

THE EFFECTS OF AIR FRESHENER EXPOSURE AT AN EARLY AGE ON HISTOLOGICAL WHITE RAT (*RATTUS NORVEGICUS*) LIVER CELLS

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INTRODUCTION

Air freshener can cause indoor air pollution if used unwisely. The air freshener contains several types of chemicals, such as Volatile Organic Compound (VOC), allergens, benzene, formaldehyde, terpenes, styrene, toluene and diethyl phthalate [1].

Exposure to formaldehyde appears to be associated with hepatotoxicity in many species, following injection, ingestion, or inhalation. There are several possible mechanisms for the toxicity. Depending on the route of exposure could include direct effects on hepatocytes and/or indirect effects through the circulatory and immune systems [2].

This study aims to determine the effects of air freshener exposure at an early age on histological liver cell

METHODS

The subjects of this study were 30 male rats (*Rattus norvegicus*) (early age 8 days). Air freshener used was produced by one factory in Indonesia, with the gel and spray forms. Subjects were divided into three groups (n=10). The control (K) (untested) group, the P1 group (given a gel air freshener exposure) and P2 group (given exposure to spray air freshener). Exposure to the subject of the group P1 and P2 from the age of 8 days up to 67 days, the initial dose of exposure 15 minutes every morning and afternoon. Subsequent doses increased by 15 minutes for each week, until the final dose of 4.5 hours.

On day 68, subjects were sacrificed and the liver tissues were removed for histological investigation. Liver histology preparations made by the method of paraffin blocks, with Hematoxyline Eosine staining technique. All preparations histology observed under binocular microscope at a magnification of 4x10 and 40x10, in the area around the vena centralis, in 5 visual fields. The degree of liver damage was assessed using a scoring system Marja Roenigk [3]. Observations were made on 100 cell liver, on each visual field. Histological observation of the cells were observed: normal cells (score 1), parenchyma degeneration (cloudy swelling) (score 2), hydropic degeneration (ballooning) (score 3) and necrosis (score 4) [4]. Data degrees of liver damage were analyzed statistically using ANOVA, followed by Tukey's test, at 95% confidence level.

RESULT

Table 1. The average score of histopathological changes in the cells, in rats control group, a group that was exposed gel air freshener, and a group that was exposed spray air freshener

Group of rats	Mean SDS of histopathological changes score Marja Roenigk
Control Group (K)	1,7897±0,15864*
Gel air freshener (P1) Group	2,4414±0,57409*
Spray air freshener (P2) Group	2,2316±0,26887*

Description: A, B, C different letters indicate significant differences in the statistical test One-Way ANOVA Post-hoc Tukey with a significance level of 95%



Figure 1A. Liver histology of control group (P.K. 40x).
Figure 1B. Liver histology of control group (P.K. 400x).
Description: (---) showed normal cells with a score of 1



Figure 2A. Liver histology of a group of rat that were exposed to the gel air freshener (P1) (P.K. 40x).
Figure 2B. Liver histology of a group of rat that were exposed to the gel air freshener (P1) (P.K. 400x).
Description: (---) showed cells with hydropic degeneration with a score of 2.

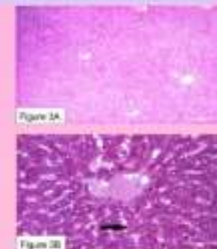


Figure 3A. Liver histology of a group of rat that were exposed to the spray air freshener (P2) (P.K. 40x).
Figure 3B. Liver histology of a group of rat that were exposed to the spray air freshener (P2) (P.K. 400x).
Description: (---) showed cell degeneration parenchyma with a score of 2.

DISCUSSION

Results of assessment of the degree of liver cell damage by using a scoring Marja Roenigk, showed there were significant differences in scores between the three groups. Scores of damage relatively high (> 2) occurred in the 2 groups of rats that were exposed to the air freshener. This suggests that exposure to air freshener cause damage to the liver cells.

It has been known that the air freshener contains various volatile compounds, including formaldehyde, that could potentially damage tissue of the body. Formaldehyde is a highly reactive substance that can interact with virtually every cellular constituent. Formaldehyde can possess systemic toxicity and may thus produce organotrophic effect on remote tissue and organs [5]. Results of investigation of the influence of this air freshener exposure (which contain formaldehyde) also according to the explanation of Beall and Utzinger who stated that formaldehyde exposure may associated with hepatotoxicity [2].

Liver tissue damage due to toxic compounds is associated with one of its functions, as a detoxification. One of the toxic compounds contained in air freshener is formaldehyde. Metabolism and detoxification of formaldehyde occurs in the liver that produce toxic metabolites which can damage the liver. Formaldehyde will be metabolized into formic acid by the enzyme formaldehyde dehydrogenase [6]. Formaldehyde dehydrogenase enzyme is oxidative enzymes located in the cytosol and mitochondria. The highest level of this enzyme consecutive are in the liver, kidney, lung and gastric mucosa. Formaldehyde exposure affects the liver cell damage by damaging the mitochondria that inhibits aerobic metabolism of cells [7].

This study has shown differences in the level of damage to liver cells of rats between groups P1 and P2. In the group P1 (which was exposed to the gel air freshener) showed more severe than P2 group. Significant differences between the groups P1 and P2 was possible because substances in spray air freshener exposure gradually decreased because of air currents in the room, especially if there is ventilation, compared with a gel air freshener substance that emits continuous exposure. Another factor that causes the difference in effect between gel air freshener dan spray air freshener is the differences in the composition of the constituent between spray air freshener and gel air freshener. Air freshener in gel form contains more formaldehyde than the liquid preparation / spray [1]. Thus, it is acceptable if the gel air freshener has a more severe effect on liver cell damage than spray air freshener.

CONCLUSION

The exposure of air freshener at an early age have a bad influence on the histological white rat (*Rattus norvegicus*) liver cells.

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