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OCCUPATIONAL HAZARDS, DISEASE SYMPTOMS AND PHYSIOLOGICAL RESPONSES IN WORKERS WITH DIFFERENT WORKLOADS UNDER OUT AND INDOOR CONDITIONS

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ABSTRACT

The present research work was carried during the period of January 2012 – January 2013 with the objective to assess the impact of thermal environment (indoors/outdoors) on the health workers carrying different workloads (heavy, moderate, light). The outdoor study targeted subjects working in building construction in Khartoum. The indoor study targeted subjects working in textile and glassware factories in Khartoum industrial area. The control subjects were selected from those employed at the National Health Laboratory. A questionnaire was designed to obtain information about workers pertaining to well-being, diseases complaints, and work accident etc.). Workers when asked to evaluate their workload as being heavy, moderate or light, outdoors (60%) and indoors (26%) rated their workload to the high temperature, while 30% of the control rated their works to the increase in working hours. 55% of the outdoors rated their workload to perform work rapidly. Most of the workers including the control rated their workload to movement of their whole body while working (40 – 80%), next came workers at outdoor conditions (~38%), with small numbers that would stand or sit.

Heat constituted most (~70%) of the hazards for indoors and outdoors workers, whereas noise and fumes were the major hazard for the control group (~20%). Nearly same percentage of outdoors workers expressed they were either exposed or not exposed to accidents while ~74% of indoor workers and 90% of the control showed that they were not exposed to accidents, with significant ($P < 0.05$) differences obtained between those who agreed and those who did not agree. most (~88%) of the outdoor and indoor workers (~77%) did not wear protective equipment. Exposure to sunlight showed that for indoors and control there was no exposure to sunlight, however, half of the workers under outdoor conditions experienced exposure to direct sun light..

Temperature sensation showed that both indoors (45%) and outdoors (47%) felt very hot, while ~35 - 40% felt hot for the indoors and control groups respectively. 60% of the control groups were not affected by the thermal environment. Excessive sweating were observed in both the control (70%) and indoor groups (72.5%). Nearly same percentages were observed for excessive (50%) and few sweating (41%) in the outdoor workers. Most (84%) of the indoor workers would respond to sweating by changing their clothes, while half of the control would do that. Outdoor workers

would resolve to other solutions (37%). Most respondents of the indoors (61.5%) and half of the control expressed that they became adapted to thermal environment after employment, whereas ~44% of the outdoor respondents became adapted after days of working.

Most of the indoor (97%) were not absent from their work, as with the control (70%) and out doors (55%). Absenteeism was once a week for outdoors (~20%) were absent from work once a week and 10% for the control. Reasons for being absent from work were either due to not finding work (29.4%) for outdoors or due to family issues (10%) for the control group. About half of the workers at out-and indoors almost never or somewhat felt hypersomnia, while 60% of the control felt hypersomnia and about 90% of workers at all sites felt easiness of movement.

More than 60% of the workers at outdoor (67.6%), and control (70%), admitted that they suffer from some diseases, whereas most of the indoor (87.2%) did not complain from any diseases. Symptoms such as disturbed appetite (>60%) was felt by indoor and outdoor workers. Most (80 – 70%) of the workers at all sites almost never felt nausea or stomach ache diarrhea and dizziness. Same applies for symptoms as; cardiovascular disturbances,irregular heartbeats, blood rushing to the head, swollen feet and chest pain. however, 50% of the control group did complain from shortness of breath. Prevalence of the symptoms was almost felt in summer during the working day especially for outdoors (81.3%), followed by control (57.1%) and indoors (50%). For outdoor workers thirst (84.8%), sweating (51.5%), fatigue (42.4%) and rise in body temperature (39.4%) were felt during summer. For the indoor workers thirst and sweating (33%) were less important, while half of the workers felt symptoms of fatigue. For the control half of the workers felt headache, while thirst and sweating received less complaints (~33%). The prevalence of the diseases showed that depression was cited by 37% of the control. Unsteadiness, hypersomnia, insomnia, aggressiveness and lower limbs coldness were expressed by 25% of the control. Acute depression and loss of concentration was cited by 33% of indoor groups.

Keywords: occupational hazards, disease symptoms, physiological responses, workloads

INTRODUCTION

In recent years, heat stress has become an increasingly important topic not only in clinical practice but in assessment in environmental working condition, occupational health, epidemiology and public health. The incidence of accidents and work-related diseases and injuries in most occupational sectors is still regrettably high; there is therefore an urgent need for preventive and protective measures to be instituted at workplaces. Studies have shown that an increase in the body core temperature which can be caused by exposure to high temperature from the environment, or heat production of working muscles, leads to negative affective responses (psychological state of emotions) (Ekkekakis *et al*., 1997). Heat cramps are sharp pains in the muscles, particularly in the abdomen muscles, thigs and those upon which there has been great physical demand (WHO, 1977). Heat rashes may develop during unrelieved exposure to humid heat with continuously wet skin. It has been observed that workers whose jobs require looking at hot-glowing materials frequently (as it is the case with glass blowers) develop cataracts more frequently than the general population.

It is important to identify potential dangers early before they result in incurable diseases. The methods for identifying occupational hazards and the health problems associated with them can be broadly listed as environmental assessment, biological monitoring, medical surveillance and epidemiological approaches.

2. MATERIALS AND METHODS

2.1 QUESTIONNAIRE

A questionnaire was designed to obtain information about workers pertaining to well-being, diseases complaints, and work accident etc.). Out of 101 distributed 84 workers responded, but all 101 workers participated in this research study.

2.1.1 Sample size

For estimation of the sample size the following formula was used:

$$n = t^2PQ/d^2$$

where:

n *=sample size*

Q *= 1-P*

t *= standard normal deviation (1.96)*

P *= proportion affected*

Q *= 1-P*

d *= degree of precision (0.05)*

3. RESULTS

3.1 WORKING HOURS AND EVALUATION OF THE WORK BY SUBJECTS:

About 46% of the workers were performing heavy work, 45 – 52% performed moderate work at indoors and outdoors, with small percentages performed light work (Table 3.1.1). Subjects related their work as heavy, moderate or low to increasing working hours as expressed by outdoors

(11.8%), indoors (15%) and control (30%), the second reason was due to high temperature as felt by outdoors (26.5%), indoors (60%) and control (10%). The third reason was due performing work rapidly as expressed by outdoors (32.4%), indoors (55%) and control (40%). The forth reason was related to type of work performance as expressed by outdoors (32.4%), indoors (10%) and control (40%). The difference among the workers was significant ($P < 0.05$) for the high temperature (Table 3.1.2). Most of the workers including the control would move their whole body while working (40 – 80%), next came part of their bodies for the outdoors (~38%), with small numbers that would stand or sit (Table 3.1.3). Workers when asked to evaluate their workload as being heavy, moderate or light, outdoors (60%) and indoors (26%) rated their workload to the high temperature, while 30% of the control rated their works to the increase in working hours. 55% of the outdoors rated their workload to perform work rapidly (Table 3.1.4).

Table 3.1.1: Evaluation of work

			Study groups		
			Outdoor	Indoor	Control
Type of work	**Heavy**	count/ percentage	15 (44.1%)	19 (47.5%)	1 (10.0%)
	Moderate	count/ percentage	18 (52.9%)	18 (45.0%)	9 (90.0%)
	Light	count/ percentage	1 (2.9%)	3 (7.5%)	0 (.0%)

Table 3.1.2.Reasons of work evaluation the work as light, moderate or heavy

Reason for workload level evaluation	Study groups			Signicance
	Outdoors	Indoors	Control	
Increase working hours	4 (11.8%)	6 (15.0%)	3 (30.0%)	$P > 0.05$
The high degree temperature	9 (26.5%)	24 (60.0%)	1 (10.0%)	$P < 0.05$
Perform work rapidly	11 (32.4%)	22 (55.0%)	4 (40.0%)	$P > 0.05$
Perform work by few workers	11 (32.4%)	4 (10.0%)	4 (40.0%)	$P > 0.05$

Table 3.1.3: Body position while performing a work

Position of performing work		**Study groups**		
		Outdoors	Indoors	Control
Sitting	count/ percentage	4 (11.8%)	2 (5.0%)	2 (20.0%)
Standing	count/ percentage	3 (8.8%)	2 (5.0%)	0.0 (.0%)
Moving	count/ percentage	13 (38.2%)	4 (10.0%)	2 (20.0%)
Whole body	count/ percentage	14 (41.2%)	32 (80.0%)	6 (60.0%)

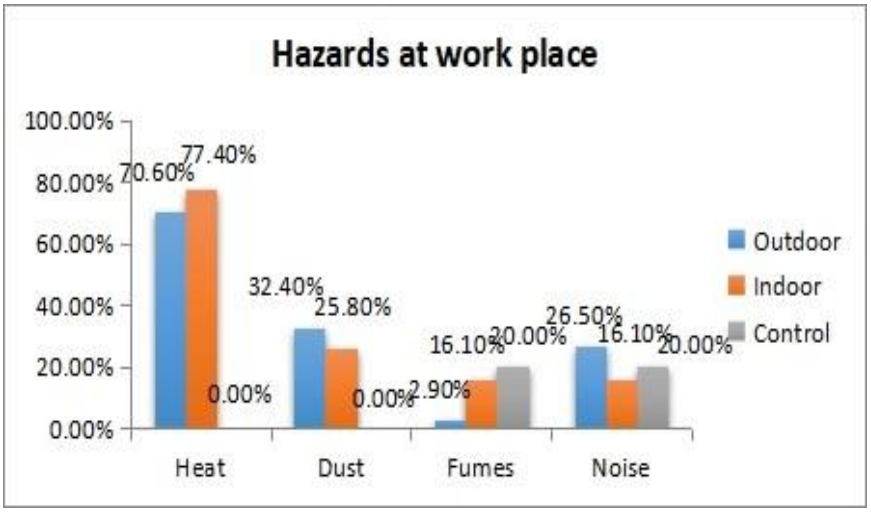
Table 3..1.4: Body parts used to perform different tasks

Parts of the body used in performing work		**Study groups**		
		Outdoors	Indoors	Control
two hands	count/percentage	11 (32.4%)	3 (7.5%)	6 (60.0%)
2hands with 1 or 2 legs	count/ percentage	3 (8.8%)	0 (0.0%)	1 (10.0%)
whole body	count/percentage	20 (58.8%)	37 (92.5%)	3 (30.0%)

3.2 WORK HAZARDS

Heat, dust, fumes, and noise constituted work hazards. Heat constituted most (~70%) of the hazards for indoor and outdoor workers, whereas noise and fumes were the major hazard for the control group (~20%) (Figure 3.2).

Figure 3.3 Occupational hazards at work place



3.3 Accidents complaints

Nearly same percentage of outdoor workers expressed either exposed or not exposed to accidents while ~74% of indoor workers and 90% of the control showed that they were not exposed to accidents, with significant ($P < 0.05$) differences obtained between those who agreed and those who did not agree (Table 3.3). Most accidents were related to work (Table 3.3.1). About 50% of the outdoors workers related accidents to falling of objects on hands and legs, whereas 30% related accidents to hands and legs missing. Accidents due to burn or falling constituted negligible percent (Table 3.3.2).

Table 3.3: Accidents complaints

Have you ever exposed to work accidents?		Study groups			P-value
		Outdoor	Indoor	Control	
Accidents exposure	Yes	15 (44.1%)	10 (25.6%)	1 (10.0%)	P < 0.05
	No	19 (55.9%)	19 (74.4%)	9 (90.0%)	
If yes, Indicate?	Work accidents	4 (11.8%)	8 (25.8%)	1 (10.0%)	P > 0.05
	Falling accidents	3 (8.8%)	0.0 (.0%)	0.0 (.0%)	P > 0.05

Table 3.3.1: Types of accidents

		Study groups		
		Outdoor	Indoor	Control
Accident you are exposed to?	Falling of the whole body	1 (6.7%)	0 (0.0%)	0 (0.0%)
	Foot slipping	2 (14.3%)	1 (10.0%)	0 (0.0%)
	Burn	0 (0.0%)	1 (10.0%)	0 (0.0%)
	Falling of objects on hands and legs	8 (50.9%)	0 (0.0%)	0 (0.0%)
	Hands and legs missing	3 (21.4%)	3 (30.0%)	0 (0.0%)
	Others	1 (6.7%)	5 (50.0%)	10 (100.0%)

3.4 Personal protective equipment

Protective equipment worn during working hours showed that most (~88%) of the outdoor and indoor workers (~77%) did not wear protective equipment (Table 3.4). 81.8% of outdoor and 68.6% of indoor workers would not wear protective equipment because they were not available, 57.1% of the control thought that they were not important (Table 3.4.1). About 90% of indoor and control group wore mixed fabrics of cotton and polyester during summer while 50% of outdoor workers worn the mixed fabrics (Figure 3.4).

Table 3.3.1.1: Reasons that causes the accidents

		Study groups		
		Outdoor	Indoor	Control
Temperature	count/percentage	1 (6.7%)	1 (10.0%)	0 (0.0%)
Not wearing protective equiment	count/percentage	7 (46.7%)	2 (20.0%)	0 (0.0%)
Protective equip not availab	count/percentage	3 (21.4%)	0 (0.0%)	0 (0.0%)
things on the ground	count/percentage	3 (21.4%)	2 (20.0%)	0 (.0%)
Others	count/percentage	1 (6.7%)	5 (50.0%)	10 (100.0%)

Table 3.3.1.1.2: Work accidents time

			Study groups		
			Outdoor	Indoor	Control
When did the accident happened ?	Before days	count/percentage	3 (21.4%)	1 (10.0%)	0 (0.0%)
	Before weeks	count/percentage	4 (28.6%)	1 (10.0%)	0 (0.0%)
	Before months	count/percentage	2 (14.3%)	3 (30.0%)	10 (100.0%)
	Before ye	count/percentage	5 (35.7%)	2 (20.0%)	0 (0.0%)
	Frequent	count/percentage	0 (0.0%)	3 (30.0%)	0 (0.0%)

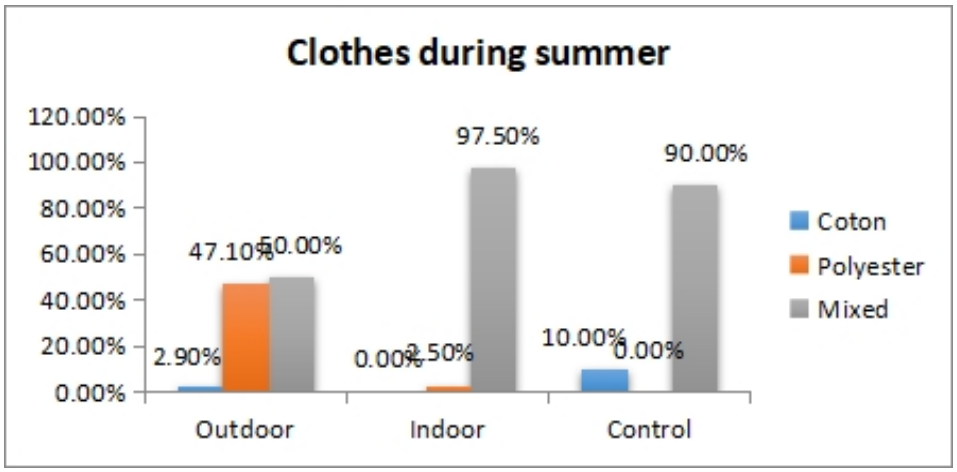
Table 3..4: Protective equipment

Protective equipment worn during working hours		Study groups		
		Outdoor	Indoor	Control
Overall	Count/percentage	0 (0.0%)	8 (20.0%)	3 (30.0%)
Protective shoes	Count/percentage	2 (5.9%)	1(2.5%)	0 (0.0%)
gloves	Count/percentage	0 (0.0%)	0 (0.0%)	1(10.0%)
Head protective	Count/percentage	1 (2.9%)	0 (0.0%)	0 (0.0%)
Not wearing protective equipment	Count/percentage	30 (88.2%)	31 (77.5%)	6 (60.0%)

Table 3.4.1: Wearing protective equipment

Reasons for not wearing protective equipment?			Study groups		
			Outdoor	Indoor	Control
Why?	Not important	Count/percentage	4 (12.1%)	10 (28.6%)	4 (57.1%
	Not available	Count/percentage	27 (81.8%)	24 (68.6%)	3 (42.9%
	Not suitable	Count/percentage	2 (6.1%)	1 (2.9%)	0 (0.0%)

Figure 3.4 Types of cloths during summer

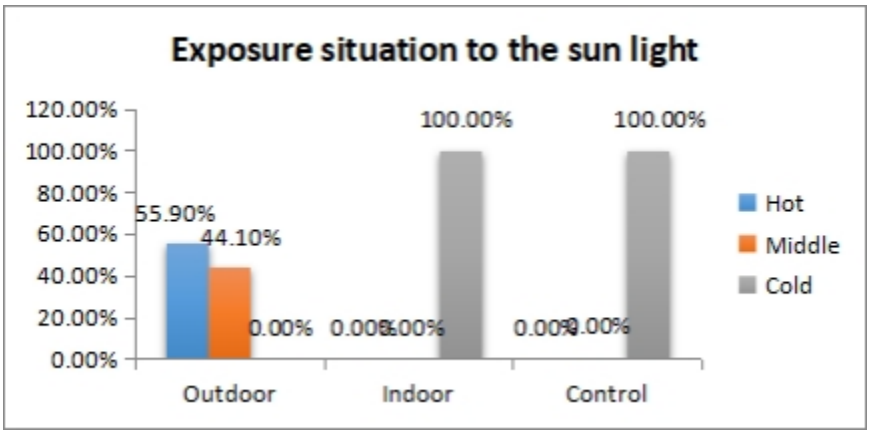


3.5 Physiological responses

3.5.1 Exposure to sunlight, temperature sensation, sweating and adaptation

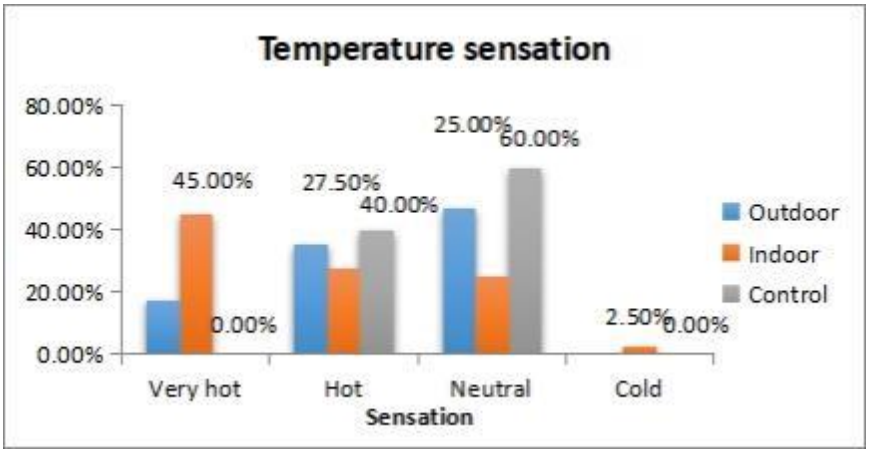
Exposure to sunlight showed that for indoors and control there was no exposure to sunlight, however, half of the workers under outdoor conditions experienced exposure to direct sun light (Figure 3.5.1).

Figure 3.5.1Exposure to the sun light



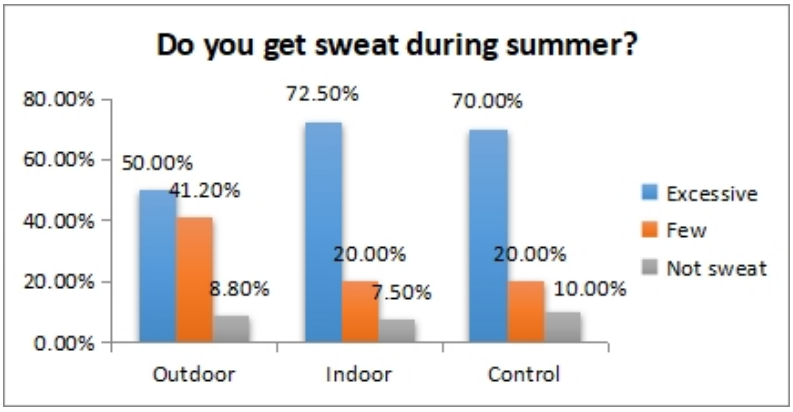
Temperature sensation showed that both indoors (45%) and outdoors (47%) felt very hot, while ~35 - 40% felt hot for the indoors and control groups respectively. 60% of the control groups were not affected by the thermal environment (Figure 3.5.2).

Figure 3. 5.2Temperature sensation at work places



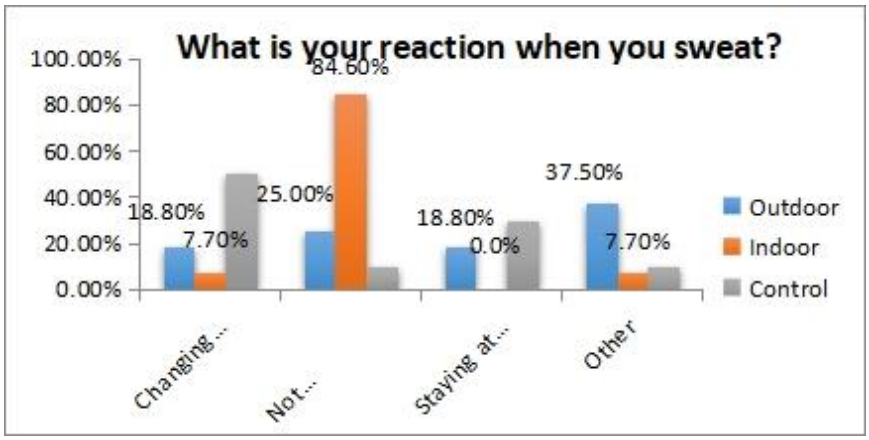
Excessive sweating were observed in both the control (70%) and indoor groups (72.5%). Nearly same percentages were observed for excessive (50%) and few sweating (41%) in the outdoor workers (Figure 3.5.3).

Figure 3.5.3 sweating during summer



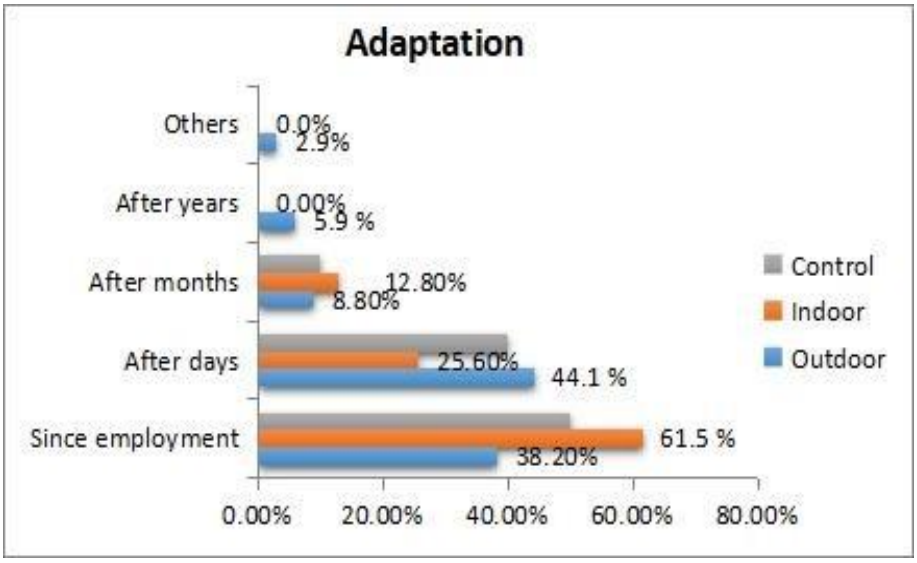
Most (84%) of the indoor workers would respond to sweating by changing their clothes, while half of the control would do that. Outdoor workers would resolve to other solutions (37%) (Figure 3.5.4).

Figure 3.5.4 Response to sweat



Most respondents of the indoors (61.5%) and half of the control expressed that they became adapted to thermal environment after employment, whereas ~44% of the outdoor respondents became adapted after few days of working (Figure 3.5.5).

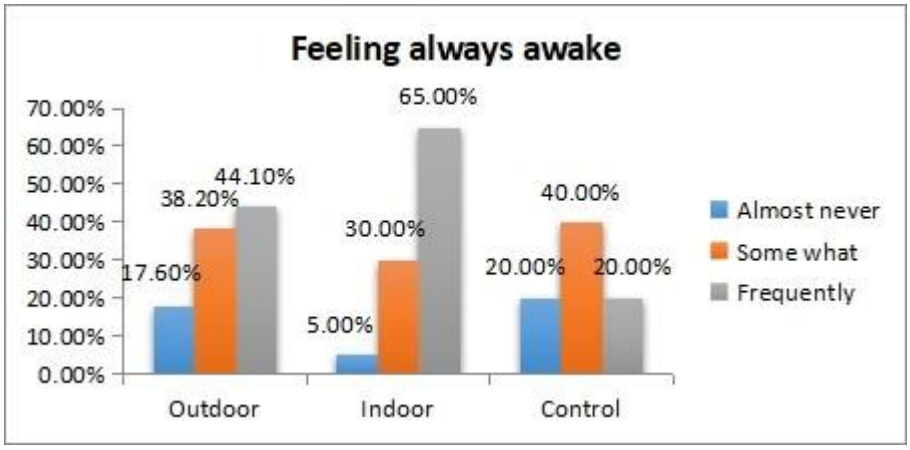
Figure 3.5.5 Adaptation to working conditions



3.6 SENSATION OF AWAKENS, ALERT AND FATIGUE

About 44% of indoor workers and 65% of outdoor workers felt frequently awake, while 40% of control somewhat felt awake (Figure 3.6.1). About half of the workers under out- and indoors conditions felt somewhat alert, while half of the control group almost never felt alert. About 42% of indoor workers frequently felt alert (Figure 3.6.1.1).

Figure 3.6.1 Frequently towards feeling always awake



During work 67% of indoor group did not feel fatigue, followed by 50% and 20% for outdoor and control group respectively. Fatigue was felt sometimes by 60% of control group followed by little percentages for both indoor and indoor groups (11 - 17%). little percentages did not always felt fatigue (figure 2.6.2.2)

After work, 75% of indoor workers felt fatigue while outdoors and control showed little percentages (26 - 20%). About half of the outdoor and the control groups sometime felt the fatigue while very little percent of the indoor felt the fatigue for some time. Groups who did not the fatigue varied from 30% (control group), 23% (outdoor group) and 15% (indoor group) (Figure 3.6.2.3).

3.7 ABSENTEEISM

Most of the indoor (97%) were not absent from their work, for the control and indoor, it was 70% and 55% respectively. The absence percentages were 44 and 30% for the outdoor and control respectively (Figure 3.7)

Duration of absenteeism showed that for outdoors ~20% were absent from work once a week. 10% of the control were absent once a week, 3 days a week and 3 days a month, while 2.5% of indoors were absent 3 days a week (Figures 3.7.1, 3.7.2,.3.7.3). Reasons for being absent from work were either due to not finding work (29.4%) for outdoor workers and due to family issues (10%) for the control group (Figure 3.7.4).

3.8 HYPERSOMNIA AND EASINESS OF MOVEMENT

About half of the workers at out-and indoors almost never or somewhat felt hypersomnia, while 60% of the control felt hypersomnia (Figure 3.8). About 90% of workers at all sites felt easiness of movement (Figure 3.8.1).

Figure 3.6.1.2 Feeling alert

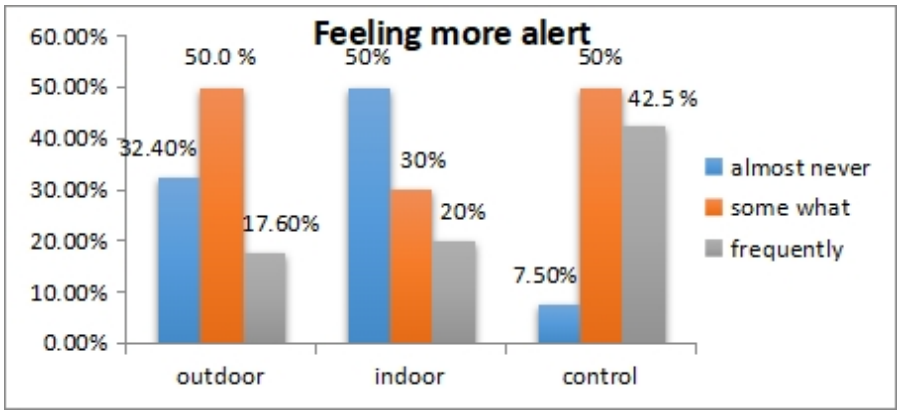


Figure 3.6.2 Fatigue occurrences

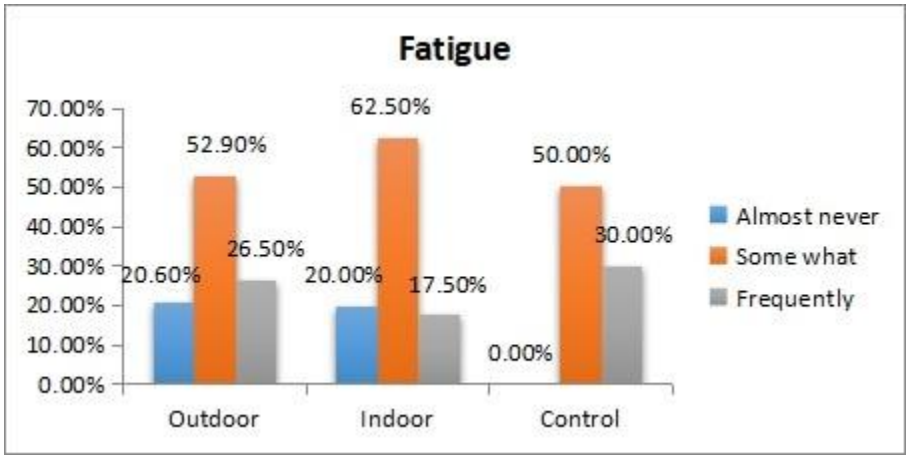


Figure 3.6.2.1 Fatigue before working day

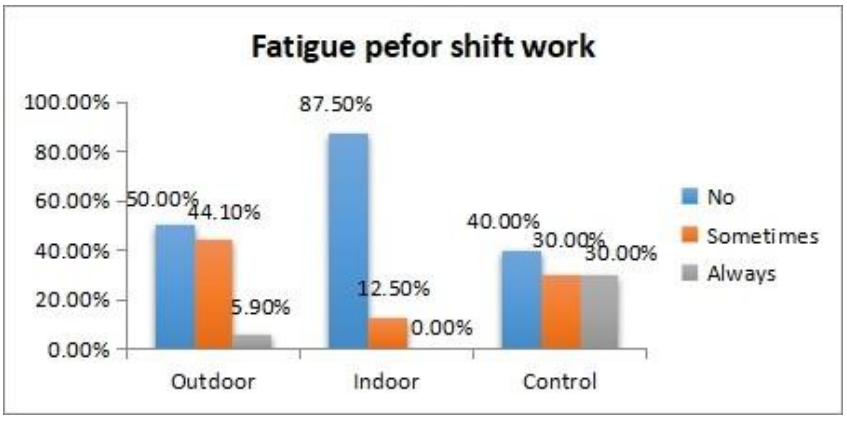


Figure. 3.6.2.2 Fatigue during working day

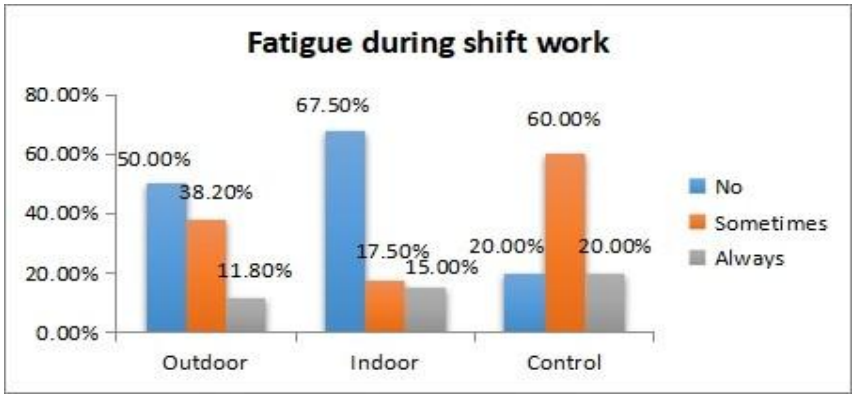


Figure 3.6.2.3 Fatigue after working day

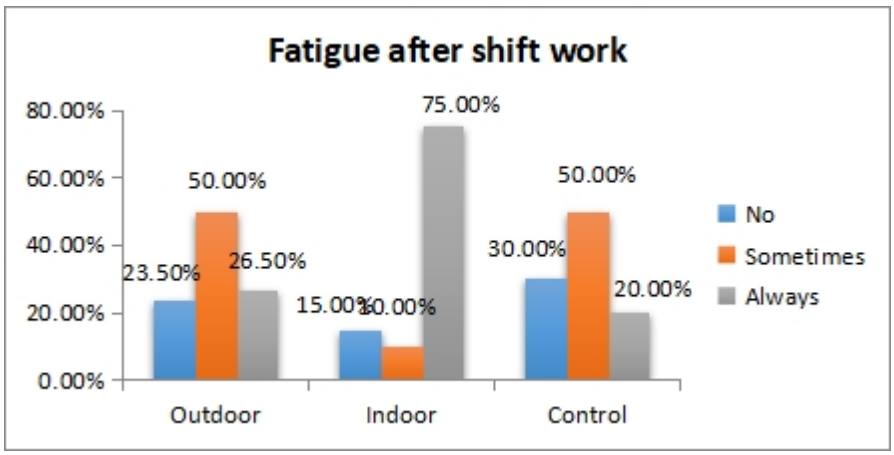


Figure 3.7 Percent absentee of workers

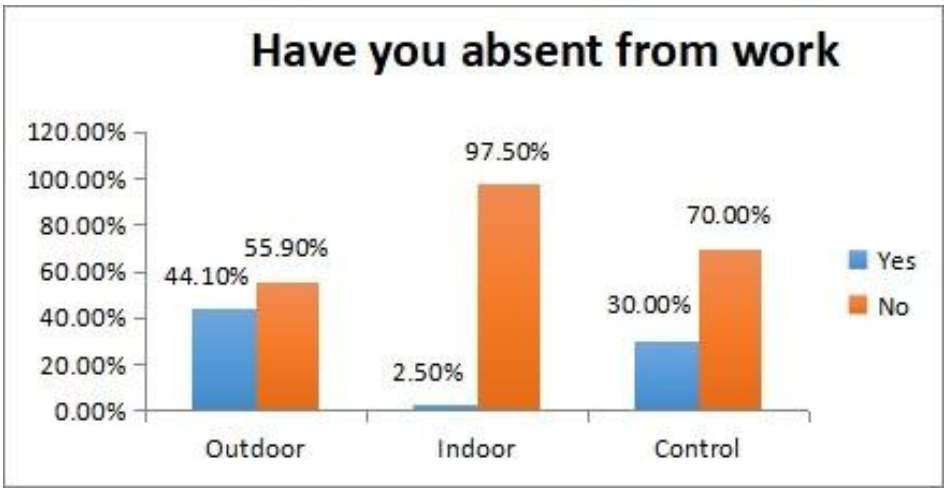


Figure 3.7 Frequency of absenteeism

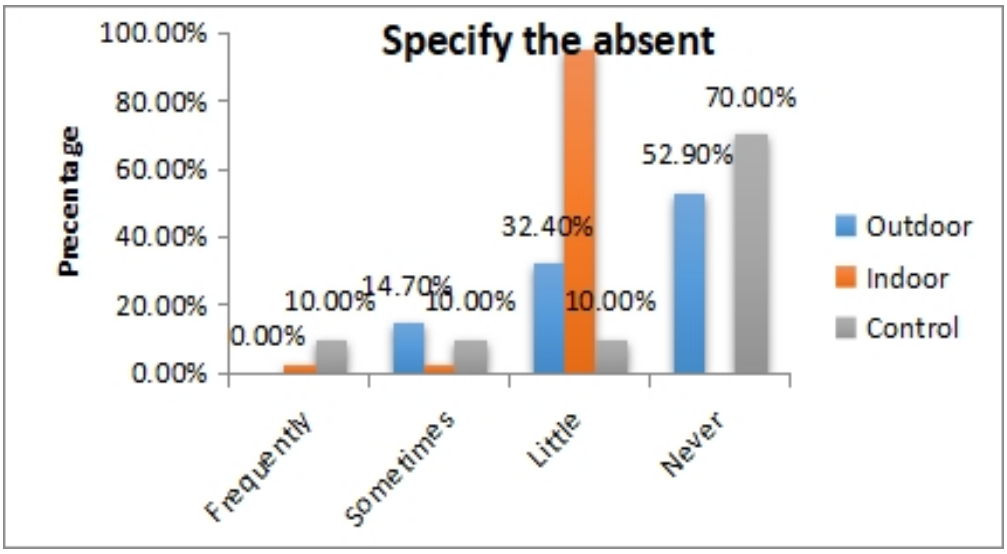
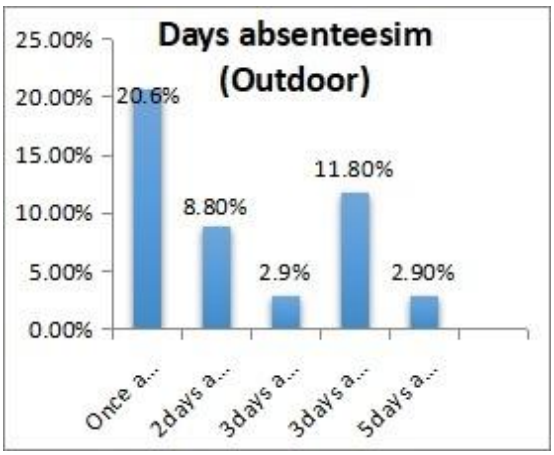


Figure 3.7.1 Days of absenteeism for outdoor Figures 3.7.2 Days of absenteeism for indoor



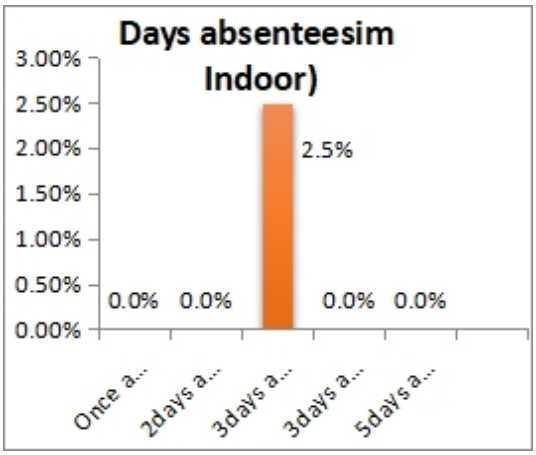


Figure 7.2.3 Days of absenteeism for control

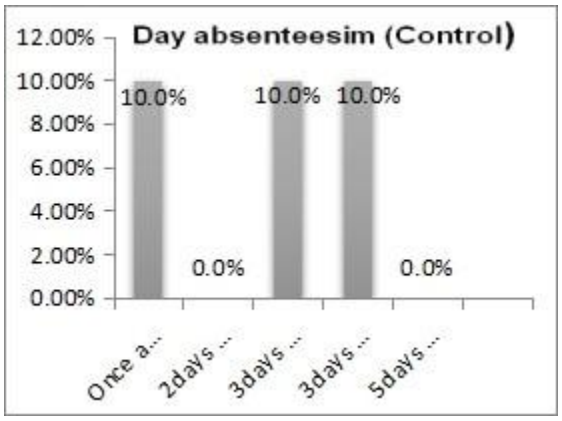


Figure 3.7.4 Reasons for absenteeism

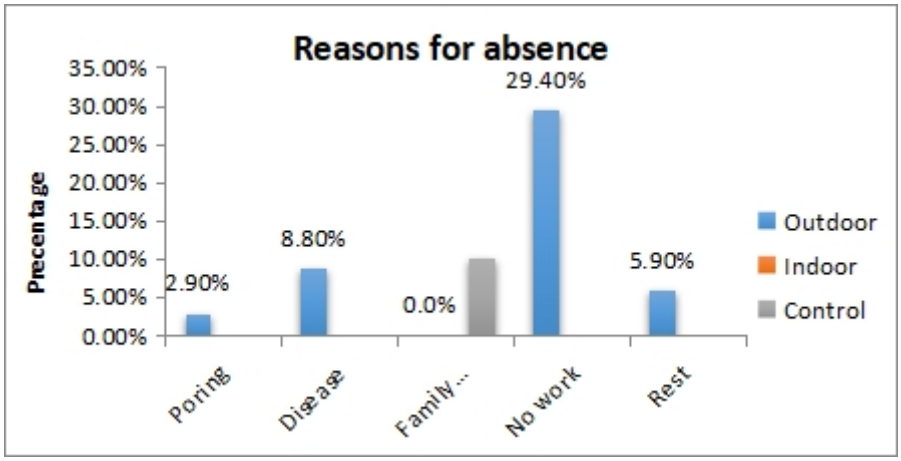


Figure 3.8 Tendency towards feeling hypersomnia

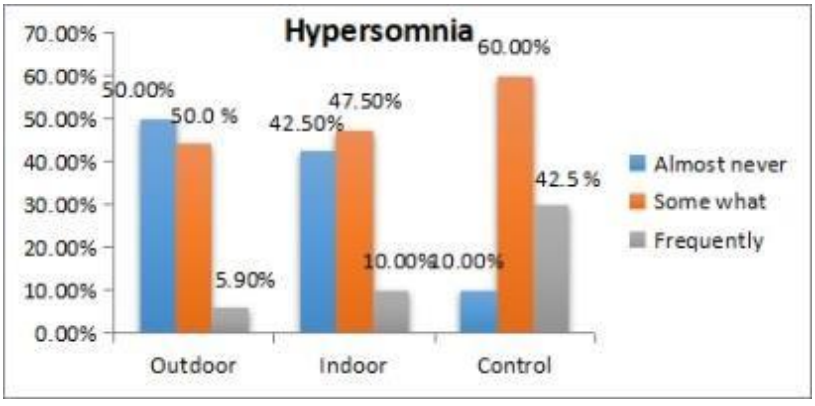
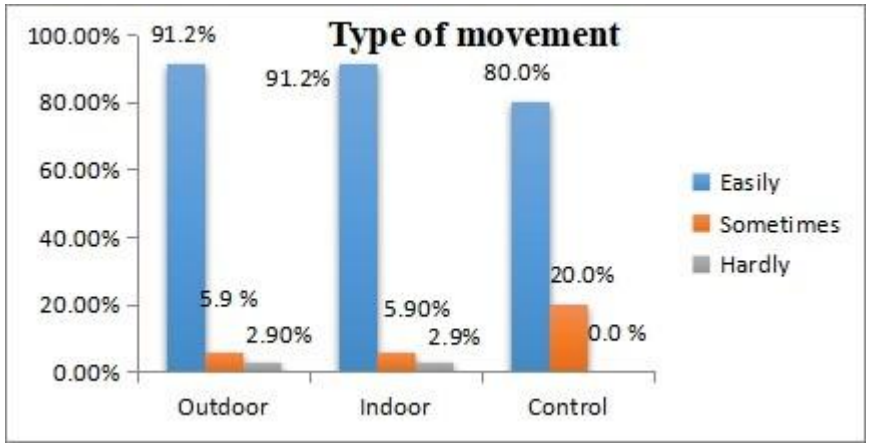


Figure 3.8.1 Easiness of movement

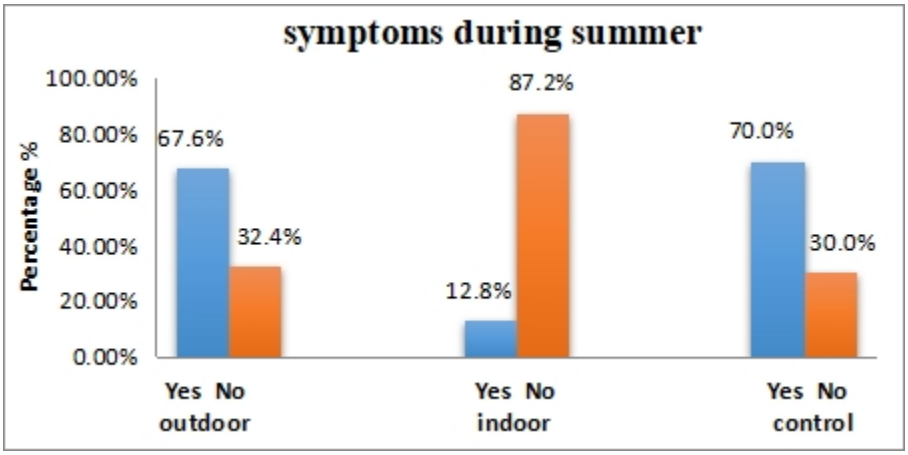


3.9 DISEASES COMPLAINTS

3.9.1 DISTURBANCE OF APPETITE, NAUSEA, STOMACH ACHE, INDIGESTION, ABDOMINAL PAIN, DIARRHEA, AND DIZZINESS

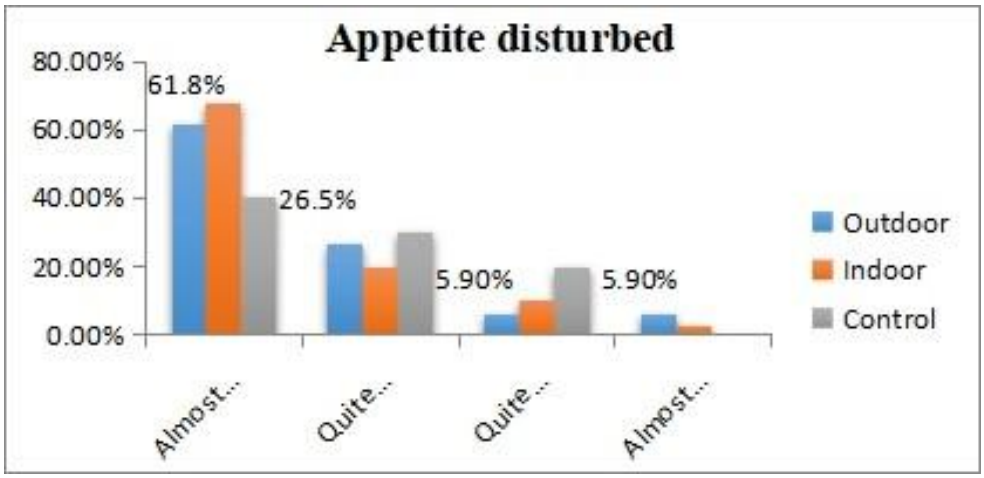
More than 60% of the workers at outdoor (67.6%), and control (70%), admitted that they suffer from some diseases, whereas most of the indoor (87.2%) did not complain from any diseases (Figure 3.9.1.1).

Figure 3.9.1.1 Diseases complaints during summer



About more than 60% of workers at out-and indoor felt disturbed appetite, while 40% of the control group felt disturbance of appetite, 30% quite seldom and 20% felt quite often disturbed appetite respectively for the control group, whereas for the rest of the groups these categories represented very few percentages (Figure 3.9.1.2).

Figure 3.9.1.2 Disturbance of appetite complaints in out-indoor and control workers



Most (80 – 70%) of the workers at all sites almost never felt nausea (Figure 3.9.1.3). 82.5% of indoor workers, 60% of control and 58.8% of outdoors workers almost never felt stomach ache, while 32.4% of outdoor workers quite seldom felt stomach ache (Figure 3.9.1.4).

Figure 3.9.1.3 Nausea complaints in out-indoor and control workers

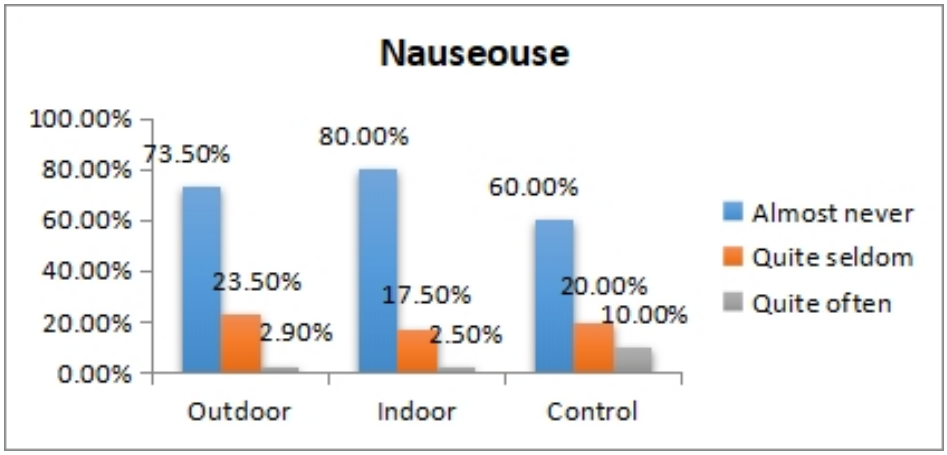
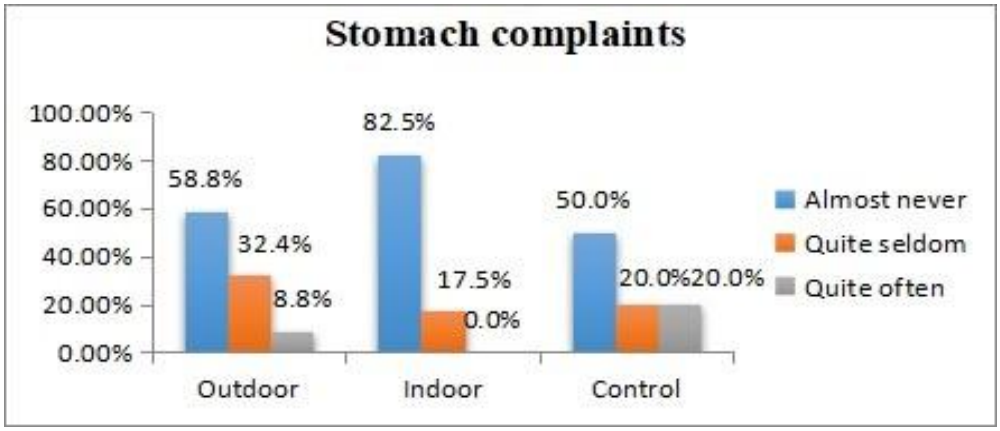


Figure 3.9.1.4 Stomachache complaints in out-indoor and control workers



Most of the workers at indoor (80%), outdoors (70.6%) did not feel indigestion, while 60% of the control did not feel indigestion but 23.5% quite seldom felt indigestion, small percentages felt either quite or almost always did feel indigestion (Figure 3.9.1.5). About 70% of workers at all sites almost never felt abdominal pain, whereas about 20% quite seldom felt the pain (Figure 3.9.1.6).

Figure 3.9.1.5 Indigestion complaints in out-indoor and control workers

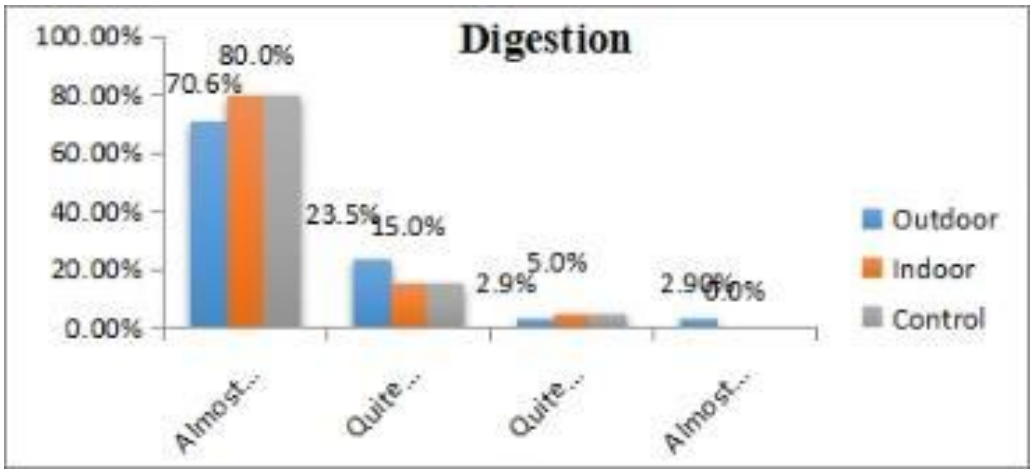
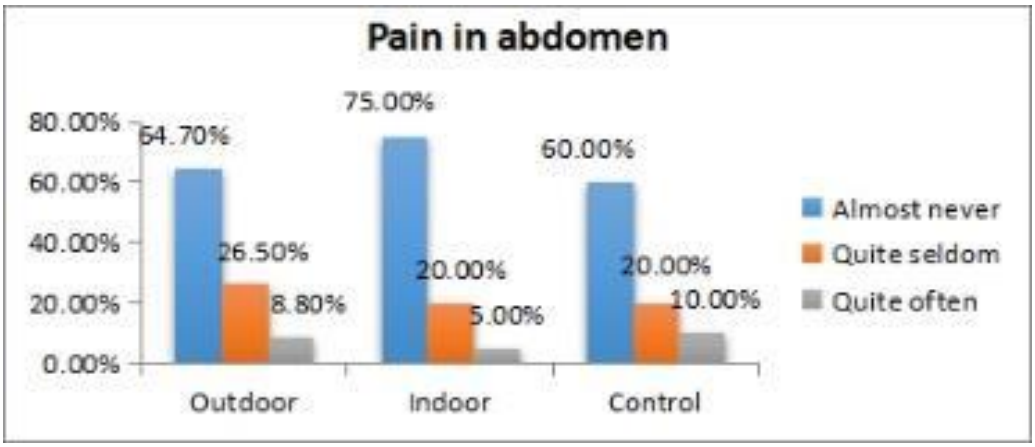


Figure 3.9.1.6 Abdominal pain complaints in out-indoor and control workers



About 70% of out-and indoor workers almost never suffered from diarrhea, but about half of the control group almost never suffered from diarrhea (Figure 3.1.7). Most out-and indoors (~80%) did not suffer from dizziness, while ~60% of the control suffered from dizziness (Figure 3.9.1.8).

Figure **3.9.1.7** Diarrhea complaints in out- indoor and control workers

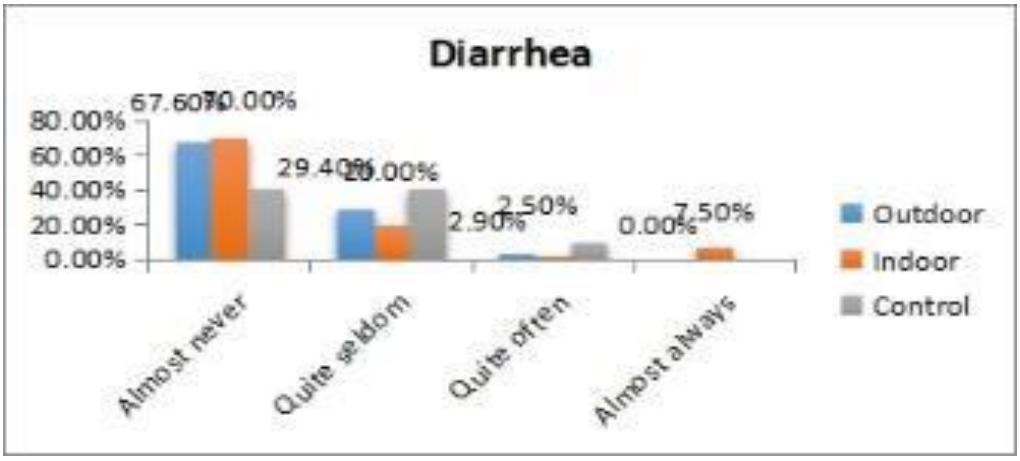
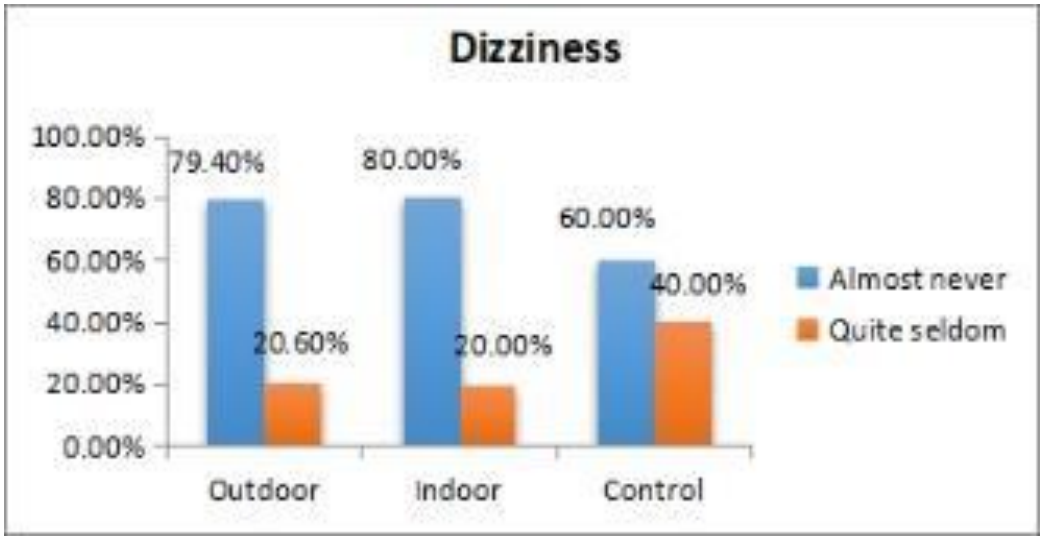


Figure **3.9.1.8** Dizziness complaints in out-indoor and control workers



3.9.2 CARDIOVASCULAR DISTURBANCES (IRREGULAR HEARTBEATS, BLOOD RUSHING TO THE HEAD)

Most of the indoor (80%) and outdoor (70%) workers, while 60% of the control did not suffered from cardiovascular disturbances (Figure 3.9.2.1). Also about 80% of all workers did not felt irregular heartbeats (Figure 3.9.2.2), similar percentages were observed for those not suffering from blood rushing to the head (Figure 3.9.2.3). Most of the workers (80 – 90%) did not complain from swollen feet (Figure 3.9.2.4). Chest pain complaints were almost not felt at outdoors (76.5%), indoors (82.5%), and control (60%) (Figure 3.9.2.5).

3.9.3 RESPIRATORY DISTURBANCES (CHEST TIGHTNESS, SHORTNESS OF BREATH)

Most of the workers at all sites did not complain of chest tightness (80 – 70%) (Figure 3.9.3.1). Similar observations were obtained for shortness of breath, however, 50% of the control group did complain from shortness of breath (Figure 3.9.3.2).

Figure 3.9.2.1 Cardiovascular disturbances complaints in out-indoor and control workers

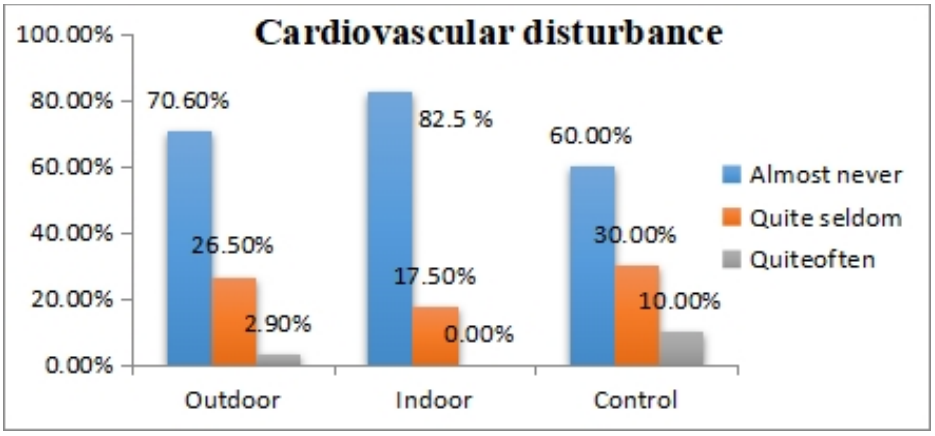


Figure 3.9.2.2 Irregular heart beats

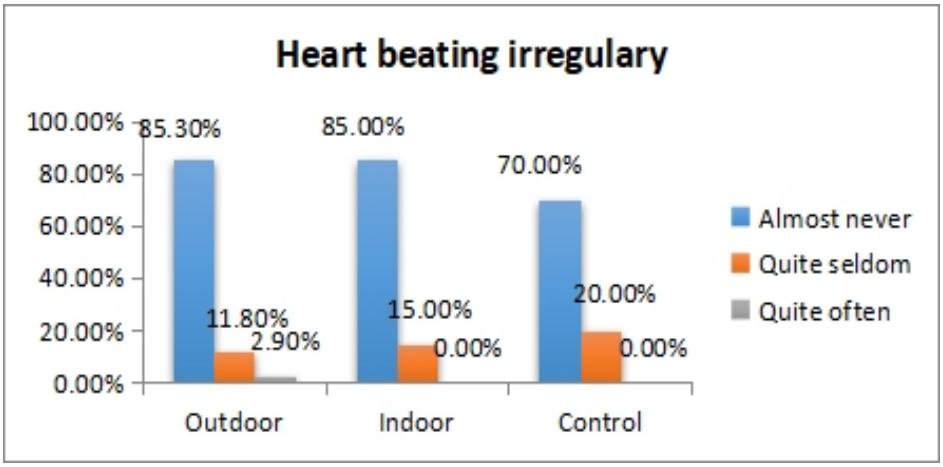


Figure 3.9.3.1 Blood rushing to head complaints in out-indoor and control workers

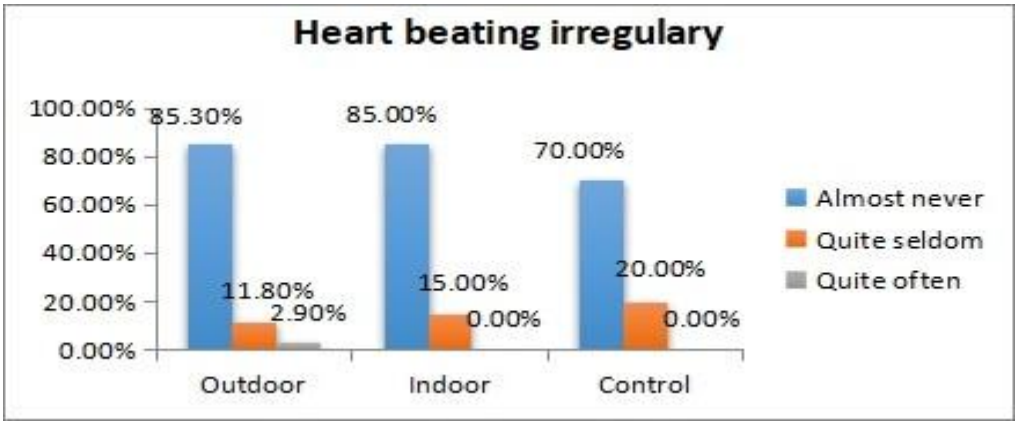


Figure 3.9.3.2 Swollen feet complaints in out-indoor and control workers

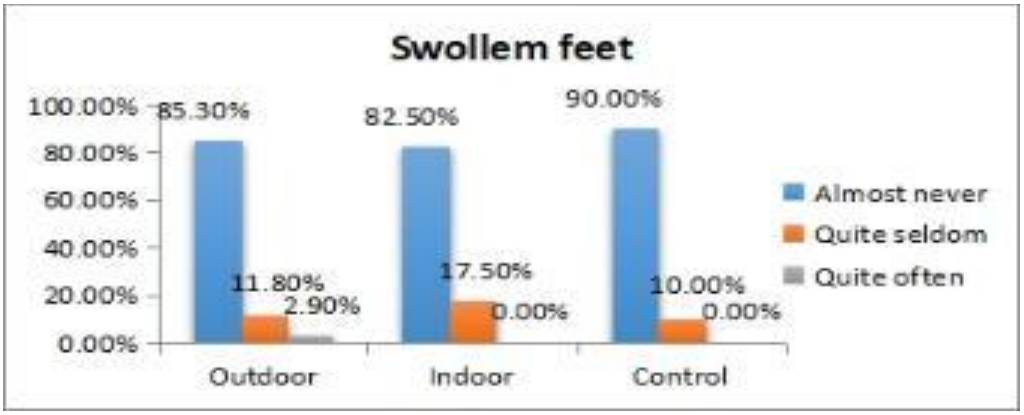
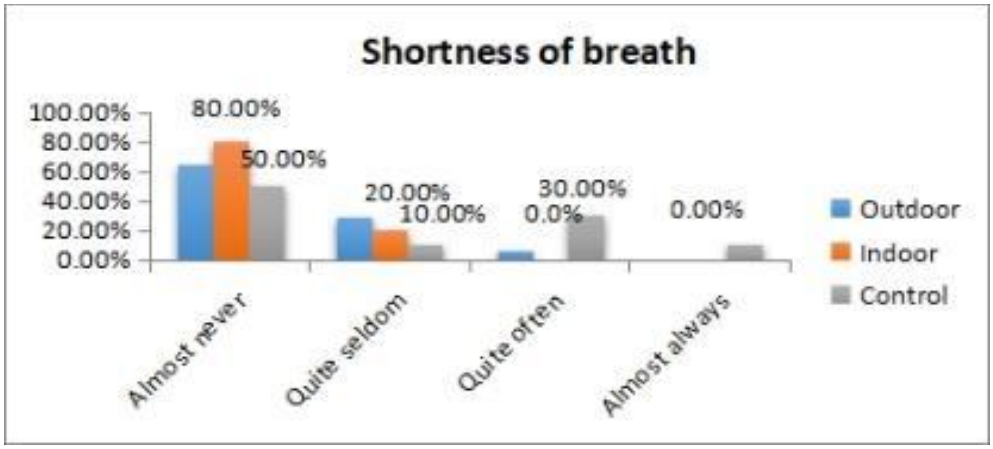


Figure 3.9.3.3 Chest pains complaints in out-indoor and control workers

Figure 3.9.3.4 Chest tightness complaints in out-indoor and control workers

Figure 3.9.3.5Shortness of breath complaints in out-indoor and control workers



3.9.4.1 SYMPTOMS DURING SUMMER

Most of indoor workers (87.2%) and outdoor (70%) did not feel unhealthy symptoms during summer, whereas 67.6% of the control felt the same (Figure 3.9.4.1).

3.9.4.2 OCCURRENCE OF DISEASES SYMPTOMS

Percentages for appearance of diseases symptoms were felt by 66.7% of the indoor workers followed by control (42.6%) and outdoor workers (38.7), after middle period of experiencing the work. Start of the symptom was almost felt during the working day for the control (85.7%), indoor (66.7) and outdoor (43.4%) workers. Summer period was the most important for the prevalence of the symptom in all groups especially for outdoors (81.3%), followed by control (57.1%) and indoors (50%). Most expressed that the reasons for the symptoms were heavy work stress (Table **3.9.4.2.1**).

Figure 3.9.4.1 **Symptoms during summer**

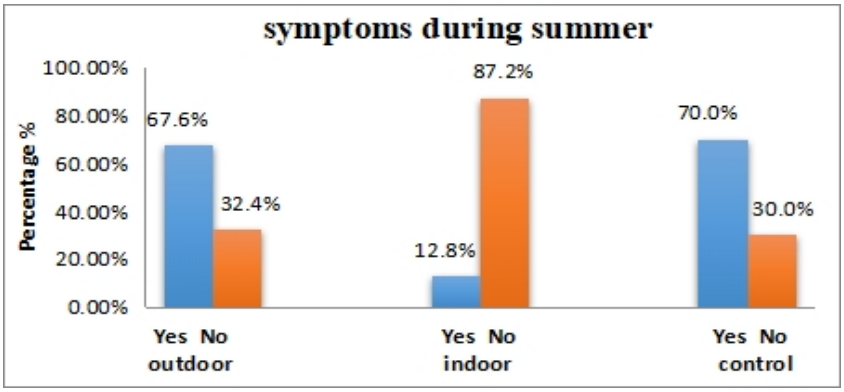


Table 3.9.4.2.1 Occurrence of diseases symptoms

		Study groups		
		Outdoor	Indoor	Control
Appearance of symptoms	Before employment in this job	5(16.1%)	0(0.0%)	0(0.0%)
	After a short period	10(32.3%)	0(0.0%)	2(28.6%)
	After middle period	12(38.7%)	4(66.7%)	3(42.9%
	After a long period	4(12.9%)	2(33.3%)	2(28.6%)
start of feeling of the symptoms	Before starting work day	6(20.0%)	1(16.7%)	0(0.0%)
	During working day	13(43.4%)	4(66.7%)	6 (85.7%)
	After working day	11(36.6%)	1(16.7%)	1(14.3%)
Time of feeling of the symptoms	Morning	5(15.6%)	1(16.7%)	0(0.0%)
	Afternoon	15(46.9%)	2(33.3%)	5(71.4%)
	Night	7(21.9%)	3(50.0%)	1(14.3%)
	Not know	5(15.6%)	0(0.0%)	1(14.3%)
State season when symptoms increased?	Summer*	26(81.3%)	3(50.0%)	4(57.1%)
	Winter	2(6.3%)	2(33.3%)	1(14.3%)
	All the round	4(12.5%)	1(16.7%)	2(28.6%)
Did the Symptoms cause absenteeism?	Yes	12(37.5%)	3(50.0%)	0(0.0%)
	No	20(62.5%)	3(50.0%)	7(100.0%)
Reasons of symptoms ?	Malnutrition	3(9.4%)	1(16.7%)	1(12.5%)
	protective cloths not available	2(6.3%)	0(0.0%)	1(12.5%)
	Heavy work stress	19(59.4%)	4(66.7%)	3(37.5%)
	Unsafe working environment*	1(3.1%)	1(16.7%)	4(50.0%)
	Others	3(9.4%)	1(16.7%)	3(37.5%)

3.9.4.2.2 SYMPTOMS AND PREVALENCE OF SUBJECTIVE HEALTH SYMPTOMS DURING SUMMER

For outdoor workers thirst (84.8%), sweating (51.5%), fatigue (42.4%) and rise in body temperature (39.4%) were felt during summer. For the indoor workers thirst and sweating (33%) were less important, while half of the workers felt symptoms of fatigue. For the control half of the workers felt headache, thirst and sweating received less complaints (~33%) (Table 3.9.4.2.2.1). The prevalence of the diseases showed that depression was cited by 37% of the control.Unsteadiness, hypersomnia, insomnia, aggressiveness and lower limbs coldness were expressed by 25% of the control. Acute depression and loss of concentration was cited by 33% of indoor groups (Table 3.9.4.2.2.2)

Table 3.9.4.2.2.1 : Symptoms during summer among study groups

		Study groups		
Subjective Symptoms		Outdoor	Indoor	Control
General symptoms	Feel uncomfortable	5 (15.2%)	2 (33.3%)	1(12.5%)
	Thirst*	28 (84.8%)	2(33.3%)	2(25.0%)
	Headache	12(36.4%)	2(33.3%)	4(50.0%)
	Sweating	17(51.5%)	2(33.3%)	3(37.5%)
	Dehydration	4(12.1%)	0(0.0%)	0(0.0%)
	Paleness	0(0.0%)	0(0.0%)	1(12.5%)
	Shivering	1(3.0%)	1(16.7%)	1(12.5%)
	Eye irritation	6(18.2%)	1(16.7%)	1(12.5%)
	Fever	9(27.3%)	1(16.7%)	2(25.0%)
	Fatigue*	14(42.4%)	3(50.0%)	3(37.5%)
	Rise in body temperature	13(39.4%)	1(16.7%)	0(0.0%)
	Rhinorrhoea	6(18.2%)	1(16.7%)	0(0.0%)
	Oliguria	2(6.1%)	0(0.0%)	1(12.5%)

Cardiopulmonary	Chest pain	3(9.1%)	0(0.0%)	1(12.5%)
	Shortness of breath	2(6.1%)	1(16.7%)	0(0.0%)
	Dyspnoea	1(3.0%)	2(33.3%)	1(12.5%)
	Need more ventilation	3(9.1%)	0(0.0%)	1(12.5%)
	Palpitation	2(6.1%)	0(0.0%)	0(0.0%)
Gastrointestinal	Abdominal pain	1(3.0%)	0(0.0%)	1(12.5%)
	Stomache	2(6.1%)	0(0.0%)	2(25.0%)
	Loss of appetite	2(6.1%)	0(0.0%)	1(12.5%)
	Nausea	1(3.0%)	0(0.0%)	2(25.0%)
	Constipation	2(6.1%)	0(0.0%)	1(12.5%)
	Diarrhea	1(3.0%)	0(.0%)	1(12.5%)
Musculoskeletal	Fingers and toes _pain	1(3.0%)	0(0.0%)	1(12.5%)
	Fingers stiffness	1(3.0%)	0(0.0%)	0(0.0%)
	Joint pain	6(18.2%)	0(0.0%)	0(0.0%)

Table 3.9.4.2.2. Prevalence of subjective symptoms during summer among study groups

Subjective Symptoms		**Study groups**		
		Outdoor	**Indoor**	**Control**
Psychiatric	Depression	1(3.0%)	0(0.0%)	3(37.5%)
system				
	Stressed	0(0.0%)	0(0.0%)	1(12.5%)
	Acute	7(21.9%)	2(33.3%)	1(12.5%)
	Aggressive	4(12.1%)	0(0.0%)	3(37.5%)
	Thinking concrete	1(3.0%)	1(16.7%)	1(12.5%)
	Loss of concentration*	3(9.1%)	2(33.3%)	5(62.5%)
	Confused	4(12.1%)	1(16.7%)	0(0.0%)
Central nervous	loss of consciousness	0(0.0%)	0(0.0%)	1(12.5%)

system	Muscle cramps	4(12.1%)	0(0.0%)	1(12.5%)
	Syncope			
	Convulsion	2(6.1%)	1(16.7%)	0(0.0%)
	dizziness			
	Drowsiness*	1(3.0%)	0(0.0%)	1(12.5%)
	Unsteadiness			
	Hypersomnia	0(0.0%)	1(16.7%)	0(0.0%)
	Insomnia			
	Hardheadedness	3(9.1%)	1(16.7%)	0(0.0%)
	Lower limbs coldness			
		3(9.1%)	0(0.0%)	2(25.0%)
	Peripheral numbness			
		3(9.1%)	0(0.0%)	2(25.0%)
		1(3.0%)	1(16.7%)	2(25.0%)
		1(3.0%)	1(16.7%)	0(0.0%)
		4(12.1%)	0(0.0%)	2(25.0%)
		1(3.0%)	0(0.0%)	0(0.0%)
Skin	Skin ulcer	1(3.0%)	0(0.0%)	1(12.5%)
	Itchy			
	Sun lesions	1(3.0%)	0(0.0%)	0(0.0%)
	Skin rash			
	Skin allergy	1(3.0%)	1(16.7%)	0(0.0%)
	Skin irritation			
		0(0.0%)	0(0.0%)	0(0.0%)
		2(6.1%)	1(16.7%)	0(0.0%)
		3(9.1%)	0(0.0%)	0(0.0%)

DISCUSSION

In this study summer period was the most important for the prevalence of the symptom in all groups especially for outdoors (81.3%), followed by control (57.1%) and indoors (50%). Most expressed that the reasons for the symptoms were heavy work stress. Most of indoor workers rated their work as heavy due to high temperature while outdoor workers rated it to rapid, work while the control rated it to increase in working hours. In either cases, body is gaining heat either from the environment or from muscle activities. Similarly. it has been shown that body core temperature which can be caused by exposure to high temperature from the environment, or heat production of working muscles, leads to negative affective responses (psychological state of emotions) (Ekkekakis *et al*., 1997).

The effect of elevated body temperature could be reflected on that 60% of the control group sometimes felt fatigue during the work, while 75% of indoor workers felt fatigue after work. Also about more than 60% of workers out-and indoors felt disturbed appetite, while 40% of the control group felt disturbance of appetite, while ~60% of the control suffered from dizziness. Similarly, it was shown that heat

exhaustion associated with loss of sweat that brings about hypohydration (reduction in body water content) and hypernatraemia result in weakness, fatigue, dizziness, anxiety, oliguria (scanty urination), tachycardia (rapid heartbeat) and moderate hyperthermia, heat exhaustion usually develops a few days after the development of water depletion leading to headache, dizziness, weakness, fatigue, nausea, vomiting, diarrhea, anorexia, muscle spasms and mental confusion are common symptoms (Tokuo, 1998).

CONCLUSIONS AND RECOMMENDATIONS

Symptoms of thermal stress injuries were felt most during summer as thirst for outdoor, fatigue, and headache. Work hazards were related mostly to heat and dust. Accident complaints were expressed more by the outdoor groups and related to falling objects. Workers were not equipped with the right clothing recommended by OSHA (1999). A properly designed and applied acclimatization program decreases the risk of heat-related illnesses which should be established by the employer. Occupational health services covering all workers should be established. Education and training are vital components of safe, healthy working environments. The suitable personal protective equipment should be available for all workers ((ACGIH, 1975).

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