

Original Paper
ISSN: 2321-1520

Health Risk Assessment on Women Rag Pickers of Ahmedabad

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Received Date :9-2-2018

Published Date : 7-3-2018

Abstract

Waste is an unavoidable by-product of human activities. If accumulated, it leads to degradation of urban environment, stresses natural resources and leads to health problems. Rag pickers play an important but usually unrecognized role in the waste management system of Indian cities. They collect garbage in search of recyclable items that can be sold to scrap merchants (paper, plastic, tin, etc.). This paper presents a study on the women rag pickers of Ahmedabad city with focus on their socio-economic and occupational health aspects. The data has been developed through questionnaire survey by filling up of performa and hematological and oxidative stress analysis on peripheral blood. The results indicate health risks on women rag pickers at the dumping site of Ahmedabad city.

Keywords: Rag pickers, Occupational health hazards, Complete Blood Count, Oxidative Stress

Introduction

Rag picking is one of the inferior economic activities in the urban informal sector, largely undertaken by Women and Children belonging to socio-economically backward sections of the society for their survival and for supplementing their family income. These individuals are not educationally equipped or skillful and thus by way of refuse collection contribute to household income or own survival. Rag pickers are subjected to various types of chemical poisons and infections. Because of malnutrition they suffer from retarded growth and anemia. The rag pickers are highly

susceptible to diseases like tuberculosis and cancer due to their exposure to hazardous materials and also addiction to chewing and smoking low grade tobacco. Illiteracy and low social upbringing along with strive for survival make them alcoholics and then they switch to hard liquors and drugs. Inferior personal hygiene and street lives more often make them victims to HIV-AIDS. Hence, this study was undertaken to estimate the health risks in female rag pickers of Ahmedabad, Western Zone of Indian Subcontinent.

Materials and Methods

In Ahmedabad there are an estimated 30,000 waste pickers and a large proportion of them are women and children. Overall in the state of Gujarat there are estimated to be over 100,000 waste pickers. The present study has been approved by Institutional Ethical Committee and only female rag pickers working on the dumping sites were enrolled after taking written informed consent. A total of 70 women exposed to various dumping sites over a period of three years were enrolled. Age matched women working around the Gujarat University area from similar socio-economic background were recruited as controls (50 individuals). All the subjects were explained purpose and nature of the study. Those who had any severe disease/infections were excluded. Medical examination was performed by doctor and specific points were noted in the Performance. Blood samples were collected by technical staff with no potential risk and were tested for various haematological and oxidative stress parameters. In the present study, 7ml of blood sample was taken out of which 2ml was transferred in 2.0ml EDTA vial and samples were analyzed in fully automated Haemotolyzer. A copy of report was given to respective control and exposed subjects for their future treatment. Remaining 5ml of sample was used to separate serum from the sample for performing various oxidative stress parameters. All calculations were confirmed by software Graph-Pad prism-6. Statistical analysis was done using 'Chi-square test' and Student's t-test.

1. Hematological Study:

Haemoglobin, Red Blood Cell Count, Red Cell Distribution Width, White Blood Cell Count, Eosinophils, and Platelet count.

2. Oxidative stress analysis:

Superoxide Dismutase (Sod), Kakkar et al. (1984).

Catalase (CAT), Sinha and Ashru (1972).

Glutathione Peroxidase (Gpx), Rotruck et al. (1973).

Glutathione reductase (GR), Carlberg and Mannervik (1975).

Glutathione-S-transferase (GST), Habig et al. (1974).

Glutathione (GSH), Rotruck et al (1973).

Lipid Peroxidation (LPO), Ohkawa et al. (1979).

Total Protein, Lowry et al. (1951).

Results

Table 1 shows the family size of the subjects' and reveals that 41% of exposed workers have large families as compared to Control group who majorly belong to small (54%) and medium (42%) families and the results were highly significant ($P < 0.0001$). As per this study, 63% of the exposed women, had alcoholic father or husband or male member of the family which is significantly ($P < 0.01$) above the Control women (38% have father/husband alcoholic).

Many Exposed individuals (70%) had significantly ($P < 0.0001$) higher number of injuries through needle/syringe, dog bites, harsh chemicals, metal scraps etc. as compared to Control subjects (26%). Only 23% of Exposed individuals use personal protective equipment like gloves, masks and tools for rag picking which is non-significant as compared to Control (38%) and this increases their chances of injuries and infections.

Dietary habits reveal that 87% of Exposed subjects eat mixed food (vegetarian and non-vegetarian) as compared to Controls (28%). Results show that only 41% of Exposed subjects use Private toilet as compared to Control (68%). The rhythm of menstruation is significantly irregular ($P < 0.01$) in Exposed (64%) as compared to Controls (30%).

Table 2 shows non-significant decrease in number of Exposed subjects (44%) having less than 12 g/dl of Haemoglobin (Hb) as compared to Control subjects (52%). Amongst the exposed subjects, 2% individuals showed abnormal increase in Hb (more than 15 g/dl) which was not observed in Control subjects. The results show 3% of Exposed subjects showing less than normal values of Red blood cell (RBC) count as compared to 6% Controls. Only 65% of Exposed showed normal RBC count as compared to Control 72%. The exposed subjects showed abnormally high RBC count (32%) as compared to Controls (22%). The Red cell distribution width (RDW) levels showed significantly increased values ($P < 0.05$) in Exposed (48%) as compared to Controls (28%). The results showed non-significant increase in Exposed subjects (26%) having high values of White blood cell (WBC) count as compared to Controls (20%). 2% of Control subjects showed decrease in WBC count which is not observed in Exposed subjects. The Table 2 indicates highly significant increase ($P < 0.0001$) in Exposed individuals (46%) having high eosinophils as compared to Control subjects (10%). The table shows few numbers of subjects (2% Control and 2% Exposed) having low and other few (8% Control and 4% Exposed) having high platelet count which is non-significant ('Chi-square test').

Table 3 Shows results of Oxidative Stress Assay performed on Control and Exposed subjects with Mean \pm Standard Error (S.E) for all parameters. These parameters were found to decrease significantly. The activity of enzymes like Superoxide Dismutase (SOD), Catalase (CAT), Glutathione Peroxidase (GPx), Glutathione (GSH), Glutathione Reductase (GR) and Glutathione-S-Transferase (GST) in samples of Exposed subjects as compared to Controls were much lower. There was highly significant increase in Lipid Peroxidation (LPO) of Exposed subjects as compared to Controls. Total serum Protein (TP) was found to be decreased with high significance according to Student's t-test in Exposed subjects as compared to Controls.

Table 1: Showing General Characteristics of Control and Exposed Subjects (Chi-square test).

| Categories | Control (n = 50) | Exposed (n = 70) |
|---------------------------------------|------------------|------------------|
| Size of family (***) | | |
| Small (1-5) | 27 (54%) | 15 (22%) |
| Medium (6-8) | 21 (42%) | 26 (37%) |
| Large (9 and above) | 2 (4%) | 29 (41%) |
| Father/Husband Alcoholic (***) | | |
| Yes | 19 (38%) | 44 (63%) |
| No | 31 (62%) | 26 (37%) |
| Injury during work (***) | | |
| Yes | 13 (26%) | 49 (70%) |
| No | 37 (74%) | 21 (30%) |
| Use of Masks/Gloves (ns) | | |
| Yes | 19 (38%) | 16 (23%) |
| No | 31 (62%) | 54 (77%) |
| Dietary habits (***) | | |
| Vegetarian | 36 (72%) | 9 (13%) |
| Mixed | 14 (28%) | 61 (87%) |
| Use of toilet (**) | | |
| Public | 16 (32%) | 41 (59%) |
| Private | 34 (68%) | 29 (41%) |
| Rhythm of menstruation (**) | | |
| Regular | 35 (70%) | 25 (36%) |
| Irregular | 15 (30%) | 45 (64%) |

P > 0.05 (ns), P < 0.05 (*), P < 0.01 (**), P < 0.001 (***)

Table 2: Showing Haematological Parameters in Control and Exposed Subjects (Chi-square test).

| Complete Blood Count (CBC) | | |
|---|------------------|------------------|
| Categories | Control (n = 50) | Exposed (n = 70) |
| Haemoglobin (Hb) (ns) | | |
| < 12 | 26 (52%) | 31 (44%) |
| 12 -15 (Normal range) | 24 (48%) | 38 (54%) |
| > 15 | 0 | 1 (2%) |
| Red blood cell (R.B.C) Count (ns) | | |
| < 3.8 | 3 (6%) | 2 (3%) |
| 3.8 – 4.8 (Normal range) | 36 (72%) | 46 (65%) |
| > 4.8 | 11 (22%) | 22 (32%) |
| Red cell distribution width (RDW) (*) | | |
| 11.6 – 14 (Normal range) | 14 (28%) | 34 (48%) |
| > 14 | 36 (72%) | 36 (52%) |
| White blood cell (WBC) Count (x 1000) (ns) | | |
| < 4 | 1 (2%) | 0 |
| 4 – 10 (Normal range) | 39 (78) | 52 (74%) |
| > 10 | 10 (20%) | 18 (26%) |
| Eosinophils (***) | | |
| 0 – 7 (Normal range) | 45 (90%) | 38 (54%) |
| > 7 | 5 (10%) | 32 (46%) |
| Platelet Count (x 10000) (ns) | | |
| < 15 | 1 (2%) | 1 (2%) |
| 15 – 40 (Normal range) | 45 (90%) | 66 (94%) |
| > 40 | 4 (8%) | 3 (4%) |

P > 0.05 (ns), P < 0.05 (*), P < 0.001 (***)

Table 3: Showing Oxidative stress analysis among Control and Exposed Subjects (Student's t-test).

| Sr. No. | ROS Parameters | Control (n=50) | Exposed (n=70) |
|---------|--|----------------|-------------------|
| 1. | Superoxide Dismutase (SOD) | 20.76 ± 0.85 | 17.69 ± 0.63*** |
| 2. | Catalase (CAT) | 23.40 ± 0.63 | 20.44 ± 0.43*** |
| 3. | Glutathione Peroxidase (GPx) | 58.98 ± 0.44 | 49.19 ± 0.32*** |
| 4. | Glutathione (GSH) | 72.97 ± 0.72 | 57.49 ± 0.93*** |
| 5. | Glutathione Reductase (GR) | 22.60 ± 0.41 | 18.07 ± 0.38*** |
| 6. | Glutathione-S-Transferase (GST) | 21.10 ± 0.3 | 18.19 ± 0.26*** |
| 7. | Lipid Peroxidation (LPO) | 14.78 ± 0.62 | 22.02 ± 0.53*** |
| 8. | Total Protein (TP) | 1.20 ± 0.038 | 0.839 ± 0.033 *** |

Values are Mean ± S.E. Protein content (mg protein/100µl serum) ; LPO, lipid peroxidation (NM MDA/100µl serum); GSH, total glutathione (nM total GSH/100µl serum); SOD, superoxide dismutase (units of SOD/100µl serum); CAT, catalase (nMH₂O₂/100µl serum); G-Px, glutathione peroxidase(mM GSH/100µl serum); G-Rd, glutathione reductase (nM NADPH oxidized/100µl serum); GST, Glutathione-s-Transferase (µMoles CDNB-GSH conjugate/100µl serum).

***p < 0.001

Discussion

According to findings of present study, the rag pickers are exposed to harsh weather conditions surrounded by stray animals and infectious solid waste that may induce them to many diseases. Rag pickers (Control and Exposed group) develop addictions of chewing pan, tobacco and gutkha which act as confounding factors and could further aggravate the effects of occupational exposure. Most of them have alcoholic father/husband which gives family women more burden to earn for the family. Inhalation of noxious gases leads to cough, nasal irritation, dimness of vision and throat congestion amongst the rag pickers. The rag pickers do not use protective masks or gloves for waste-picking, instead, they use their bare hands and thus often get sick and injured. Lack of precautionary safety measures and unawareness regarding health were the main causes of deteriorated health conditions. As most of them use public toilets, they often get urinary tract infections (UTIs) and this may be also a reason for getting frequent fever. Also, most of rag pickers follow home remedies and do not consult doctor due to their ignorance of risks and low finances. Results show more irregular rhythm of menstruation in Exposed subjects. This may be due to hormonal imbalance, too much exertion, Polycystic ovary syndrome (PCOS), stress, Overactive thyroid (hyperthyroidism) or underactive thyroid (hypothyroidism), Uterine fibroids etc.

Complete Blood Count analysis:

Results showed more number of Exposed subjects having less than 12 g/dl of Hb. There are

many reasons for anemia such as loss of blood, nutritional deficiency (iron, vitamin B12, and folate), kidney failure, and abnormal hemoglobin structure (sickle cell anemia or thalassemia). High Hb levels (as observed in exposed subjects) indicate conditions like advanced lung disease (eg. emphysema), certain tumors and premature RBC death. The reason for elevated Hb levels of exposed women rag pickers can be due to their mixed diet. Non-significant increase in RBC counts of subjects especially in Exposed individuals indicate conditions like poor heart or lung function, abnormal RBC breakdown (leads to elevated haemoglobin) and hypoxia. The results showed significant increase in number of Controls and Exposed having high RDW levels which could happen because of iron deficiency anemia or thalassemia intermedia (Capanzana et al. 2017). Higher numbers in both Control and Exposed subjects indicate greater variation in cell size. High levels of WBC count in Exposed subjects may be due to leukocytosis which is triggered by infections, tissue damage, asthma, tuberculosis, smoking, leukemia, stress, immune system disorders. The result indicates highly significant increase in Exposed individuals having high eosinophils as compared to Control subjects. Exposed individuals showed higher-than-normal level of eosinophils which can lead to eosinophilia which is caused by allergies, asthma, inflammatory conditions, parasitic infections, reactions to medications etc. (Ayik et al. 2003). Elevated platelet count in few subjects (thrombocytosis) can be correlated with conditions like Cancer, Chronic Myeloid Leukemia (CML) along with multiple infections, while low platelet count (thrombocytopenia) in some others point towards conditions like decrease of platelets in bone marrow or platelets being destroyed in blood stream.

Oxidative Stress Analysis:

Oxidative stress and free radical production are involved in the etiology of various chronic conditions, including cancer, atherosclerosis, neurological and cardiovascular diseases and exposure to toxic conditions. The results showed increased Oxidative stress through significantly decreased activity of cellular anti-oxidant enzymes like Superoxide Dismutase (SOD), Catalase (CAT), Glutathione Peroxidase (GPx), Glutathione (GSH), Glutathione Reductase (GR) and Glutathione-S-Transferase (GST) in serum samples of Exposed subjects as compared to Controls. There was highly significant increase in Lipid Peroxidation (LPO) of Exposed subjects as compared to Controls. Increased LPO is a clear indication of damaged membranous organelles of the cell. Total serum Protein (TP) was found to be increased significantly in serum samples of Exposed subjects as compared to Controls. Elevated total protein in Exposed samples may indicate conditions like inflammation or infections, such as viral hepatitis B or C, or HIV, bone marrow disorders, such as multiple myeloma or Waldenstrom's disease. Further, occupational exposure can induce DNA damage through enhanced oxidative stress and free radical generation in the cells. Also, phagocytic cells associated with inflammation are a major source of oxidative stress to the biological system (Yang et al., 2001). Study on Municipal Solid Waste (MSW) handlers showed a significant decrease in the enzymatic antioxidants like SOD and CAT as well as the non-enzymatic redox sensitive thiol compound, reduced GSH (Odewabi and Ogundahunsi et al., 2012). The rag pickers deal with lot of plastic materials which can also increase the oxidative stress levels. Free radicals have been implicated in pathways of metabolism of drugs and environmental chemicals (Sati et al., 2011).

Conclusion

The results clearly showed the damage that has occurred to the women rag pickers due to

the occupational exposure, which if not cured or taken care of can lead to various ailments in them and in their children as they are also present at dump site for long hours and exposed to unhealthy conditions. The CBC analysis showed high prevalence of Eosinophilia in Exposed subjects as compared to Controls which is caused by allergies, asthma, inflammatory conditions, parasitic infections and reactions to medications. The increased Oxidative stress through decreased activity of cellular anti-oxidant enzymes in serum samples of Exposed subjects as compared to Controls was observed, which is a clear indication of damaged membranous organelles of the cell. They were advised, counselled and provided medicines on basis of their reports at regular intervals of the study period. They were also given safety and precautionary measures (gloves/masks) at the health camps arranged by respective Municipal Counsellor of that area. Further research is needed to develop some natural/herbal antioxidant therapy which can reduce the long term harmful effects of high oxidative stress on these rag pickers.

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