INPLASY

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Antioxidants with protective effects against oxidative stress induced by formaldehyde exposure: a systematic review

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ADMINISTRATIVE INFORMATION

INTRODUCTION

Review question / Objective Formaldehyde (FA), a cancer-causing substance, induces cell damage and oxida-tive stress via reactive oxygen species (ROS). FA may trigger allergic reactions manifested by allergic rhinitis, various chemical sensitivities, and bronchial asthma, cytotoxicity, genotoxicity, mutagenesis, and carcinogenesis (especially for nasopharyngeal area], along with leukemogenesis. It could also affect the liver, kidney, brain cortex, and to impair the lipid metabolism. The neurotoxicity is emphasized by symptoms such as headache, sleep disorders, memory loss, dizziness, severe fatigue, thirst, irritability, lethargy, and behavioral and sensory-emotional disorders cognitive disorders, neurodegeneration and Alzheimer disease. The purpose of the study was to determine whether there are any antioxidants that can guard against the negative effects of FA exposure.

Rationale Since the exposure of humans to high concentration of formaldehyde is considered non-ethical, most studies are performed on animal models. Therefore, we have decided to conduct a systematic review of existing literature on animal studies regarding the effect of antioxidants on formaldehyde induced tissular changes.

Condition being studied Research has demonstrated that formaldehyde-induced tissue damage is significantly impacted by oxidative stress due to the elevated levels of reactive oxygen species produced by the chemical. Antioxidant compounds lessen oxidative stress by either encouraging the activity or development of antioxidant enzymes or by chemically reacting and neutralizing free radicals. They can be synthetic or natural, like plant extracts. Due to their lower side effects, medicinal herbs have long been utilized as an alternative to traditional allopathic therapy. They

could also be effectively applied to reduce the harmful effects of FA.

METHODS

Search strategy Literature search was done by using four databases: Pub Med, Science Direct, SpringerLink and Wiley for articles published up to 1 September 2023, using a search strategy following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA).

Participant or population Rodents with oxidative stress induced by formaldehyde exposure (rats and mice).

Intervention Groups with formaldehyde administration by inhalation or intraperitoneally, groups with antioxidant administration intragastric/intramuscular and groups with formaldehyde + antioxidant. Antioxidants prior, during or following the formaldehyde exposure were used.

Comparator Comparison with control group: normal saline.

Study designs to be included Case-control animal studies.

Eligibility criteria 1) Animal model (rat or mouse) that was exposed to formaldehyde in different conditions2) The treatment group received different antioxidants3) The biochemical (oxidative stress markers, inflammation markers) and histopathological changes (including routine stain hematoxylin eosin, other histochemical analysis and immunohistochemistry) that were indicative for oxidative stress have been considered for analysis 4) In vitro studies, studies with models other that rats or mouse, studies without formaldehyde exposure and without antioxidant treatments, studies without biochemistry or histopathological analysis, studies without control group and publications such as: books or book chapters, letters, editorials, reviews, short communications, human studies, theses, conference abstract were excluded.

Information sources 1) Electronic databases: Literature search was done by using four databases: Pub Med, Science Direct, SpringerLink and Wiley for articles published up to 1 September 2023, using a search strategy following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)
2) Records from citation searching from article references by manual search.

Main outcome(s) Biochemical and histopathological analysis.

Additional outcome(s) None.

Data management Firstly, the papers have been screened based on their title and abstract and then we read the complete texts of the articles that meet our criteria, before deciding which ones to include in our study. Each article has been separately evaluated by two observers for each phase. Any disagreement was resolved by discussing with a third reviewer. The articles that were not available in full text and reviews have been excluded excluded from our search. The flow chart of searching strategy was done by using PRISMA guidelines. All data will be tabulated in order to exemplify the antioxidant effect. The following data were extracted: experimental groups, sample size, treatment design, species of rodents, sex, age, formaldehyde and antioxidant exposure, doses and route of administration, duration of administration, biochemical analysis, histopahological analysis, methods used, histopathological description and immuno-histochemistry positivity, first author, year of publication.

Quality assessment / Risk of bias analysis SYRCLE's risk of bias tool for animal research will be used to evaluate the quality of each included study. Risk of bias will be evaluated for each study considering selection bias (Sequence generation, Baseline characteristics, Allocation concealment), performance bias (Random housing, blinding), detection bias (Random outcome assessment, blinding), attrition bias (Incomplete outcome data), reporting bias (Selective outcome reporting) and other sources of bias.

Strategy of data synthesis There was a qualitative analysis by drawing tables with a description of biochemical and histopathology effect.

Subgroup analysis Species of animals (rat, mice); Design of study (treatment); Type of injury (formaldehyde exposure); Route of treatment: intragastric, intraperitoneal, intramuscular, inhalation.

Sensitivity analysis None.

Language restriction English.

Country(ies) involved Romania.

Keywords formaldehyde; oxidative stress; antioxidants; histopathology.

Dissemination plans Submission to a journal.

Contributions of each author
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