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Effects of Chemicals on Students, Technicians, Faculties of S.G.S. Govt. P.G. College, Sidhi (M. P.) India

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Abstract: *This study reveals relative impact of chemicals on science students than that of art & commerce students in some Educational Institute. It is found that the exposure of science students to organic reagents such as acetone, benzene, chloroform and ethanol in the laboratory concerns because these are the reagents identified to be most frequently used in the laboratory. This study observed that there was a significant difference in the effect of exposure between science and Art, Commerce student. However the severity of symptoms can not be associated to the length of exposure of these individuals. It was found in the study that students from the science stream are more likely to experience Physiological complain as compared to students from the Arts and Commerce Stream.*

Keywords: *Organic chemical, acetone, chloroform, Benzene, Ethanol, Science students and Odds ratio.*

I. Introduction

The health concern of the students, technicians and faculty members associated with science laboratories in the educational institutions now become essential to be taken into consideration for its full scale study, and then its removal. Because, the students associates with these laboratory for longer time almost 3 to 6 year during graduation and post graduation. The other students who are not associated with these laboratory but they study in the same institutes are also having the affect generated by organic chemicals in form of chemical fume, which linger in the air. The laboratory technicians are more proned towards the hazardous affect of chemical because of their closeness with the chemicals for longer time. The faculties concerned may have the least exposure but his may not be outweighed

Being aware of the health hazards and the precaution that they should take to protect their health, students, faculty members and laboratory technicians are required to wear personal protective garments when inside the laboratory especially when dealing with chemicals. But this may not provide enough assurance that they are fully protected from the potential risk of exposure.

Looking into this problem, this study undertaken and research analysis done specifically the health concerned of the science students, lab technician and faculty members of S.G.S. Govt. P.G. College, Sidhi, Madhya Pradesh by applying odd ratio methodology.

II. Need Of The Study

The chemicals are known to be carcinogenic but are not devoid of other toxic effects. Acetone, Alcohols, benzene and Chloroform are identified to be the most frequently used organic chemicals in the laboratory. Benzene is a human carcinogen; spillage on skin may cause redness and sores. General irritation and corneal damage may result upon contact of the eyes with the chemicals[6]. Contact with low to moderate levels of benzene for a short time can cause headache, vomiting, disorientation, shakiness, elevated heart rate and loss of consciousness. Chronic occupational exposure to benzene has been known to cause hematological effect, suppression of the production of RBC and WBC in the blood that is Pancytopenia and number of cells in the bone marrow. While chloroform has been known to be carcinogenic in laboratory animals but there is concern over long-term human exposure to this solvent[7]. Chloroform affects central nervous system, liver and kidney after breathing air containing large amount of chloroform. It also causes fatigue, dizziness and headache if one breathes about 900 parts in a million part of air for a short time period. It also causes sores in skin when contact to chloroform.

About Acetone, it is reported that it causes irritation in nose and throat fatigue, dizziness, headache and drunkenness, drowsiness, nausea and vomiting. The higher concentration of Acetone can cause collapse, coma and death, Prolong contact to skin may cause deffating of skin and produce dermatitis[5].

The exposure to ethanol causes irritation of the eyes and nose, headache, drowsiness, fatigue and narcoses. Its affect on the skin may causes dermatitis[11]. The reported evidence in regards to the impact of these chemicals on human health, inspire us to undertake this research work as a case-study and go ahead to reaware all the person concerned, for the sake of their health etc.

III. Objective Of The Study

This study focus to assess the association of exposure to organic reagents with its symptom experienced by the student, technician and faculty members belongs to science stream, with that of other belong to Arts and Commerce Stream as a control. The following steps undertaken during this study as a key objective-

1. Established indentified symptoms with chemical found in laboratory.
2. Established the differences found in symptoms of all those belong to science stream with that of Art and Commerce Stream person.
3. Correlation established between time periods of exposure with that of symptom identified.

By comparing the symptom found with persons belong to science steam with that of person belong to Art/Commerce Stream, we found certain significant result, that certainly help us to re-aware all those, who are involve in laboratory related activities.

IV. Material And Methods

For the Cohort Study of this project work, two groups of students has been constituted, first group consist of total 35 students, 5 each from, graduate classes (5+5+5) BSc I, II, III Year), 10 each from Post Graduate classes (MSc P/F Chemistry students (10+10) it become total 35 students of Science Stream (SS). In the second group, 35 students were taken for study belong to Arts and Commerce Stream, in a mixed manners 20 (10 UG and 10 PG) from Arts and 15 from commerce (10 UG and 5 PG). Now for the further study the two groups of students that is SS and ACS are to be mentioned. The ACS groups have been taken as control group. And 8 laboratory technician and 10 faculty members by random sampling i. e. total of 88 persons have been registered for the overall study.

Since the usual course of study in the college is 5 years but can extend as long as 6 to 8 years. It is well known that the groups of students taken from Arts Commerce Stream (ACS 35) are not associated with laboratory work but are surely exposed to unfavorable condition during their stay in the college campus especially nearer to laboratory in the college composite building hence they have been treated as control group of student for studying this research project.

The questionnaire covering the personal health profiles of students. Were distributed to selected student both (SS and ACS) groups. The questions have been tabulated and grouped into Neurologic, Cardiovascular, Renal, Gastrointestinal, etc. All the respondents have been asked to identify the severity and state remarks regarding the symptoms experienced. Certain questions have also been included in the questionnaire given to these selected students belongs to Science Stream (SS) about the chemical they handle during lab work with relative duration of their exposure.

V. Data Analysis

Measure of central tendency, that is mean) and standard deviation of variables were calculated along with considering the demographic variables such as sex, age and length of stay. ANOVA (Analysis of Variance) were done, with the comparison of each strata of the study, population with the symptoms experienced, α is set as 0.05.

A Simple Linear Regression Analysis was used to determine if there is a relationship between the length of exposure to chemicals (in hours) and the appearance or severity of the symptoms experienced by the students length of exposure (x), severity of symptoms (y).

Analysis of Variance (ANOVA) to compare if there is a significant difference in the signs and symptoms experienced by the SS students as compared to Controls group i.e. ACS group students. All results of the statistical analysis were generated using STATA™ 9.1 Statistical Software. Meanwhile, the group aimed to assess the risk of a particular outcome (symptom) if a certain factor (exposure) is present. The analysis appropriate for this was Odds Ratio[8].

As for the study, the severity of symptoms experienced by the SS group of students as compared to controls (ACS) were assessed. The odds of the symptoms occurring to the students exposed to organic chemicals is the probability of the symptoms occurring divided by the probability that it will not occur (e.g SS (+/-) / ACS (+/-)). If the odds are greater than one, the event (e.g. experience of symptoms due to exposure) is more likely to happen than not. If the odds are less than one, then, the event is less likely to happen than not.

VI. Result And Discussion

There are 78 (90 %) out of the 88 participants, responded to the questionnaire given to them mean age was 21.8 years (range: 18 to 48), there were 45 female and 30 males and 3 did not mentioned their gender. Mean duration of exposure during their study or stay in the college was 3.5 years (range: 1 to 20). Common complaints in the SS group of Students was laboratory generated pollution related Coughs and colds, fever and fatigue. Majority of the students complaints was among the subjects are related with the Central Nervous System (CNS) followed by Gastrointestinal Tract (GIT) (Table 2.)

In general, SS group of students that is BSc and MSc student (BSc students opted chemistry and All MSc students of chemistry) are having more laboratory classes according to their curriculum compared to control group (ACS) and hence SS group students showed more health complain.

Exposure to chemicals of SS group of Students is not a significant predictor of the appearance and severity of symptoms (P>0.05) while the exposure to chemicals of ACS group of students is a significant predictor of the appearance and severity of symptoms (P>0.05) (as in Table 4).

Although faculty participants showed CNS complaints while lab technicians showed both CNS and GIT Complaint more. Although the Severity of symptoms for faculty member and control group is significantly lower as compared to the students belongs to SS group and lab technicians (as showed in Table 2).

This could be brought about by the means by which they are exposed to organic chemicals, that is, relatively less. Computed Odds Ratio shows that students from SS group are more times likely to experience physiological complaints compared to students of ACS group (Central Group) (Table 2), because courses offered by the latter group (ACS) are less likely to have laboratory work means there is no exposure to organic chemicals.

Based on literature, CNS- related complaints may be associated with exposure to Chloroform[5], although headache in particular, can be experienced with exposure with the other chemicals. GIT complains may be correlated with Acetone[10] and Benzene[9] exposure. Exposure to either one of the chemicals may be related with the Dermal- related complains among the participants.

The assumption that SS group of students have greater symptoms experienced along with the severity is proved to be significant. All the groups, students, faculty members and laboratory Technicians have significant differences on these parameters. This could be brought about by the intensity by which they are exposed to the organic chemicals. The length of stay is thus evaluated to be of significance among the students. Greater complaints are manifested at the later years of study.

Limitation of the Study:

The following are the limitation taken into consideration during study -

1. This study did not clear that which chemical available in the lab was directly responsible for certain health problem prevails with any participant
2. Other factors such as participant's personal lifestyles and the environment where they live, may have contributed towards their complaints.
3. The Faculty member respondents were not representative of the entire faculty of the college.

VII. Conclusion

Majority of the complaints among science group students are related with Control Nerrous System (CNS) and Gastro Intestinal Tract (GIT) which may be associated with Chloroform, Ethanol, Acetone and Benzene exposure. There was also seen a significant difference in complaints from 1st year to 5th year students including Lab Technicians and Faculty members. The assumption that BSc/MSc students have greater symptoms experienced along with the severity is proved to be significant. However, the severity of symptoms cannot be associated to the length of exposure of these individuals.

Recommendations Suggested

Recommendation for improving the prevention and management of exposure to the chemicals in the laboratories may be enhanced by education on the hazards of chemicals and training on their proper handling to students using the laboratory as well as with the laboratory aids, cleanup of emitted air, implementation of best laboratory practices and proper removal of waste generated within and outside the laboratories.

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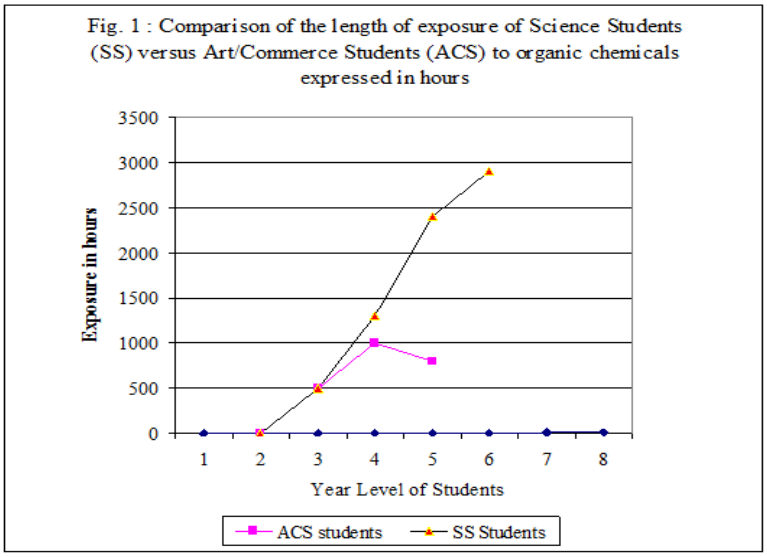

Table 1 Summary of the negative, positive and severity responses of the respondents

Students	Year	Severity of Symptom Experienced		
		Negative (-)	Positive (+)	Severe (+++)
		Mean ± SD[a]	Mean ± SD[b]	Mean ± SD[c]
BSc	I	19.1616 ± 2.4318	1.9981 ± 0.9876	0.1926 ± 0.2873
	II	19.2514 ± 2.3774	2.8891 ± 1.0731	0.0831 ± 0.1839
	III	8.6334 ± 2.2801	2.0121 ± 1.1162	0.7276 ± 0.3992
MSc	IV	20.1239 ± 2.8354	1.5609 ± 0.5371	0.4987 ± 0.3889
	V	16.9874 ± 2.7983	2.9879 ± 0.9873	0.6274 ± 0.3998
BA/BCom	I	20.8743 ± 2.6619	1.8216 ± 0.8231	0.1803 ± 0.2311
	II	15.9991 ± 2.3456	1.8341 ± 1.0121	0.0002 ± 0.0001
	III	16.6254 ± 2.4437	1.0001 ± 0.5964	0.0451 ± 0.0012
MA/MCom	IV	20.9897 ± 2.5561	1.0121 ± 0.6123	0.0951 ± 0.2143
	V	19.5563 ± 2.3964	2.0916 ± 0.8964	0.1601 ± 0.2153
Faculty Member		16.8918 ± 3.1413	1.1107 ± 0.7251	0.3712 ± 0.5231
Lab Technician		15.9754 ± 1.7612	2.0964 ± 0.8543	0.3439 ± 0.2496

a = mean and standard deviation for all the system involved based on the number of negative response
b = mean and standard deviation for all the system involved based on the number of positive response
c = mean and standard deviation for all the system involved based on the number of severe response

Table 2- Summary of the Two-way ANOVA Results of the respondents

Students	α	**P-value**	**Finding**
BSc Ist Year Vs BA/BCom Ist Year	0.05	0.0019 (P < 0.05)	Ist Year BSc Students have greater symptoms than BA/BCom Ist Year Students
BSc IIst Year Vs BA/BCom IInd Year	0.05	0.0008 (P < 0.05)	IInd Year BSc Students have greater symptoms than BA/BCom IInd Year Students
BSc IIIst Year Vs BA/BCom IIIrd Year	0.05	0.0193 (P < 0.05)	IIInd Year BSc Students have greater symptoms than BA/BCom IIInd Year Students
MSc (P) Vs MA/MCom (P) Ist	0.05	0.0035 (P < 0.05)	MSc (P) Students have greater symptoms than MA/MCom (F) Year Students
MSc (F) Vs MA/MCom (F)	0.05	0.0018 (P < 0.05)	MSc (F) Students have greater symptoms than MA/MCom (F) Year Students
BSc/BA/BCom Vs Faculty Members Vs Lab Technician	0.05	0.00124 (P < 0.05)	There is no Sufficient evidence to conclude that the symptoms experienced between the groups is equal
BSc/MSc Vs BA/BCom/MA/MCom	0.05	0.00124 (P < 0.05)	There is no evidence that the symptoms experienced between the groups is equal therefore science students are more likely to experience the complaints