

## FORMALIN: KNOWLEDGE, ATTITUDE AND ETHICAL PRACTICES OF UNDERGRADUATE STUDENTS IN NORTH INDIA



### Anatomy

**KEYWORDS:** Formalin, knowledge, under graduate, adverse effects

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### ABSTRACT

**Introduction:** Formalin, which is widely used in anatomical laboratories exceeds the permissible range level. This has raised concerns about its effect on first professional medical students. **Methods:** The present study aims at assessing knowledge, attitude and practices of 200 first professional medical students about the use of formalin through a structured and validated questionnaire. **Results:** Most of the respondents answered satisfactorily about formalin and its composition. Irritation and burning sensation in eyes, nose, throat as well as lacrimation was proposed as the most common side effect of formalin (70%). Most of the respondents believed that existing infrastructure does not fulfill the required standards and formalin should be replaced by some other non-irritant chemical. **Conclusion:** The study identifies knowledge gaps and perceptions of medical students regarding use of formalin which will provide a breakthrough for replacing formalin with a better non-irritant chemical.

### Introduction

Formaldehyde (HCHO) is a colourless, flammable gas, extremely soluble in water; the aqueous solution about 37 percent by weight or 40 percent by volume formaldehyde is called formalin.<sup>1</sup> Formaldehyde was discovered in 1856 by the British chemist, August Wilhelm Von Hofmann. Around 100 years ago, formaldehyde was established as the classical fixative and can now be described as the stock-in-trade of all hospital anatomy and pathology laboratories. Anatomists, researchers and technicians in histology, pathology and embalming laboratories, as well as medical students during their dissection course are all exposed to formalin. Toxic effects of formaldehyde in humans are discussed in relation to occupational exposure and tolerance to this agent. In the United States, the permissible limits for occupational exposure to formaldehyde are 3 ppm for an 8-hour time.<sup>2</sup> Such levels are reached and exceeded in anatomical laboratories where bodies are embalmed and dissected or even in histology laboratories. Carcinogenic and mutagenic properties of formaldehyde have been reported in lower mammals and in vitro studies which has led to concern about a possible role in human cancer.<sup>3</sup> The rampant use of formalin in Anatomy laboratories such as, the dissection hall for preservation of cadavers, dissected and prosected anatomical specimens and histology laboratory for the preparation of histology slides, exposes the medical first professional undergraduate students to its adverse effects. On taking into consideration, the heavy use of formalin in medical colleges for teaching and research purposes, the present study endeavours to get acquainted with the knowledge, attitude and practices of medical students regarding its use in Anatomy laboratories.

### Materials and Methods

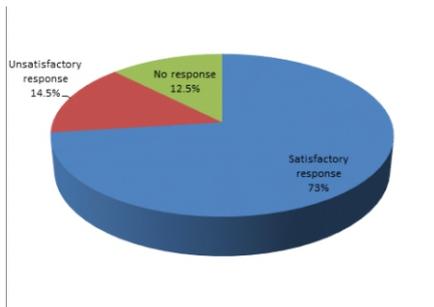
The present study is a questionnaire-based study on the knowledge, attitudes and practices (KAP) related to the use of formalin in cadaveric dissection halls for medical education. After proper ethical considerations, the study was conducted on 200 first professional medical undergraduate students of Lady Hardinge Medical College, New Delhi, the only medical college in North India providing medical education to female undergraduate students exclusively. The respondents were asked to fill a proforma providing general information about themselves in the form of age, blood group, and history of allergic disorders, followed by a questionnaire, without revealing their names in order to obtain unbiased answers. All the 200 respondents were asked to answer a fourteen item self-administered, structured and validated questionnaire about knowledge, beliefs and attitudes towards use of formalin for teaching purposes in the department of anatomy. The items included in the questionnaire were to judge the awareness about formalin as a

chemical preservative and its adverse effects on human body; preventive measures that are being taken or that can be taken to reduce the adverse effects, and other alternatives for alleviating the symptoms produced by formalin fumes. The items included both open-ended and closed ended questions which were categorized into four sets. The first set of questions evaluated the knowledge of the respondents about the chemical fixative, formalin; its composition, indications or uses and side effects. The second set of questions assessed the duration of exposure to formalin and short-term as well as long-term side effects experienced by students on exposure to it. The third set of questions were framed to find out the perception of medical students about the adequacy of existing infrastructure for demonstration and practicals in Anatomy laboratories, especially, the dissection hall and anatomy museum. It also assessed the adequacy of use of protective gear by medical students for dealing with anatomical specimens. The fourth set of questions analyzed the measures suggested by respondents for decreasing the adverse effects of formalin in the form of use of other protective equipments and modifications in the infrastructure. It also evaluated whether the students wanted to replace formalin with some other non-irritant chemical and their knowledge about the existence of the same. They were also asked whether they wanted the replacement of cadavers with artificial anatomical specimens made of chemical materials. The open and closed-ended questions were scrutinized separately. The data collected from the respondents was analyzed, tabulated and the results were summarized by subjecting to calculation of percentages using Microsoft Excel (2007).

### Results

After comprehensive analysis of the data obtained in the questionnaire, several significant results were obtained. The respondents i.e., the first professional M.B.B.S students (n=200), were in the age group of 17-23 years. Maximum respondents (48.5%) were of 19 years of age followed by 18 years (24%) and 20 years (20%) old respondents respectively. All the respondents were females. On inquiring the respondents about their blood group, four respondents gave no response. So, out of 196 respondents, 76 (38.7%) belonged to blood group B positive followed by O positive in 52 (26.5%) cases. Least number of respondents belonged to blood group AB negative. The history of allergic disorder was seen in 14(7%) respondents while 186(93%) respondents were not suffering from any allergic disorder.

In response to the first set of questions, out of 200 students, 146 (73%) could answer satisfactorily about formalin and its composition while 29 (14.5%) could not furnish a satisfactory answer and 25 students (12.5%) did not respond to this question.(Fig. 1)

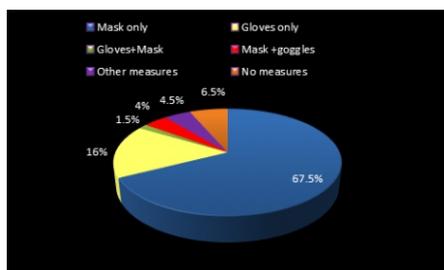


**Fig 1: Pie chart showing the percentage of students with responses to first set of question about formalin and its composition**

When asked about the uses of formalin, 184 respondents (92%) claimed formalin to be used as a preservative while 4(2%) students claimed uses other than as a preservative; 11(5.5%) did not respond while only 1(0.5%) did not know the indications of formalin. On inquiring about the adverse effects of formalin, the responses given by the undergraduate students were: Pungent smell(7%), Irritation and burning sensation in eyes, nose, throat and lacrimation(70%), itching of eyes(15%), pain in eyes and throat(10%), reddening of eyes(40%), sore throat(30%), nasal congestion(25%), nasal discharge(46%), cough(23%), nausea(27%), itching (40%), skin allergy(19%), Hairfall and alopecia((63%), irritability(10%), headache(16%), memory loss and dementia(9%), fainting(1%), drowsiness(2%),euphoria(1%), demyelination of nerve fibres(11%), neuron degeneration(5%),carcinogenic(30%).

In response to second set of questions, the duration of exposure was less than 1 year for all subjects and amongst the 200 respondents, adverse effects due to formalin persisted in 132 cases (66%) while 61 cases (30.5%) did not suffer from any long-term side effects and 7(3.5%) students did not respond to this question.

In response to third set of questions, when asked about the protective measures used by them, 135(67.5%) used only mask, 32(16%) used gloves only, 3(1.5%) respondents used gloves and mask both, 8(4%) used mask and goggles both, 9(4.5%) used other measures while 13(6.5%) of them did not use any protective measure.(Fig.2)



**Fig 2: Pie chart showing the percentage of respondents using various protective measures**

When asked whether the existing infrastructure fulfils the required standards, 132(66%) respondents were not satisfied; 46(23%) were satisfied with the existing infrastructure while 21(10.5%) did not respond to this question and 1(0.5%) of them did not know about the same (Table 1).

**Table 1: Distribution of students according to responses on whether existing infrastructure fulfils the required standards**

Responses	Number	Percentage (%)
Yes	46	23
No	132	66
Did not respond	21	10.5
Don't know	1	0.5

In response to fourth set of questions, only 23(11.5%) students came up with suggestions, 148 did not respond and 29 had no suggestions to give. Other measures and infrastructure suggested regarding the use of formalin in the department of anatomy were better exhaust fans and proper ventilation, air conditioning of anatomical laboratories, placing formalin-filled containers with prosected specimens outside the dissection hall in separate rooms, use of protective goggles, face masks and gloves being made mandatory in dissection hall, washing the cadavers and dissected specimens with water before it is used for demonstration and dissection, use of less irritant preservatives in embalming fluid, reduce duration of exposure per day, covering the cadavers in the dissection hall when not in use, maintaining cleanliness in the dissection hall, use of alternative preservative with less side effects, live video demonstrations of the dissection session by senior faculty, simulated models, better embalmed cadaver for dissection, provision of handwash in department, better embalming of cadavers, more number of cadavers for dissection, less students per table, clean dissection tables, prevention of formalin dripping from specimens in the hall.

145(72.5%) students believed that formalin should be replaced by some other chemical, 31(15.5%) believed it should not be replaced, 19(9.5%) students did not respond and 5(2.5%) did not know. When asked about the other chemical that can be used to replace formalin, 153(76.5%) respondents could not suggest any; while 47(23.5%) students did not respond. According to 171(85.5%) respondents, cadaver should not be replaced with some other method of teaching; only 8 cases (4%) wanted replacement of cadaver while 21 did not respond.

**Discussion**

Formaldehyde is a chemical fixative and anatomical as well as histological techniques are built upon the use of these agents in order that fixed tissue should resemble as accurately as possible the form that it held in life. In the current study, irritation and burning sensation in eyes, nose, throat and lacrimation were described as the most common side effects by 70% respondents followed by hairfall and alopecia(63%), reddening of eyes(40%) and carcinogenicity(30%) apart from other side effects. Similar side effects have been reported by other authors.<sup>4, 5</sup> The adverse effects due to formalin persisted in 132 cases (66%) in the present study which is in coherence with the results of few other studies.<sup>6, 7</sup> Various kinds of protective measures are used by the respondents in this study. Similar precautions have been recommended to reduce formaldehyde exposure to the lowest feasible level.<sup>2,8,9</sup> Most of the respondents believed that existing infrastructure was inadequate and desired improved ventilation as well as reduction or replacement of formalin in primary fixative which is similar to suggestions made by researchers of other studies<sup>10, 11</sup> Phenoxyethanol has been recommended by some authors as an alternative to formalin.<sup>12</sup> In the present study, respondents were unaware of this chemical.

**Conclusion**

The present study identifies knowledge gaps and perceptions of medical students regarding use of formalin which will provide a breakthrough for replacing formalin with a better non-irritant chemical.

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