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ASENSORY ATTRIBUTES AND FLAVONOID CONTENT OF HIMALAYAN

***RHODODENDRON ARBOREUM* FLOWERS BASED TEA**

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ABSTRACT

An attempt was made to develop tea from Himalayan *Rhododendron arboreum* flower petals with different proportions of *Tulsi* and mint by two methods i.e. boiling method and infused method. Developed samples were subjected to sensory evaluation for taste, odour, flavour, colour and overall acceptability using 9-point hedonic scale through a panel of 50 untrained members. There was found to be a significant (at 5 % level) difference between all the four attributes among all treatments. The sensory analysis revealed that by boiling method, the most acceptable treatment was the tea with 4 gm of *Rhododendron* with 0.5 gm of *Tulsi* i.e. TBT₁. Among treatment based on different proportions of mint, the treatment TBM₁ (0.5 gm of mint and 4 gm of *Rhododendron*) was most acceptable. By infusion method, the most acceptable treatment was the tea with 3 gm of *Rhododendron* with 0.5 gm of *Tulsi* i.e. TIT₁. Among all

treatments based on different proportions of mint, the treatment TIM₁ (0.5 gm of mint and 3 gm of *Rhododendron*) was most acceptable. The total flavonoid analysis revealed that was flavonoid content was highest in the treatments TIT₁ i.e. with 0.5 gm *Tulsi* and 3 gm *Rhododendron* (12.27 mg Quercetin Acid Equivalent) and was found to be lowest in the treatments TIM₁ i.e. with 0.5 gm mint and 3 gm *Rhododendron* (4.38 mg Quercetin Acid Equivalent).

Keywords: *Rhododendron arboreum*, anti-diabetic, anti oxidant, flavonoids, sensory evaluation

INTRODUCTION

The nature is endowed with a rich genetic diversity of plant foods. The less important, so-called underutilized remain uncared and confined to natural wild, semi-wild and semi-domesticated conditions. Many of temperate plants are remained unutilized inspite of their high nutritional, medical and therapeutic value. *Rhododendron arboreum*, is one of them. It is an evergreen branched tree is considered to be one of the most beautiful and adorable *Rhododendron* species [1]. *Rhododendron* has been derived from Greek word ‘Rhodo’ meaning rose and ‘Dendron’ meaning tree. The plant is best grown in moist soil. It generally grows above the sea level between 1500 and 2000 m [2] which attains a height of over 100 feet [3]. The plant requires no shade to semi shade for its growth. It is one of the highly valuable flowers grown at high altitude in India [2]. It belongs to family, Ericaceae [4].

The trunk is usually branched (Orwaet *al.*, 2009), reddish brown in colour and also is soft and rough [5]. The leaves of this plant are 10-20 cm in length and 3.6 cm in width [6]. It is glossy green in colour [3]. The fruit is 3.8 cm and 1.25 cm in length and width, respectively.

Rhododendron is grown in the South and North Eastern Asia, North America and Western Europe. The species of *Rhododendron* are distributed worldwide and are found in highest number in China while India has around 80 species [7].

In India, it is grown in the Himalayas, Kashmir, Assam, Arunachal Pradesh, Sikkim and Manipur in India [7]. It blossoms in the months of March-April and June- September and each tree has around twenty blossoms [1]. *Rhododendron* is a national flower of Nepal and state flower of Uttarakhand [8]. The colour ranges from deep red or pale pink flowers [9].

Many value added products of *Rhododendron arboreum* flowers though are used rural population such as jams, jellies, honey, pickles, syrup, squash, preserve, *Rhodo* juice. Even the preparation of *Rhododendron* wine has also been attempted [7].

The plant contains phytochemicals, alkaloids, saponins, glycosides, flavonoids, steroids and some of the important minerals which play a major role in promoting health [7]. Pharmacological research data have concluded that *Rhododendron* has anti diabetic, anti hyperlipidemic, anti-inflammatory, cardio friendly properties because of its good antioxidant profile [10]. The author also revealed that ethanol aqueous extract of *Rhododendron* has anti hyperglycemic and anti hyperlipidemic values which aid in insulin secretion [10]. Due to the phenolic acids present in the leaves and flowers of *Rhododendron* it has a great anti diabetic potential [7].

Therefore, the present study has been conducted with an objective to prepare tea

from *Rhododendron* flowers using two different methods to well utilize its flavonoid content.

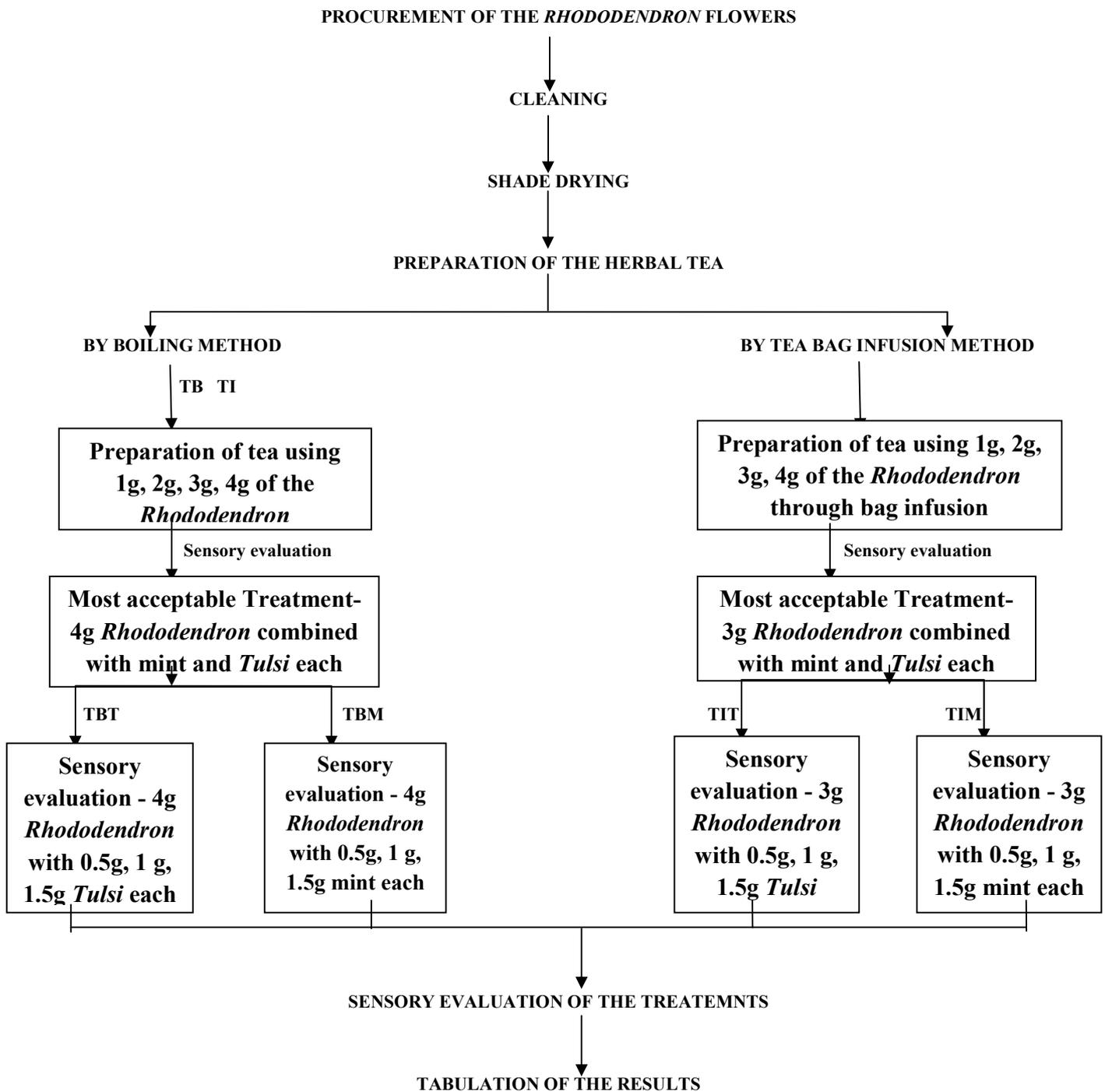
METHODOLOGY

Procurement of raw materials

The flowers of the *Rhododendron arboreum* were procured from the local areas of Himachal Pradesh, India. The procured sample was brought to Food and Nutrition laboratory of Department of Nutrition and Dietetics, MRIIRS, Faridabad. After sorting, the flower petals were shade dried. The fresh leaves of *Tulsi* and mint used in the preparation of the herbal tea were procured from the local markets of Faridabad. The leaves were sorted and washed under running water. Finally the leaves of min and *Tulsi* were shade dried. In boiling method, the tea was prepared by putting the *Rhododendron* petals in boiling water for 3 minutes. Similarly in tea bag infusion method, the tea bags were prepared and *Rhododendron* petals was put into it and then was infused in boiling water for 3 minutes.

Table 1: Different treatments to develop *Rhododendron* tea

Code	Treatments
TB	Treatment with boiling method
TBT	Treatment with boiling method using <i>Tulsi</i>
TBM	Treatment with boiling method mint
TI	Treatment with infusion method
TIT	Treatment with infusion method using <i>Tulsi</i>
TIM	Treatment with infusion method using mint



Flow Chart 1: Steps involved in preparation of different tea treatments

Sensory Evaluation

Sensory evaluation was performed using 9 point hedonic scale as given by [11]. A panel of 15 untrained members were chosen for the initial treatments i.e. treatment TB and treatment TI. Their honest expression was assessed to find out the most acceptable treatments for the further evaluation. A panel of 50 untrained members was chosen for the final treatment with mint and *Tulsi* for both boiling as well as infusion method. Their honest expressions were recorded for further evaluation. The overall acceptability was calculated by finding out the mean average of the other four attributes (colour, flavour, odour and taste).

Chemical Evaluation

The chemical analysis was done for each prepared final treatments i.e. *treatments TBT* (treatment using boiling method with *Tulsi*), *treatments TBM* (treatment using boiling water with mint), *treatments TIT* (treatment using infusion method with *Tulsi*) and *treatments TIM* (treatment using infusion method with mint) by spectrophotometer method in which 50 ml treatments was collected and supernatant was collected. Quercetin was used as standard and calibration curve was plotted. Finally the absorbance was taken at 420 nm against

blank using UV Visible spectrophotometer [12].

Statistical Analysis

After collecting the required data, keeping in view the specific objectives of the study, the data was analyzed statistically using mean and standard deviation and analysis of variance test [13].

RESULTS AND DISCUSSIONS

Sensory Evaluation of *Rhododendron* tea with *Tulsi* using boiling method

The data regarding sensory acceptability of *Rhododendron* tea with *Tulsi* is presented in **Table 2**. There was found to be a significant difference (at 5 % significant level) between the colour, flavour, odour, taste and overall acceptability of all the four treatments.

In case of colour, among all the treatments, the mean acceptability score was maximum for the treatment TBT₁ i.e. 4 g *Rhododendron* with 0.5 g *Tulsi* and was scored as liked moderately (7.86) by the panelists while minimum scores were given to treatment TBT₃ i.e. 4 g *Rhododendron* with 1.5 g *Tulsi* (liked slightly; 6.7) by the panelists. In case of flavour, among all the treatments, the treatment TBT₁ i.e. 4 g *Rhododendron* with 0.5 g *Tulsi* was scored highest as liked moderately (7.32) while the treatment TBT₃ i.e. 4 g *Rhododendron* with 1.5 g *Tulsi* with

(6.12) was scored least as liked slightly (6.12) by the panelists.

In case of odour, among all the treatments, treatment TBT₁ i.e. 4 g *Rhododendron* with 0.5 g *Tulsi* was rated with the mean acceptability score of 7.44 i.e. liked moderately while the treatment TBT₃ i.e. 4 g *Rhododendron* with 1.5 g *Tulsi* was rated as 6.38 i.e. liked slightly by the panelists. In case of taste, treatments TBT₁ i.e. 4 g *Rhododendron* with 0.5 g *Tulsi* was scored highest as liked moderately (7.52) by the panelists while treatment TBT₃ i.e. 4 g *Rhododendron* with 1.5 g *Tulsi* was rated least as liked slightly (6.66) by the panelists.

The overall acceptability scores as depicted in Table revealed that treatment TBT₁ i.e. 4 g *Rhododendron* with 0.5 g *Tulsi* was rated highest for colour flavour and texture and least scoring was for treatment TBT₃ i.e.

Sensory Evaluation of *Rhododendron* tea using with mintboiling method

The data pertaining to sensory acceptability of *Rhododendron* tea with mint is presented in **Table 3**. There was found to be a significant difference (at 5% significant level) between the colour flavour, odour, taste and overall acceptability of all treatments.

In case of colour, among all the treatments, treatment TBM₁ i.e. 4 g *Rhododendron* with

0.5g mint was scored highest as 7.26 i.e. liked moderately by the panelists while treatments TBM₂ i.e. 4 g *Rhododendron* with 1 g mint had least mean sensory acceptability scores of 6.94(liked slightly). Similar results were obtained in case of flavour, treatment TBM₁ i.e. 4 g *Rhododendron* with 0.5 g mint was liked slightly (6.8) while treatment TBM₃ i.e. 4 g *Rhododendron* with 1.5 g mint had mean sensory acceptability score of 6.16 (liked slightly).

In case of odour, both treatments i.e. TBM₁ and treatments TBM₂ i.e. 4 g *Rhododendron* with 0.5 g mint and 4 g *Rhododendron* with 1 g mint respectively, were liked slightly (6.72) by the panelists while treatment TBM₃ i.e. 4 g *Rhododendron* with 1.5 g mint was liked slightly (6.6) by the panelists. In case of taste, again the treatment TBM₁ was cored highest as 6.76) while TBM₃ was rated least among all treatments. The overall acceptability of all treatments revealed that most preferred treatment was TBM₁ i.e. 4 g *Rhododendron* with 0.5 g mint while lest preferred was TBM₃ i.e. 4 g *Rhododendron* with 1.5 g mint.

Sensory Evaluation of *Rhododendron* tea using infusion method with *Tulsi*

The data regarding sensory acceptability of *Rhododendron* tea with *Tulsi* is presented in **Table 4**.

There was found to be a significant difference (at 5% significant level) among scores of the colour, flavour, odour, taste and overall acceptability of all the 4 treatments.

In case of colour, among all the treatments, treatment TIT₁ i.e. 3 g *Rhododendron* with 0.5 g *Tulsi* was scored highest as 7.88 i.e. liked moderately by the panelists while treatments TIT₃ i.e. 3 g *Rhododendron* with 1.5 g *Tulsi* was scored as 6.8 i.e. liked slightly by the panelists. In case of flavour and odour similar results were obtained i.e. TIT₁ was rated highest as liked moderately by the panelists while treatments TIT₃ was scored low as liked slightly.

The sensory scores followed the same trend for taste also. It is evident from the data in the Table that treatment TIT₁ i.e. 3 g *Rhododendron* with 0.5 g *Tulsi* was more acceptable than TIT₃ i.e. 3 g *Rhododendron* with 1.5 g *Tulsi*.

Sensory Evaluation of *Rhododendron* tea using boiling method with mint

There was found to be a significant difference (at 5% significant level) between the colour, flavour, odour, taste and overall acceptability of all the 4 treatments.

The data regarding sensory acceptability of *Rhododendron* tea with mint is presented in **Table 5**. Just like other treatment, this *Rhododendron* tea with mint followed the

same trend and sensory evaluation score revealed treatment TIM₁ i.e. 3 g *Rhododendron* with 0.5 g mint was more liked as compared to the treatment TIM₃ i.e. 3 g *Rhododendron* with 1.5 g mint. And were scored as 7.51 (liked moderately) and 6.44 (liked slightly) respectively.

Flavonoid content of different treatments

The flavonoid content of all treatments is presented in **Figure 1**. It is very evident from the graph that the flavonoid content was found to be highest in the treatments TIT₁ i.e. treatment by infusion method with 3 gm *Rhododendron* and 0.5 gm *Tulsi* (12.27 mg Quercetin Acid Equivalent) and was found to be lowest in the treatments TIM₁ i.e. treatment by infusion method with 3 gm *Rhododendron* and 0.5 gm mint (4.38 mg Quercetin Acid Equivalent). The flavonoid content in treatments TBT₁ i.e. treatment by boiling method with 4 gm *Rhododendron* and 0.5 gm *Tulsi* (6.57 mg Quercetin Acid Equivalent). The flavonoid content in treatments TBM₁ i.e. treatment by boiling method with 4 gm *Rhododendron* and 0.5 gm mint was 10.26 mg Quercetin Acid Equivalent.

According to a research, fifteen Thai infusions were studied for their flavonoid, total phenolics and non flavonoid content. Among all of them, green tea is recognized

as the richest source of total flavonoids and total phenols. The total flavonoid content in the green tea was analyzed to be 125 mg GAE/100 ml [14].

Table 2: Mean sensory acceptability scores of Rhododendron tea with Tulsi using boiling method

Treatments	Colour	Flavour	Odour	Taste	Overall acceptability
TBT ₁ (4 g Rhododendron with 0.5 g Tulsi)	7.86*±1.10	7.32*±1.47	7.44*±1.42	7.52*±1.32	7.53*±1.01
TBT ₂ (4 g Rhododendron with 1 g Tulsi)	7.16*±1.34	6.78*±1.38	6.66*±1.47	6.8*±1.59	6.84*±1.05
TBT ₃ (4 g Rhododendron with 1.5 g Tulsi)	6.7*±1.56	6.12*±1.38	6.38*±1.58	6.66*±1.42	6.46*±1.16
TBT ₀ (Control treatments)	6.2*±1.7	5.56*±1.90	5.9*±1.74	5.36*±2.02	5.75*±1.29

Values are expressed as mean ± standard deviation; *At 5% level of significance

Table 3: Mean sensory acceptability scores of Rhododendron tea with mint using boiling method

Treatments	Colour	Flavour	Odour	Taste	Overall acceptability
TBM ₁ (4 g Rhododendron with 0.5 g mint)	7.26*±1.22	6.8*±1.46	6.72*±1.29	6.76*±1.45	6.88*±1.20
TBM ₂ (4 g Rhododendron with 1 g mint)	6.94*±1.31	6.58*±1.44	6.72*±1.19	6.62*±1.55	6.72*±1.15
TBM ₃ (4 g Rhododendron with 1.5 g mint)	6.98*±1.37	6.16*±1.67	6.6*±1.32	6.18*±1.73	6.48*±1.34
TBM ₀ (Control Treatments)	6.24*±1.42	5.78*±1.76	5.9*±1.71	5.7*±1.94	5.9*±1.35

Values are expressed as mean ± standard deviation; *At 5% level of significance

Table 4: Mean sensory acceptability scores of Rhododendron tea with Tulsi (Infusion method)

Treatments	Colour	Flavour	Odour	Taste	Overall acceptability
TIT ₁ (3 g Rhododendron with 0.5 g Tulsi)	7.88*±1.09	7.46*±1.42	7.52*±1.34	7.56*±1.22	7.6*±0.96
TIT ₂ (3 g Rhododendron with 1 g Tulsi)	7.1*±1.35	6.7*±1.35	6.78*±1.34	6.9*±1.53	6.86*±1.01
TIT ₃ (3 g Rhododendron with 1.5 g Tulsi)	6.8*±1.49	6.1*±1.94	6.44*±1.64	6.72*±1.4	6.51*±1.2
TIT ₀ (Control treatments)	6.06*±1.64	5.54*±1.86	5.78*±1.7	5.36±1.91	5.69*±1.24

Values are expressed as mean ± standard deviation; *At 5% level of significance

Table 5: Mean sensory acceptability scores of Rhododendron tea with mint (Infusion method)

Treatments	Colour	Flavour	Odour	Taste	Overall acceptability
TIM ₁ (3 g Rhododendron with 0.5 g Tulsi)	7.76*±1.11	7.26*±1.38	7.5*±1.26	7.52*±1.24	7.51*±1.0
TIM ₂ (3 g Rhododendron with 1 g Tulsi)	7.08*±1.28	6.86*±1.32	6.82*±1.36	6.68*±1.5	6.85*±1.05
TIM ₃ (3 g Rhododendron with 1.5 g Tulsi)	6.7*±1.56	6.1*±1.93	6.56*±1.31	6.42*±1.49	6.44*±1.24
TIM ₀ (Control treatments)	5.96*±1.84	5.52*±1.94	5.84*±1.65	5.36*±1.94	5.67*±1.4

Values are expressed as mean ± standard deviation; *At 5% level of significance

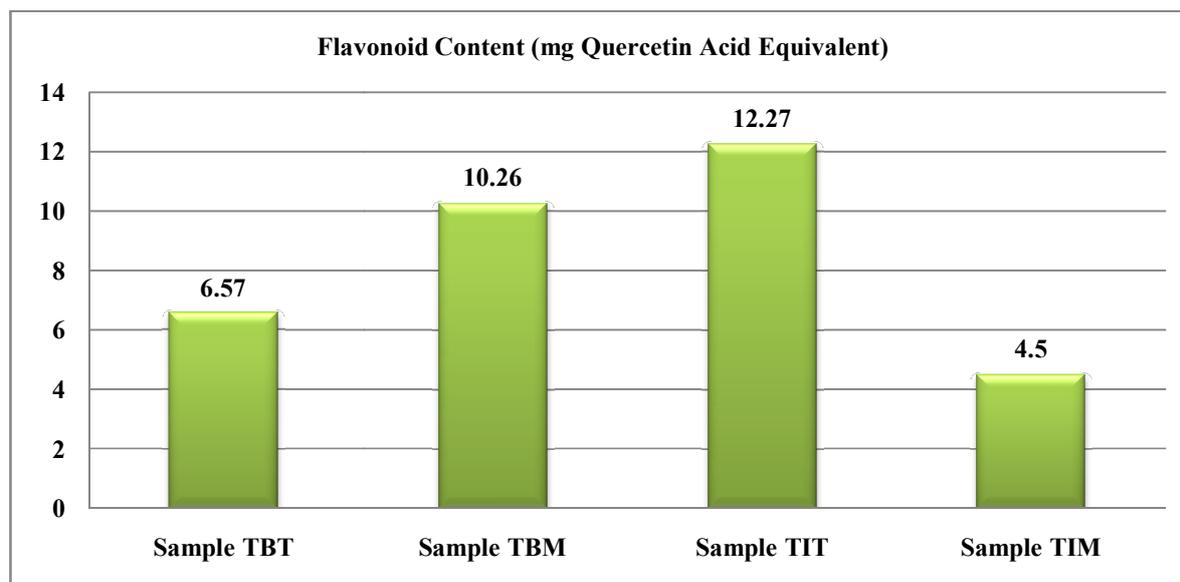


Figure 2: Flavonoid content of different treatments (Quercetin Acid Equivalent)

CONCLUSION

The above findings revealed that *Rhododendron* petals can be well used to prepare tea. The acceptability of which can be enhanced by adding mint of *Tulsi*. Moreover, it is containing good amount of flavonoids too. Thus it can be well utilized by diabetic and hyperlipidemic group of population. But more clinical studies are required to see the effect of *Rhododendron* infusion on blood sugar and cholesterol level.

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