

Levels of Liver Markers in Textile Processing and Dyeing Industry Workers

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ABSTRACT

Background: The textile dyeing industries has been condemned as being one of the world's most offenders in terms of pollution. The workers from textile processing and dyeing industry are exposed to various processing chemicals, dyes and different pollutant for long term which may causing hazardous effects on various organs like particularly lung, liver, kidney have become important issue and less data available which explain the effects of these chemicals on biochemical parameters. **Aim and Objectives:** The aim of this study is to estimate the levels of Liver function markers in textile processing and dyeing industry and healthy controls.

Materials & Methods: In this study, 95 subjects working in textile processing and dyeing industry more than 5 years and 95 healthy controls of both gender matching in age and sex were included. The analysis of biochemical parameters was done by using standard grade reagents and chemicals. Serum Bilirubin, Serum Glutamate Oxaloacetate Transaminase (SGOT/AST), Serum Glutamate Pyruvate Transaminase (SGPT/ALT), Alkaline Phosphatase, Serum Protein, Albumin, were assayed by autoanalyzer using diagnostic reagent kit.

Results: In the present study Mean of serum bilirubin, SGOT, serum SGPT and alkaline phosphatase is more in Textile processing and dyeing industry workers than controls. There was no significant change in mean difference of serum proteins, serum albumin and serum globulin ($P > 0.05$) but highly significant change seen in serum albumin ($P = 0.00$) as compared to control.

Conclusion: Significant changes were observed for various parameters like serum bilirubin, SGOT, SGPT, alkaline phosphatase, serum proteins are associated with the increased risk of dysfunction of the liver among the textile processing and dyeing industry workers. Increased awareness and early diagnosis of the exposure to toxic substances in textile processing and dyeing industries are essential for performing prompt management, improving clinical outcomes.

Key words: Liver function, Textile processing and dyeing industry

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INTRODUCTION

The textile dyeing and washing industry plays an important role in the economic growth as well as the environmental sectors of India. The textile industry continues to be the second largest employment generating sector in India.^[1] The textile dyeing industries has been condemned as being one of the world's most causable in terms of pollution. There are many dyeing industries in Maharashtra which consist of great deal of variety of processes such as fiber synthesis, weaving, manufacturing, dyeing and finishing. There are many health and safety issue associated with the textile processing and

dyeing industry workers. They include; chemical exposure from the processing and dyeing of materials, exposures of various solvents, exposure of cotton and other organic dusts and noise exposure.^[2,3]

Processing and dyeing is one of the critical procedure in textile industry in which the workers get expose to a number of hazardous chemicals like caustics, bleaching agents, chromophores and organic solvents like formaldehyde, benzene and different chemical dyes. These chemicals gain

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entry into the human body through inhalation or skin contact. Systemic effect may occur beyond the site of contact if the hazardous chemicals and dye is absorbed into blood stream and distributed throughout the body. The dye is usually used as an aqueous solution and if these substances spread out in the environment, they may cause huge adverse impact on the environment.^[4]

In the past, a number of epidemiological studies were performed to evaluate possible health risk in textile industry workers. Contact dermatitis, asthma, irritation, of eyes and skin chronic bronchitis, tuberculosis, bladder cancer, lung function, allergies and increased levels of T3 and T4 have been reported diseases among subjects working in dyeing or printing in textile industry.^[5-8]

The liver is the main primary target organ responsible for the metabolism of drugs, toxic chemicals, organic solvents and involved in the detoxification as well as excretion of foreign materials. Work activities with hepatotoxins exposures are numerous and, moreover, organic solvents are used in various industrial processes. Organic solvents used in different industrial processes may be associated with hepatotoxicity.^[9,10] Chronic exposure of these chemicals leads to intoxication of these organs. Liver is the major organ for the first target of chemical induced tissue injury. Previous studies also remarked hepatic malfunction in workers occupationally exposed to dye has been reported.^[11] The workers from textile processing and dyeing industry are exposed to various processing chemicals, dyes and different pollutant for long term which may causing hazardous effects on various organs like particularly lung, liver, kidney have become important health issue. Hence, present study has been undertaken to assess the biochemical parameters associated with hepatic damage in textile processing and dyeing industry workers in Maharashtra.

METHODS

Ninety-five workers exposed to textile dusts, fumes of dyes, having direct contact with dyeing chemicals in textile processing and dyeing industry were included in this study. Ninety-five controls of both gender matching in age and sex from a textile industry pollution free area and had never been directly exposed to these dyes were included in this study. The study was conducted on with age group between 30 to 60 years. The analysis of biochemical parameters was done by using standard grade reagents and chemicals. Serum Bilirubin, Serum Glutamate Oxaloacetate Transaminase (SGOT/AST), Serum Glutamate Pyruvate Transaminase (SGPT/ALT), Alkaline Phosphatase, Serum Protein, Albumin, were assayed by autoanalyzer using diagnostic reagent kit .

The exclusion criteria were includes subjects of any systemic or metabolic disease, liver disease, vascular diseases, renal artery stenosis, alcoholics, those who were taking any medication last few years and pregnant female. Upon the inclusion of the subjects, a record was made containing current history, diet along with laboratory investigations and previous history of any disease. The subjects who are willing to participate with informed consent were included in the present study. All controls were free from infection and on no medication during the last two weeks. The research sturdy protocol was approved by Institutional ethical committee and informed consent were obtained in written form from each subject before they were included in the study.

Distribution of study subjects:

| Group I | N = 95 | Subjects working in textile dyeing industry more than 5yrs. (Working hours 8 hours per day) |
|----------|--------|---|
| Group II | N = 95 | Healthy controls. |

Collection of Blood Samples:

The sample of blood was collected from each subject under aseptic precautions by using vacutainers. The blood samples was allowed to clot at room temperature for 20–30 minutes & serum was separated from cells by centrifugation for analysis of biochemical parameters. The analysis of biochemical parameters was done by using standard grade reagents and chemicals. Serum Bilirubin, Serum Glutamate Oxaloacetate Transaminase (SGOT/AST), Serum Glutamate Pyruvate Transaminase (SGPT/ALT), Alkaline Phosphatase and Serum Protein, were performed by autoanalyzer using diagnostic reagent kit as per the manual provided by the manufacturer.^[12]

Statistical Analysis

The SPSS software, version 22 was used to analyze the statistical analysis. The statistical analysis was done using the “z” test. All results were calculated as mean ± SD and a “p” value of <0.05 was considered statistically significant. Mean values were compared using the paired’ test

RESULTS

Table 1: The mean value of Serum Bilirubin , SGOT , SGPT, Alkaline Phosphatase and Serum Proteins in textile processing and dyeing industry workers and controls.

| Name of Parameter | Workers (n = 95) | | Control (n = 95) | | Significance | |
|---|-----------------------|--------------------|------------------|--------------------|-------------------------|-------------------------|
| | Mean ± S.D | Std. Error of mean | Mean ± S.D | Std. Error of mean | | |
| Serum Bilirubin Mg / dl | Total | 0.94 ± 0.36 *** | 0.04 | 0.82 ± 0.21 | 0.02 | Z = 2.821 P = 0.005 |
| | Direct | 0.54 ± 0.28 *** | 0.03 | 0.23 ± 0.08 | 0.01 | Z = 10.143 P = 0.000 |
| | Indirect | 0.41 ± 0.24 *** | 0.02 | 0.60 ± 0.21 | 0.02 | Z = -5.704 P = 0.000 |
| Serum SGOT U/L | 63.97 ± 16.14 *** | 1.66 | 30.09 ± 6.21 | 0.64 | Z = 19.095 P = 0.000 | |
| Serum SGPT U/L | 53.23 ± 19.89 *** | 2.04 | 26.23 ± 6.14 | 0.63 | Z = 12.64 P = 0.000 | |
| Serum Alkaline Phosphatase Ukat/l | 134.95 ± 17.36 *** | 1.78 | 79.06 ± 17.78 | 1.82 | Z = 21.922 P = 0.000 | |
| Serum Protein g/dl | Total | 6.90 ± 0.83 * | 0.08 | 7.93 ± 7.87 | 0.81 | Z = 1.267 P = 0.208 |
| | Albumi n | 3.95 ± 0.89 *** | 0.09 | 4.43 ± 0.38 | 0.04 | Z = 4.841 P = 0.000 |
| | Globuli n | 2.94 ± 1.09 * | 0.11 | 3.56 ± 7.82 | 0.80 | Z = 0.746 P = 0.457 |

The statistical method use to compare data was unpaired 't' test

*P > 0.05----- Not Significant

**P < 0.05----- Significant

***P < 0.001-----Highly Significant

There is highly statistically significant difference in means of serum bilirubin, serum SGOT, serum SGPT and serum alkaline phosphatase (P < 0.001) as compare to controls. Mean of serum bilirubin, serum SGOT, serum SGPT and alkaline phosphatase is more in Textile processing and dyeing industry workers than controls. There was no significant change in mean difference of serum proteins, serum albumin and serum globulin (P > 0.05) but highly significant change seen in serum albumin (P = 000) as compared to controls.

DISCUSSION

The Indian textile industry is a significant contributor in the Indian economy, in terms of its contribution to industrial production, employment and exports. Extensive scientific and industrial development have resulted in the destruction of the environment, as well as adverse effects on human health.^[13,14] Dying is one of the critical procedures in textile industry in which the workers can expose to a wide range of chemicals that are utilized in the working environment. Little information is available about possible toxic effect in workers from textile dyeing plants.^[15]

The liver performs multiple diverse functions essential to life, such as synthesis, excretion, and detoxification are major among the others. Several factors contribute to liver toxicity like, various chemicals used in textile and dyeing process, which have hazardous effects on workers involved in this process. Exposure to organic solvents may induce liver toxicity because most of the chemicals are metabolized in the liver and toxic metabolites generated through the metabolism are main cause of liver damage.^[16]

Bilirubin is the end product of heme catabolism. Bilirubin is bound to albumin in the plasma and is delivered to the liver in the form of albumin-bound bilirubin. Table 1 shows that statistically significant difference in mean levels of serum bilirubin in study groups ($P < 0.001$) as compared to controls. Our observations are similar with previous studies which reported that lead content of dye used in textile industry have hepatotoxic effect.^[17,18] The elevation of serum bilirubin value after swallowing of lead acetate may be induces activation of heme oxygenase. Bilirubin is conjugated with glucuronide in the smooth endoplasmic reticulum of liver, but under the effects of lead toxicity, the conjugation of bilirubin with glucouronoid may be become inactive.^[19]

SGOT and SGPT are the most frequently used indicators of hepatic cell necrosis. In our research study we observed the significant differences with hepatic enzymes SGOT and SGPT. The elevation in the concentration of serum SGOT and serum SGPT suggest the existence of hepatic damage which may develop a mechanism of cytotoxicity against hepatocytes with the passage of enzymes into blood stream. The significant elevation of SGOT and SGPT may be due to necrosis of hepatocytes under influence of xenobiotics (20). Benzanthrone (BA) and 3-bromobenzanthrone (BBA) are the contents of dye intermediates used in the production of textile and dye processing may also be responsible for disturbance of membrane integrity. The significant elevation of these enzymes was attributed to disturbance of membrane integrity by both BA and BBA.^[21,22]

Alkaline phosphatase is present in all tissues of the body and its concentration is high in liver, bones, intestine, kidney and placenta. Table 1 shows serum alkaline phosphatase level (ALP) was found to be significantly increased in the study subjects as compared to controls. Exposure of organic solvents and hazardous synthetic dyes in textile industry may leads to hepatocellular damage which indicated by vacuolation, swelling and necrosis of the liver cells, which usually results in disturbed or imbalanced intermediary metabolism, as a result of cellular damage, enzyme like alkaline phosphatase reach out into the serum and hence their level indicates the type and extent of damage inflicted.^[23-25]

Serum proteins, play many different functions, including transport of lipids, hormones, vitamins and minerals in the

circulatory system and the regulation of cellular activity and functioning of the immune system (Table 1). There was no significant change in mean difference of serum total proteins and serum globulin ($P > 0.05$) but highly significant change seen in serum albumin ($P < 0.001$, $P = 000$) as compared to controls.

In our study, we found lower mean levels of serum total protein, albumin and globulin in the study group than controls involving impaired synthetic function. This is because the liver is the primary site of the synthesis of plasma proteins, disturbances of protein synthesis therefore occur as a consequence of impaired hepatic function which will lead to a decrease in their serum concentrations. The lower serum albumin levels of in textile industry workers may indicate a reduction in the synthetic function of the liver relative to exposure of harmful organic solvents.^[26] Recent studies reported that formaldehyde exposure in textile and dyeing industry leads to disturbances in the synthesizing and excretory functions of the liver. However, formaldehyde-albumin adduct formation following formaldehyde exposure account for the lowering the albumin levels observed in exposed workers in textile industry.^[27]

CONCLUSION

Our study supports the hypothesis that exposure of different solvents, dyes and pollutant in textile and dyeing industry leads to develop impairment of liver functions. The findings of present study highlight that an exposure of solvent, dye and pollutant may be toxic, which in the case of the liver, can be alter it's functions. As such, there is a need to draw the attention of exposure of harmful chemicals, dust and different pollutant to the hazardous effects and subsequent health implications of textile processing and dyeing industry workers. Therefore, present result advised people to take care during working in textile processing and dyeing industry. The workers should improve their working methods, or they should use proper protection equipments for decreasing the magnitude of their exposure to the chemicals being used.

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