

Protective effects of Vitamin C on kidney performance of an adult male rat exposed to formaldehyde

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ABSTRACT

Formaldehyde is a chemical material with a nasty smell which is used in fixing cadavers, histology processes, synthetic resins, wooden and plastic productions and industrial fiber production. Formaldehyde has also a negative effect on body organs such as kidney. The target of this study is investigation of protection effect of Vitamin C on kidney performance of male rate exposed to formaldehyde, with regard to this fact that antioxidants like Vitamin C play a crucial role on protection against the damage occurred by smelling formaldehyde. 24 adult male rats were involved in this study with 250-300 gr weights. The rats were divided into 3 groups. The first group called control group (c) receive 1cc/kg formaldehyde and the second group (E1) received 10mg/kg formaldehyde and the third group (E2) received 10 mg/kg formaldehyde with 200 mg/kg Vitamin C for 10 days by daily injection. After 3 weeks of the last injection, phlebotomy was performed and the serum level of urea and creatinine was evaluated and compared in three groups. The result of Urea level comparison was meaningful among three groups ($P < 0.05$). In the groups receiving formaldehyde and Vitamin C at the same time, there were not any significant difference related to the Urea level with control group ($P = 0.239$). The Urea level of E2 group in comparison with E1 group was not meaningful ($p = 0.149$). However, the comparison of creatinine was meaningful among these groups ($P < 0.05$). However, treatment with Vitamin C in the E2 group, could not significantly effect on creatinine increase ($P < 0.05$). The level of creatinine in E2 group is not meaningful rather than E1 group. In conclusion, it was observed that 10 days injection of 200 (mg/kg) Vitamin C in the peritoneal can avoid increasing of Urea due to formalin among adult rats.

KEY WORDS: FORMALDEHYDE, KIDNEY, VITAMIN C, RATS

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INTRODUCTION

Formaldehyde is a chemical material with a nasty smell (Golalipour et al. 2007). Which is used in fixing cadavers, histology processes, synthetic resins, wooden and plastic productions and industrial fiber production formaldehyde has a negative effect on performance of body organs (Mendis-Handagama et al. 2007). It is metabolized to formic acid by dehydrogenase formaldehyde and dehydrogenase aldehyde enzymes in the liver and erythrocyte which is excreted through urine, excretion and breathing with different macromolecules such as protein, acid nucleic or interact with the light molecules like amino acid (Cheng et al. 2003; Collins and Lineker, 2004). Formaldehyde can cause oxidative stress in the body and has a bad effect on respiratory system and blood circulation and kidney (Kini et al. 2004). Antioxidants such a components that help body to destroy free radicals oxidative stress is actually imbalance between oxidants and antioxidants. When the amount of oxidants increases, the cells are damaged. Antioxidants include Vitamin A, E, C, Zn and selenium which play a crucial role on inhibition of free radicals and stability of cell membrane (Kini et al. 2004). Vitamin C (Ascorbic Acid) is a white or yellow odorless solid substrate with the molecular formulation of C₆H₈O₆. Ascorbic Acid is produced in the liver of plants and animals (except some special kind and human). Vitamin C operates as antioxidants in the body and cause acceleration of Fe, Cu and also revives of folic acid and collagen making (Kum et al. 2011). Vitamin C as a soluble antioxidant becomes active by moving oxygen and nitrogen elements (Rekha et al. 2011).

Vitamin C has also an important role in protecting the kidney and it can prevent increasing urea and creatinine in the oxidative damage (Sokkary and Awadalla, 2011; Agarwal et al. 2010; Yurdakul et al. 2010). One of the most important damage of formaldehyde is kidney damage (Umemura et al. 2009; Coronel et al. 2010). Oxidants are able to change proliferative in the glomerule structure of kidney (Coronel et al. 2010; Saleem et al. 2012). Antioxidants consumption can prevent damage of kidney (Djeffal et al. 2011; Ememghorashy et al. 2012; Claudia et al. 2003; Qiu et al. 2010; Zhou et al. 2006). The kidney performance can be evaluated by investigating the indicators of blood (Hai Xia et al. 2012; Ukmali et al. 2011). With regard to the formaldehyde effects in making oxidative stress, free radicals and their effect on kidney performance and in accordance with the performed studies related to the formaldehyde on the kidney tissue changes as glomerule vascular congestion and also minor decline holes in the pipe cells and studies about the protection effect of Vitamin C on prevention of formaldehyde damage (Sajadi et al. 2008; Farmahini

et al. 2008), in this study, we decided to investigate the protection effect of Vitamin C on kidney performance of rats after exposing to formaldehyde.

METHODOLOGY OF PLAN PERFORMANCE

Ether was used in this study to anesthesia the rats and 5cc syringe with anatomy tools was used for phlebotomy and also centrifugal tool for separating rat's serum. In this study 24 adult rat of vista breed were selected and divided into 3 equal groups. The first group (C) received 1cc/kg of normal saline and the second group (E2) received 10 mg/kg formaldehyde and the third group (E3) received both 10mg/kg formaldehyde and 200 mg/kg Vitamin C in 10 days by injection into peritoneal. During the study, the rats were under normal condition of shelter with 24±2 temperature and appropriate feeding. 3 weeks after finishing the injection phlebotomy, after anesthesia by sterile syringe was performed. After making flocculation by centrifuge, samples were separated with 1500 rpm during 10 minutes and they were kept in -20 c till testing for evaluation of urea and creatinine. The amount of urea and creatinine by using Pars Azmoon kits and auto analyzer tool (Biotechnica Instrument BT 1000) were evaluated and Calorimetric was done on kits to evaluate urea and jaffe was performed to evaluate creatinine. Data analysis after entering the data to SPSS Ver 18 was done by using Shapiro-wilk test to investigate normality of cantinas quantitative data distribution. The explicit result of the groups was reported as average and deviation from standard deviation. The comparison between the investigated groups was performed by using ANOVA test. If the average differences of statistic results were meaningful the LSD test were used to compare them. The meaningful level was considered less than 0.05 (P<0.05)

RESULTS

The urea result was meaningful in 3 groups (P<0.05) and the increase of urea in E1 group (after receiving formaldehyde) rather than C group (after receiving normal saline) was also meaningful (P<0.05). While the increase amount of urea in E2 group (after receiving formaldehyde and Vitamin C) rather than C group was not meaningful (p=0.239). The increase amount of urea in E1 group rather than E2 was not meaningful (p=0.149). The creatinine result in 3 groups was meaningful (p<0.05). The increase amount of creatinine of E1 group in comparison with C group was also meaningful (p<0.05) and the increase amount of creatinine in E2 group in comparison with C group was also meaningful (p<0.05). While the increase amount of creatinine

Table 1. Urea and Creatinine average table

P	E2	E1	Control	
P=0.036	41.68±3.60	45.42±4.99	38.64±5.52	Urea Ave.
P=0.001	0.74±0.09	0.75±0.06	0.46±0.05	Creatinine Ave.

in E group rather than E2 group was not meaningful ($p=0.847$).

DISCUSSION

Formaldehyde can affect the body organs due to creating free radicals (Yurdakul et al. 2010). Formaldehyde can also affect the kidney performance such as excretion of waste substances (Umemura et al. 2009). Antioxidant can prevent the harmful effect of formaldehyde. Vitamins are one of the most important antioxidants – especially Vitamin C – which play an effective role in protection against oxidative damage caused by free radicals (Coronel et al. 2010). On the other hand, this Vitamin can enhance the activity of antioxidant enzymes in the kidney tissue (Saleem et al. 2012). This study is similar to the Kum C study for investigating urea amount (Kum et al. 2011). Although in the Kum C study, the effect of formalin smell on rat's body was investigated and the meaningful difference was just related to the urea amount. While in our study the meaningful difference in the Creatinine and urea was observed between the group exposed to formaldehyde and the control group ($p<0.05$).

In the study of Sajad, et al., injecting Vitamin C causes the decrease of urea and creatinine meaningful ($p<0.05$). In the patients suffering from kidney damage under analysis treatment (Sajadi et al. 2008) however, according to our study, injecting Vitamin C had not a significant effect on decreasing the creatinine amount in the rat's exposed to the formaldehyde. The result of this part of the study which is the main part of it is similar to other studies related to the investigating the protection effect of this Vitamin C is effective on prevention against bad effect of some substrates like formaldehyde due to reducing the amount of free radicals. In this study, the result of investigating urea and creatinine in 3 groups had a meaningful difference ($p<0.05$) in which the amount of them in the rats exposed to formaldehyde had a significant difference with the control group. The injection of Vitamin C enhance the changes of the urea amount ($p<0.05$). However, there were not any meaningful changes relate to the creatinine ($p>0.05$). The average of creatinine in E2 group exposed to formaldehyde and

treated by Vitamin C (0.74 ± 0.09) was less than E1 group (0.75 ± 0.06).

Although these changes couldn't make an effect in the meaningful difference between E2 group and control group. With regard to the above and the performed experiments, it was observed that formaldehyde known as a harmful substrate and exposing to formaldehyde can effect on excretion substrate from kidneys. In this study formaldehyde was the cause of the meaningful difference in the creatinine and Urea level in the group exposed to formaldehyde in comparison with control group.

In various studies, the effects of antioxidants as a protection agent on body organs have been approved. In this study, injecting the Vitamin C could prevent meaningful changes in the urea level of the group exposed to the formaldehyde. According to the above results, it was concluded that injecting of 200 mg/kg Vitamin C into peritoneal during 10 days can reduce the increase of urea amount due to formalin in the adult male rats.

CONCLUSION

With regard to the performed study, Vitamin C can be used as one of the most important antioxidants which have a protective relative effect against kidney poisoning by formaldehyde.

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