

# FORMULATION AND EVALUATION OF HERBAL TABLETS CONTAINING *RUMEX ACETOSA* LINN EXTRACT

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## ABSTRACT:

Medicinal plants have curative properties due to the presence of various complex chemical substances of different compositions, which are found as secondary plant metabolites in one or more parts of these plants. *Rumex acetosa*, Convolvulaceae is an annual extensive perennial climber with large ovoid and tuberous roots herb indigenous to India and widely used in the treatments of inflammation & oxidative stress. There exist a large number of studies that support the illness effects of traditional herbal medicines. Plants have several health benefits because of the abundance of phytochemicals found in the plant, including phenylpropanoids, isoprenoids, alkaloids, and sulphated compounds. They possess biological qualities including anticancer, antifungal, anti-dysenteric, antioxidant, anti-inflammatory, antiulcer, antibacterial, anti-coagulant, and antihypertensive properties. This will also facilitate the development of new therapeutic methods and drug discovery. The present paper deals with the formulation and evaluation of anti-inflammatory & anti-oxidant activity of tablets prepared from the methanolic extract of the selected plant. A solid pharmaceutical dosage formulation using a novel dry plant extract using various excipients viz., lactose, Mannitol, Starch, Magnesium Stearate, and Talc by direct compression was reported to be statically significant as anti-inflammatory & anti-oxidant activity. The present communication also deals with the evaluation of formulated tablets (weight variation, friability, hardness, and disintegration time).

**KEYWORDS :** *Rumex acetosa* , Herbal Tablets , Antioxidant , Anti-inflammatory , herb

## 1. Introduction

Herbal Medicine is the oldest form of healthcare known to mankind. Herbs have been used by all cultures throughout history. It was an integral part of the development of modern civilization. Primitive man observed and appreciated the great diversity of plants available to him. The plants provided food, clothing, shelter, and medicine. Much of the medicinal use of plants seems to have been developed through observations of wild animals and by trial and error. As time went on, each tribe added the medicinal power of herbs in their area to its knowledge base. They methodically collected information on herbs and developed well-defined herbal pharmacopoeias. Indeed, well into the 20th century much of the pharmacopoeia of scientific medicine was derived from the herbal lore of native people. Many drugs commonly used today are of herbal origin. Indeed, about 25 percent of the prescription drugs dispensed in the United States contain at least one active ingredient derived from plant material. Some are made from plant extracts; others are synthesized to mimic a natural plant compound. Herbal medicinal products are defined as any medicinal product, exclusively containing one or more active substances. WHO reports 80% of the world's population relies on the drug of natural origin[1].

*Rumex* is a widespread plant genus in the Polygonaceae family. It is the second biggest genus in this family. Most of its species may be found in the United States, Asia, Africa, and Europe, particularly in the northern hemisphere. [2]. Sorrel, a leafy green that has been consumed for centuries, is known for its unique, tart flavor due to the presence of oxalic acid. It's a versatile ingredient used in a wide range of dishes, and herbal remedies, and even as a source for various dye colors. Its sharp, sour-lemony taste complements many ingredients well, including meats, cheeses, and dairy products. Due to its anti-inflammatory, antioxidant, diuretic, antibacterial, antihypertensive, analgesic, antiviral, and antifungal qualities, these compounds have been used in traditional medicine since ancient times. Numerous medical illnesses, including constipation, diarrhea, edema, diabetes, jaundice, infections, scurvy, and problems with the gall bladder and liver, have been treated with it. It has been suggested that the rhizomes and petals contain substances that might prevent the development of cancer.[3]. The Polygonaceae family of plants is recognized for their production of different secondary metabolites that are biologically important. These metabolites include anthraquinones, stilbenoids, glycosides, naphthalenes, leucoanthocyanidins, steroids, flavonoids, and phenolic acids.[4]. Various health conditions are treated using them in traditional medicine. Examples include infections, diarrhea, mild diabetes, edema, jaundice, and constipation as well as being used as a diuretic, antihypertensive, and analgesic. They are also used to address liver, skin, and gallbladder disorders, as well as inflammation. Researchers have shown interest in the *Rumex* genus because of its medicinal properties and phytoconstituents. The extracts and compounds obtained from these plants have displayed different pharmacological activities, which include antitumor, anti-inflammatory, antioxidant, antibacterial, antifungal, and antiviral properties, both *in vitro* and *in vivo*[4][5].

### 1.1 Taxonomy :

*R. acetosa* is a perennial herb that is dioecious and wind-pollinated and thrives in a broad range of environments. It has a slender fibre root that originates from a short woody stock stem that is subsimple and It can reach heights between 30-60 cm with deep grooves. The leaves range in length from 5 to 15 cm. The radical leaves are oblong-obtuse, cordate, hastate, or sagittate in base, and they have petioles. Sessile cauline plants. The bottom leaves have a thin petiole with ragged stipules. With six to eight flowering whorls and a constricted anicle, the racemes are loose. The branches lack leaves and are rigid and upright. The male's outer sepals are reflexed, and its edges are scarious. There are orbicular valves. It is a triangular achene fruit. The large, ovate, mature female perianth can be either pink or scarlet in color [6]. Plants known as docks or sorrel are currently categorized under the *Rumex* genus.

*R. acetosa*, in particular, is known by a variety of names. These include common sorrels, garden sorrels, sheep sorrels, red sorrels, sour weed, and field sorrels. The *Rumex* species have numerous common names, some of which can be confusing due to their overlap. In English, it's also referred to as garden sorrel, in Ayurveda, it's known as chuukaa, and locally it's called ambat chuka[7].

**Table no 1 . Taxonomical Classification[8]**

Kingdom	Plantae
Order	Caryophyllales
Family	Polygonaceae
Genus	Rumex
Species	<i>Rumex acetosa</i>
Binomial Name	<i>Rumex acetosa</i> Linn

### 1.2 Chemical composition:

A complex process of separation has been employed to obtain extremely potent compounds from both the above-ground and below-ground parts of the *R. acetosa* plant. This process has led to the discovery of 19 distinct substances, including naphthalenes, anthraquinones, and flavonoids. Among these, some noteworthy compounds are musizin, torachryson-glucoside, emodin, chrysophanol, quercetin, and quercetin-3,3-dimethyl ether. The isolated compounds have undergone testing for their antibacterial activity, and the naphthalenes have demonstrated significant effects against specific bacterial species.[9]. Additionally, after further examination of the methanolic extract of *R. acetosa*, several other important compounds have been identified, including tannin, saponin, alkaloids, polysaccharides, anthraquinones, soluble starch, and flavonoids. On the other hand, coumarin was not found in the extract. These findings offer valuable insights into the potential therapeutic applications of *R. acetosa*[10].

**Table 2 - Ethnomedicinal Importance of *Rumex acetosa*[10]**

Plant part	Medicinal use	Pharmacological activity	Phytochemical present
Whole plant	Gastrointestinal disorder, dermatological infections, cure for cutaneous diseases, jaundice, vomiting, liver problems.	Antimutagenicity or antigenotoxic activity, antiperiodontitis, anti-cancer, antipyretic, diuretic, mild purgative.	Polyphenols, dimeric and trimeric proanthocyanidins
Flower	Used to treat tumors and lumps.	Antiproliferation activity	Polyphenol
Leaf	Treatment of diarrhea, cramps, and constipation. Fever, worms, anorexia, blood purifier, used for tumor and lump treatment.	Bruises, warts, abscesses, wounds, itchy skin, jaundice, laxative	Polyphenol Tannins and phenolic acids
Stem	Treat stomach discomfort and distress. Treatment for constipation, diarrhea, and cramping		Tannins and phenolic acids
Root	Fever, tenesmus, gonorrhea, dysentery, ulcer, scabies, kidney diseases, skin itch, against gastritis and gastric ulcers	Antioxidant, hemostatic, astringent	Polyphenol Anthraquinones
Plant juice	Clearing acne, Lowering High Blood Pressure		

### 1.3 Uses:

Sorrel, scientifically known as *Rumex acetosa*, is a plant species that is widely popular in horticulture and cuisine circles due to its distinct sour taste, which comes from its high oxalic acid content. This sour-lemony flavor complements various ingredients such as meat, cheese, and milk, making it a versatile culinary ingredient. Young immature leaves and sprouts have a mild flavor that works well in salads and sandwiches, while mature leaves are generally cooked and used in soups, stews, or sauces. Apart from its culinary uses, many species of the genus *Rumex* possess biological activities. For centuries, the roots and other tissues of these plants have been used in folk remedies due to their anti-inflammatory, antiviral, diuretic, antioxidant, analgesic, antimicrobial,

antihypertensive, and anti-fungal properties. These properties have made them useful in treating health disorders such as constipation, diarrhea, diabetes, edema, infections, jaundice, and scurvy, as well as liver and gallbladder disorders[5][11][12][13][14]. According to research, the antioxidant capacity of sorrel is roughly equivalent to that of Japanese green tea[15]. The flowers and rhizomes of the plant are known to contain specific compounds that exhibit tumor-arresting properties. These compounds have been suggested to possess significant potential in the development of novel anti-cancer agents[13][16].

Historically, boiled sorrel water has been applied topically for the treatment of chickenpox, shingles, boils, poison ivy, blisters, acne, and other skin sores. Its analgesic and anti-inflammatory properties are thought to alleviate pain and itching and speed up the healing process. Additionally, drinking sorrel water infused with honey has been traditionally used to reduce fever and relieve sinus infections.[2][3]. Several *Rumex* species possess potent biological traits such as antioxidant, anti-cancer, antiviral, immune-stimulating, antiscorbutic, and antipyretic properties. The following characteristics have contributed to the widespread use of these natural remedies to cure a diverse range of medical conditions, such as urinary inflammation, chronic cutaneous ailments, skin burns, gallstones, hepatitis, jaundice, fever, and osteomyelitis, as well as their ability to function as anti-cancer, diuretic, and laxative agents.[10]. The plants belonging to the sorrel genus exhibit various medicinal properties such as anticancer, antidiarrheal, antioxidant, analgesic, anti-inflammatory, anthelmintic, and antibacterial effects. They can function as tonics, diuretics, or hypertensive agents. Sorrel is a potent remedy for several medical conditions, including scorpion stings and gastrointestinal distress. It is worth noting that sorrel and mallow, two members of the same family of plants, share several similar characteristics. A biologist named Avicenna, who is 35 years old, has been incorporating sorrel in his treatment regimen for irregular uterine bleeding.[17]. Interestingly, studies have suggested that sorrel might have beneficial effects in the treatment of cervical cancer.[10].

**Table 3 - Medicinal Applications for *Rumex acetosa***

Uses/effects	Plant part	Bioactive chemicals, possible pathways	References
Tumour growth arrest, apoptosis, and antimutagenic properties.	Aerial parts	Anthraquinones (esp. Emodin)	[18]
Positive nutrient and weight gain	Leaf	Amino acids, minerals	[19]
Antiproliferative (tumor growth inhibition)	Flowers	Phenolic compounds (flavan-3-ols)	[13]
Antibacterial, cytotoxic, antitumor	Leaf	Producing silver nanoparticles with leaf extract.	[20]
Antihypertension	Leaf	Vasodilator and NO and COX enzyme inhibitors	[21]
Antioxidant activity	Leaf	Not known	[15]
Antiviral (HSV-1 virus)	Aerial parts	Oligomeric proanthocyanidins, Flavan-3-ols	[14]
Anti-inflammatory (periodontitis)	Aerial parts	Galloylated proanthocyanidins	[22]
Gastritis, gastric ulcer	Leaf	Anthraquinones	[23]
Viral infections, acute viral rhinosinusitis	Whole plant	Not known	[24]
Emesis, gastrointestinal motility disorders	Green parts	Activation of muscarine receptors, Ca <sup>2+</sup> blockage	[7]
Astringent (diarrhea, skin irritations), infections	Aerial parts		[25]

## 2. MATERIALS AND METHODS:

The whole plant of *Rumex Acetosa* was collected from Gunjal Wadi, sangamner, Maharashtra, In January 2025. The plant was then authenticated by the head of the botanical department of Shramik College, Sangamner[26].

## 2.1 Extraction Process

The preliminary phytochemical screening of the plant involves extraction of the plant material and identification of the plant's active constituents.

## 2.2 Preparation of Extracts

### Method of Extraction

Continuous hot percolation process by using Soxhlet apparatus.

### Materials:

1. Soxhlet apparatus
2. methanol
3. Distilled water
4. Shade dried coarse powder of *Rumex Acetosa Linn.*

### Methanolic extract

The shade-dried coarsely powdered plants *Rumex Acetosa Linn.* (30gms) were extracted with methanol (60-65°C) until the extraction was completed. After completion of extraction, the solvent was removed by distillation. The yellowish-brown colored residue was obtained. The residue was then stored in a desiccator.[27].

## 2.3 Formulation Of Tablets

The plant extract was mixed with the excipients and compressed into tablets. The details of the composition are given in table no 1[28].

**Table 4:** Formulation of Tablets ( For each 500 mg tablet )[29]

Ingredients	Amount Taken	Uses
Plant extract	50 mg	API
Lactose	100 mg	Diluent
Mannitol	200 mg	Filler
Starch	100 mg	Binding Agent
Dextrose	20 mg	Sweetener
Magnesium Stearate	15 mg	Lubricant
Talc	15 mg	Anti Adherent

## 3. EVALUATION OF IN-VITRO ANTI-OXIDANT- -INFLAMMATORY ACTIVITY OF EXTRACT OF *RUMEX ACETOSA LINN*

### 3.1 In-Vitro Study

#### 3.1.1 Scavenging of 2,2-diphenyl-1-picrylhydrazyl radical (DPPH assay):

This is the simplest and most widely reported method for screening antioxidant activity in foods and many plant drugs. In this assay, the purple chromogen radical 2,2-diphenyl-1-picrylhydrazyl (DPPH) is reduced by antioxidant/reducing compounds to the corresponding pale yellow hydrazine. The procedure involves the measurement of a decrease in absorbance of DPPH at its absorption maxima of 518 nm, which is proportional to the concentration of free radical scavenger added to the DPPH reagent solution. The activity is expressed as inhibitory concentration IC<sub>50</sub>, that is the amount of antioxidants necessary to decrease by 50% the initial DPPH concentration. The lower IC<sub>50</sub>, the higher is the "antiradical efficiency"[30].

#### 3.1.2 Requirements :

- DPPH Solution
- Ethanol
- Distilled water
- Dried plant extract

### 3.1.3 Procedure :

Prepare the stock solution of DPPH in ethanol (2 gm of DPPH powder diluted with 20 ml ethanol). Then prepare the blank and test solutions. The Blank solution contains DPPH solution with water, and the test solution contains DPPH solution with plant extract. Incubated the both solution for 24 hrs at 37°C. Then the different concentrations of both solutions ( 10,20,30,40 and 50 µg/ml ) observed in the preparation under the UV spectrophotometry recorded the absorbance and calculated the % decrease.

**Table 5:** Preparation of stock solution of DPPH solution[31]

Tube	Ethanol	DPPH solution	Concentration (mg/ml)	Plant extract (mg)
1	10 ml	1mg	0.1 mg/ml	–
2	10 ml	1 mg	0.1 mg/ml	2 mg
3	10ml	2 mg	0.2 mg/ml	2 mg

### 3.2.1 bovine serum albumin denaturation ( Inhibition of protein)

The anti-inflammatory activity of leaf extracts *A. indica* and *L. inermis* was studied using inhibition of albumin denaturation which was studied according to Mizushima and Kobayashi and Sakat et al. followed with minor modifications[32].

**3.2.2 Requirements:** bovine serum albumin, plant extract, distilled water, diclofenac sodium, hydrochloric acid, phosphate buffer

### 3.2.3 Procedure

Test solution (0.5 ml) consists of 0.45 ml of bovine serum albumin (5% w/v aqueous solution) and 0.05 ml plant extract (separately) in the suitable solvents of different concentrations (50, 100, and 200 µg/ml). The test control solution (0.5 ml) consists of 0.45 ml of bovine serum albumin (5% w/v aqueous solution) and 0.05 ml of distilled water. The product control solution (0.5 ml) consists of 0.45 ml of distilled water and 0.05 ml of plant extract in suitable solvents of different concentrations (50, 100, and 200 µg/ml). The standard solution (0.5 ml) consists of 0.45 ml of bovine serum albumin (5% w/v aqueous solution) and 0.05 ml of different concentrations (50, 100, and 200 µg/ml) of diclofenac sodium. All the above solutions were adjusted to pH 6.3 using 1N hydrochloric acid. The samples were incubated at 37°C for 20 minutes, and the temperature was increased to keep the samples at 57°C for 3 minutes. After cooling, 2.5 ml of phosphate buffer was added to the above solutions. The absorbance was measured using an ultraviolet-visible spectrophotometer at 416 nm.

The percentage inhibition of protein denaturation was calculated as: Percentage inhibition = (Abs control – Abs sample) × 100/Abs control.[33]

**Table no 6.** Preparations of solutions

Tube	bovine serum albumin	plant extract	diclofenac sodium	distilled water
1	0.45 ml	0.05 ml	–	–
2	0.45 ml	–	–	0.05 ml
3	0.45 ml	–	0.05 ml	–

(-) = Absence

## 4. RESULTS AND DISCUSSION

Antioxidant anti-inflammatory plants an important role in inhibiting oxidative stress and inflammation thus providing protection to humans against viruses. Realizing the fact this research was carried out to evaluate the Antioxidant and Anti-Inflammatory activity of Methanolic extract tablets of *Rumex Acetosa Linn.*

### 4.1 Phytochemical Investigation

**Table 6:** Percentage yield of extraction of *Rumex Acetosa Linn.*

Plant used	Part used	Percentage yield	
		Methanol	Distilled Water
<i>Rumex Acetosa Linn</i>	Whole plant	6%	10%

**Table 7:** Preliminary Phytochemical screening of both extracts of tuberous roots of *Ipomoea digitata* Linn.

Name of extract	Methanol	Distilled water
Anthraquinone glycosides	+	+
Cardiac glycosides	+	+
Flavones	+	+
Alkaloids	+	+
Tannins	+	+
phenolic compounds	+	+
Fats	-	+
Proteins	-	+
Carbohydrates	-	+
Saponins	+	+

(+) = Presence ; (-) = Absence

Phytochemical analysis showed the existence of therapeutically active components. Extracts of *Rumex acetosa* tested positive for the presence of medicinal compounds such as phenolic compounds, tannins, saponins, alkaloids, flavones, and anthraquinones glycosides. However, the extracts did not contain any steroids and c-glycosides.

## 4.2 Preformulation studies

### 4.2.1 Evaluation of powder blend :

The granules obtained for the trial batches were satisfactory. No rat holing was observed during the flow of granules from the hopper. Capping and sticking were not observed. The results are provided in Table 8. From the compressibility index and Hausner's ratio values obtained for the granules of batches, the granules were found to have good flow properties.

### 4.2.2 Evaluation of Tablets :

The tablet parameters observed are given in Table 9. The tablets were compressed at the specified weight (500mg). The maximum weight variation of the tablets was  $\pm 2.9\%$ , which falls within the acceptable weight variation range of  $\pm 5\%$ , hence the tablets of all batches passed the weight variation test. Hardness for tablets of all batches was in the range of 3.0 kg/cm<sup>2</sup>, which falls above the limit of not less than 3.0 kg/cm<sup>2</sup>. The friability value for tablets of none of the batches was more than 3%. The thickness of the tablets of all the batches was found in the range of 4 – 4.5 mm indicating fairly acceptable tablets. Disintegration time is an important parameter of the tablet. An ideal tablet should disintegrate within 15 minutes. The tablets of all the batches disintegrated within 10 minutes 40 seconds.

**Table 8:** Evaluation of Powder Blend

Batch	Bulk density (gm/ml)	Tapped density (gm/ml)	Carr's index (%)	Hausner ratio	Angle of repose (°)
1	0.83	0.90	14.4	1.24	39.69
2	0.90	0.98	15	1.15	38.71
3	0.85	0.91	14.7	1.2	39.69
4	0.83	0.96	15.1	1.15	38.93

**Table 9:** Evaluation of Tablets

Batch	Hardness (kg/cm <sup>2</sup> )	Thickness (mm)	% weight variation	% friability	Disintegration time
1	3	4	2.9	3	8 min
2	3	4.5	2.5	2.6	9 min 10 sec
3	3	4	2.5	2.8	10 min
4	3	4	2.7	3	10 min 40 sec

### 4.3 Anti-oxidant & Anti-Inflammatory Activity

#### 4.3.1 In-Vitro Anti-Oxidant Studies :

The % decrease in DPPH of methanolic extract of *Rumex Acetosa* was studied. The extract, Phytochemical, inhibited the free radicals of DPPH. In the human body, free radicals are present, which causes inflammation or increases oxidative stress. Both the extracts show the inhibition of free radicals. From the observation, it was found that the methanolic extract of the dried plant of *Rumex Acetosa* has free radical inhibition activity. As compared to the standard drug, it has less activity, but compared to the water extract, it has more activity. The results are provided in Table 10

**Table no 10.** % decrease in protein denaturation

S.No.	Absorbance at 412 nm	% decrease in protein denaturation
Blank	1.78	-
Control	3.972	-
Sample	3.150	43.415%

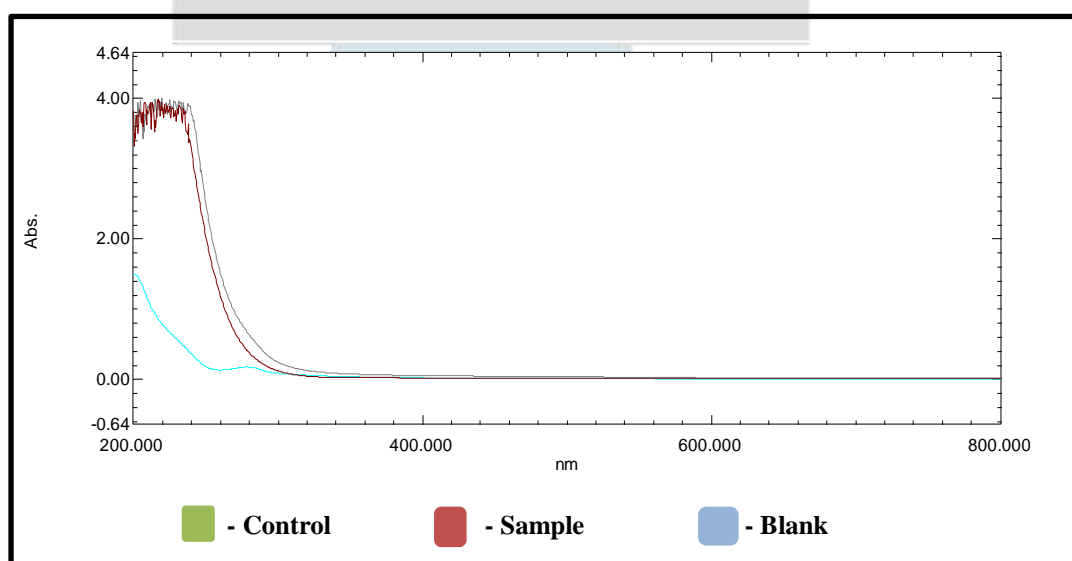
#### 4.3.2 In-Vitro Anti-Inflammatory Studies :

Inducing the unfolding and aggregation of BSA protein, in the protein denaturation method, the BSA protein reacted positively against the plant extract of leaves of *Rumex Acetosa* and was detected by measuring changes in its structure or function, often using techniques like UV spectrophotometry. From the observation, it was found that the methanolic extract of *Rumex Acetosa* has protein denaturation activity. The results are provided in Table 11

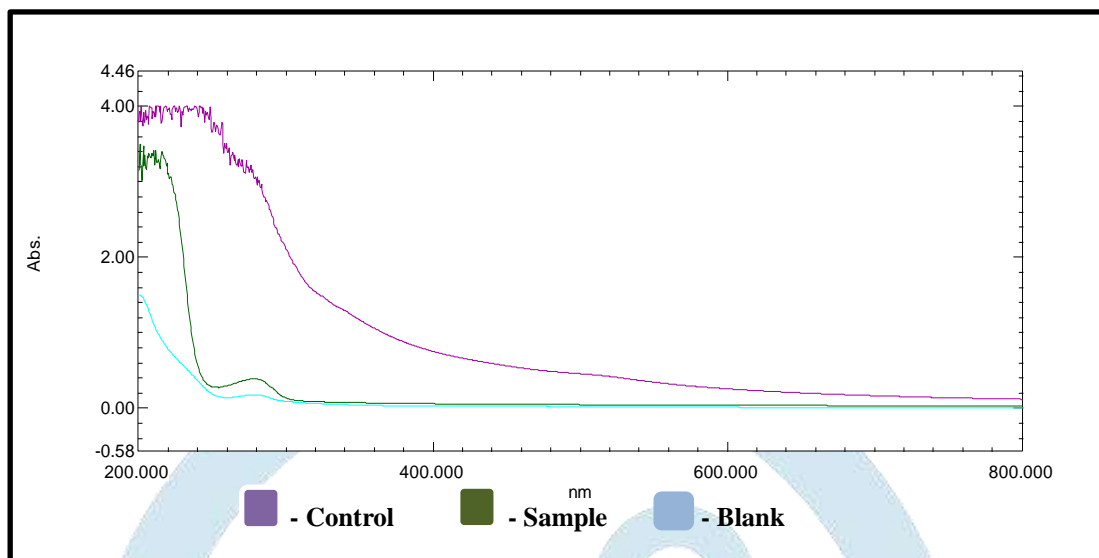
**Table No. 11.** % decrease in protein denaturation

Sr. No.	Absorbance at 206 nm	% decrease in protein denaturation
Blank	1.78	-
Control	3.96	-
Sample	3.56	7.72

#### UV Spectroscopy Analysis



**Figure 1:** UV spectrum of *Rumex Acetosa Linn* extract



**Figure 2:** UV spectrum of *Rumex Acetosa Linn* extract

## 5. SUMMARY AND CONCLUSION :

The study investigates the formulation and evaluation of herbal tablets containing methanolic extract of *Rumex acetosa*, a medicinal plant known for its therapeutic properties due to various phytochemicals. The research highlights *Rumex acetosa* (also known as sorrel), which is noted for its anti-inflammatory and antioxidant activities and its historical use in traditional medicine to treat a variety of ailments.

1. Herbal Properties:- *Rumex acetosa* is recognized for its curative effects linked to secondary metabolites such as flavonoids, alkaloids, and phenolic compounds. It has demonstrated biological activities, including anticancer, antibacterial, antioxidant, and anti-inflammatory properties.

2. Preparation of Tablets:- The formulation involves mixing plant extract with excipients like lactose, mannitol, and magnesium stearate, followed by direct compression to form tablets weighing 500 mg. The tablets were evaluated for weight variation, friability, hardness, and disintegration time.

3. Evaluation of Tablet Characteristics:- Results showed acceptable weight variation ( $\pm 2.9\%$ ), hardness above the minimum requirement ( $3.0 \text{ kg/cm}^2$ ), and disintegration time within an ideal range (less than 15 minutes).

4. Antioxidant Activity:- The DPPH assay indicated that the methanolic extract exhibited free radical scavenging activity, although it was less potent compared to a standard drug but more effective than the aqueous extract.

5. Anti-Inflammatory Activity:- The protein denaturation method demonstrated the extract's ability to inhibit bovine serum albumin (BSA) denaturation, indicating its anti-inflammatory effects. The extract showed a percentage decrease in protein denaturation, suggesting its potential effectiveness in reducing inflammation.

Conclusion: The study confirms the potential of *Rumex acetosa* extracts in herbal tablet formulation, highlighting significant antioxidant and anti-inflammatory activities. This lays the groundwork for further exploration into developing natural therapeutic agents based on traditional medicine practices.

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