# EFFECT OF COMBINED ADMINISTRATION OF VITAMINS C AND E ON SOME RENAL FUNCTIONS INDICES OF RATS EXPOSED TO NITROCELLULOSE THINNER


PRESENTED BY

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# INTRODUCTION:

- Nitrocellulose thinner (NCT) is an industrial solvents commonly used in furniture, paints and automobile spray-painting industries.

- It contains such organic chemical agents, as ethylbenzene or toluene and butyl acetate.

- These chemical substances are known to constitute chemical pollutants in different environments.

- WHO (2005) reported that these chemical pollutants are detectable in household and workplace air. Hence, exposure to chemical pollutants from nitrocellulose thinner in indoor and outdoor environments may be common.

- Exposure to this solvent may be by direct inhalation of the volatile constituents, or ingestion of foods and drinks contaminated by the solvents during use.

- Particularly, occupational exposure to mixtures of toluene, ethylbenzene and butyl acetate have been reported in painting or lacquering workplaces (Seeber et al., 1996; Jovanovic et al., 2004; Faber et al., 2006).
- Also, exposure to nitrocellulose thinner, and related organic solvents has been reported to induce haematotoxicity, hepatotoxicity and nephrotoxicity in humans and experimental animals (Jovanovic et al., 2004; Faber et al., 2006; Patil et al., 2007; Uboh et al., 2012a,b; 2013).

- There is scarcity of information on the protective agents against nitrocellulose thinner induced toxicities.

- This study therefore assessed the effect of combined administration of vitamins C and E on some renal functions indices of rats exposed to nitrocellulose thinner

# MATERIALS AND METHODS:

- Animal Handling and Treatment: Fifty four apparently normal matured male albino Wistar rats (180 to 200g), obtained from Biochemistry Department Experimental Research Animal House of the University of Calabar, Calabar, Nigeria, were used in this study. They were fed with standard laboratory diet and tap water. The work was carried out under 12 hours light/dark cycle illumination and room temperature of 25 ± 2°C.

## Materials and Methods Cont'd

- Preliminary acute toxicity studies in mice, gave $LD_{50}$ of 16.0ml/kg (i.e., 160.2mg/kg, by weight) body weight of nitrocellulose thinner (solubilized in Grand pure soya beans oil).
- Hence, 4.0ml/kg (i.e., 40mg/kg, by weight) body weight concentrations (25% of $LD_{50}$) were used in this study.
- The animals were distributed into nine groups, with six rats each, as highlighted below:

## Materials and Methods Cont'd

- **Group 1:** Comprised of six rats receiving 1.0ml/kg body weight of distilled water for 28 days
- **Group 2:** Comprised of six rats receiving 1.0ml/kg body weight of vegetable oil for 28 days
- **Group 3:** Comprised of six rats receiving 600IU/kg body weight of vitamins C for 28 days.
- Group 4: Comprised of six rats receiving 200IU/kg body weight of vitamins E for 28 days
- Group 5: Comprised of six rats receiving 600IU/kg body weight of vitamins E and C, respectively, for 28 days
- **Group 6:** Comprised of six rats receiving 4.0ml/kg body weight of nitrocellulose thinner (NCT) for 28 days.

## Materials and Methods cont'd

- Group 7: Comprised of six rats receiving 4.0ml/kg body weight of NCT + 600IU/kg body weight of vitamin C for 28 days
- Group 8: Comprised of six rats receiving 4.0ml/kg body weight of NCT + 200IU/kg body weight of vitamin E for 28 days
- Group 9: Comprised of six rats receiving 4.0ml/kg body weight of NCT + 200IU and 600IU/kg body weight of vitamins E and C, respectively, for 28 days

- The animals were sacrificed, 24 hours after the 28$^{th}$ day of experimental period.

- Animal experiments were carried out according to the Guidelines of Institution's (University of Calabar, Nigeria) Animal Research Ethics Committee, with reference to the Guide for the Care and Use of Laboratory Animals (NRC, 1995).

- Collection and preparation of blood for analyses: Blood samples were collected by cardiac puncture, under chloroform vapor anaesthesia, 24 hours after termination of NCT administration, into sterile plain sample bottles.
- The blood samples were allowed to clot and centrifuged with Table-top centrifuge (MSE model, England) at 3000 rpm for 10 minutes to obtain the serum, which was used for the biochemical assays.

- **Biochemical analyses:** The concentrations of creatinine, urea, uric acid, electrolytes (including $Na^+$, $K^+$, $HCO_3^-$ and $Cl^-$ ) in the serum were determined using referenced standard methods.
- Reagent kits obtained from Biosystems Laboratories (S. A. Costa Brava, Barcelonia, Spain) and Randox Laboratories (United Kingdom) were used in the study.
- All the reagent kits were of analytical grade.

- **Statistical Analysis:** Results were presented as mean ± S.E.M.
- The data generated from the study were statistically analysed using one-way analysis of variance (ANOVA) with SPSS window statistical software programme.
- Student "t" test was also used for pair-wise comparison, and differences were considered significant at $p<0.05$.

# RESULTS:

- The results of this study are presented in Tables 1 - 4.
- The results showed no significant ($p>0.05$) difference in serum creatinie, urea, uric acid, $Na^+$, $K^+$, $HCO_3^-$ and $Cl^-$ levels among and within the groups of animals administered vitamins C and E, either individually or in combination, compared with the control animals that respectively received distilled water and vegetable oil.

# Results cont'd

- Results from other experimental groups showed that serum creatinie, urea, uric acid, $K^+$, $HCO_3^-$ and $Cl^-$ levels were significantly ($p<0.05$) increased following exposure to NCT, and decreased to levels within the control range by vitamins C and E, administered either individually or in combination.

- Moreover, serum $Na^+$ level decreased by NCT was also significantly ($p<0.05$) increased to levels within the control range by the vitamins.

Table 1. Effect of vitamins C and E on some serum renal functions assessment metabolites in rats

| Group | Treatment | Creatinine (mmol/l) | Urea (mmol/l) | Uric acid (mmol/l) |
|---|---|---|---|---|
| 1 | Distilled water | 1.5±0.3 | 36.9±3.8 | 2.4±0.6 |
| 2 | Vegetable oil | 1.6±0.4 | 38.1±4.0 | 2.6±0.8 |
| 3 | Vitamin C | 1.6±0,6 | 37.2±2.9 | 2.6±0.7 |
| 4 | Vitamin E | 1.7±0.5 | 38.6±3.6 | 2.7±0.4 |
| 5 | Vitamins C + E | 1.8±0.5 | 38.8±4.2 | 2.8±0.6 |

Values are presented as mean ± SEM; n = 6.

# Table 2. Effect of vitamins C and E on some serum renal functions assessment metabolites in rats exposed to NCT

| Group | Treatment | Creatinine (mmol/l) | Urea (mmol/l) | Uric acid (mmol/l) |
|---|---|---|---|---|
| 2 | Vegetable oil | 1.6±0.4 | 38.1±4.0 | 2.6±0.8 |
| 6 | NCT | 5.8±0.8* | 80.1±3.8* | 6.6±1.1* |
| 7 | NCT + Vit. C | 1.8±0.6[a] | 40.8±3.3[a] | 2.8±0.6[a] |
| 8 | NCT + Vit. E | 2.1±0.8[a] | 42.2±3.7[a] | 3.0±0.8[a] |
| 9 | NCT +Vit.C+ E | 1.9±0.4[a] | 41.3±4.5[a] | 2.8±0.7[a] |

Values are presented as mean ± SEM; n = 6. *P<0.05 compared with “Grp” 1; [a]P<0.05 compared with “Grp” 2

# Table 3. Effect of vitamins C and E on some serum renal functions assessment electrolytes in rats

| Group | Treatment | $Na^+$ (mEq/l) | $K^+$ (mEq/l) | $Cl^-$(mEq/l) | $HCO_3^-$ (mEq/l) |
|---|---|---|---|---|---|
| 1 | Distilled water | 143.6±6.2 | 1.6±0.3 | 80.7±4.6 | 12.8±2.6 |
| 2 | Vegetable oil | 142.8±8.2 | 1.7±0.5 | 81.2±5.1 | 13.2±3.5 |
| 3 | Vitamin C | 143.8±7.8 | 1.6±0.6 | 80.4±6.3 | 12.6±2.8 |
| 4 | Vitamin E | 142.7±8.4 | 1.7±0.9 | 81.5±5.8 | 13.4±3.7 |
| 5 | Vits C + E | 143.4±8.6 | 1.6±0.7 | 80.8±6.7 | 12.7±3.3 |

Values are presented as mean ± SEM; n = 6.

# Table 4. Effect of vitamins C and E on some serum renal functions assessment electrolytes in rats exposed to NCT

| Group | Treatment | $Na^+$ (mEq/l) | $K^+$ (mEq/l) | $Cl^-$(mEq/l) | $HCO_3^-$ (mEq/l) |
|---|---|---|---|---|---|
| 2 | Vegetable oil | 142.8±8.2 | 1.7±0.5 | 80.2±5.1 | 13.2±3.5 |
| 6 | NCT | 118.7±10.2* | 5.6±2.1* | 128.3±4.4* | 30.7±5.1* |
| 7 | NCT + Vit. C | 140.7±7.6[a] | 1.9±0.4[a] | 84.2±3.2[a] | 14.2±2.3[a] |
| 8 | NCT + Vit. E | 141.8±8.3[a] | 2.4±0.6[a] | 90.1±4.1[a] | 15.0±3.1[a] |
| 9 | NCT +Vit.C+ E | 141.5±8.7[a] | 2.1±0.9[a] | 86.3±3.8[a] | 14.8±2.8[a] |

Values are presented as mean ± SEM; n = 6. *P<0.05 compared with “Grp” 1; [a]P<0.05 compared with “Grp” 2

## CONCLUSION:

- The results recorded for this study suggest that the constituents of nitrocellulose thinner, or their metabolites, are reactive capable of interacting with the renal tissues to cause oxidative stress induce nephrotoxicity (Uboh et al., 2013).
- This observation supports our earlier reports on nitrocellulose thinner induced nephrotoxicity in experimental animals (Uboh et al., 2012a; 2013)

## Conclusion Cont'd

- The results of this study also indicated that the nitrocellulose induced nephrotoxicity may be ameliorated by the administration of vitamins C and E, either in combination or singly.
- This report correlates the results of our earlier study on the hepatoprotective effect of vitamins C and E against gasoline vapor-induced liver injury in male rats (Uboh et al., 2011, 2012b,c).

## Conclusion Cont'd

- Based on the results obtained from this study, it may be concluded that administration of vitamins C and E, either in combination or singly, provides protection against nitrocellulose thinner-induced nephrotoxicity in male albino Wistar rat model.

# THANK YOU

# ACKNOWLEDGEMENT


- All my Post graduate students.
- All the technical staff of Biochemistry Department, University of Calabar, Nigeria.

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