

A Descriptive Study of Clinical, Hematological, and Biochemical Parameters of Inhalant Users Seeking Treatment at a Tertiary Care Center in India

Rizwana Quraishi, Raman Deep Pattanayak, Raka Jain, Anju Dhawan

ABSTRACT


Background: Inhalant (or solvent) abuse is the purposeful inhalation of vapors or gases, intended to produce pleasurable psychoactive effects. There is a dearth of Indian studies on inhalant users. **Aim:** The present study aimed to describe the socio-demographic, clinical, and psychosocial characteristics of inhalant users visiting a Tertiary Care Center in North India. **Materials and Methods:** The study was a retrospective chart review for 50 inhalant users who sought treatment for the first time from the center over a period of 2 years. All patients seeking treatment for inhalant use at the center were evaluated by a psychiatrist. **Results:** Mean age of the sample was 17.16 ± 4.09 years and majority comprised of children and adolescents (72.2%). There were only three girls (6%). Majority comprised of school drop-outs (82%), from lower socio-economic status (80%). Mean age of initiation of first substance was 14.13 ± 4.27 years and inhalants were first drugs for 38%. Duration of inhalant use ranged between 1 month and 7.5 years. Use was mostly uninterrupted, and 88% were dependent users. Correction fluid was the commonest product, used by huffing or sniffing. A large majority (86%) had used at least one other substance besides inhalants, and 8% reported involvement in high-risk sexual behaviors. Comorbid psychiatric disorder was seen in 8% of sample. Positive family history was observed in 30% of the sample. The mean hemoglobin of the sample was 11.88 ± 0.60 , with low hemoglobin in 25% of users. Neutrophils, lymphocytes, eosinophils, and monocytes were elevated beyond normal in 10.8%, 6.5%, 15.2%, and 7.5%, respectively. There was no evidence of leucopenia. Bilirubin and serum glutamic pyruvic transaminase was elevated in 6.6% and 13% of inhalant users, respectively. **Conclusion:** The study adds to the limited data available on the treatment-seeking inhalant users from Indian settings. There is a need to examine the pattern of inhalant use in larger samples, across multiple sites in a prospective manner.

Key words: Adolescents, blood profile, India, inhalant abuse, solvent

INTRODUCTION

Inhalant abuse is the purposeful inhalation of vapors

or gases, intended to produce pleasurable psychoactive or mind-altering effects.^[1] Inhalants are often initiated during childhood or adolescence as these are cheap and easily available products. Several household or commercial products can be abused as inhalants, but are often perceived as innocuous or harmless. These include volatile solvents (e.g. correction fluid/typewriter eraser fluid, gasoline, glue, paint thinner, nail polish remover); aerosols (e.g. spray paint, hair spray); gases (e.g. nitrous oxide, helium); or nitrites (e.g. amyl and butyl nitrites).^[1-3] The acute effects resemble that of other central nervous system (CNS) depressants,

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notably alcohol. As the inhalants are instantly absorbed in the lungs, intoxication with inhalants occur rapidly and is relatively short-lived.^[3,4] Toluene is a common ingredient in many commonly used inhalants, and its average elimination half-life from breath is only 25 min and blood concentrations drop below detectable levels within 4-10 h. However, it gets deposited in the fat-rich areas, including, white matter of brain, getting eliminated at a slower rate from adipose tissue (half-life 0.5-2.7 days).^[2,5]

Inhalants are among the most hazardous substance of abuse in view of a wide variety of acute and chronic health consequences.^[6-8] Inhalant use may be associated with a substantial hematological, renal, hepatic, and neurological damage. Long-term inhalant use can result in bone marrow suppression, leading to leukopenia, anemia, thrombocytopenia, and hemolysis. Sudden death may occur due to cardiac arrhythmias (especially ventricular fibrillation), aspiration or asphyxia.^[9]

The abuse of inhalants appears to be a world-wide problem. As far as national prevalence in India is concerned, the National Household Survey (for the population aged 12-60 years) did not identify inhalant use.^[10] A school-based survey from Manipur found a 1-year prevalence of 4% for use of inhalants,^[11] and few studies have found high rates of inhalant use, among other substances, in street children.^[12-14] Another study from Hyderabad described the profile and determinants of inhalant use among street children who were in observation homes.^[15]

Available studies from the treatment settings are quite few, and can be summarized as follows. The presence of inhalant use was initially documented by case reports^[16-18] and case series.^[19-21] Prior studies by Kumar *et al.*^[22] ($n=21$), Verma *et al.*^[23] ($n=25$), and Verma *et al.*^[24] ($n=36$) have described the socio-demographic and clinical profile of inhalant users seeking treatment at a tertiary care settings. No previous Indian study has reported the hematological and biochemical profile of inhalant users.

In view of the paucity of studies, it is important to document the clinical and laboratory parameters among the treatment seeking inhalant users. The present study was planned with an aim to describe the clinical, hematological, and biochemical parameters of inhalant users visiting a tertiary care center in north India.

MATERIALS AND METHODS

The study was conducted at a tertiary care specialty hospital in India. This de-addiction treatment center

is actively involved in research, training, and policy development and draws patients from several states of India. The center has a fully equipped laboratory for substance use disorders, where the investigations are carried out free of cost as a policy for the patients visiting the center for treatment.

A 2-year retrospective chart review was conducted for a period between February 2009 and January 2011 for inhalant users who sought treatment for the first time from the center and underwent blood investigations at the center's laboratory. All patients seeking treatment for inhalant use at the center were initially evaluated by a psychiatrist. After a thorough history and clinical evaluation, the patients were sent to laboratory for routine investigations. From each subject, 5 ml of a blood sample was collected. The biochemical measures assessed in the blood sample includes, total bilirubin, serum glutamic oxaloacetic transaminase (SGOT), serum glutamic pyruvic transaminase (SGPT), total protein, albumin, and alkaline phosphatase. All the biochemistry reagents were purchased from Roche Diagnostics and performed on Echo plus biochemistry autoanalyzer (Logotech Pvt. Ltd., India). The hematological measure includes hemoglobin, total and differential leukocyte counts, red blood cell count, and erythrocyte sedimentation rate. The study was carried out in accordance with the ethical standards of declaration of Helsinki and complete confidentiality has been ensured.

Descriptive statistics have been employed to describe the socio-demographic, clinical, and laboratory profile of the sample.

RESULTS

Of the initially screened 68 patients, data were complete or retrievable for 50 patients, which formed the study sample.

Socio-demographic characteristics

Table 1 shows the detailed socio-demographic characteristics of inhalant users. Of the total sample, 10.0% ($n=5$) were children, 62.2% ($n=31$) were adolescents and 28.0% ($n=14$) were above 18 years of age, mostly young adults. There were three female users in the sample. A large majority (82%) of sample comprised of school drop-outs and 14% stayed away from home/alone, mostly on streets.

Clinical characteristics

Table 2 shows the clinical characteristics of inhalant users. Mean age of initiation of first substance was 14.13 ± 4.27 and tobacco was the commonest first substance (54.0%) followed by inhalants (38.0%). Median duration of inhalant use was 2 years, ranging

Table 1: Socio-demographic profile of inhalant users

Variable	Mean±SD/Frequency (%)
Age: Mean (in years)	17.16±4.09
Gender	
Male	47 (94.0)
Female	03 (6.0)
Education (in years)	
Nil	11 (22.0)
≤5 years	22 (44.0)
6-10 years	14 (28.0)
11-12 years	03 (6.0)
Educational status	
Studying	09 (18.0)
School drop-out	41 (82.0)
Marital status	
Married	03 (6.0)
Unmarried	47 (94.0)
Residence	
Rural	12 (24.0)
Urban	38 (76.0)
Socio economic status	
Poor	40 (80.0)
Middle	09 (18.0)
High	01 (2.0)
Living arrangement	
Alone	07 (14.0)
Nuclear family	35 (70.0)
Joint family	08 (16.0)

SD – Standard deviation; n=50

from 1 month to 7.5 years at the time of seeking treatment. The use was continuous and interrupted for almost all users. Majority preferred using the inhalants by huffing (72.0%) and was regular dependent users (88%). Correction fluid (whitener/thinner) was the most common product used while adhesive glues were used by only 6% of the sample. No other type of inhalant (aerosols, gases, nitrites) was reported besides the volatile solvents.

One-third (32%) of the sample had been involved in illegal activities at some point, and 8% had reported high-risk sexual behaviors. Nearly 70% patients sought help on family's insistence, 20% on initiatives by social welfare/non-governmental organizations, and only 10% sought help on their own initiative [Table 2].

Family history of substance use disorders was observed in 30% of the sample [Figure 1], which included alcohol dependence (14%) and opioid dependence (12%) among fathers. In addition, inhalant dependence was seen in elder brothers in 8% of the cases.

Concurrent substance use and psychiatric comorbidities

Figure 2 shows the life-time and current (past 1 month) substance use in the sample. Table 3 shows the substance

Table 2: Clinical characteristics of inhalant users

Variable	Mean±SD (%)
Age of initiation of first substance (in years)	14.13±4.27
Nature of first substance	
Tobacco	27 (54.0)
Alcohol	02 (4.0)
Cannabis	02 (4.0)
Inhalants	19 (38.0)
Peer influence as an initiating factor	
Present	40 (80.0)
Absent	10 (20.0)
Duration of inhalant use	Median: 24 months (range 1 month to 8.5 years)
Preferred method of inhalant use [#]	
Huffing	36 (72.0)
Sniffing	08 (16.0)
Pattern of inhalant use [†]	
Abuse	06 (12.0)
Dependent use	44 (88.0)
Complications associated with substance use	
Physical (generalized weakness, weight loss, poor appetite, headache, abdominal pain)	36 (72.0)
Psychological (guilt, shame, low self-esteem)	32 (64.0)
Social (outcast, stigma)	31 (62.0)
Financial	30 (60.0)
Familial (quarrels, conflicts, poor relations)	25 (50.0)
Memory problems (self-reported/informant)	
Present	02 (4.0)
Absent	48 (96.0)
Involvement in illegal activities (e.g., pick-pocketing)	
Present	16 (32.0)
Absent	34 (68.0)
High risk sexual behavior	
Present	04 (8.0)
Absent	46 (92.0)
Abstinence	
No attempts	43 (86.0)
1-5 unsuccessful attempts	05 (10.0)
Significant (>1 month) abstinence attempts	01 (2.0)
Motivation to quit substance use	
Poor (external pressures for help-seeking)	26 (52.0)
Fair (external+internal reasons)	17 (34.0)
Good (self-motivated)	07 (14.0)
Help sought on insistence of	
Family	35 (70.0)
Self	05 (10.0)
Non-governmental organization	10 (20.0)

SD – Standard deviation; [#]Data missing for six patients; [†]As defined for DSM-IV-TR – Diagnostic and statistical manual fourth edition, text revision diagnosis; n=50

use and psychiatric comorbidities in the sample of inhalant users. A large majority (86%) of the sample has used at least one other substance besides inhalants. Besides inhalants, tobacco, alcohol, and cannabis were the three commonly used drugs in that order. Comorbid psychiatric disorder was seen in 8% of the sample.

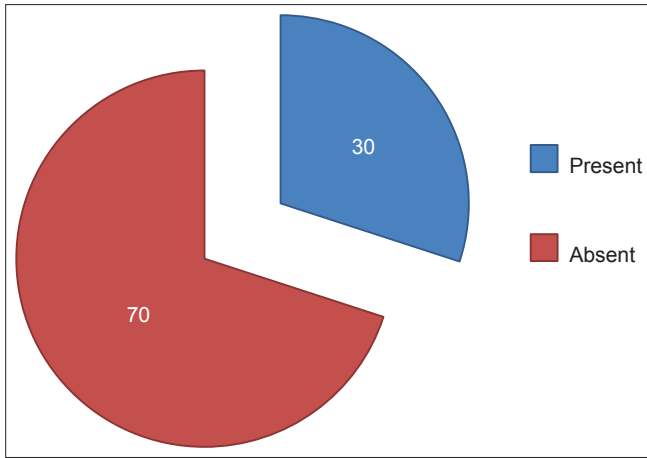


Figure 1: Family history of substance use disorders among inhalant users

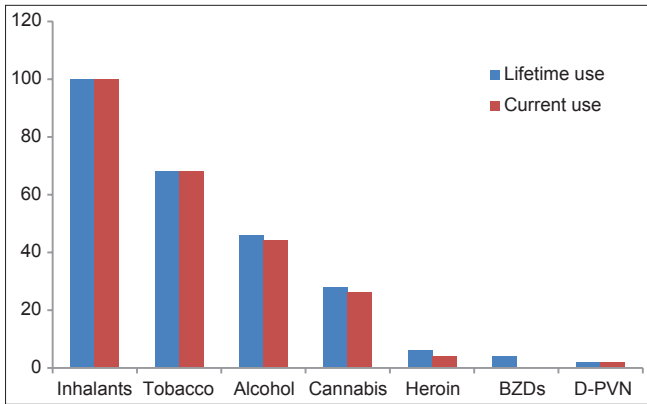


Figure 2: Life-time and current substance use in the sample (n = 50)

Laboratory parameters

The hematological and biochemistry profile of the sample is shown in Table 4. The mean hemoglobin of the sample was 11.88±0.60, with low hemoglobin in 25% of the inhalant users. Neutrophils, lymphocytes, eosinophils, and monocytes were elevated beyond normal in 10.8%, 6.5%, 15.2%, and 7.5%, respectively. Bilirubin was elevated in 6.6% of sample while SGOT and SGPT were elevated in 2.2% and 13% of inhalant users respectively.

DISCUSSION

The study adds to available information on the treatment-seeking inhalant users from Indian settings. Inhalants are commonly used by the younger population and eventually are either stopped or replaced by other substances by adulthood.^[3,4] Majority of sample (72%) comprised of children or adolescents, youngest one being only 7 years of age. Notably, 28% of patients were aged over 18 years, indicating that inhalant use may persist beyond adolescence in some users. The sample comprised of predominantly male users (94%), similar to previous studies^[22-24] with an exclusively male sample. The three females in the current study were between 11

Table 3: Substance use and psychiatric comorbidities

Variable	Frequency (%age)	
Use of other substance/s (besides inhalants)		
Present	43 (86.0)	
Absent	07 (14.0)	
Type of substance use	Ever use	Current use
Inhalants	50 (100.0)	50 (100.0)
Tobacco	34 (68.0)	34 (68.0)
Alcohol	23 (46.0)	22 (44.0)
Cannabis	14 (28.0)	13 (26.0)
Heroin	03 (6.0)	02 (4.0)
Benzodiazepines	02 (4.0)	0 (0.0)
Dextropropoxyphene	01 (2.0)	01 (2.0)
Comorbid substance use disorder(s) (life-time)		
Tobacco dependence	21 (42.0)	
Alcohol dependence	07 (14.0)	
Cannabis dependence	09 (18.0)	
Opioid (heroin) dependence	03 (6.0)	
Comorbid psychiatric disorder (life-time)		
Present	04 (8.0)	
Absent	46 (94.0)	
Nature of psychiatric disorder		
Psychotic disorder	02 (4.0)	
Bipolar disorder-single manic episode	01 (2.0)	
Major depression	01 (2.0)	

n= 50

Table 4: Biochemistry and hematological profile

Variable	Mean±SD	% outside the normal limit
Hematological profile		
Hemoglobin	11.88±0.60	↓ 25.0 (12/48)
Total leukocytes	8048.88±1190.42	↑ 2.0 (01/45)
Neutrophils	65.50±4.98	↑ 10.8 (05/46)
Lymphocytes	29.71±3.71	↑ 6.5 (03/46)
Eosinophils	3.19±2.95	↑ 15.2 (07/46)
Monocytes	1.60±0.63	↑ 7.5 (03/40)
Biochemistry profile		
Urea	32.03±9.61	Nil
Creatinine	0.86±0.18	Nil
Bilirubin	0.60±0.33	↑ 6.5 (03/46)
Total protein	7.42±0.75	↑ 2.2 (01/46)
Albumin	4.41±0.48	↑ 2.2 (01/46)
SGOT	29.40±13.44	↑ 2.2 (01/46)
SGPT	30.71±23.04	↑ 13.0 (06/46)
Alkaline phosphatase	406.88±171.68	↑ 2.3 (01/44)

SD – Standard deviation; SGOT – Serum glutamic oxaloacetic transaminase; SGPT – Serum glutamic pyruvic transaminase; ↓ – Decrease; ↑ – Increase

and 13 years of age, had used inhalants for 1-4 years and all had heroin dependent fathers, indicating the need to study this sub-population further for specific risk factors and family characteristics.

A large majority (82.0%) of inhalant users were school drop-outs. Inhalant is common in poor and underprivileged with low resources to support

education, but there can be at least two other plausible explanations. Chronic use of inhalants may lead to subtle cognitive impairments,^[7,8] interfering with an academic performance. Conversely, pre-existing behavioral problems, for example, conduct disorder could increase the risk of both dropping out of school and initiating drugs. School drop-out rates were reportedly high in previous Indian and international studies as well.^[4,22-25] Majority (85%) of treatment-seeking sample stayed with families, and family members were the primary agents to insist and bring 70% of sample for treatment. In India, families form the mainstay of support and are willing to engage extensively in the treatment process. This aspect could be utilized in the psychosocial therapies and long-term care of the patient. Rest 16% of the sample was brought to treatment on the initiative of social welfare organizations working with the street or homeless children. This sub-population may have different treatment needs and require special considerations in the management.^[26]

Inhalants were the first substances of abuse in 38% of the sample and a large majority reported concurrent use of other legal substances, most common being tobacco. Inhalants are cheap, legal, easily available, and perceived as innocuous products, which may contribute to their popularity as first drugs of abuse among the younger population,^[3,25] besides other gateway drugs viz. tobacco, alcohol and cannabis. A small percentage of the sample had also shown progression from legal substances to illicit drugs (heroin: 6%), which is a worrisome trend and points to a need to intervene for inhalant users, which largely remains a hidden population.

In 30% of sample, a family history of a substance use disorder was present in a first degree relative. The substance use among close family members may indicate a biological vulnerability as well as increase in environmental risk factors for initiation and maintenance of substance use. Similar rates for family history (25-48%) have been reported in the previous Indian studies too.^[22-24]

The use of inhalants was largely uninterrupted and continuous, with a median duration of 2 years and no prior abstinent attempt. Further, motivation to seek help was poor in half of the sample. There is a need to promote awareness about various health complications associated with inhalant use. Health Education could be delivered for inhalant users in community settings and may empower them to make informed choices.^[27] There is also a need for screening and delivery of brief interventions (using the principles of motivational interviewing) for early, inhalant users in various opportunistic health-care and community settings.

Early interventions can reduce the health related harms and psychosocial consequences seen in prolonged drug use.^[28] Nearly two-third of the sample had significant physical, psychological, and social complications as a result of inhalant use, and one-third were involved in pick-pocketing and other anti-social activities. Previous studies have also documented a wide range of psychosocial complications^[22] in inhalant users. A small, but significant percentage (8%) of the sample reported involvement in high-risk sexual behaviors. Adolescence may involve sexual experimentation and a low perception of risks. Use of inhalants in adolescents may further increase the risk of engagement in high-risk behaviors, for example, unprotected sex. There is a need to document the prevalence of high-risk sexual behaviors and infections, including human immunodeficiency virus, in this population sub-group.

In the routine laboratory tests, one-fourth of the sample was found to have hemoglobin levels below normal for their age. The inhalant users mostly came from lower socio-economic strata, which increases the risk for poor nutrition and inhalant use is likely to contribute to self-neglect, missed meals, and anemia. Inhalants are also known to cause hematological abnormalities, including anemia,^[5,6] but it is difficult to comment on causation in a retrospective study. In a previous study of 25 inhalant users from Istanbul,^[29] only one user had low hemoglobin level and only one had elevated SGPT.

Between 6.5% and 10.8% of sample in the present study had elevated differential leukocyte counts. Inhalants are usually associated with the aplastic anemia, bone marrow suppression, etc., and elevated rates may be caused by a wide range of health conditions such as parasitic infections, viral or fungal infections, chronic inflammatory diseases, tuberculosis, drugs, allergies, skin inflammations, and immunodeficiency, which warrants careful clinical attention. A small percentage of the sample had derangements in liver function tests, with 6.6% experiencing an increase in Bilirubin and 13% increase in SGPT. Inhalants are also known to cause hepatotoxicity and chronic, heavy use of inhalants may have contributed to hepatic derangements in the sample. This finding could also be due to co-occurring alcohol use in the sample. Further, inhalant users may be at risk of various medical illnesses, including hepatitis, which may have contributed. Those with significant derangements were referred to a medical specialist for further assessment, but a large proportion of them dropped out of follow-up.

Although the inhalants are known to produce several hematological and biochemical side-effects,^[5,6] not all previous studies have replicated this finding,^[29] which may be due to a small sample or heterogeneity

of chemical constituents of inhaled products across different studies. The present study showed subnormal hemoglobin as a common laboratory abnormality in the sample while elevated liver function tests and elevated leukocyte counts were seen in a small percentage. It is difficult, though, to precisely delineate a single causative factor in a retrospective study. There is a need to conduct a prospective study with the larger samples of inhalant users, for prevalence of laboratory abnormalities and correlation with inhalant use parameters, and impact of abstinence, if any.

Several other limitations need to be considered. As these findings are from one setting, results may not be generalized to other treatment settings in the country. The study was conducted retrospectively, and sample was non-consecutive. Additional clinical and laboratory parameters could have been collected in a prospective study. The study, however, adds to the limited literature on profile of inhalant users visiting treatment settings in India. Future research should examine the profile and pattern of inhalant use in the larger samples, across multiple sites in a prospective manner, taking into account multiple variables.

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