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Effect of Green Tea on Testosterone and Estradiol hormones in Albino Rats

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Green tea is very common among diet conscious individuals. It helps in reducing risk of cardiac disease, different cancer types, also aid in oral health and many other physiological functions including reduced effect on hypertensive, controls weight of body, inhibits bacterial growth, contains antiviral properties, increased density of bones and neuroprotective power. But its effect on reproduction is not very well known. To find the effect of green tea on reproduction and weight loss this research was conducted. Forty albino rats were divided into four groups (group 1, group 2, group 3 and group 4). Group 1 was fed with tap water while group 2, group 3 and group 4 were fed with green tea with 1.5 g/100 ml, 2 g/100 ml and 2.5 g/100 ml per day respectively for thirty days. After a month, their blood sample was collected to examine testosterone and estradiol hormones. Their body weight was also measured and data was subjected to statistical analysis. Group 4 showed most weight gain in rats where mice were starting to gain weight. They all had increased testosterone level than normal and reduced estradiol levels. Group 2 showed no much of effect whereas group 3 was seen going towards overweight.

Keywords: Green tea, Testosterone, Estradiol

INTRODUCTION

A beverage prepared from dried tea leaves known as green tea is consumed most widely in world among all age groups for refreshment and health benefits (Sattar, 2011). Green tea is consumed as a natural herbal remedy due to its anti-oxidative, anti-inflammatory and anti-carcinogenic (Benelli et al. 2002). Green tea, black tea oolong tea is obtained from a plant known as *Camellia Sinensis* which is processed differently to attain different levels of oxidation (Weisburger and Chung, 2002). This tradition was originated from China in 6th century and spread all across the world (Sattar, 2011).

In 1958 its cultivation started in Pakistan and it became one of the entertainment sources for

society. Sixty-seven percent of people in Pakistan consume green tea to attain its health benefits and to reduce weight (Naveed et al. 2014). Obesity is a threats to populations and it is increasing worldwide specially in developed countries. Along with obesity comes a lot of health issues in which hormonal imbalances is common or some time hormonal imbalances may cause obesity (Stelzer et al. 2012 and Gupta et al. 2012). Obesity may result due to hormonal disturbances of sex-hormones in body. Sex hormones includes of testosterone (known to be male hormone) and estrogen (female hormone), both sexes have both hormones but are present in different quantities. Concentration of estrogen is lower in males and testosterone levels are low in

females (Hess et al. 1997).

Surplus of estradiol (in both genders) is an immense risk factor for overweight or obesity and may result in more fat around the belly (Torrens et al. 2009). Excess of testosterone (in both genders) promote fat distribution which is more male like (around abdominal or around the waist line). Due to promoted testosterone women also gain weight more around their waistline (Shi et al. 2009). Progesterone is the precursor of estradiol which together regulates cyclic changes in ovaries and uterus (Pasquali et al. 2007).

MATERIALS AND METHODS

Preparation of Green tea:

Fill the pan with water and heat until it boils. Place green tea leaves into the hot water and leave for 2-3 minutes. Place tea strainer on jug and pour the heated water from the pan into the jug. Let your tea cool down before giving them to rats. Quantities were measured as 1.5 g/100ml, 2.0 g/ 100 ml and 2.5 g/100 ml for group 2, group 3 and group 4 respectively.

Sample Collection:

Forty albino rats of either sex were purchased from National Institute of Food Science and Technology, University of Agriculture, Faisalabad. The animals were kept under similar conditions in animal room for one month. Rats were divided into four groups on basis of feed variation given to them.

Group (1)	Normal routine rat feed + tap water, 30 days
Group (2)	Normal routine rat feed + 1.5 g green tea/100ml/day, 30 days
Group (3)	Normal routine rat feed + 2.0 g green tea/100ml/day, 30 days
Group (4)	Normal routine rat feed + 2.5 g green tea/100ml/day, 30 days

Area of Research:

The research trial was carried out at National Institute of Food Science and Technology and Institute of Home Sciences, University of Agriculture Faisalabad and samples of testosterone, estradiol and progesterone were analyzed in the Rifha Laboratories, Faisalabad.

Collection of Blood Samples:

Blood samples were collected from rats after slaughtering them. 3ml volume of blood was taken in Vacutainer blood collection tube and centrifuged at 3000 RPM for 7 to 10 minutes.

Parameters:

Physical Parameter:

Body Weight

Body weight of each rat was measured by weighing balance.

Serum Biochemistry:

Testosterone (ng/ml)

Commercially available ELISA Test for the Quantitative Determination of Testosterone in Human Serum or Plasma kit was used to determine its serum concentration (Winters et al, 1998).

Estradiol (pg/ml)

Commercially available ELISA Test for the Quantitative Determination of Estradiol in Human Serum or Plasma kit was used to determine its serum concentration (Bradlow et al. 1998).

Progesterone (ng/ml)

Commercially available ELISA Test for the Quantitative Determination of Progesterone in Human Serum or Plasma kit was used to determine its serum concentration (Bouchard et al. 1991).

RESULTS

Weight

Weight on Day 1

Groups and their interaction (group x animals) was found non-significant and animals was found significantly different at $P < 0.01$. Overall mean weight on day 1 was non-significantly different in all groups and animals. Overall mean weight in animals were significantly increased in rats as compared to mice. However, the overall mean weight on day 1 was non-significantly different in all groups.

Weight on Day 15

Groups was found non-significant and animals and their interaction (group x animals) was found significantly different at $P < 0.01$. Overall mean weight on day 15 was significantly increased in rat

on group 4 as compared to other groups and animal. Overall mean weight in animals were significantly increased in rats as compared to mice. However, the overall mean weight on day 15 was non-significantly different in all groups.

Weight on Day 30

Groups, animal and their interaction (group x animals) was found significant different at $P < 0.01$. Overall mean weight on day 15 was significantly increased in rat on group 4 as compared to other groups and animal. Overall mean weight in animals were significantly increased in rats as compared to mice. However, the overall mean weight on day 15 was non-significantly different in all groups.

Testosterone

Groups, animal and their interaction (group x animals) was found significant different at $P < 0.01$. Overall mean testosterone hormone was significantly increased in rat on group 4 as compared to other groups and animal. Overall mean testosterone in animals were significantly increased in rats as compared to mice. However, the overall mean testosterone was significantly increased in group-4 as compared to other groups.

Estradiol

Groups, animal and their interaction (group x animals) was found significant different at $P < 0.01$. Overall mean estradiol hormone was significantly increased in mice on group-4 as compared to other groups and animal. Overall mean estradiol in animals were significantly increased in mice as compared to rats. Instead estradiol levels were extremely low in rats. However, the overall mean estradiol was significantly increased in group-4 as compared to other groups.

Progesterone

Groups, animal and their interaction (group x animals) was found significant different at $P < 0.01$. Overall mean progesterone hormone was significantly increased in mice on group-2 as compared to other groups and animal. Overall mean progesterone in animals were significantly increased in mice as compared to rats. However, the overall mean progesterone was significantly increased in group-2 as compared to other groups.

DISCUSSION

Overall weight loss in mice was observed in

zero to fifteen days but after that they started to gain weight because of high estrogen levels in their bodies. Whereas increase in rat's body weight was experienced only due to high levels of testosterone and extreme low levels of estradiol in them which can become a cause of infertility in them.

According to a research low levels of testosterone may cause low sex drive, loss of muscle mass leading to osteoporosis and accumulation of fat around belly (Goldstat et al. 2003).

However, the overall mean testosterone was significantly increased in group-4 as compared to other groups. So we can say that testosterone was increased in both genders but much significantly in rats. Due to this increased level of testosterone, rats gained weight instead of losing it and weight also started to increase in mice. High levels of testosterone above the required levels are not healthy for males and females also. It may be a cause of abdomen fat in both leading towards obesity.

Excess of estradiol may cause depression, fluid retention, weight gain, panic attacks, hypothyroidism, heavy periods, and uterine fibroids and may increase risk of breast and uterine cancer (Saldanha et al. 2011). Another research suggests estrogen receptors in the brain appear to help control energy expenditure and food intake. Estrogen receptors in the hypothalamus cause them to eat more and gain extra weight. Estrogen reduction during menopause causes weight gain in women. One theory suggests that breast and endometrial cancer is linked to the overproduction of estrogen (Prins and Korach, 2008). Overall mean estradiol in animals were significantly increased in mice as compared to rats. Instead estradiol levels were extremely low in rats. However, the overall mean estradiol was significantly increased in group-4 as compared to other groups. These results shows that increased estrogen levels is the cause mice started to gain weight and they have more chance of acquiring breast cancer. Whereas in rats estradiol level dropped to lowest. This is a problem for them as estradiol is also of importance in males. Nevertheless, this hormonal imbalance leads towards infertility and other unwanted health problems.

Andersen study enlisted that low levels of progesterone in males can reduce reproduction in males by lowering sex drive, erectile dysfunction, baldness and prostate enlargement is also seen in many. Whereas too much progesterone may lead

to increased testosterone levels and symptoms of testosterone excess (Andersen et al. 2004). Overall mean progesterone in animals were significantly increased in mice as compared to rats. However, the overall mean progesterone was significantly increased in group-2 as compared to other groups.

CONCLUSION

All-over the world people consume green tea to reduce weight mainly. They forget to maintain its intake as it is considering harmless so far. But according to many studies it is not declared as harmless. It can have certain side effects if taken in excess. It may reduce weight for certain time but if one kept drinking it in excess it may lead towards weight gain as it increases level of testosterone in body and reduce level of estradiol. This effect of green tea may be more pronounced in males rather than females as levels of testosterone in males are already high. But in females it altered balance of estradiol which can lead to weight gain and risk of breast cancer. During my one month of research group 4 showed most weight gain in rats where mice were starting to gain weight. They all had increased testosterone level than normal and reduced estradiol levels. Group 2 showed no much of effect whereas group 3 was seen going towards overweight. People should work more on this aspect of green tea.

CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

AUTHOR CONTRIBUTIONS

TN conceived the idea of working on green tea and its effects on hormones. HI supervised and guided the process of research whereas SA, AI, AA, HA, IA made valuable contribution in process of research writing. All authors contributed to the manuscript.

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