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PROTECTIVE EFFECTS OF ETHANOLIC LEAF EXTRACTS OF *CORCHORUS FASCICULARIS* IN PHENYLHYDRAZINE INDUCED ANEMIC RATS

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ABSTRACT: The aim of the present study is to evaluate the anti anemic activity of ethanolic leaf extract of *Corchorus fascicularis* against phenylhydrazine-induced hemolytic anemia in rats. Phenylhydrazine (40mg/kg) was administered intraperitoneally for 2 days to induce anemia in rats. The animals were divided into five groups of 6 animals each. Group I served as normal control, group II as anemic control, group III as reference control administered with vitamin B₁₂ and group IV and V animals were treated with 100 mg/kg and 200mg/kg of ethanolic leaf extract of *Corchorus fascicularis* Linn. (CFE). All the test drugs were administered once daily for 28 days through the oral route. On 1st, 14th and 28th-day blood were withdrawn, through sinus puncture under phenobarbitone anesthesia and subjected to the estimation of RBC, Hb and percentage Hematocrit. Both the ethanolic leaf extracts of *Corchorus fascicularis* Linn. and vitamin B12 significantly increased the RBC, Hb and Hematocrit levels which conclude that *Corchorus fascicularis* Linn. leaf extract exhibits anti-anemic activity.

INTRODUCTION: Anaemia is a common blood disorder that affects people of all ages, although the people at greater risk are the elderly, young women of child-bearing age and the infants. This condition is not a disease but could develop as a result of various diseases. There are over 400 types of anemia, many of which are rare but in all cases, there is lower than normal number of circulating red blood cells. Presently, more than half of the world's population will experience some forms of anemia in their lifetime¹. The great loss in terms of clinical diagnosis and treatment and even depletion in human resources as a result of anemia could be prevented with adequate knowledge.

The incidence of anemia is higher in the third world than in developed countries due to the presence of many aggravating factors such as poor nutrition, high prevalence of blood parasites example, Plasmodium, trypanosomes and helminthes infestation. It is also known that women are susceptible to anemia during pregnancy due to high demand from the developing fetus^{2,3}.

Although, there are various drugs for the treatment of anemia, they are not affordable to many poor people especially those in developing countries such as India. Also, the rural populations in various parts of the world do not have adequate access to high-quality drugs for the treatment of anemia, so they depend heavily on plants and herbal products for the treatment of diseases and anemia. As a result of the fact that anemia is very common and the incidence is likely to increase in future¹. There is a need to prevent it or seek more cost-effective and better treatment strategies.

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Anemia is one of the numerous ailments claimed to have been successfully treated with plant materials by traditional medicine practitioners. In China, for instance, blood diseases such as malformation of blood circulatory system, anemia, varicose veins, and hemorrhages have been treated with plant materials⁴. The crude extract of *Fagara zanthoxylum* was reported to be effective in the treatment of sickle cell anemia⁵. It was also reported that the aqueous crude extract of *Telfairia occidentalis* leaves has haematinic activity⁶. It is well established that man consumes a wide variety of local crops and vegetables, which are believed to contribute significantly to the improvement of human health in terms of disease prevention and therapy^{5,6}.

Among the different species of *Corchorus* reported in India, *Corchorus fascicularis* (Tiliaceae) is considered the most important for its medicinal properties. The plant extract has been reported to possess anti-inflammatory, antipyretic, antiviral, anthelmintic, anticarcinogenic, hepatoprotective activities. Early studies documented the presence of flavonoids, xanthenes, terpenoids, iridoid and secoiridoid glycosides in the *Corchorus fascicularis* plant⁷⁻¹².

Traditionally, the plant was used as Antianemic medicines; therefore, it developed an interest for its evaluation for their anti-anemic property, whether it is having or not.

MATERIALS AND METHODS:

Plant Collection: The leaves of plant *Corchorus fascicularis* were collected from the campus of Satara College of Pharmacy Degaon, Satara. The plant was authenticated in Yashawantrao Chavan Institute of Science, Satara, Department of Botany, Maharashtra, India. The dried uniform leaves powder was used for the extraction of constituents of the plant.

Preparation of Extract: Freshly collected leaves of the plant *Corchorus fascicularis* were washed, shade dried under room temperature for three weeks. The dried plant material was made to a coarse powder and weighed the quantity of the powder (500gm) was subjected to hot extraction in a Soxhlet apparatus, using alcohol at a temperature range of 60 - 70 °C. After extraction, the extract

was completely dried and weighed. The extract was concentrated by evaporation of solvent at room temperature¹³.

Experimental Animals: Wistar rats (30) of both sexes, weighing between 150 - 250 gm were used for this study. The animals were housed in plastic cages and acclimatized for two weeks in the animal house. They had been maintained under standard conditions (room temperature 25 ± 3 °C, humidity 35 - 60%, light and dark period 12/12 h). All animals had a regular supply of clean drinking water and food. All the procedures and protocols were reviewed and approved by the Institutional Animal Ethics Committee of Satara College of Pharmacy, Satara.

Preliminary Phytochemical Test: The defatting is done by petroleum ether. The alcoholic extract obtained by the above methods from *Corchorus fascicularis* were subjected to a qualitative test for the identification of various plant constituents by the standard procedures¹⁴.

Induction of Anaemia: Anaemia was induced in rats by intraperitoneal administration of 40 mg/kg/day of phenylhydrazine (PHZ) for two days (D₀ and D₁). The treated rats with phenylhydrazine whose hemoglobin concentration was < 13 g / dl were considered as anemic and included for the study. Phenylhydrazine induces hemolysis of RBCs by inducing the formation of toxin, free radicals that can attack cellular macromolecules like hemoglobin, resulting in oxidative damage within RBCs, resulting in their destruction^{15,16}.

Treatment of the Animals: Five groups of six rats were formed and treated daily for 4 weeks as follows:

- **Group I (G₁):** Normal control received 10 ml/kg of 0.5% CMC (Carboxy Methyl Cellulose) from day D₂ to D₂₈.
- **Group II (G₂):** Anaemic control received 0.5% Phenyl hydrazine from day D₀ to D₁.
- **Group III (G₃):** Treated with Vitamin B₁₂ Syrup (1 ml/day) from day D₂ to D₂₈.
- **Group IV (G₄):** Treated with ethanolic extract of *C. fascicularis* (CFE) (100 mg/kg) from day D₂ to D₂₈.

- **Group V (G₅):** Treated with ethanolic extract of *C. fascicularis* (CFE) (200mg/kg) from day D₂ to D₂₈.

All administration was done orally using oropharyngeal cannula once per day for 28 days (4 weeks).

Analysis of Haematological Parameters: Blood samples were collected from the rats by tail incision before induction of anemia (D₀), after induction of anemia with PHZ (D₂) and at 2nd and 4th weeks of treatment^{17, 18}. The Red Blood Cell number (RBC), Haemoglobin concentration (Hb) and Haematocrit were determined at days D₂, D₁₄, D₂₈, using an Automatic Blood Cell Counter and the variations of average values of hematological parameters were calculated, relative to the mean values of D₀ and D₂.

Statistical Analysis: Graph Pad Prism 5.0 software (Microsoft, USA) was used for the analysis of the results obtained. The mean value is accompanied by the Standard Error of Mean (mean ± SEM). It was taken to the ANOVA test to verify the normality of variables. The comparisons of mean values of the different parameters were performed. The significance level was set at p<0.05.

RESULTS: Ethanol, extract *C. fascicularis* of was prepared by continuous hot extraction method using soxhlet apparatus and the yield was 2.1% w/w. The color of the ethanol extract was dark green, Phytochemical screening test was performed

on CFE. CFE phytoconstituents present saponins, tannins, phenols, coumarins, alkaloids and anthraquinones plant constituents present.

Effect of Alcoholic Extracts of *C. fascicularis* Leaves on Body Weight: Table 1 shows the different body weights of the rats before induction of anemia (D₀), after induction of anemia with PHZ (D₂) and at 4th weeks of treatment. There was weight loss in rats of the five treated groups with phenylhydrazine at day D₂ (8.75%). A gradual increase in weight was observed after treatment in the following days.

TABLE 1: THE EFFECT OF *CORCHORUS FASCICULARIS* EXTRACT (CFE) ON BODY WEIGHT

Drug Treatment	Body Weight (gm)		
	Day2	Day14	Day28
Normal	238.33	240.66	242.33
Control	±0.99	±0.81	±1.25
Anaemic	235	227	218
Control	±0.25	±0.18	±0.76
STD (Vit.B ₁₂)	230	232	235
Syrup)	±0.98	±0.45	±0.23
CFE (100 mg/kg)	231	220	225
	±0.95	±0.53	±0.46
CFE (200 mg/kg)	231	234	241
	±1.40	±0.41	±0.58

Effect of Alcoholic Extracts of *C. fascicularis* Leaves on Haematological Parameters:

Red Blood Cells: After injection of phenylhydrazine to rats of the four groups, except, the normal group, there was a decrease in red blood cells (48.03%) at day D₂.

TABLE 2: THE EFFECT OF *CORCHORUS FASCICULARIS* EXTRACT (CFE) ON HEMOGLOBIN, RBC AND HTC IN PHENYLHYDRAZINE INDUCED ANEMIC RATS

Drug treatment	Haemoglobin (gm/dl)			RBCs (million cells/cu mm)			HCT (%)		
	DAY ₂	DAY ₁₄	DAY ₂₈	DAY ₂	DAY ₁₄	DAY ₂₈	DAY ₂	DAY ₁₄	DAY ₂₈
Group 1 (Normal)	17.18	18.25	18.38	4.58	4.62	4.72	42.55	43.29	43.68
	±1.22	±1.29	±1.40	±0.64	±0.69	±0.81	±0.97	±0.79	±0.98
Group 2 (Negative Control)	10.9	11.7	12.2	2.367	2.8	2.9	23.80	28.10	29.20
	±0.11 a**	±1.24	±1.42	±0.12a**	±0.54	±0.59	±0.86 a**	±0.92	±0.99
Group 3 (STD.)	40.68 ^c	35.89 ^c	33.62 ^c	48.47 ^c	39.39 ^c	38.55 ^c	44.06 ^c	35.53 ^c	33.15 ^c
	±0.13 a**	±0.18**	±0.24***	±0.48a**	±0.59**	±0.70***	±0.80a**	±0.89**	±0.97***
Group 4 (CFE 100 mg/kg)	11.6	13.6	14.57	2.2	3.1	3.9	23.30	32.40	36.86
	±0.16 a**	±0.20*	±0.25*	±0.42 a**	±0.48*	±0.50**	±0.77 a**	±0.87*	±0.95 **
Group 5 (CFE 200 mg/kg)	10.8	13.9	16.18	2.4	3.4	4.39	23.29	35.58	39.25
	±0.19 a**	±0.29*	±0.31***	±0.42 a**	±0.52*	±0.64***	±0.79 a**	±0.88*	±0.99***
	37.13 ^c	24.25 ^c	11.4 ^c	47.59 ^c	26.40 ^c	06.99 ^c	45.26 ^c	17.81 ^c	10.12 ^c

Values are in mean ± SEM. n = 6. Superscript a*, a**, a*** denote statically significant at p<0.05 and p<0.01 p<0.001 when compared to normal group. Superscript * and ** and *** donate statically significant at p<0.05 and p<0.01 p<0.001 when comparison to Negative Control group. Superscript c denoted percentage decrease compare with Normal Control group.

An increased number of red blood cells were observed after treatment in the 24 days. The result shows that the activity of rats of the groups G₃, G₄ and G₅ have almost completely inhibited at the 2nd week (82.57%, 74.70%, and 75.45% inhibition, respectively.) By the 4th week, (94.74% in rats of group G₃, 80.95% in rats of group G₄ and 89.61% in rats of group G₅. inhibition respectively) **Table 2**.

Hemoglobin: The administration of phenylhydrazine at day D₂ caused a significant decrease (p<0.01) in hemoglobin rate of rats of groups G₂, G₃, G₄, G₅ of 37.03%. After treatment, a progressive inhibition is obtained on the following days **Table 2**. The results show on one hand that, the rats those, received vitamin B₁₂ and those, which received an alcoholic extract of *C. fascicularis* have almost completely recovered at the 4th week (p<0.05).

Haematocrit: The administration of phenylhydrazine also decreased hematocrit at day D₂. This decrease is 45.23% at D₂. After treatment, the increased rate of hematocrit at day D₁₄ (2nd week) was 89.75% in untreated anemic rats, 89.87%, 74.87%, 83.39 respectively in the rats of groups G₃, G₄, G₅. By the 4th week (D₂₈), 80.76%, in rats of group G₃, 80.28% in rats of group G₄, and 78.98% in rats of group G₅ **Table 2**.

DISCUSSION: PHZ is a non-immunogenic drug that induces changes in the red cell membrane, which result in oxidative denaturation of Hb. The effect of the denaturation is the formation of an altered Hb called "Heinz bodies" which reduces the life span of the erythrocytes¹⁹. This is often characterized by a significant increase in the incidence of micronucleated polychromatic and hypochromic erythrocytes resulting in increased mean cell volume and decreased mean cell Hb concentration values^{20, 21}. Altered erythrocytes are removed by the spleen and liver of the reticuloendothelial system resulting in compensated hemolytic anemia. PHZ-induced anemia is a model for the study of hematinic effects.

In this study, a significant decrease in Hb, RBC count, and hematocrit was observed following PHZ injection to the experimental animals (p<0.05). The results of this study indicated that the whole

alcoholic extract of *Corchorus fascicularis* increased significantly the concentration of hemoglobin, red blood cell count, and the packed cell volume mainly one week after the treatment. The increase in the blood indices was progressive giving the highest effect on the second week of treatment. Under normal condition, the body can generate new RBCs to replace the lost red cells; this will take much longer time as shown in this study. The increases in the hematological indices exhibited by *Corchorus fascicularis* extract might be with the Vitamin and mineral contents of the leaves of *Corchorus fascicularis*. These constituents are well known hemopoietic factors that have a direct influence on the production of blood in the bone marrow.

CONCLUSION: Today, a wide range of people are found to be anemic, especially, females, and thus, they go for allopathic iron supplements, which comes up with a large number of adverse effects like constipation, irritation, stomach upset, pain, diarrhea, nausea, and vomiting. So, this plant extract may prove helpful in an anemic patient, as it contains inorganic substance like iron. In the pharmacological evaluation of selected plant, *i.e.*, *Corchorus fascicularis* for the anti-anemic activity by using Wistar rats, from the results, it is concluded that, as the concentrations of the alcoholic extract increases, the anti-anemic property of the plant also increases. And so, the alcoholic extracts in moderate concentrations are useful in the treatment of anemia.

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