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PROTECTIVE EFFECT OF COENZYME Q_{10} AGAINST CARBON TETRACHLORIDE-INDUCED LIVER INJURY

SATORU SUGIYAMA, MASAYASU KITAZAWA, TAKAYUKI OZAWA,
KOHJI SUZUKI* and YOHEI IZAWA*

Department of Biomedical Chemistry, Faculty of Medicine, Nagoya University
Tsuruma-cho 65, Showa-ku, Nagoya 466, Japan
** Burn Center, Department of Plastic Surgery, Chukyo Hospital*
Sanjo, Minami-ku, Nagoya 457, Japan

INTRODUCTION

Hepatotoxicity of carbon tetrachloride (CCl_4) was caused by its lipoperoxidative action.[1] Administration of α-tocopherol, a conventional anti-oxidant, was revealed[2,3] to be effective in preventing liver injury induced by CCl_4.

We demonstrated[4] that Coenzyme Q_{10} (CoQ_{10}) has anti-oxidative activity, as well as α-tocopherol. This experiment was done to investigate whether or not CoQ_{10} prevents liver injury induced by CCl_4.

MATERIALS AND METHODS

Female Wister strain rats were used. Rats were divided into 4 groups. Group 1(7 rats): The control: without any treatment. Group 2(8 rats): CCl_4 administered per os. Group 3 (8 rats): CoQ_{10} and CCl_4 administered. Group 4 (6 rats): CoQ_{10} administered. Rats in all groups were fed by standard rat-food for 3 days. CoQ_{10} (10 mg/kg) was jnjected to rats in group 3 and 4 in three successive days. On the 3rd day, CCl_4-parafin liq. (1:1, v/v, 2.5 ml per kg) was administered to rats in group 2 and 3. Three hours after CCl_4 administration, liver was isolated and homogenated using teflon Potter Elvehjem homogenizer. Rats in group 1 and 4 were also killed on the day and their livers were isolated and homogenized. Lipoperoxides in liver homogenates were measured by Yagi's method.[5] Blood in all rats was taken immediately before liver isolation. Serum GOT and GPT levels were measured by Lippi and Guidi method.[6]

RESULTS

Lipoperoxides in liver homogenates and serum GOT and GPT levels in all groups are shown in Table I. Administration of CCl_4 elevated lipoperoxides in liver homogenates. Serum GOT and GPT were also elevated simultaneouly by administration of CCl_4. When CoQ_{10} was pre-administered, despite subsequent administration of CCl_4, both the increase in lipoperoxides in liver homogenates and the elevation of serum GOT and GPT were well prevented.

杉山　理・北沢正康・小沢高将・鈴木康治・井沢洋平
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Table 1. The quantity of lipoperoxides and serum GOT and GPT levels in four groups

	Lipoperoxides (n mole/mg protein)	GOT	GPT
Group 1 (The control)	1.5±0.4	136.4±39.1	36.7±5.5
Group 2 (CCl_4 administered)	4.9±2.6**	2026.9±174.5**	960.6±404.7**
Group 3 (CoQ_{10}, CCl_4 administered)	2.1±0.4#	731.9±479.8##	117.5±72.4##
Group 4 (CoQ_{10} administered)	1.6±0.4	157.7±28.6	35.7±5.4

(mean ± S.D.)

**,##: P<0.01, #: P<0.05
**: Group 1 *vs.* Group 2
#,##: Group 2 *vs.* Group 3

DISCUSSION

Mellors and Tappel[7] had been reported that CoQ_6 has an anti-oxidant activity *in vitro*, and suggested that ubiquinones might be effective in the relief of certain vitamin E deficiency syndrome. However, anti-oxidative action of ubiquinones has been scarcely studied because of its shortage of supply. Recently, as the supply of CoQ_{10} was much improved, anti-oxidative action of CoQ_{10} has been reconsidered.

Recknagel *et al.*[1] reported that unsaturated fatty acids were attacked by free radicals arisning from CCl_4 metabolism and that liver injury was caused by CCl_4-induced lipoperoxidation. It is revealed that administration of CoQ_{10} prevented the increase in lipoperoxides and serum GOT and GPT level. This result suggests that CoQ_{10} as well as α-tocopherol, protects unsaturated fatty acids against attacks by the free radicals, and prevents liver injury induced by CCl_4 administration. CoQ_{10} might be effective to prevent the pathological disorders based on lipid peroxidation, and its clinical usage are expected much more.

SUMMARY

Administration of CCl_4 induced the increase of lipoperoxides in liver and elevated serum GOT and GPT simultaneously. Pre-medication of CoQ_{10} prevents both the increase of lipoperoxides induced by CCl_4 administration and the elevation of serum GOT and GPT.

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