# The Protective Effects of Garlic on Thyroid Function in Amphetamine Receiving Rats

Tavakoli P, Ahmadi R , and Amin N

***Abstract*—**Studies show that garlic has protective effects on various body systems. The aim of this study was to investigate the effects of garlic on serum levels of T3 and T4 in amphetamine receiving male rats**.** In this laboratory experimental study, male Wistar rats were randomly divided to control group, and normal saline1, amphetamine (4mg/kg) and "amphetamine (4mg/kg) + garlic extract (40mg/kg)" receiving rats. The injections were carried out once a week. After 6 weeks, blood samples were collected using cardiac puncture method and following serum collection, the levels of T3 and T4 were measured by radioimmunoassay. The data were statically analyzed using ANOVA. The results of the present study show that there was no significant difference in serum levels of T3 and T4 in rats receiving normal saline compared with control animals. However, serum levels of T3 and T4 significantly increased in rats receiving amphetamine compared to control group ($P<0.05$, $P<0.01$, respectively). Serum levels of T3 and T4 did not significantly change in rats receiving amphetamine + garlic extract compared to control group. The findings suggest that garlic extract has protective effects against increased thyroid function in amphetamine receiving rats **.**

***Index Terms*—** *Amphetamine, Garlic, T3, T4, Rat.*

## I. Introduction

Garlic contains chemical components such as: sulfur-containing compounds allicin[1,2], diallylpolysulfides, and enzymes, B vitamins, proteins, minerals, saponins, flavonoids, a nonsulfur compound with a γ-pyrone skeleton structure with antioxidant effects and antimicrobial effects[3 - 5]. Recently, it has been found that the sulfur-containing compounds of garlic have anti-mutagenesis and anti-carcinogenesis effects. In vivo studies show that garlic and its associated sulfur components suppress the incidence of tumors in rodent models [6-8]. Epidemiological findings also demonstrated an inverse relationship between garlic consumption and the incidence of stomach, colorectal and prostate cancer[9 -11]. In fact, a close relationship has been shown in epidemiological, clinical, and preclinical studies between feeding habits, including garlic intake, and the incidence of cardiovascular diseases in humans [12].Also, Saponins have been found to have biological benefits and have been utilized pharmaceutically[13]

**Parisa Tavakol**i (*corresponding author) is with **Young Researchers Club elites**, Islamic Azad University, Eslamshahr Branch, Eslamshahr, Iran (e-mail: parisa.tavakolli@yahoo.com).

**Rahim Ahmadi** (PhD) is with the Department of Physiology, Faculty of Basic Sciences, Islamic Azad University, Hamedan Branch, Hamedan, Iran. (e-mail: Rahahmadi2012@yahoo.com).

On the other hand, the thyroid hormones, triiodothyronine ($T_3$) and thyroxine ($T_4$) are tyrosine-based hormones produced by the thyroid gland that are primarily responsible for regulation of metabolism[14], [15].Thyroid-stimulating hormone (also known as TSH or thyrotropin) is a hormone that stimulates the thyroid gland to produce thyroxine ($T_4$), and then triiodothyronine ($T_3$) which stimulates the metabolism of almost every tissue in the body [16].

Since, Methamphetamine is a synthetic central nervous system stimulant which releases high levels of dopamine, thereby enhancing mood [17 ],[18]. Studies have shown that stimulant drugs influence many physiological functions such as hormone secretion, neurotransmitters release and autonomic nervous system activity [19 ]. Methamphetamine , nausea, hyperactivity , insomnia, use can cause mild side effects such as heart palpitationsand vomitingshortness of breathteeth grindingchat anorexia, dry mouth and nose, dilated pupils and elevated blood pressure [20],[21]. Studies show that ،Traditional Medicine can act on secretion of releasing hormones from anterior pituitary by which influence thyroid gland function [22], [23], which in turn can influence testes metabolism and so function. In contrast to other findings show that, the hypothalamic-pituitary-thyroid (HPT) axis seems to be more resistant to the psychostimulant action[24].

The aim of this study was to investigate the effects of garlic on thyroid function in amphetamine receiving rats

## II. Material and Methods

### A. Animals

Adult Wistar rats weighting 200±30g were purchased and raised in our colony from an original stock of Pasteur institute (Tehran, Iran).The temperature was at 23±2 $^0$C and animals kept under a schedule of 12h light:12h darkness (light on at: 08: 00 a.m.) with free access to water and standard laboratory chow. Care was taken to examine the animals for general pathological symptoms. Food was withheld for 12-14h before death.

### B. Protocol of Study

In this laboratory experimental study, male Wistar rats control group, and normal saline1, amphetamine (4mg/kg) and "amphetamine (4mg/kg) + garlic extract (40mg/kg)" receiving rats. The injections were carried out once a week. After 6 weeks, blood samples were collected using cardiac puncture method and following serum collection, the levels of T3 and T4 were measured by radioimmunoassay. All animal experiments were carried out in accordance with the guidelines of Institutational Animals Ethics Committee.

### C. *Statistical Analysis*

All values are presented as mean ± S.E.M. Statistical significance was evaluated by one-way analysis of variance (ANOVA) using SPSS 19. Significance was measured using Fisher's least significant for the exact P values and significant differences are noted in the results. Differences with P<0.05 were considered significant

## III. Results

Figure I and II show serum levels of T3 and T4 in male rats.

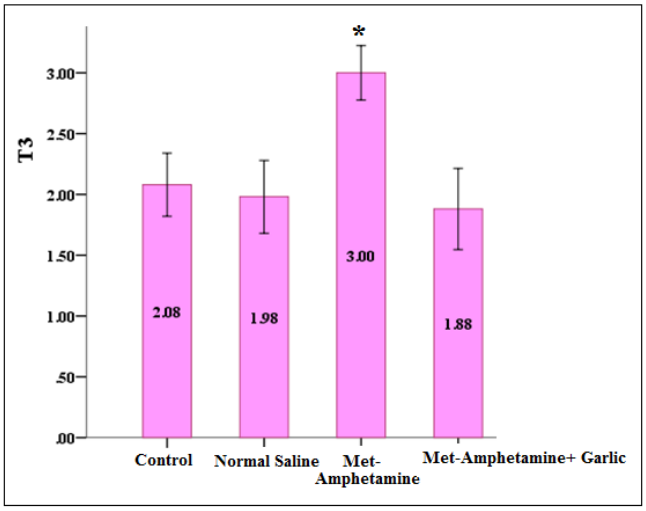


Fig.1: Serum concentrations of T3 in control and rats receiving normal saline, met-amphetamine, and "met-amphetamine+ garlic extract". * indicates significant difference compared to control animals.

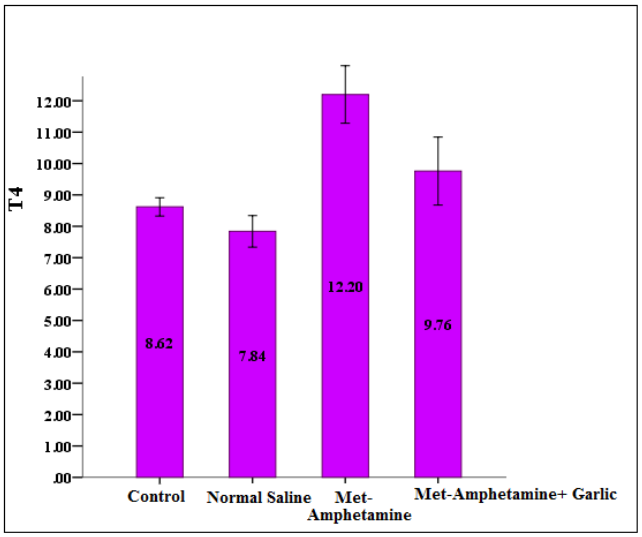


Figure I: Serum concentrations of T4 in control and rats receiving normal saline, met-amphetamine, and "met-amphetamine+ garlic extract". * indicates significant difference compared to control animals. The results of the present study show that there was no significant difference in serum levels of T3 and T4 in rats receiving normal saline compared with control animals. However, serum levels of T3 and T4 significantly increased in rats receiving amphetamine compared to control group (P<0.05, P<0.01, respectively). Serum levels of T3 and T4 did **not** significantly change in rats receiving amphetamine + garlic extract compared to control group.

## IV. Discussion

Our study indicated that serum T3 and T4 levels increased in amphetamine receiving rats, however, administration of garlic extract withstand against this increase in T3 and T4 levels. Studies show the effects of herbal on thyroid function [25], [26]. There is also significant association between metabolism-enhancing effect and thyroid gland of amphetamine [27]. According to reports, methamphetamin has impairing effects on CNS [28] by which can bring about disturbances in neurochemistry of brain and impose dysfunction of body systems relating to nervous system [29] Such drug abuse can make several pathophysiological effects on the endocrine system, cardiovascular system, liver, kidneys and reproductive system [30]. Since, the protective effects of garlic on thyroid function may come from the effects of garlic and components - in particular allicin and flavonoids. Allicin is an angiotensin II inhibitor and has vasodilating effects [31],[32], and Flavonoids and saponins regulate thyroid function by way of their general characters of anti-oxidation and inflammatory inhibition. [33 ]. Also garlic can lower blood pressure in patients with hypertension [34],[ 35].

## V. Conclusion

The findings suggest that garlic extract has protective effects against increased thyroid function in amphetamine receiving rat.

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