



UVB induced hyperthyroidism: Alteration on ovarian weight of female Wistar rat

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ABSTRACT

The present study was investigated to the UVB radiation induced hyperthyroidism on female Wistar rats. In addition, we designated the preventive effect of Curcumin and Ascorbic acid against hyperthyroidism induced by UVB radiation. Twenty four adult healthy female Wistar rats weighing 130-150 grams (g) were used. It is divided into four groups, first was control group, second was UVB treated group, third was UVB+Curcumin (Cur) group and last fourth group was UVB + Ascorbic acid (AA) group, for 15 days exposure. We found that UVB radiation shown on the female Wistar rat alteration on the animal body weight, thyroid weight, ovary weight and thyroid hormones as compare to control group. It is concluded that UVB radiation shown the hyperthyroidism and their alteration of ovary weight on female Wistar rat and preventive effect of curcumin and ascorbic acid.

KEYWORDS: Wistar rat, Ultraviolet, thyroid, ovary, curcumin and ascorbic acid.

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INTRODUCTION

All living organisms on Earth are being continuously exposed to certain amount of radiation initiating from a variety of sources. Whole body exposure to irradiation causes damage cellular, physiological and biochemical reactions inside living cells. Ultraviolet (UV) is a non-ionizing radiation and contain a band of electromagnetic radiations with wave length from 200nm to 400nm. Being present in the sunlight, UV radiations are an important source of energy and have sufficient power to penetrate the body cells consequently, the chemical and biological effects generated by these radiations have are much greater than simple heating effects. Radiation emitted and transmitted through different sources are absorbed by the animal body tend to be a very high up environmental toxin. UV radiations have the potential to bear both positive and negative effects, there by affecting the well-being of animals and humans. UV radiations are non-ionizing and are classified into three types UVC, UVB & UVA. UVC (200-280 nm, shortwave length) is lethal than UVB (280-320nm, medium wave length) [1, 2, 3]. When cells or tissues are exposed to UV radiation, the water molecules undergo dissociation (radiolysis) and produce free radicals and related species in the form of ROS. These, in turn, can act on biomolecules such as DNA, lipids and proteins, and cause oxidative damage [4, 5, 6]. The ovary is a primary functional organ of the female reproductive system, and it plays physiological roles body. Triiodothyronine (T3) and thyroxine (T4) are essential for normal reproductive function. Thyroid hormones can affect the oocytes, sperm, and embryo during fertilization, implantation and placentation. However, the association between hyperthyroidism and infertility is evidenced and scarce and sometimes conflicting. Infertility may occur in hyperthyroid females, but euthyroidism can restore these abnormalities [7, 8, 9, 10]. Thyroid hormones are described to affect both reproduction and pregnancy [11]. In the present study, we also investigated the preventive effect of antioxidants (ascorbic acid and curcumin) against the hyperthyroidism induced by UVB radiation and their alterative effect of ovarian weight.

MATERIAL AND MATHOD

Chemicals

Ascorbic acid was purchased from Sigma-Aldrich Co., USA and Curcumin purchase from Himedia and rests of the chemicals used were purchased from Central Drug House (P) Ltd, New Delhi.

UV irradiation

UVB light (TL 20W/01 UVB Narrowband made in Germany), which emits UVB in the range of 280-320nm (UVB), was used as the source to irradiate the Wistar rat. The irradiance was two hours for 15 days.

Experimental animals and design

Female adult Wistar rat weighing 130-150 grams (g) were purchased from the college of Veterinary sciences and Animal husbandry Mhow (22.55° N, 75.75° E, M.P), India. The Ethical approval was given from Department of Pharmaceutical Sciences Dr. Harisingh Gour Vishwavidyalaya (A Central University) (Registration 379/CPCSEA/IAEC-2018/2017), Sagar (M.P.) (23.88° N, 78.73° E); International guidelines were followed for care and use of laboratory animals. All animals (n=24) were housed in plastic cages and were fed on standard laboratory diet daily food and water ad libitum. Rats were kept on laboratory condition.

The experimental rats randomly divided into four groups. The experimental groups were administrated different doses as follows:

Group I: - **(Control Group)** normal food and water ad libitum

Group II: - **(UVB treated Group)** received a dose of 280 nm of UVB radiation for 2 hours for 15 days.

Group III: - **(UVB treated group + Curcumin)** UVB treated group received a dose of Curcumin (25 mg/kg bw) orally for 15 days.

Group IV: - **(UVB treated + Ascorbic acid)** UVB treated group received a dose of Ascorbic acid (250 mg/kg bw) orally for 15 days.

Sample collection

At the end of the experiment, animals were anesthetized, blood collect by cardiac puncture and sacrificed by cervical dislocation thyroid and ovaries were dissected out, washed in ice-cold phosphate buffer saline and stored at -20 °C for further analysis. Blood stand on room temperature and after 30 minute blood was centrifuge and collected serum in fresh tube and store for hormonal analysis.

Measurement of Body weight, thyroid and ovaries weight

Body Weight measurement was performed before and after experiment. Thyroid and ovaries weight measurement was performed after experiment. Both thyroid and ovaries weight measurements were done with an electronic balance (Sartorius, BP210 S).

Thyroid hormones analysis

Detection of T3, T4, TSH measured using ELISA provided by The Calbiotech Inc. (California, USA) (12). The entire assay was performed in triplicate.

Statistical analysis

All statistical analysis was performed using one way ANOVA. The data are expressed as mean \pm SD. Student t test was applied for comparison between control and each treated group individually. Level of significance at * $p < 0.05$, ** $p < 0.01$ and *** $p < 0.001$ was considered significant.

RESULT

Body weight, thyroid weight and ovary weight

The body weight of UVB treated female Wistar rats show a significant reduction in body weight as compared to control group. It was observed that Curcumin (Cur) and Ascorbic Acid (AA) treatment increases the body weight significantly ($p < 0.01$) as compared to UVB and there are significance differences as compare to control group (Figure 1). A significant decrease ($p < 0.05$) in the weight of thyroid was observed on UVB treatment in female Wistar rats, while a poorly increase was noted on Antioxidants administration in both groups (Figure 2). A significant reduced ($p < 0.01$) in the weight of ovary was observed on UVB treatment in female Wistar rats, while a significant increased on Antioxidants administration in both groups (Figure 3).

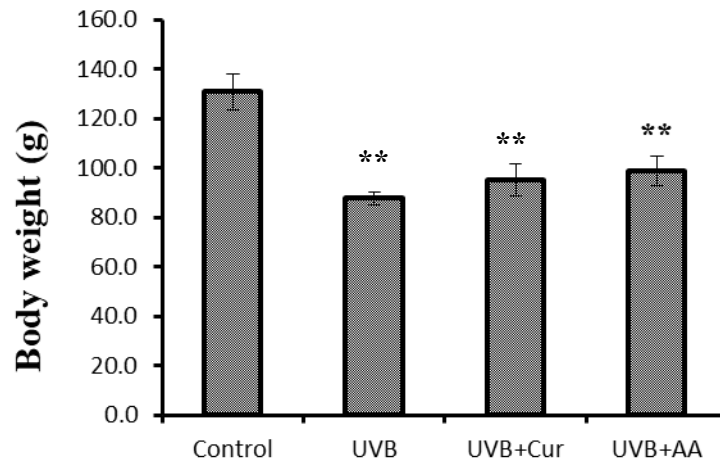


Figure 1 Effect of UVB Radiation and the role of Curcumin and Ascorbic acid administration on body weight. Values are presented as mean \pm SD. Significant difference from control group (** $p < 0.01$).

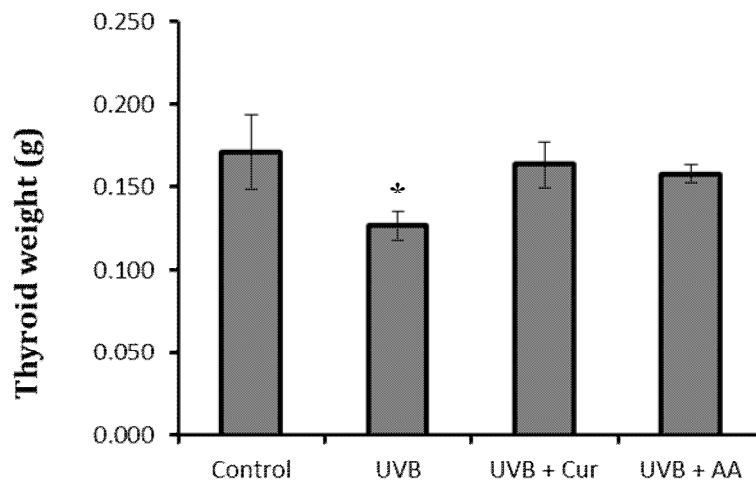


Figure 2 Effect of UVB Radiation and the role of Curcumin and Ascorbic acid administration on thyroid weight. Values are presented as mean \pm SD. Significant difference from control group (* $p < 0.05$).

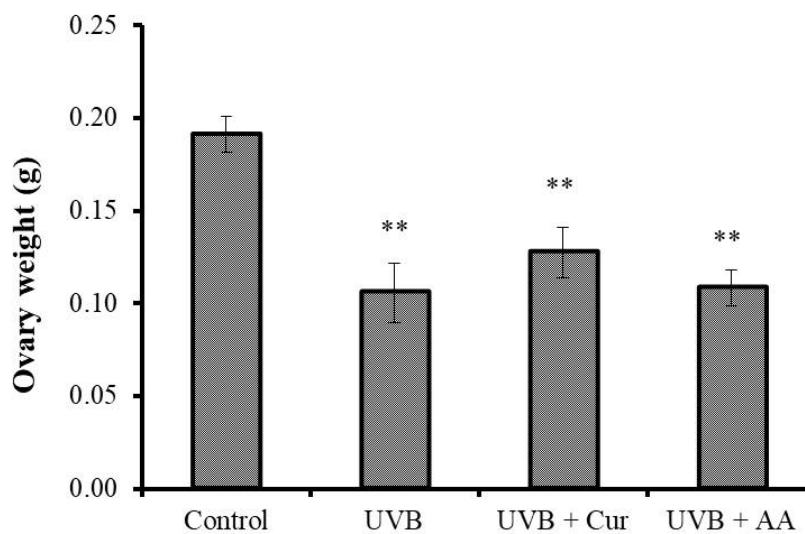


Figure 3: Effect of UVB Radiation and Curcumin and Ascorbic acid administration on ovarian weight. Values are presented as mean \pm SD. ** $p < 0.01$ significant difference from control group.

THYROID HORMONES

Thyroid hormones showed the hyperthyroidism. UVB treated female Wistar rats show significantly increases ($p < 0.001$) in T3 and T4 level ($p < 0.05$) as compared to control group. Administration of curcumin and ascorbic acid significant decrease ($p < 0.001$) T3 level and decrease T4 level. A significant decrease ($p < 0.001$) in TSH level was observed on UVB treatment in female Wistar rats and significant increase ($p < 0.001$) was noted on Antioxidants administration in both groups (Figure 4)

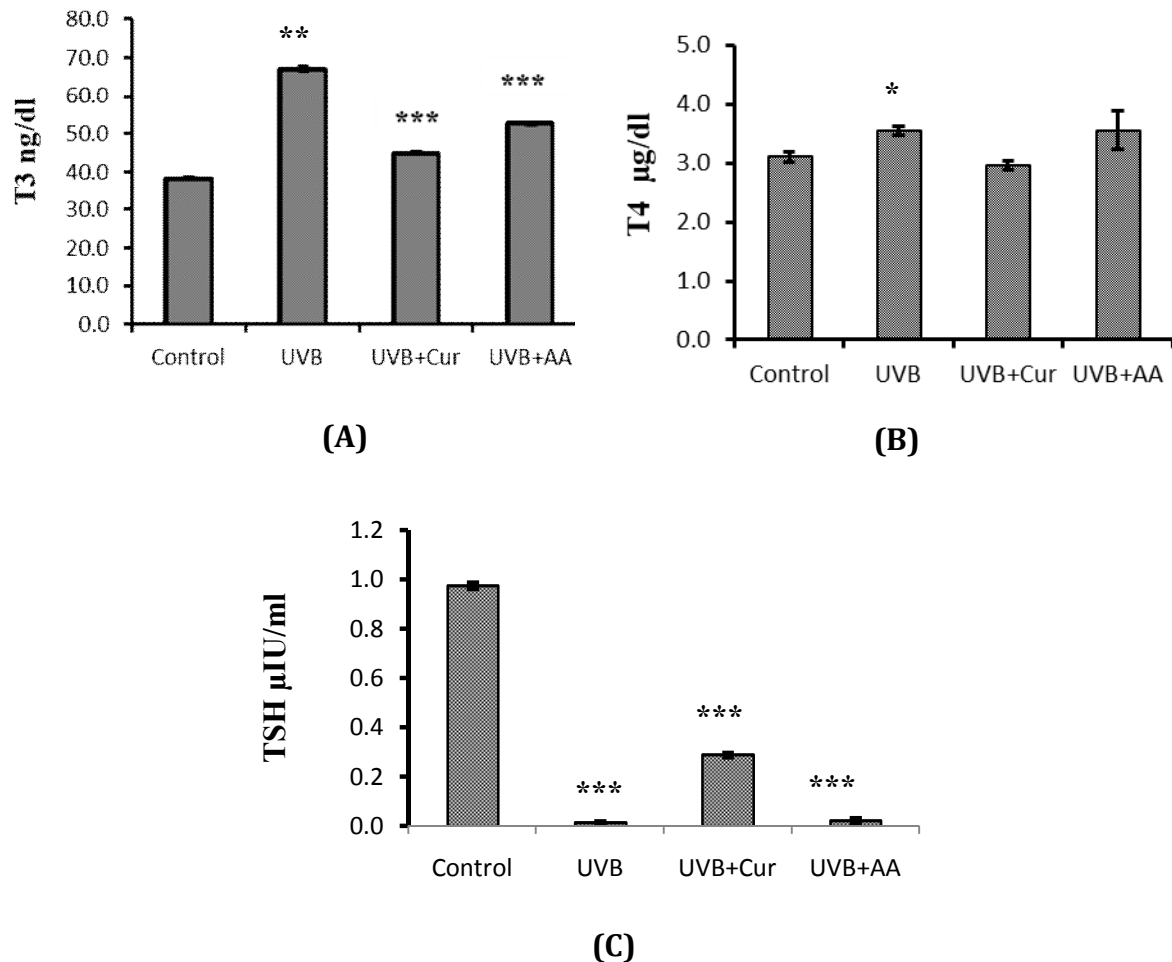


Figure 4. Effect of UVB Radiation and Curcumin and Ascorbic acid administration on Thyroid hormones. (A) Level of T3 (B) Level of T4 (C) Level of TSH. Values are presented as mean \pm SD. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ significant difference from control group.

DISCUSSION

These results indicate that experimental UVB induced hyperthyroidism has a very direct effect on the reproductive processes. Many reports discussed the association between infertility and hyperthyroidism in animal models [13, 14]. Radiation interacts with biological systems to induce excessive fluxes of free radicals that attack various cellular components [15]. Radiation-induced damage might result in adverse health effects within hours to weeks and delayed effects may be observable many months after exposure [16]. UVB radiation was non-ionizing radiation, which meant that this radiation was able to non-ionise the material in its path. In this case, the cells of the ovaries were actively divided into blood cells and ovarian gametes. These cells were very sensitive to the effect of radiation and as a result, damaged ovarian cells [17]. UV radiation affected the blood hormonal level significantly [18]. In this experiment UVB exposure induced hyperthyroidism and their alternative effect of ovary weight. UVB induced hyperthyroidism significantly decrease body weight, thyroid weight and ovary weight. In hyperthyroidism T3 level increased and T4 level significantly increased. TSH level significantly decreased. Both antioxidants (curcumin and ascorbic acid) showed the protective effect of the endocrine system, increased body and thyroid weight as well as brought an increase in ovary weight.

CONCLUSION

In conclusion, the results obtained indicate that hyperthyroidism induced by UVB radiation affect the ovary weight. UVB exposures showed the hyperthyroidism and significantly increase T3 and T4 level and significantly decrease TSH level. And also showed the significantly decrease body weight and thyroid weight. Curcumin and ascorbic acid showed the protective effect on hyperthyroidism. UVB induced hyperthyroidism shown the alteration on ovary weight.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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