

# Survey of Blood and Urine Biological at Petrochemical firefighters

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## Abstract

**Background and Objective:** Firemen have one of the most dangerous and hazardous jobs which is associated with high levels of physical stress, heart arrest, different types of strains, and many accidents. According to the National Fire Protection Agency, the death rate of firemen who lost their lives during emergency operations was 56 between 1990 and 2000. **Materials and Methods:** This descriptive, analytical study was carried out on 89 firemen working in a petrochemical plant. To compare the level of firemen's blood factors with normal levels, a confidence interval of 95% was set. SPSS software (version 16) was used to analyze the data, and the cut-off point of .05 was considered as statistically significant. Random sampling was employed, and the data were based on firemen's medical examination and test profiles. **Results:** The average body mass index of the firemen was 25.3 with its maximum and minimum being 39 and 16.2, respectively. The most abnormal factor in firemen's blood was the cholesterol which was higher than the normal range. **Conclusion:** The findings showed that the most common diseases among the firemen were high Cholesterol and high aspartate transaminase which could be the result of long sedentary positions and exposure to chemicals.

**Key words:** Fire extinguishing, firemen, health index, petrochemistry

## INTRODUCTION

One of the riskiest jobs is fire suppression, which is associated with heart attacks, high levels of physical stress, and high levels of injuries such as sprain and others.<sup>[1]</sup> Every year, statistics show that fire suppression is the most dangerous jobs in the world. The deaths rate of the firefighters who lost their lives during firefighting during the years 1990–2000, according to the National Fire Protection Agency (NFPA), has evaluated equal to 56%.<sup>[2]</sup> Heart attacks are a major cause of death among firefighters while 50% of deaths among firefighters are due to heart attacks.<sup>[3]</sup> NFPA has estimated that 82,250 people of firefighters in 2001 have been damaged during the activity. On this basis and in accordance with the methods that have been used, the estimated costs of the firefighters' damages and what has been done for the prevention of them is between 2.8 and 7.8 billion dollars during 1998–2008, according

to the NFPA.<sup>[4,5]</sup> These costs include compensation to the injured person, the costs of medical and insurance, long-term care, reduced efficiency, and production and administrative costs, etc.<sup>[6,7]</sup> Fabrize *et al.* (2014) conducted a study on 161 of America firefighters and studied firefighters fitness with a wide range of age groups. The aim of the study on these persons was to evaluate elasticity, strength, speed, and endurance of the firefighters.<sup>[8]</sup> Creating and running a program associated with occupational health and safety of firefighters in fire services, undoubtedly, will prevent deaths and injuries and accidents among firefighters.<sup>[9]</sup> Some of the documents contained in NFPA confirm that improving lifestyle will reduce deaths and injuries among firefighters.<sup>[10,11]</sup> Many of the deaths and injuries also can be

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reduced by programs related to health and physical fitness of firefighters in the fire suppression services, so it is essential that the causes and origins of these injuries and accidents in the firefighters to be studied. In this study, while addressing the existing problems, we will be trying to fix the gap.

## MATERIALS AND METHODS

This descriptive study was performed on 89 of the firefighters in a petrochemical complex (2004–2014). The population includes numbers of firefighters who are working in a petrochemical complex on the basis of contractual and officially. The target population includes 89 employees which 30 persons are working on the basis of contractual and 59 persons officially. Sampling in this study was conducted using census. Data were analyzed using statistical software SPSS software (version 16, SPSS Inc., Chicago, IL, USA). To evaluate the frequency distribution of the participants regarding demographic characteristics, frequency distribution table (frequency and percentage) and statistical indicators (mean and standard deviation) were used. To examine the mean differences of blood factors, the 95% confidence interval was used. The significance level was set at 0.05.

## RESULTS

### Demographic information

In this study, information about physical condition and diseases of firefighters has been collected from the firefighters examination records that are available in Petrochemical Complex Clinics; the basic information includes first name, family name, age, gender, weight, height, body mass index (BMI), marital status, educational status, smoking, and work experience.

Furthermore, other indicators, such as blood pressure and pulse, are available in the demographic data section which will be measured and evaluated each year during the examination.

### Clinical status

This information, which is related to the diseases and the individual clinical situation, includes the status of sight and vision and diseases of the cardiovascular system (blood pressure, blood sugar, blood lipids, etc.). Blood items such as white cell count, red blood cells count (RBC), percentage of hemoglobin, hematocrit (percentage of RBCs in the blood), mean corpuscular volume (average volume of globin), mean cell hemoglobin, aspartate transaminase (AST), alanine transaminase (ALT), fasting blood sugar, low-density

**Table 1:** Firefighters frequency distribution table in terms of marital status

Marital status	Frequency (%)
Single	17 (19.1)
Married	72 (80.9)
Total	89 (100)

**Table 2:** Firefighters frequency distribution table in terms of smoking

Smoking	Frequency (%)
Yes	8 (0.9)
Good	81 (0.91)
Total	89 (100)

**Table 3:** Firefighters frequency distribution table in terms of work experience

Work experience	Frequency (%)
1–5 years	46 (51.7)
6–10 years	32 (0.36)
11 years and older	11 (12.4)
Total	89 (100)

lipoprotein, high-density lipoproteins, triglycerides, and total cholesterol (T.CLO) (the amount of total cholesterol in blood) are also evaluated individually. Frequency of marital status and smoking status and work experience are presented in Tables 1-3.

The clinical data is related to the years 2012 and 2013 which actually represents the health of the blood system. Comparison of average blood parameters with the normal average illustrated in Table 4.

Then, the frequency distribution of firefighters regarding demographic characteristics such as marital status, smoking, and work experience using frequency distribution table and in terms of demographic characteristics such as age, weight, height, and BMI is shown using tables.

The Mean and standard deviation for age of the firefighters were 35.6 and 8.7 years, respectively, and their minimum and maximum age were 25 and 57 years of age, respectively. The mean and standard deviation for weight of the firefighters were 79.6 and 10.7 kg, and minimum and maximum values of the firefighters were 52 and 125 kg weight, respectively. The mean and standard deviation for height of firefighters were 177.6 and 6.2 cm, and minimum and maximum values of their height was 161 and 192 cm, respectively; mean and standard deviation for BMI of firefighters were 25.3 and 3.5 kg/m<sup>2</sup>, respectively, and minimum and maximum values of BMI was 16.2 and 39.0 kg/m<sup>2</sup>, respectively.

**Table 4:** Comparison of average blood parameters with the normal average

Item	Year				Normal values	Unit
	2012		2013			
	Average	SD	Average	SD		
RBC	5.02	0.63	5.11	0.67	4.7–6.1	1,000,000/ml
TG	176.3	87.7	179.3	88.1	<200	Mg/dl
AST	31.64	5.55	32.04	6.01	<37	U/L
ALT	40.29	10.77	40.95	10.28	<41	U/L
LDL	36.34	8.01	36.97	7.98	<130	Mg/dl
HDL	63.93	14.02	64.76	14.12	>60	Mg/dl
WBC	7373.03	1390.12	7373.03	1390.12	5000–10,000	1000/ml
HGB	14.74	0.90	14.88	0.94	14–18	g/dl
HCT	44.00	2.50	44.32	2.53	42–52	%
MCV	88.78	5.51	89.44	5.49	80–100	Fl
MCH	28.68	2.02	29.12	2.06	28–32	Pg
CLO	189.64	47.01	203.05	48.01	<200	Mg/dl
HB	15.10	0.91	15.51	0.86	18–20	g/dl

SD: Standard deviation, RBC: Red blood cells, TG: Triglycerides, AST: Aspartate transaminase, ALT: Alanine transaminase, LDL: Low-density lipoprotein, HDL: High-density lipoproteins, WBC: White blood cells, HGB: percentage of hemoglobin, HCT: Hematocrit, MCV: Mean corpuscular volume, MCH: Mean cell hemoglobin, HB: hemoglobin, CLO: clostrol

## DISCUSSION AND CONCLUSION

Physical needs of a firefighter are too widespread, and they must have a deep sleep at rest so that they must have maximum alertness and intelligence at important times to accomplish the task. In addition, they have to carry their heavy equipment; however, they wear protective equipment which is too heavy.<sup>[12]</sup>

Many firefighters are at risk for heart diseases, and the nature of the work requires that the firefighters remain at a level of physical fitness to cope with coronary heart diseases.<sup>[13]</sup> Moreover, when the National Association of Fire Protection (NFPA) investigated data associated with injuries in the years 1993 to 1997, findly they research nature of the injuries about the moderate and severe injuries.

Results of previous studies show that halothane and enflurane cause liver toxicity (an increase in liver enzymes).<sup>[14]</sup> Kay *et al.* based their studies on humans and animals suggest that chemicals in fuels often cause a gradual increase in liver enzymes.<sup>[15]</sup> ALT and AST are enzymes that are released from the liver parenchymal cells.<sup>[14,15]</sup> Moreover, they are the most reliable indicators in liver significant diseases caused by chronic injuries of necrosis and liver cells.<sup>[13]</sup>

ALT, due to the main presence in liver cytosol, is considered as a more specific marker than AST in liver inflammations.<sup>[16]</sup> AST increases in acute liver damages but also is present in RBCs, kidneys, pancreas, heart muscle, etc.; therefore, it is not merely confined to the liver,<sup>[17]</sup> and increased levels of AST enzyme is not a specific marker for liver cell damage.<sup>[15]</sup> Moreover, increased levels of enzyme AST is not a specific

marker for liver cell damage.<sup>[16]</sup> In this study, enzyme AST was higher than the normal range. An increase in ALT and AST enzymes may be due to the blockage of bile ducts.<sup>[14]</sup> Brunt *et al.* conducted a study on firefighters to examine the effects of emissions from fires on their liver system.<sup>[14,17]</sup> Drugs such as midazolam, thiopentone, mannitol, phenytoin, and cefazolin affect the liver function and blood flow; among these drugs, midazolam is considered as one of the most effective drugs on the liver function and blood flow.<sup>[14]</sup>

Brunt *et al.* believe that emissions of organic fuels can produce liver damaged and consider as the causative agent of an increase in hepatic transaminase.<sup>[14,17]</sup> Furthermore, a group of medications can cause abnormal level of the enzymes, medications which are used for reducing pain such as aspirin, acetaminophen, Tylenol, ibuprofen (Motrin, Advil), naproxen (Naprosyn), diclofenac (Voltaren), and phenylbutazone (Butazolidine), antiepileptic drugs such as phenytoin (Dilantin), valproic acid, carbamazepine (Tegretol), and phenobarbital, antibiotics such as the tetracyclines, sulfonamides, isoniazid, sulfamethoxazole, trimethoprim, and nitrofurantoin, as well as lowering drugs cholesterol include statins (Lipitor, Pravachol, Mevacor, etc.).<sup>[17]</sup> In addition, firefighters are potentially faced with a combination of states of stress, heat and high body temperature, as well as a combination of chemicals released from burning materials during a fire. When people are exposed to such stressful situations repeatedly, disorders will be created for people, that over time, these effects on the various systems of the body. In such stressful situations, such as a fire, researchers have found that the body's response is associated with physiological changes. In this case, more adrenaline is entered into the bloodstream;

muscles are stretched, rapid breathing, heart rate increases and blood pressure rises.<sup>[16]</sup> Some researchers have estimated that more than half of the firefighters have significantly overweight problems, research in the American Dietetic Association has shown that many firefighters are not aware of their overweight or obese.<sup>[14]</sup> The results show that blood cholesterol of some firefighters is higher than normal; it could have many reasons, one of the reasons is the lack of movement of firefighters during the break sufficiently, which they according to sports facilities at their disposal must do physical exercise, and appropriate exercise to avoid the problems associated with increased blood cholesterol. Another reason is an increase in their blood cholesterol, firefighters desire of these people to eat fatty foods in their meals, who these people said given that all these people work in their working shifts experience shift, shift and eating fatty snacks is another reason for it.<sup>[16]</sup> Moreover, the percentage of firefighters as well as have AST liver hormone years higher than normal during the 2 years, according to what are mentioned in the medical records of the persons, firefighters working in the petrochemical industry are faced with organic matter such as polyvinyl chloride, benzene and toluene, and likely, these materials over time affect their hepatic system, and according to what are listed in occupational toxicology resources, these substances increase the secretion of liver enzymes. Although the firefighters are faced with these materials lower than the allowable limit; however, over time, chronic effects of materials become apparent.<sup>[14,17]</sup>

If obesity is responsible for AST, weight loss of 5%–10%, leads to enzymes return to normal levels. If an abnormal level of enzymes continues despite abstinence from alcohol, weight loss, and stopping drugs, blood tests can be performed to help determine the therapeutic process.<sup>[17]</sup>

It is recommended that firefighters, especially those older than 40 years, avoid eating high-fat foods, have exercise during the work shift sufficiently, and necessary measures must be taken to ensure the health of firefighters before hiring them using the tests and physical examinations. The employment of people with underlying medical conditions, medical history must be avoided, and according to the standards of NFPA, and the examinations upon employment and periodic examinations should be carried out under supervision of the occupational medicine specialists and occupational health professionals.

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