

# Effect of Combined Carbimazole and *Curcuma longa* Powder in Human Thyroid-Stimulating Hormone and Thyroperoxidase Antibody in Hyperthyroidism

Ahmed Abdi Hassan, Mustapha Muhammad Aliyu

**Abstract**—Turmeric (*Curcuma longa*) belongs to the ginger family and is used for food coloring mostly in Asian countries. It has long traditional medicinal value for the treatment of inflammations with excellent antioxidant properties. The purpose of this study is to investigate the efficiency of turmeric powder in the treatment of hyperthyroidism when combined with carbimazole antithyroid drug. The trial was conducted on 20 hyperthyroid patients but only 16 of them were successfully enrolled for the study. The 16 patients were divided into two equal groups where one group was treated with the only carbimazole while the other group was treated with a combined approach of carbimazole plus turmeric for 6 months consecutively. The result obtained is promising showing an average improvement of 99% in Thyroid-stimulating hormone (TSH) and 88% Thyroid Autoantibodies (TPOAb) in patients treated with the combined approach compared to those treated with the only carbimazole with an average of 3% and 18% of TSH and TPOAb improvement respectively. However, no major difference has been observed in both T4 and T3. Therefore, turmeric powder is a promising treatment if carefully and consistently combined with carbimazole antithyroid drug at very low amounts of 1.5 to 2 grams for at least 2 to 3 times a week.

**Keywords**—Thyroid, curcuminoids, turmeric, thyroxine, triiodothyronine, thyroid stimulating hormone, TPOAb.

## I. INTRODUCTION

THYROID is an important ductless gland in the body located around the neck and it produces hormones that control development, growth, and temperature through the rate of metabolism. The gland is affected by various disorders ranging from common goiter to most dangerous endocrine neoplasia which accounts for approximately 1.5% to 2.1% in the universe. The disorder related to the gland is usually associated with iodine deficiency which is estimated to be affecting 35% to 40% of the world population [1] and autoimmune thyroid disease (AITDs). The AITDs is either graves' disease hyperthyroidism (thyrotoxicosis) that affects 1% of women or 1-2% hypothyroidism which is Hashimoto's. These two conditions are about 5-10 times less prone to men than women [2]. Hyperthyroidism is generally, an abnormality of the thyroid gland which produces excessive amounts of thyroid hormones causing the person to have

irregular heartbeats and heart failure in severe cases [3], raised body temperatures, increased appetite, weight loss, anxiety, tremor, difficulty in sleeping, warm moist skin, fatigue, and muscle weakness [4]. In fetal hyperthyroidism, it causes growth retardation, craniosynostosis, non-immune fetal hydrops, and in extreme conditions intra-uterus death [5], [6]. Therefore, generally, hyperthyroid can either be toxic adenoma or multinodular goiter as well as graves disease [7].

Thyroid associated illness is generally linked to iodine nutrition, which is a key determinant however, many other factors play a critical role such as age, endocrine disruption, smoking status, ethnicity, genetical vulnerability, immune inhibitors, geographical location, and environmental factors [8]. In addition, some Chinese weight-loss herbal medicine was found to contain thyroid hormones which may also interfere with hormone balancing [9]. Therefore, many studies have attempted to effectively treat the illness including Chinese herbal medication but unfortunately, most of these findings have drawbacks and require continuous improvement and update as a priority area [10], even recently, the relationship between breast cancer and thyroid disorder have been studied intensively [11] and its effects on endometrial cancer (EC) and the role it plays in the carcinogenesis has also been investigated in a different study [12].

Turmeric is a coloring yellow spice often used in Asian countries as a food flavor, it is a ginger family (Zingiberaceae) [13]. Curcumin is the major component of turmeric that is responsible for the yellow coloring [14] and interestingly, it was recently confirmed that it contains water-soluble compound turmerin [15], Fig. 1. Turmeric is also used as a traditional medicine in India, particularly for the treatment of inflammations, because most of the chronic ailments such as diabetes, cancer [16]-[18], Alzheimer's disease, hypertension, etc. can be controlled by reducing the inflammation [19], [20] and besides, turmeric is reported to be an excellent antioxidant and reduces the growth of tumors in mice and rats [21], [22]. Furthermore, it is observed that turmeric can be excellent anti-microbial in addition, to liver, kidney, nerve, antirheumatic, and heart protection properties [19], [23]. In another study, it is also reported to have promising performance in the improvement of lipid profile and glycemic status control [24]. Dosage and side effects always play a critical role in the use of medicine and no aftermath reaction has been established in turmeric use but

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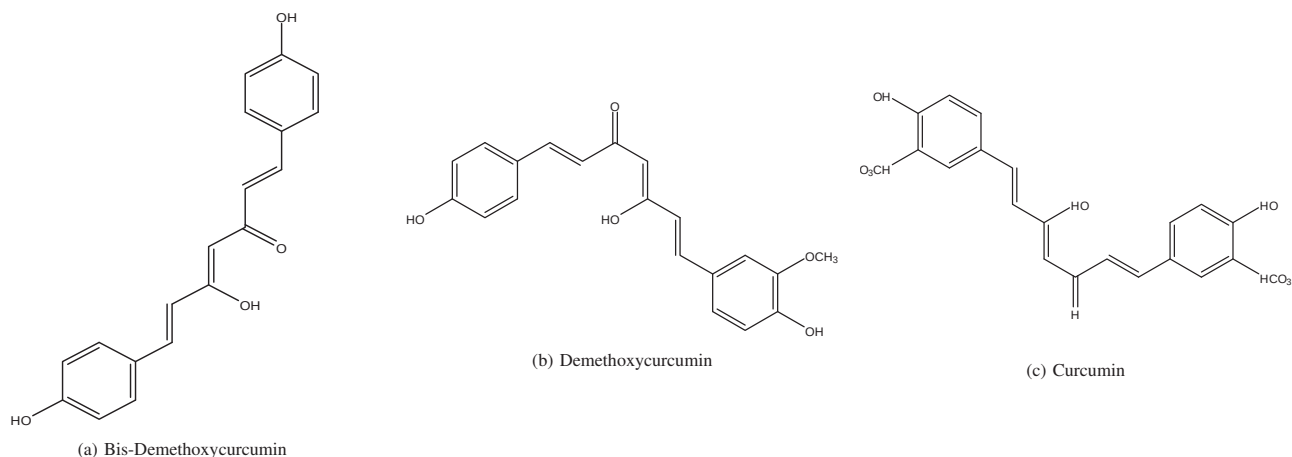


Fig. 1 Main structures of Curcuminoids in turmeric

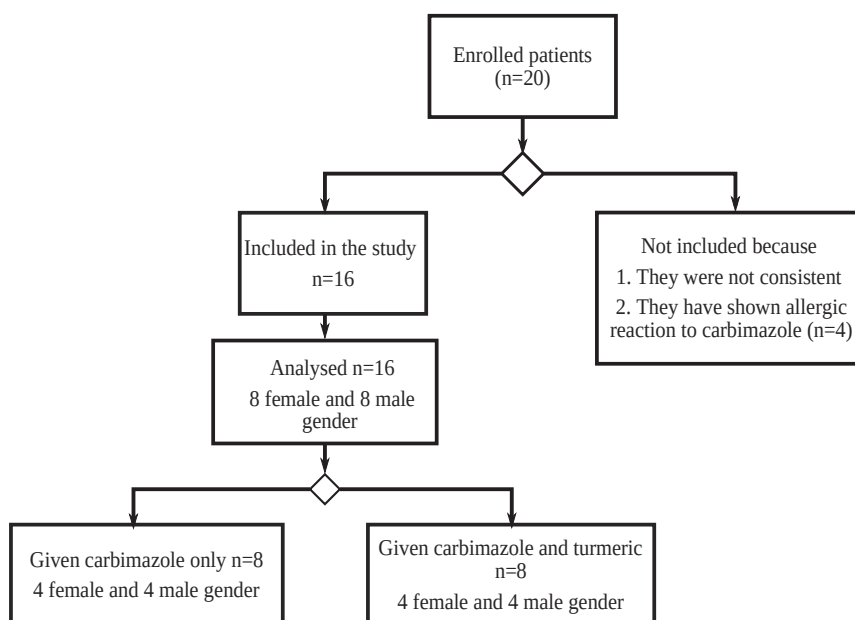


Fig. 2 Activity diagram for the experiment

it's recommended that curcumin daily intake range between 0–3 mg/kg body weight [25]. Although, the major problem attributed to curcumin component is bioavailability and poor solubility [17], pH-dependent silica nanoparticles have been reported to enhance solubility [26] and lipid nanoparticles to improve bioavailability as well as increasing efficiency [27],

The known treatment approaches for graves' disease or hyperthyroidism are anti-thyroid drug treatment, radioactive iodine (RAI), and surgery [28], [29] However, radioactive iodine is associated with increased solid cancer [30]. Carbimazole is the common medicine administered to patients with suppressed TSH level and elevated thyroxine (T4) and triiodothyronine (T3) hormones but, its only effective in reducing the T3 and T4 levels and takes a longer duration in stabilizing the TSH level which is the main stimulating hormone [31] nonetheless, recently Gan et al. reported effective approach which still requires validation and approval [32]. Graves' disease relapses 30% to 70% but Le

Moli et al. investigated corticosteroid pulse therapy which reduces the reversion rate of the disease but still not officially approved [33]. Also, treatment of the condition in pregnant mothers is controversial because carbimazole and methimazole are both associated with abnormalities in physiological developments and their replacement with propylthiouracil is toxic [34]. Moreover, most of the chemotherapy approaches have serious toxicity effects, unlike curcumin which is an organic compound [35]. To the best of our knowledge turmeric powder has never been investigated for the treatment of hyperthyroidism. Therefore, this study examines the impact of turmeric traditional herbal medicine on the TSH and TPOAb levels of hyperthyroid patients.

## II. MATERIALS AND METHODS

Turmeric powder was obtained from different local markets in Saudi Arabia and Kenya. A half-full teaspoon which is approximately 1.5 to 2 grams of the powder is added to a

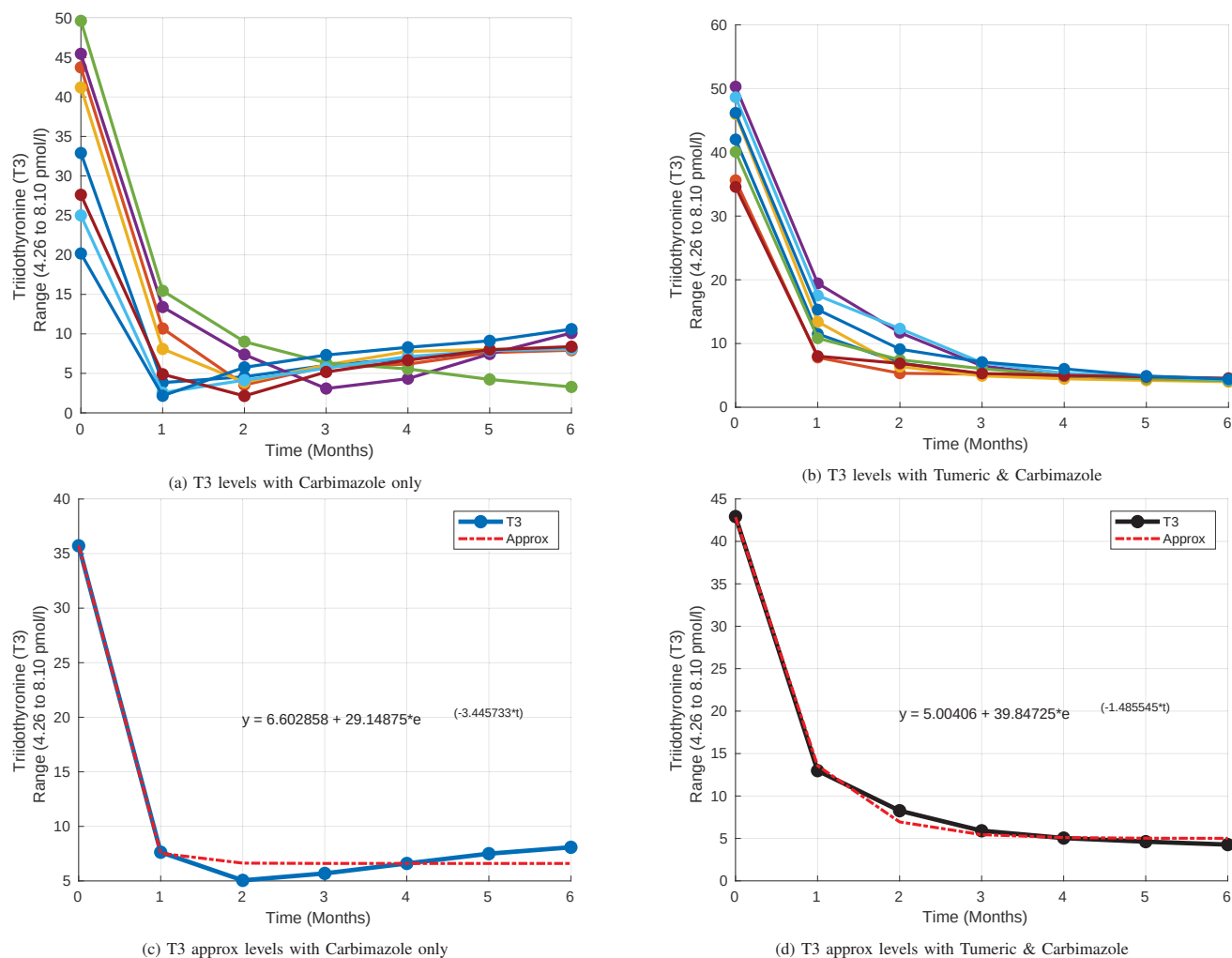


Fig. 3 T3 levels of patients given Carbimazole with and without Tumeric for 6 months

glass of milk and a glass of water and boiled together for 10 to 15 minutes stirred continuously for proper mixing and homogeneity [36]. The warm mixture is sieved and drank by the patient at least 2 to 3 times a week.

The study invited 20 patients undergoing treatment in different hospitals in Kenya and Saudi Arabia and assured them of handling their data with confidentiality. 10 patients were treated with only Carbimazole and not given turmeric the remaining 10 patients were treated with combined turmeric and carbimazole. The study considered smokers and non-smokers however, during the study the smokers were told to quit smoking voluntarily, both female and male gender were also included of different age brackets ranging from 18 years to 68 years. Patients were reviewed every month in their respective clinics by endocrinologists or general physicians. The carbimazole starting daily dose for all patient was ranging from 20mg to 40mg which was later adjusted according to their responses [29]. The patients with known drug allergic reaction or that have shown skin rashes were excluded from the study and out of the 20 participants only 16 (8 male and 8 female) were successfully enrolled for the study and out of the 16 participants 8 were treated with carbimazole alone while

the other 8 patients were treated with combine carbimazole and turmeric for six consecutive months. All patients were also told to reveal any blood spots in the stool or the nose or any other abnormality, as turmeric is suspected to cause internal bleeding, but no patient reported any bleeding signs or other concerns in the cause of the treatment [37] and besides, all participants were advised to minimize stress during the treatment.

### III. RESULTS AND DISCUSSION

The study was conducted on 16 hyperthyroid patients consisting of 8 women and 8 men which were categorized into two groups. The first group was given the only carbimazole while the second group is given carbimazole and turmeric, Fig. 2. The two groups were of an equal number of the male and female gender. Table I also shows basic health parameters data of the patients' understudy before the treatment started and it was noted that approximately 94% of the patients had improved parameters in the first 4 weeks of the treatments in both the groups when they were administered with carbimazole to lower their T4 and T3 combined with Propranolol as a beta-blocker to reduce the elevated systolic

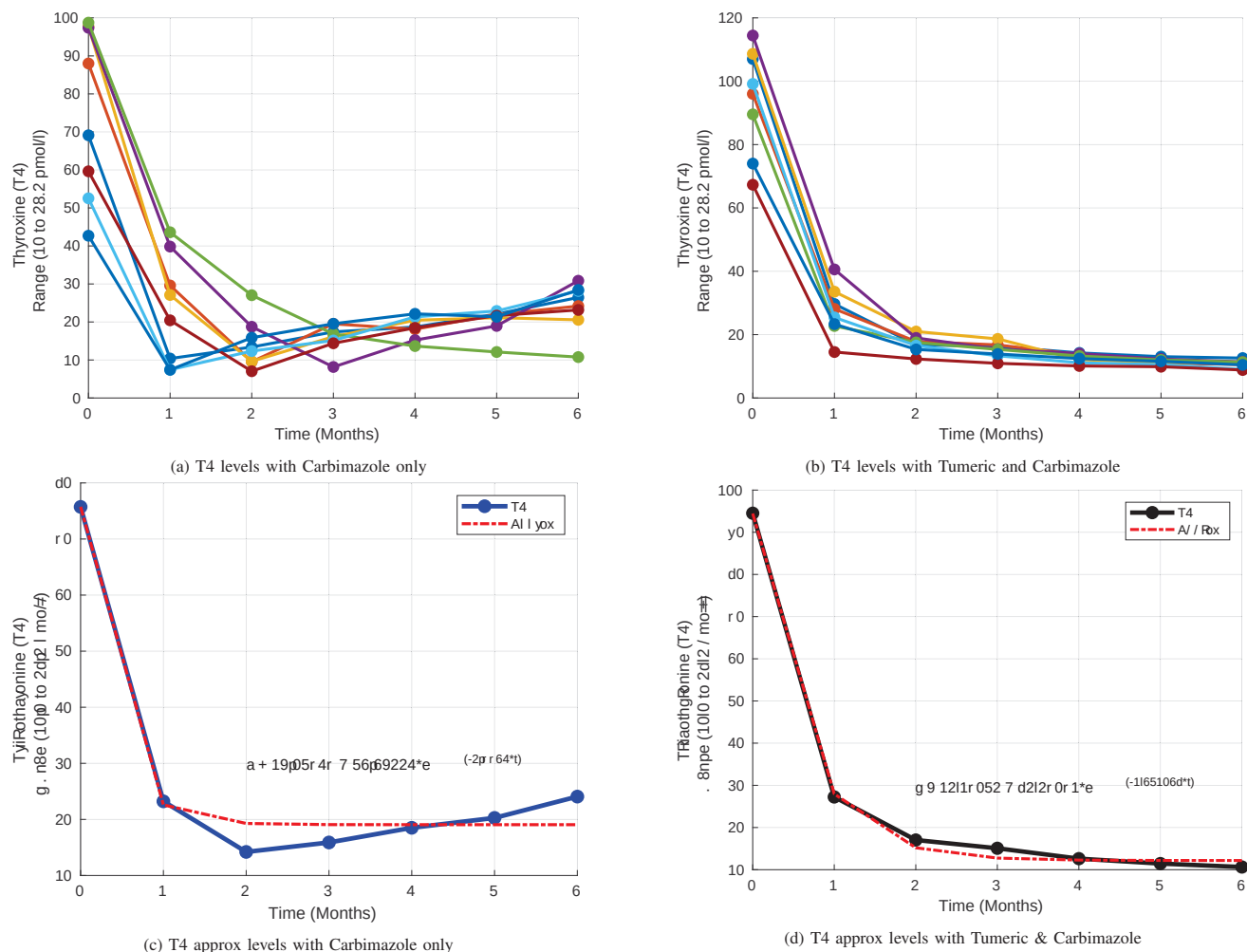


Fig. 4 T4 levels of patients given Carbimazole with and without Tumeric for 6 months

TABLE I  
 CHARACTERISTICS OF THE TWO GROUPS (MEAN ± SD)

	Carbimazole treated patients		Carbimazole and turmeric treated patients	
	Male	Female	Male	Female
Number	4	4	4	4
Age (Years)	28 ±9.5	34.75 ±7.5	41.5 ±15.5	40 ±12.2
Age >40 years (%)	25	25	50	50
Height (cm)	186.7 ±4.8	167.0 ±7.3	179.1 ±7.6	167.2 ±8.0
Weight (kg)	69.8 ±11.5	68.3 ±6.1	72.5 ±12.3	72.5 ±15.6
Smoker	2	0	1	0
Non-smoker	2	3	1	4
Ex-smoker	0	1	2	0
Hemoglobin (Hb)	12.9 ±0.4	11.0 ±1.0	12.0 ±1.2	11.3 ±1.1
Systolic Blood Pressure (mmHg)	140.5 ±6.1	136 ±17	125.5 ±10.6	133.8 ±10.2
Diastolic Blood Pressure (mmHg)	72.5 ±7.1	77 ±4.3	74 ±3.4	75 ±5.9
Heart beat Rate	110 ±14.4	119.3 ±43.5	95.3 ±28.1	111.3 ±33.6
Alanine Transaminase SGPT (ALT)	60 ±9.22	59 ±6.82	59.75 ±10.28	59.25 ±7.85
Aspartate Aminotransferase SGOT (AST)	37.24 ±6.07	37.51 ±3.35	34.16 ±7.81	35.80 ±6.37

blood pressure and the same trend has been noted in other literature [38].

Fig. 3 shows the level of T3 in the eight participants in two groups; those taking Carbimazole only and those that

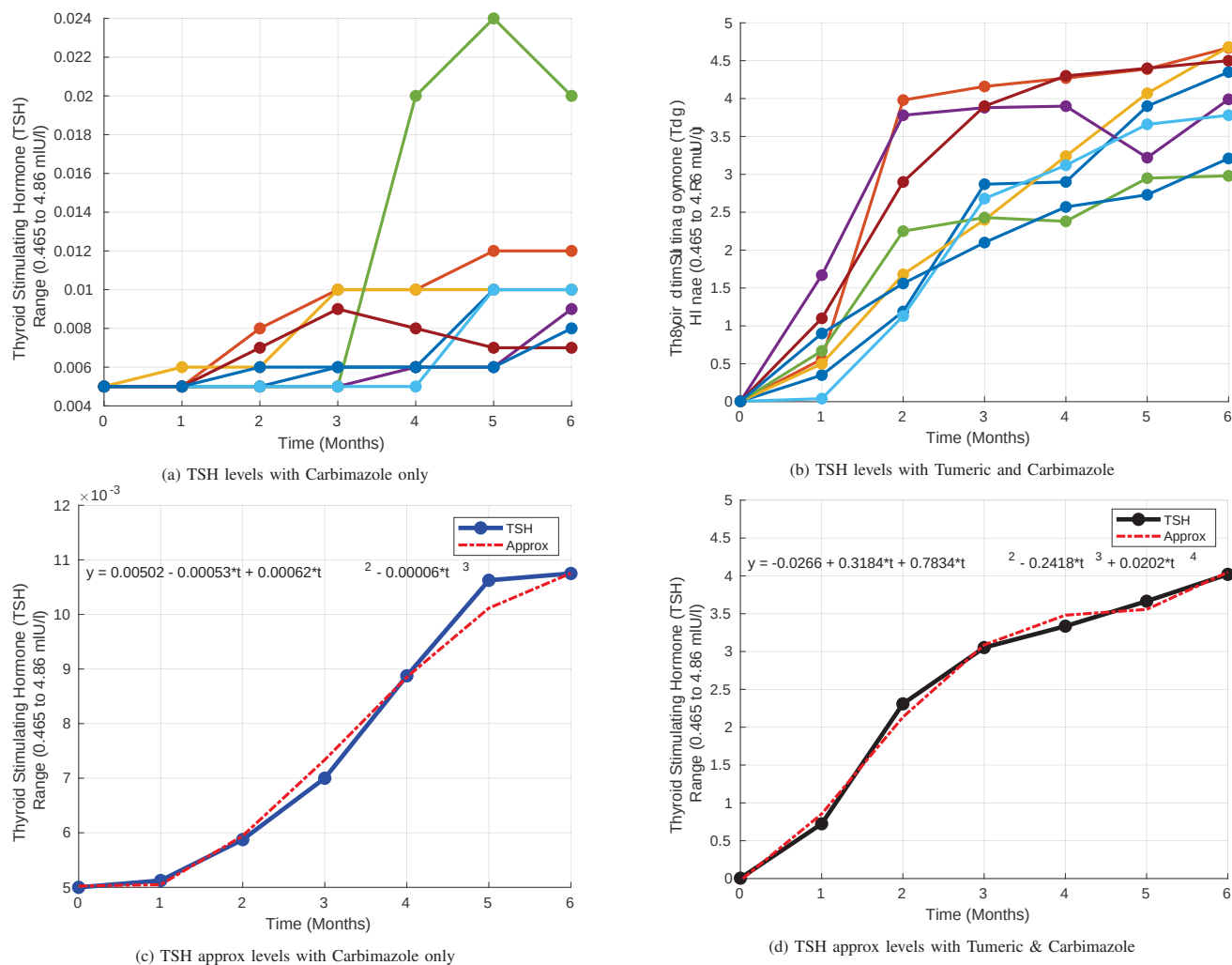


Fig. 5 TSH levels of patients given Carbimazole with and without Tumeric for 6 months

combined Tumeric and Carbimazole. Fig. (3a) and Fig. (3b) show the individual levels of T3 in the participants in the two groups. It can be seen that in both cases, the results show a similar trend among all the participants. To investigate the trend, the average of the daily T3 levels were taken in both groups in Fig. (3a) and Fig. (3b) to produce Fig. (3c) and Fig. (3d) respectively. A closer look at Equations (1) and (2) representing T3 level for patients taking Carbimazole and those taking both Carbimazole and Tumeric respectively, it is clear that those patients taking Carbimazole alone lower their T3 levels twice faster than their counterparts. This is evident from the coefficients of the time variable  $t$  where  $-1.49 \times 2.32 \approx -3.45$ . However, the equations show that eventually (*i.e.*  $\lim(t \rightarrow \infty)$ ) those taking both Tumeric and Carbimazole will have  $\approx 1.60$  pmol/l less T3 than those who did not take Tumeric. In any case, the patients who did not take Tumeric will end up with  $\approx 6.60$  pmol/l of T3 while their counterparts will end up with  $\approx 5.00$  pmol/l.

$$y_1 = 6.60 + 29.15e^{(-3.45t)} \quad (1)$$

$$y_2 = 5.00 + 37.85e^{(-1.49t)} \quad (2)$$

$$y_1 = 19.06 + 56.69e^{(-2.78t)} \quad (3)$$

$$y_2 = 12.17 + 82.27e^{(-1.65t)} \quad (4)$$

Similar to T3, T4 as shown in Fig. 4, shows a natural exponential function as shown in (3) and (4). This means after a while (*i.e.* 4 months or more), the T4 levels will stabilize at  $\approx 19.06$  pmol/l in the patient that takes carbimazole and  $\approx 12.17$  pmol/l in those who took both carbimazole and Tumeric. Also, the equations show that those taking carbimazole only lower their T4 levels 1.68 times faster than those who took both carbimazole and Turmeric.

The thyroid-stimulating hormone (TSH) is an important factor that regulates the other two metabolic hormones the T4 and T3. Following 6 months of the treatment, the distinct variation in TSH levels among the study group was imminent because those who consumed only the carbimazole have shown only 3% of an average improvement in their level as shown in Fig. 5a, unlike the participants who have combined treatment of Turmeric and carbimazole that have recorded excellent improvement levels of an average of more than 99%

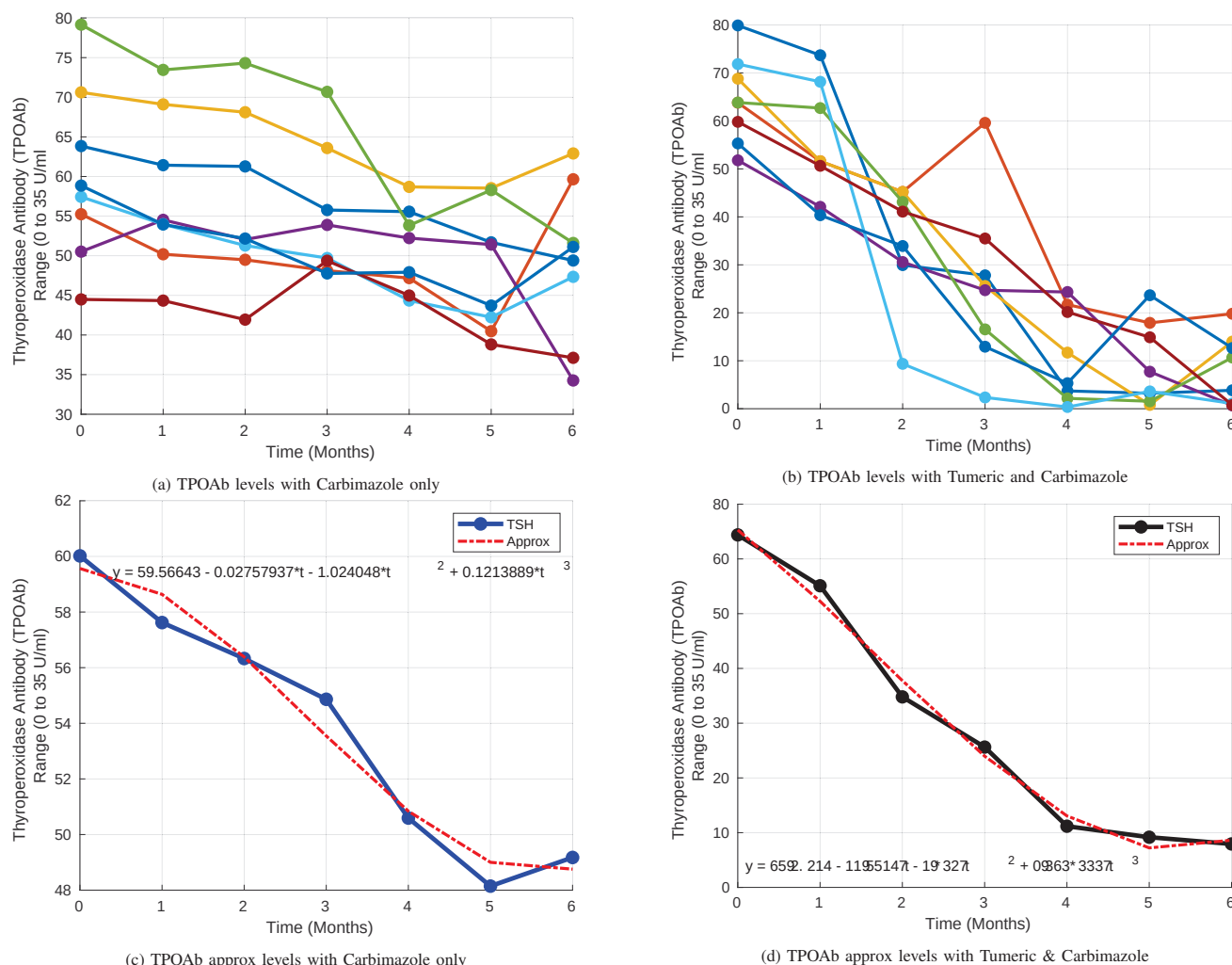


Fig. 6 TPOAb levels of patients given both Tumeric and Carbimazole for 6 months

as indicated in Fig. 5b with 94% improvement in the first 4 weeks of the study period. Therefore, it can be concluded that the consumption of 1.5 to 2 grams of turmeric was responsible for improving the TSH levels to the normal range of 0.465-4.86 mIU/l for both mild and high hyperthyroid patients. This is supported by (5) and (6) describing TSH for those patients that took carbimazole only and those who took carbimazole and turmeric respectively. The latter shows a large increase in TSH given its fact that the coefficients and order of the equation are larger than that of the earlier. Furthermore, a similar pattern has been observed when levothyroxine (T4) was used to decrease solitary thyroid nodule size [39].

$$y_1 = 0.005 - 0.001t + 0.001t^2 - 0.0001t^3 \quad (5)$$

$$y_2 = -0.03 + 0.32t + 0.78t^2 - 0.24t^3 + 0.02t^4 \quad (6)$$

$$y_1 = 59.57 - 0.03t - 1.02t^2 + 0.12t^3 \quad (7)$$

$$y_2 = 65.29 - 11.55t - 1.83t^2 + 0.36t^3 \quad (8)$$

This study has also considered the impact of turmeric when combined with carbimazole on the TPOAb levels and a very low improvement of 18% has been recorded when the only carbimazole was administered compared to a significant improvement of 88% when the combined approach was used as indicated in Fig. 6a and 6b respectively, and a similar trend has been reported in the literature showing the direct relationship between the TSH level and TPOAb [40], [41]. Moreover, this argument is supported by (7) and (8) describing the TPOAb levels of patients who took carbimazole only and those who took carbimazole and turmeric respectively. It is evident from the higher negative coefficient of  $t$  (i.e. -11.55) in (8) than in (7).

#### IV. CONCLUSION

Hyperthyroidism and other thyroid disorder remain one of the challenges in the world today. Therefore, this study presents turmeric powder as an important supplement that significantly improves TSH and TPOAb levels of hyperthyroid patients when combined with carbimazole antithyroid drug. Generally, turmeric powder is a herbal cheap and readily available treatment for hyperthyroidism if carefully used by

the patients and has no reported side effects compared to the chemotherapy approach which can cause severe allergic reaction in some of the patients and other adverse effects. However, further studies are needed particularly to investigate the component of turmeric that is responsible for this breakthrough, fix the right dosage and the most suitable drug delivery system to be employed.

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#### DECLARATION

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