effects include odour discomfort, sensory irritation to upper airways and eyes, lung effects, and finally eczema.

In this study, the number of women involved in the production area was ten times higher than men. In general, women reported a higher prevalence of common health symptoms associated with the indoor environment. Women were more likely to suffer from SBS symptoms such as fatigue, headache, irritated or dry eyes, and skin symptoms as compared to men (21, 22). They were more sensitive to environmental factors, perceive their health problems more intensely, and had more health-seeking behavior for perceiving and reporting health problems (23,24). A similar finding by Chirico et al. (25) reported a strong relationship between cases of SBS and smoking behaviour ($p<0.05$). Indeed, an association of smoking status with SBS symptoms was also in compliance as the behavior which could exert significant influence on symptoms of SBS among office workers (24) and hospital workers (26). Thus, smoke-free policies and legislation should be enforced in the workplace to reduce the risk of SBS symptoms among workers.

Limitation

This study was able to assess the selected IAQ parameters as well as the relationship between IAQ and SBS among workers who might get exposed. The SBS symptoms could not be confirmed by self-reported symptoms due to reliability issues as the workers' medical records should also be taken into consideration. However, they were not available and accessible at that moment.

CONCLUSION

Temperature, PM_{10}, and HCHO levels in the garment manufacturing section were not within the acceptable limit set by the Malaysian Standard (ICOP-IAQ 2010). Moreover, the prevalence of Sick Building Syndrome (SBS) was 82.1%. Fatigue, feeling-headed, and headache were highly prevalent among the workers with 85.0%, 83.3%, and 75.3% respectively. This indicated that workers were at risk of suffering SBS related to poor IAQ. Relative Humidity (RH) level had a significant association with scalp itchiness while HCHO level had a positive association with skin's itchiness, scalp's itchiness, and irritation of the eye. Age, gender, smoking status, and years of employment were predictors for few SBS symptoms of such as fatigue, dizziness, stuffy nose, and eye irritation ($p<0.05$). Thus, regular maintenance of ventilation and control measures are important for maintaining good indoor air quality to avoid future health problems for the workers.

ACKNOWLEDGEMENTS

The authors would like to convey a heartfelt appreciation to the School of Chemical and Energy Engineering, Faculty of Engineering UTM, and the School of Health Sciences Universiti Sains Malaysia (USM) for providing the instruments to conduct the study. Special thanks to the Safety and Health Officer (SHO), Mr. Mohd Zulhairie Ab Rahman, and respondents who had participated in this study. Their willingness and invaluable contribution to this research would ultimately help to improve the workers' well-being soon. This work was financially supported by a research grant from UTM with code number Q.J130000.3551.05G50.

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