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### Effect of Leaves of *Artemisia vulgaris* L. on Growth of Rats

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To know the effect of leaves of *Artemisia vulgaris* Linn. on growth of rats, male albino rats were divided into three groups. First group of animals took normal diet while the second and third groups of animals took a mixture of normal diet and powdered leaves of *Artemisia vulgaris* Linn in the doses of 500 mg/kg and 1 g/kg respectively. In all the three groups growth of rats was checked up to 40 days. On 20<sup>th</sup> and 40<sup>th</sup> days of experiment blood pyruvate level was measured. Intestines of rats were also assayed for pyruvate dehydrogenase and transketolase activity. It was found out that growth of rats which took powdered leaves of *Artemisia vulgaris* Linn. with normal diet was stunted. Growth inhibition was dose dependant. Rats developed symptom of anorexia and became weak. Blood pyruvate level was elevated and intestinal pyruvate dehydrogenase activity was lowered. Pyruvate thus could not be converted to acetyl coenzyme A needed for generation of energy. Lack of energy caused growth inhibition in rats. Further, intestinal transketolase activity was found decreased. Due to this in pentose phosphate pathway there was insufficient production of NADPH and pentose sugars needed for synthesis of nucleic acid. This also caused growth inhibition in rats.

**Keyword:** *Artemisia vulgaris* Linn., Pyruvate Dehydrogenase, Transketolase, Pentose Phosphate Pathway.

#### 1. Introduction

*Artemisia vulgaris* Linn. is a perennial shrubby aromatic plant throughout the hills of India. The plant is abundant in Sikkim and Darjeeling Himalayas in the middle and upper hill forest up to the height of 2000- 5000 ft. The plant has different names : Titeypati in Nepali, Tuk – gnyel in Lepcha, Dhama naga in Tibetan, Dona in Hindi, Nagdamini in Bengali, Barha in Sanskrit and Indian worm wood in English. The whole plant has medicinal values. Medical uses of the plant as recorded in Ayurvedic literature are : used as appetizer, cures “kapha”, asthma and itching, prevents convulsion. Water extract

of the plant is good larvicide like kerosene. It has also feeble insecticidal property. It is antibacterial and antifungal too<sup>1,2</sup>.

*Artemisia vulgaris* Linn., a member of the family Asteraceae, has been used worldwide in folk medicine since ancient times<sup>3,4</sup>. In modern research the plant is coined as tonic, antimalarial, antihelmintic, antimicrobial, antioxidant and antidiabetic<sup>5</sup>. *Artemisia vulgaris* Linn. is also known having beneficial effect in treating wounds, bronchitis, ulcers, and tuberculosis in traditional Anatolian medicine<sup>6-9</sup>. The chemical studies on *Artemisia vulgaris* Linn. indicate that compounds like terpenoids and flavonoids are present in the plant which are

responsible for for flavouring foods or liqueurs<sup>[5]</sup>.

As *Artemisia vulgaris* Linn. has wide medicinal use, it was thought worthwhile to study the toxic effect, if any, of this plant. In present communication effect of leaves of *Artemisia vulgaris* Linn. on growth of rats is being reported.

## 2. Materials and Methods

### 2.1 Plant Material

Leaves of *Artemisia vulgaris* Linn. were collected from the medicinal plants garden of the University of North Bengal and authenticated by the experts of the department of Botany of the said University. A voucher specimen was kept in the department for future reference. Leaves were sundried and powdered. The powder was used as the test drug of *Artemisia vulgaris* Linn.



Fig: Drug of *Artemisia vulgaris* Linn.

### 2.2 Animals

Male Wister strain rats, body weight between 35 and 40g, were used for this study. Animals were housed individually in polypropylene cages, maintained under standard conditions like 12h light and 12h dark cycle, 20 - 30 degree centigrade, 35 - 60 % humidity. The animal experiment was approved by the ethics committee of the Institute. Rats were fed with standard rat

pellet diet (Hindustan Lever Ltd., Mumbai, India) and provided water *ad libitum*.

### 2.3 Chemicals

All chemicals used in this study were purchased from Sigma Chemical Company, Mumbai. Chemicals were of analytical grade with high purity.

### 2.4 Experimental design

Animals were divided into three groups of 20 each. First group of animals took normal diet while animals of the second and third groups, in addition to normal diet, took test drug in the doses of 500 mg/kg and 1g/kg body weight respectively through oral route daily. Experiment was continued for 40 days. On 20<sup>th</sup> day 10 rats from each group were sacrificed. Remaining 30 rats of the three groups were sacrificed on 40<sup>th</sup> day. Blood samples and intestines were collected. Following parameters were studied.

### 2.5 Growth of rats

Growth of rats was measured on 10<sup>th</sup>, 20<sup>th</sup>, 30<sup>th</sup> and 40<sup>th</sup> day. Overall behavior of the animals was noted.

### 2.6 Blood Pyruvate Level

Blood pyruvate level on 20<sup>th</sup> and 40<sup>th</sup> day of experiment was measured by the method of Neish<sup>[10]</sup>.

### 2.7 Pyruvate Dehydrogenase Activity

Intestinal pyruvate dehydrogenase activity of the animals was noted on 20<sup>th</sup> and 40<sup>th</sup> day by the method of Bai *et al*<sup>[11]</sup>.

### 2.8 Transketolase Activity

Intestinal transketolase activity of the rats was recorded on 20<sup>th</sup> and 40<sup>th</sup> day as per the method of Bai *et al*<sup>[11]</sup>.

### 2.9 Statistical Analysis

The values were expressed as mean  $\pm$  SEM and were analyzed using one-way analysis

of variance (ANOVA) using Statistical Package for Social Sciences (SPSS). Differences between means were tested employing Duncan's multiple comparison test and significance was set at  $p < 0.05$ .

### 3. Results and Discussion

Table – 1 shows effect of powdered leaves of *Artemisia vulgaris* Linn. on body weight of rats. It appears from the table that leaves of *Artemisia vulgaris* Linn. could decrease body weight of rats. Decrease of body weight was dose dependant. For first ten days the decrease was not statistically significant for dose 500 mg/kg but was found significant for the dose of 1g/kg. But after that up to 40 days there was significant decrease ( $p < 0.001$ ) in body weight in all rats who took powdered leaves of *Artemisia vulgaris* Linn. in addition with normal diet. The animals also developed anorexia.

Effect of powdered leaves of *Artemisia vulgaris* Linn. on blood pyruvate level in rats was given in Table - 2. Blood pyruvate

level was elevated in *Artemisia vulgaris* Linn. treated rats. Elevation started from 20<sup>th</sup> day of experiment when 500 mg/kg dose was used and from 10<sup>th</sup> day when 1g/kg dose was used. Results were statistically significant up to the level of  $p < 0.001$ .

Table – 3 showed the effect of *Artemisia vulgaris* Linn. on intestinal pyruvate dehydrogenase activity. Result showed that pyruvate dehydrogenase activity was decreased in rats taking powdered leaves of *Artemisia vulgaris* Linn. daily. Effect was dose dependant and statistically significant ( $p < 0.001$ ).

Effect of *Artemisia vulgaris* Linn. leaves on transketolase activity in rats was given in Table – 4. Intestinal transketolase activity was found significantly decreased ( $p < 0.001$ ) in *Artemisia vulgaris* Linn. treated rats when compared to that of normal animals. Effect was dose dependant and statistically significant ( $p < 0.001$ ).

**Table - 1:** Effect of powdered leaves of *Artemisia vulgaris* Linn. on growth of rats  
(Changes of body weight in gram)

Group	Treatment	10 <sup>th</sup> day	20 <sup>th</sup> day	30 <sup>th</sup> day	40 <sup>th</sup> day
1.	Normal	41.8 ± 2.2	58.7 ± 2.1	62.7 ± 2.3	70.9 ± 2.3
2.	<i>Artemisia vulgaris</i> Linn. (500 mg/kg)	39.4 ± 0.7	39.4 ± 0.7*	44.6 ± 1.2*	41.1 ± 1.1*
3.	<i>Artemisia vulgaris</i> Linn. (1g/kg)	32.1 ± 0.5*	34.9 ± 0.9*	36.1 ± 1.8*	30.4 ± 1.7*

\* $p < 0.001$

**Table - 2:** Effect of powdered leaves of *Artemisia vulgaris* Linn. on blood pyruvate level (in mg/100 ml blood) in rats

Group	Treatment	20 <sup>th</sup> day	40 <sup>th</sup> day
1.	Normal	1.21 ± 0.20	1.19 ± 0.21
2.	<i>Artemisia vulgaris</i> Linn. (500 mg/kg)	4.90 ± 0.23*	6.92 ± 0.25*
3.	<i>Artemisia vulgaris</i> Linn. (1g/kg)	7.20 ± 0.66*	11.51 ± 0.99*

\* $p < 0.001$

**Table - 3 :** Effect of powdered leaves of *Artemisia vulgaris* Linn. on intestinal pyruvate dehydrogenase activity (in nmole pyruvate/ml/30°C) in rats.

Group	Treatment	20 <sup>th</sup> day	40 <sup>th</sup> day
1.	Normal	40.29 ± 2.10	38.92 ± 2.33
2.	<i>Artemisia vulgaris</i> Linn. (500 mg/kg)	24.35 ± 1.14*	17.43 ± 1.55*
3.	<i>Artemisia vulgaris</i> Linn. (1g/kg)	17.53 ± 1.16*	12.44 ± 1.03*

\*p&lt;0.001

**Table - 4 :** Effect of powdered leaves of *Artemisia vulgaris* Linn. on intestinal transketolase activity (in mili Unit / ml homogenate) in rats

Group	Treatment	20 <sup>th</sup> day	40 <sup>th</sup> day
1.	Normal	16.21 ± 1.18	15.22 ± 1.13
2.	<i>Artemisia vulgaris</i> Linn. (500 mg/kg)	8.23 ± 0.55*	6.12 ± 0.34*
3.	<i>Artemisia vulgaris</i> Linn. (1g/kg)	6.27 ± 0.22*	4.41 ± 0.13*

\*p&lt;0.001

The present study showed that leaves of *Artemisia vulgaris* Linn. could inhibit growth of rats. Growth inhibition was dose dependant. With 500 mg/kg dose of the leaves of *Artemisia vulgaris* Linn. growth of rats was not inhibited on 10<sup>th</sup> day of experiment but with 1g/kg there was growth inhibition on 10<sup>th</sup> day of experiment and the result was statistically significant. There after up to 40<sup>th</sup> day growth of rats was significantly reduced with both 500mg/kg as well as 1g/kg doses.

The growth inhibition might be related with energy yielding process. Blood pyruvate levels in rats were thus measured. It was revealed that *Artemisia vulgaris* Linn. could elevate significantly (p < 0.001) blood pyruvate level in rats. More with 1g/kg dose than with 500 mg/kg. This finding suggests that *Artemisia vulgaris* Linn. might cause a blockade in the conversion of pyruvate to acetyl coenzyme A. Thus blood pyruvate level was increased. At the same time due to not having sufficient amount of acetyl coenzyme A, energy production was poor which might cause growth inhibition in rats. Elevated blood pyruvate level might be associated with the activity of pyruvate

dehydrogenase enzyme<sup>[12,13]</sup>. Pyruvate dehydrogenase activity in rats was thus measured and it was found out that leaves of *Artemisia vulgaris* Linn. could lower the activity of pyruvate dehydrogenase. This was also dose dependant. Results were statistically significant up to the level of p < 0.001. For this blockade pyruvate could not be converted to acetyl coenzyme A and accumulated in blood.

It is known that development of anorexia is related with the activity of transketolase enzyme<sup>[14]</sup>. Intestinal transketolase activity in rats was thus measured. Results showed that leaves of *Artemisia vulgaris* Linn. could lower transketolase activity significantly (p < 0.001) in the animals. Transketolase activity was found more lower in higher doses of the test drug. Transketolase is the key enzyme in pentose phosphate pathway for production of NADPH and pentose sugar for synthesis of nucleic acids. This might be another reason of growth inhibition in rats. Pyruvate dehydrogenase and transketolase enzymes are dependant on TPP (thiamine pyruvate phosphate) for their activities<sup>[15,16]</sup>. TPP is a thiamine dependant coenzyme. It is possible that leaves of *Artemisia vulgaris* Linn. could destroy thiamine *in vivo* thus

inactivated both pyruvate dehydrogenase and transketolase enzymes. We are working now in this direction.

#### 4. Conclusion

The results may conclude that leaves of *Artemisia vulgaris* Linn. could inhibit growth of rats. This was due to blockade in energy generation process and interference in pentose phosphate pathway for production of NADPH and pentose sugar for synthesis of nucleic acids. This study is thus a message to the people for restricted use of the leaves of *Artemisia vulgaris* Linn. in treating various ailments.

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