



## VARIOUS EFFECTS OF FORMALIN AMONGST THE HEALTH WORKERS – A QUESTIONNAIRE BASED STUDY

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### ABSTRACT

**Introduction:** Fixation is a crucial step in processing of biopsy tissue specimen for the examination and archival preservation. Fixation helps to preserve cellular architecture and composition of cells in the tissue to allow them to withstand subsequent processing. **Materials and Methods:** There is 15 questions in this KAP survey and there are hundred participants in this survey including both undergraduates and post graduates students and lab technicians. **Result:** The present study showed statistically significant

### INTRODUCTION

Fixation is a crucial step in processing of biopsy tissue specimen for the examination and archival preservation. Fixation helps to preserve cellular architecture and composition of cells in the tissue to allow them to withstand subsequent processing. Fixation also preserves the proteins, carbohydrate and other bio-active moieties in their spatial relationship to the cell.

During the last few years there have been an increasing number of proprietary fixatives developed for use in histopathology and medical research. They are generally marketed as less hazardous replacements for traditional formalin fixatives or as less toxic substitutes for fixative mixtures containing mercury. In clinical practice biopsies as well as surgical resection specimens are fixed as soon as possible to avoid autolysis and putrefaction, and embedded in paraffin-wax.

Formalin-fixed, paraffin-embedded (FFPE) tissue is the routine processing method practiced in pathology departments worldwide. Fixation is a process involving a series of complex

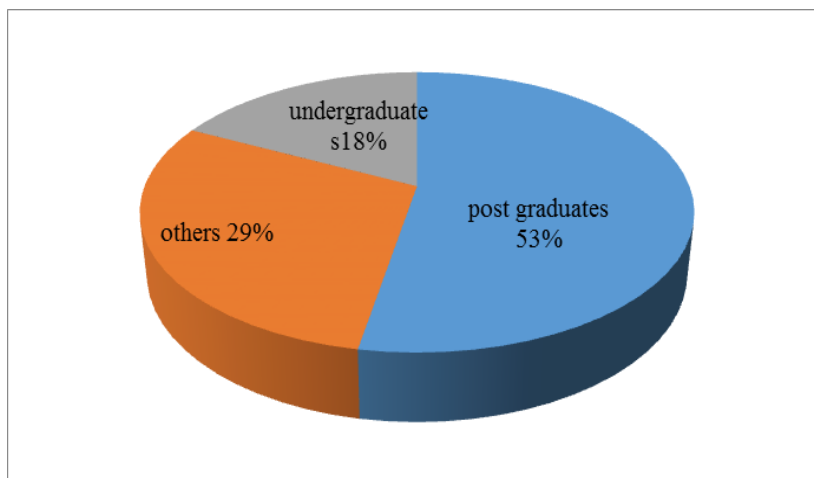
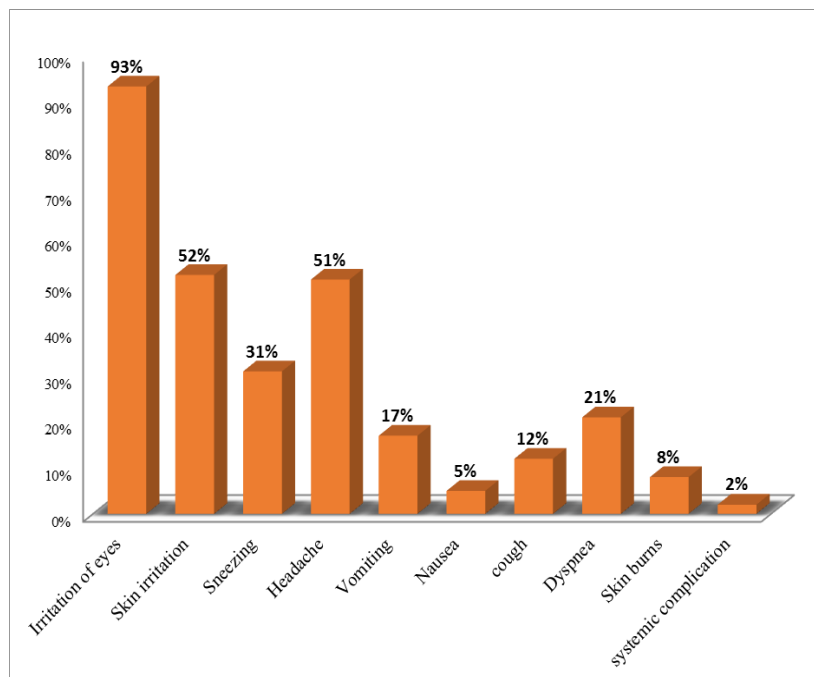
chemical modifications of macromolecules present in tissues and cells to preserve the structural and functional components as closely as possible to the living state. Formalin is a cross-linking fixative creating methylene bridges among proteins and, if not adequately buffered, results in nucleic acid fragmentation and degradation due to formic acid.<sup>[1,2]</sup>

Formalin-fixed, paraffin-embedded tissue processing represents a highly stable, cheap, and easily storable form of tissue; is an invaluable material for research in molecular medicine; and is archived in hospitals and tissue banks worldwide. However, formalin is a toxic fixative and exposure by nasal, oral, or dermal routes is a human health risk.<sup>[8]</sup> The International Agency for Research of Cancer recently classified formaldehyde as a human carcinogen, that causes nasopharyngeal cancer, and it also consider there is “strong but not sufficient evidence for causal association between leukemia and occupational exposure to formaldehyde.” For this reason, several European countries already restrict the use and import of formaldehyde because of its carcinogenic properties, and the European Union is considering a complete ban on formaldehyde usage. To overcome the problems of formalin fixation, numerous attempts have been made to find formalin-free tissue fixatives with low toxic properties and a similar quality to preserve nucleic acids proteins. Numerous formalin substitutes have been examined and seem to be appropriate for DNA and RNA analysis, but the related procedures have been poorly tested in routine pathology practice and the proteomic field.<sup>[4]</sup>

Formalin is a cadaverous chemical of 37–50 percent aqueous solution of dissolved formaldehyde (CH<sub>2</sub>O) in water. It is flammable, highly reactive with many substances and readily polymerizing colourless gas at normal temperature and pressure. In air, it is readily broken down by sunlight, with a half-life of approximately 30-50 minutes.

## MATERIALS AND METHODS

A self designed questionnaire was administered to under graduate and post graduation students and lab technicians of pathology. its Questionnaire based study which consists of 7 knowledge questions.,7 questionnaire regarding attitude and 6 perception and their attitudes towards the various effects of formalin as tissue preservation, there is 15 questions in this KAP survey and there are 100 participants in this survey including both undergraduates and post graduates students and lab technicians, this study performed in three month of duration from September 2017–November 2017.

**RESULT****Table 1: Pie chart representing the percentage of participants.****Table 2: Graph representing the various side effects of formalin.****DISCUSSION**

Fixation is a physico-chemical process that is gradual and complex, involving diffusion of fixative into the tissue and a variety of potential physical phenomenon and chemical reactions. To date, no ideal fixative has been found, i.e., a fixative that perfectly preserves cellular morphology and yet does not modify the specimen composition so as not to change the reactivity of the chemical moieties therein for subsequent detection. Because of this issue, the selection of a particular fixative generally warrants multiple and careful considerations. Unless penetration occurs, fixation is not possible.

There are 4 major groups of fixatives, namely the aldehydes, oxidizing agents, alcohol based fixatives and the metallic group of fixatives. The aldehydes (formaldehyde, glutaraldehyde) and oxidizing agents (osmium tetroxide, potassium permanganate) acts by cross-linking proteins. Alcohol based fixatives (methyl alcohol, ethyl alcohol, acetic acid) are protein-denaturing agents. Metallic group of fixatives acts by forming insoluble metallic precipitates like mercuric chloride and picric acid. The choice of the fixative is based on tissue and anticipated ancillary tests.

Formalin is the widely used fixative in pathology labs worldwide owing to its convenience in handling, high degree of accuracy and extreme adaptability. The basics of chemical reactions involved in formalin fixation have been described in literature Penetration of formalin in to the specimen is a physical process by which the solution diffuses in to the specimen to reach the innermost layers of cells. This movement of formalin is governed by several physical factors.

There are 100 participants in this survey including both undergraduates and post graduates students and lab technicians, this study performed in three month of duration.

In this study showed all the participants are aware of harmful effects of formalin and they were experienced. Most of participants experienced irritation of eyes (93%), several people also experienced skin irritation (52%) and headache (51%), those participants who daily used formalin such as lab technicians they were experienced dyspnea (21%), sneezing 31%, and vomiting (17%), cough(12%), skinburns8%,and very people experienced nausea(5%) and systemic complications(2%) results were summarised in table 2. Apart of the using several precautions they were experienced above mentioned effects of formalin.

## CONCLUSION

Current study suggested that the use of formalin with proper care such as used of gloves, mouth mask, protective eye glasses and bottle should be properly closed and should give proper instructions to the technicians to handle the formalin.

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