

## Cytological Changes in Buccal Mucosa among Glue Abusers in Shendi, Sudan

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### Abstract

**Background:** Glue sniffing among young people on the streets has gone completely out of control. The majority of street kids start out sniffing glue before moving on to other, more extreme narcotics. The organizations tackling the drug problem claim that because it is inexpensive and widely accessible, the majority of young people on the streets smell it.

**Objective:** The purpose of this study was to assess how sniffing glue affected the buccal mucosal cells.

**Materials and methods:** This cross-sectional descriptive study was carried out at Shendi town between March 2021 and March 2022. The study involved 150 participants under the age of 25, of whom 50 were glue abusers. The remaining 50 participants served as the (control 1) group and their parameters were similar to those of the abusers', with the exception that they did not abuse glue. The final 50 participants served as the (control 2) group and they appeared to be in good health and did not use tobacco, glue sniffing or another type of addiction. Buccal samples were taken from each group, strained by pap stain and microscopically examined. A standardized face-to-face questionnaire was utilized to gather data and the (SPSS) version (11.5) application was used to analyze the results.

**Results:** The study revealed a significant *P-value* of nuclear atypia among study populations, inflammation and infection was 0.000, the significant relationship of nuclear atypia with the duration of glue sniffing and dose of glue with *P-value* 0.000, 0.001 respectively.

**Conclusion:** The usage of glue caused considerable morphological alterations in mucosal cells, such as nuclear atypia and pre-nuclear halo, as well as inflammations and infections (bacterial and viral).

**Keywords:** Glue; Street children; Nuclear atypia; Buccal mucosa; Shendi

### Introduction

The most frequent oral malignant tumor is thought to be tongue-specific squamous cell carcinoma [1]. Oral cancer is one of the six most prevalent cancers in the world and is one of the top 10 leading causes of death worldwide. It is a deforming illness with a low survival rate that is common in middle-aged adults. Oral cancers are a serious health issue that affect people all over the world. Alcohol usage, areca nut use and tobacco use are the main etiological factors for the development of oral cancers. These malignancies now have five-year survival rates of between 50% and 55%. These rates primarily rely on the cancer stage at the time of diagnosis. Many manufacturers recycle and consume rubber solution (glue material) on a daily basis, but this substance is one that raises a lot of controversy because it is one of the main sources of intense addiction [2]. The adhesive method is perfect for using glue, which is made up of a variety of dangerous chemicals that fall under the category of volatile organic solvents. However, due to abuse, this substance has evolved into one of the main sources of addiction. Similar to narcotic drugs.

Glue produces a sense of activity, boosts attention and improves movement. These substances have a short-lived effect that goes away rapidly. The want to resume inhaling this chemical is no longer present. Despite the fact that glue sniffing has been associated with significant morbidity and mortality, it is still a largely un-researched and underappreciated problem. Nasal bleeding, rashes around the mouth and nose, loss of appetite and a lack of enthusiasm are long-term effects of inhaling glue. Some of the solvents are poisonous to the heart, liver, kidney and brain. Abuse of inhalants for an extended period of time can cause neurological disorders that show

damage to the areas of the brain that regulate movement, hearing, vision and cognition. The severity of cognitive impairments might range from mild dementia to severe impairment. Other organs are very hazardous when exposed to inhalants. The heart, lungs, liver and kidneys can suffer serious harm from chronic exposure. Although many disorders brought on by repeated or protracted consumption of inhalants are permanent, certain inhalant-induced damage to the neurological and other organ systems may be at least partially reversible when inhalant abuse is halted. Because it contains so many harmful chemicals, such as benzene, xylene, toluene, n-hexane, heptane, styrene, acetone, methyl ethyl ketone, methylene chloride, cyanoacrylates, trichloroethane, halogenated aromatic hydrocarbons and mineral spirits, glue inhalation is more dangerous than smoking cigarettes. Some of these substances are carcinogenic or mutagenic [3].

The primary toxin used in glue sniffing is toluene and its metabolite hippuric acid is nephrotoxic. Street youths who smoke and/or chew tobacco more frequently develop micronuclei and -H2AX foci in the oral mucosa, suggesting chromosomal and DNA damage, respectively. The severity of the genotoxic alterations in the buccal epithelial cells of these children is increased by their added habit of smelling or hunting industrial glue. Furthermore discovered a notable rise in argyrophilic nuclear organizer region (AgNOR) in buccal epithelial cells from glue-dependent kids, indicating that ribosome biogenesis was upregulated in these cells. The glue sniffers' oral mucosa has undergone genetic alterations. Therefore, it is important to promote bio-safety and health education initiatives across the country that highlight the harmful impacts of young people abusing inhalants on their health. In order to estimate the cancer risk associated with inhalant misuse, which is relatively common in industrialized nations as well, genetic markers could provide a useful method of detecting early mutagenesis events. For instance, by the time students reach the eighth grade in the United States, approximately 20% of them had at least once dabbled with inhalants and the average age of first-time inhalant abuse is 13 years. Young inhalant abusers are more prone to use other illegal drugs in the future. Intervention strategies for inhalant usage are crucial from the perspective of community health as well [4].

## Materials and Methods

### Study design

This is a descriptive cross-sectional study.

### Study area

The area is Shendi locality which is located 172.01 kilometers north of the capital, Khartoum southern part of the river Nile and covers an area of about 30 Km<sup>2</sup>.

### Sample size

One hundred and fifty buccal samples were taken from participants [5].

### Study population

Participants involved in this study were street children.

### Study duration

This study was performed during the period from March 2021 to March 2022.

### Inclusion criteria

Underage children and young adult males who were glue abusers were included in this study.

### Exclusion criteria

Age above 25 years old and who were not glue abusers were excluded from this study.

### Sample collection

At first, each participant was asked to wash his mouth to avoid contamination, after that buccal mucosa was scraped using disposable toothpaste, then the scraped material was smeared directly before drying upon a frosted end labeled microscopic glass slide. Each smeared slide was immediately fixed in 95% ethanol for at least 15 minutes [6]. After fixation slide was stained through the Papanicolaou staining method.

### Interpretation of culture growth

Identification of cellular changes achieved by the presence of the following conditions; the presence of primary criteria of malignancy (irregular chromatin pattern, chromatin strands of unequal size and shape, condensation of large chromatin clumps at nucleus border unevenly leaving empty center) to indicate cancer cells, presence of dyskaryotic cells (malignant chromatin with a normal amount of cytoplasm), presence of secondary criteria of malignancy to indicate cellular atypia (hyperchromasia, increase amount of chromatin, enlarged cells and nuclei, multinucleation, irregular nuclear border, presence of mitotic figures, abnormal enlarged and multi nucleoli), cellular changes also identified by the presence of metaplastic cells in the buccal smear, presence of keratosis (para and hyperkeratosis). Acute inflammatory change is identified by the presence of neutrophilia, while chronic inflammation is identified by the presence of lymphocytosis and macrophages [7].

### Quality controls

Sterile disposable toothpaste was used to collect the samples, the buccal sample was smeared directly to avoid air-drying artifacts. Smear was immediately fixed in 95% ethanol for the immediate killing of chromatin. All staining solutions are filtered before being used. All dishes and coplinjars were washed before and after use [8]. The quality of staining solutions is checked before used. During work, all dishes and coplinjars closed well by screw top cover to avoid evaporation and contamination. Contamination is also avoided during mounting and cover slipping [9].

## Results and Discussion

A cross-sectional study was conducted in Shendi town between March 2021 and March 2022 to assess the impact of glue sniffing on the buccal mucosal cells. A total of 150 people participated in the study, 50 of whom were glue abusers [10]. The remaining 50 people served as (control 1) and were similar to abusers in all other respects except that they did not sniff glue. The final 50 people served as (control 2) and were healthy without any known health conditions. The participants' age distribution showed that 56 were children (37.3%) and 94 were young adults (62.7%). For instance, by the time students reach the eighth grade in the United States, approximately 20% of them had at least once dabbled with inhalants and the average age of first-time inhalant abuse is 13 years [11]. Young children and adolescents can easily access glue and those most likely to abuse them are those who are between the ages of 14 and 18.

This may be due of hormonal changes that occur at this age (teenagers), since the mean age of glue abusers was 14 years old. The frequency of abusing type of glue , 100 of the participants were not glue abusers (66.7%) they controlled, 3 of them were abusers for glue only (2%), 47 were mixed (glue, tobacco and cigarette) they were (31.3%). Regarding the brands of glue, 100 of them (66.7%) were not glue abusers, 42 (28%) abused two types simultaneously (D, OK) and 8 (5.3%) abused three simultaneously (D, OK and Nokrin). The relationship between cellular alterations in buccal mucosa among glue addicts and glue type as brand names, no published reports were discovered. In terms of glue abuse symptoms, 103 of the participants have none (68.6%), 43 have respiratory symptoms (28.7%) and 4 have nervous symptoms (2.7%) (Tables 1-6).

**Table 1.** The frequency of the nuclear atypia among study populations.

Participant	Nuclear atypia		Total	P value
	Present	Absent		
Cases	50	0	50	0.000
Controls 1	40	10	50	
Controls 2	31	19	50	
Total	121	29	150	

**Table 2.** The frequency of the inflammation among study populations.

Participant	Inflammation			Total	P value
	Acute	Chronic	Absent		
Cases	0	41	9	50	0.000
Controls 1	1	10	39	50	
Controls 2	3	1	46	50	
Total	4	52	94	150	

**Table 3.** The frequency of the infections among study populations.

Participant	Infections			Total	P value
	Bacteria	HPV	Absent		
Cases	8	32	10	50	0.000
Controls 1	0	9	41	50	
Controls 2	1	6	43	50	
Total	9	47	94	150	

**Table 4.** The frequency of the perinuclear halo among study populations.

Participant	Perinuclear halo			P value
	Present	Absent	Total	
Cases	43	7	50	0.71
Controls 1	42	8	50	
Controls 2	41	9	50	
Total	126	24	150	

**Table 5.** The relationship between duration of abusing glue and nuclear atypia.

Nuclear atypia	Addiction duration/year			Total
	Less than 5	6-10	11-15	
Absent	0	0	0	0
Present	38	10	2	50
Total	38	10	2	50

**Table 6.** The relationship between the dose of glue and nuclear atypia.

Nuclear atypia	Addiction doses/day				Total
	Less than5	5-10	11-15	16-20	
Absent	0	0	0	0	0
Present	4	26	10	10	50
Total	4	26	10	10	50

This is because toluene-containing mixtures have been implicated in the causation of peripheral neuropathy, but the role of toluene is not clear because in most cases, known neurotoxins like n-hexane or methylethylketone have been present. Because the chemicals abused by inhalant users affect different types of cells, resulting in cell death studies indicate genetic changes in the oral mucosa of street boys in association with tobacco and glue sniffing or huffing habit. As a result, there was a significant difference between test and control group results with regard to nuclear atypia. The persistent use of volatile solvents like toluene damages cells and may result in an inflammatory response, there was a significant difference between the test and control group outcomes in terms of

inflammation. Chronic mucosal irritation results in the benign reactions of stratified squamous epithelium known as hyperkeratosis and parakeratosis, both of which are benign reactive changes. This study demonstrates bacterial infection with the presence of polymorph and human papillomavirus infection with the presence of koilocyte (intermediate-sized cells, nuclear atypia: Enlargement, irregular contour, hyperchromasia, slight chromatin coarseness, cytoplasmic cavities (koilocytes), keratinizing variant) [12]. There was a significant difference in the infection between the test and control groups. The results from the test and control groups did not differ significantly in terms of the perinuclear halo, which is understandable given that generic perinuclear cytoplasmic

clearance in superficial and intermediate squamous cells is linked to inflammatory conditions [13].

## Conclusion

The usage of glue resulted in significant morphological changes in mucosal cells, including nuclear atypia and pre-nuclear halo, as well as bacterial and viral infections and inflammations. The study demonstrates a statistically significant link between the dose and nuclear atypia with regard to the relationship between the dose of glue and that condition. The association between the duration of glue abuse and nuclear atypia, the study found a significant relationship between the two. However, no published studies regarding the association between prolonged glue abuse and cellular changes in the buccal mucosa among glue abusers could be found.

## Ethical Considerations

Ethical approval for the study was obtained from the board of the department of histopathology and cytology in medical laboratory sciences at Shendi university the written informed consent form was obtained from each guardian of the participant as well as from the subject himself before recruitment into the study. All protocols in this study were done according to the declaration of Helsinki.

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## Conflict of Interest

Authors have declared that no competing interests exist.

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