<table>
<thead>
<tr>
<th>S. N.</th>
<th>Title</th>
<th>Authors</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Herbal Drug Comprehensive Approach for Treating Liver Disease and Focus towards Herbal Medicine</td>
<td>Kugaler Ganesan Parthiban, Balakrishnan Senthil Kumar, Rangasamy Manivannan, Natesan Senthil Kumar</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>Capparis Decidua Edgew- A Wild Medicinal Plant</td>
<td>Sandeep B.Patil, Nilofar S.Naikwade, Chandrakant S.Magdum, Appasaheb</td>
<td>16</td>
</tr>
<tr>
<td>3</td>
<td>Additional Trunk Training Improves Sitting Balance Following Acute Stroke: A Pilot Randomized Controlled Trial</td>
<td>Vijaya Kumar, Karthick Babu, Akshatha Nayak</td>
<td>26</td>
</tr>
<tr>
<td>4</td>
<td>Triazoles: A Versatile Therapeutic Agent</td>
<td>Khange S.G., Deshmukh V.K., Mohite P.B., Pandhare R.B., Appala Raju</td>
<td>44</td>
</tr>
</tbody>
</table>
HERBAL DRUG
COMPREHENSIVE APPROACH
FOR TREATING LIVER DISEASE
AND FOCUS TOWARDS HERBAL
MEDICINE
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ABSTRACT
A western allopathic medicine is excellent in handling acute medical crises. Herbal drug demonstrate an ability to manage chronic disorders of livers since from traditional people. That western medicine has been unable to. It may be projected as herbal drug comprehensive approach, emphasis on prevention and ability to manage chronic disorder that its widespread use would improve the health.

The spectacular rise of the pharmaceutical industry had tremendous impact on disease management. There is no doubt that in extreme situations, the treatments devised by conventional/modern medicine can offer an unparalleled opportunity to relieve symptoms and save lives. Today herbal medicines are coming back into prominence because of decreasing efficacy of the modern medicines such as antibiotics, which once had universal effectiveness against serious infections. Besides, many synthetic drugs are also causing serious side effects.

The knowledge of valuable herbal plant remedies have not been documented and were orally dissipated by the triable populations. But these tribal possessed remarkably accurate knowledge about the medicinal use of the herbal plants around them. Herbal medicines often complement the conventional modern treatments providing safe, well-tolerated remedies for many chronic diseases like liver disorder, rheumatoid arthritis, diabetes, cardiovascular and neurological disorders and asthma. With the tremendous increase in the global use of medicinal plants, several concerns regarding the efficacy and safety of the herbal medicines have also been raised. Hence it has become necessary to standardize the efficacy and safety
measures so as to ensure supply of medicinal plant materials with good quality.

Key Words: Herbal Medicine, Hepatitis, Cirrhosis.

INTRODUCTION
Herbal drugs have become increasingly popular and their use is widespread. Licensing regulations and pharmacovigilance regarding herbal products are still incomplete and clear-cut proof of their efficacy in liver diseases is sparse. Its main objective is to achieve optimal health and well-being through a comprehensive approach that addresses mind body, behavior and environment. Herbal drug emphasizes prevention and health promotion and provides treatment for liver disease it considers the development of consciousness to be essential for optimal health and meditation as the main technique for achieving this. A western allopathic medicine is excellent in handling acute medical crises. Herbal drug demonstrate an ability to manage chronic disorders of livers that western medicine has been unable to. It may be projected as herbal drug comprehensive approach, emphasis on prevention and ability to manage chronic disorder that its widespread use would improve the health status of the world’s population.

Ethanobotany is an ever-growing field and forms the manstay in establishing the therapeutic potential and medicinal use of herbs growing in the interior areas of India, where a tribal people use plants of that region as medicine has already diverted the attention of the people towards herbal medicines to increase the herbal acceptability and awareness among the people there is an urgent need to develop trust and faith towards the safer indigenous system by establishing its validity in treatment for various diseases. Government of India should encourage the field of herbal plant. This in turn will help in elevating and growing the economy of the country by increasing herbal trade with the major courage around the world. This will also improve the health and quality of life of the entire nation.

The twentieth century became a triumph for the synthetic chemistry dominated pharmaceutical industry, which replaced the natural extracts with synthetic molecules. The spectacular rise of the pharmaceutical industry had tremendous
impact on disease management. There is no doubt that in extreme situations, the treatments devised by conventional/modern medicine can offer an unparalleled opportunity to relieve symptoms and save lives. Today herbal medicines are coming back into prominence because of decreasing efficacy of the modern medicines such as antibiotics, which once had universal effectiveness against serious infections. Over the years infectious organisms have developed resistance to synthetic drugs. Besides, many synthetic drugs are also causing serious side effects\textsuperscript{4}.

The knowledge of valuable herbal plant remedies have not been documented and were orally dissipated by the triable populations. But these tribal possessed remarkably accurate knowledge about the medicinal use of the herbal plants around them.

**LIVER DISORDERS**

The liver is the master organ of the body, and most people consider the liver to be more important in the normal functioning of the body than even the brain and the heart. The liver is the largest glandular organ in the body and has more functions than any other human organ\textsuperscript{5-6}.

The Liver has a pivotal role in human metabolism.

- The liver produces and secretes bile that is used to break down and digest fatty acids.
- It also produces prothrombin and fibrinogen, both blood-clotting factors, and heparin, a mucopolysaccharide sulfuric acid ester that helps keeps blood from clotting within the circulatory system.
- The liver convert’s sugar into glycogen, synthesizes proteins and cholesterol and converts carbohydrates and proteins into fats.
- It also produces blood protein and hundreds of enzymes needed for digestion and other bodily functions.
- The liver also produces urea, while breaking down proteins, stores critical trace elements such as iron and copper, as well as vitamins A, D, and B12.

The maintenance of a healthy liver is vital to overall health and well being. Unfortunately, the liver is often abused by environmental toxins, poor eating habits, alcohol, and prescription and over the counter drug use, which can damage and weaken the liver and
eventually lead to hepatitis, cirrhosis and alcoholic liver dysfunction. Conventional medicine is now pursuing the use of natural products such as herbs to provide the support that the liver needs on a daily basis. Many ayurvedic herbs have a long history of traditional use in revitalizing the liver and treating liver dysfunction and disease. Problems associated with liver dysfunction can ultimately lead to serious illness such as hepatitis, jaundice, cirrhosis, fatty liver, alcoholic liver disease, and biliary cirrhosis. Symptoms and signs of liver disease include yellow discoloration of the skin and eyes, dark urine, gray, yellow or light colored stools, nausea, vomiting and/or loss of appetite, vomiting of blood, bloody or black stools, abdominal swelling, prolonged generalized itching, unusual change of weight, abdominal pain, sleep disturbances, mental confusion, and fatigue or loss of stamina.

**Hepatitis:**
Hepatitis refers to an inflammation the liver and is usually but not always the result of virus. Infect hepatitis can be caused by alcohol and chemical as well as auto immune hypersensitivity reaction. The most common hepatitis viruses affecting the liver are named for letters of the alphabet: hepatitis A, hepatitis B, hepatitis C, hepatitis D, and hepatitis E.

**Hepatitis A:**
It is transmitted through food. Once infected with HAV, some symptoms such as dark yellow urine and fatigue will begin to appear within 25 days.

**Hepatitis B:**
It is on the increase world-wide. It is transmitted through direct contact with blood, serum, saliva, faeces, urine, and sexual contact.

**Hepatitis C:**
It is transmitted through blood and body fluids in transfusions, injections, the sharing of IV needles with drug users, and possibly by sexual contact with exposed partners.

**Hepatitis D**
Only occurs in the presence of Hepatitis B virus.

**Hepatitis E**
It is another common type of hepatitis in developing countries. It occurs in epidemics. The infection route for it is faecal-oral, the same as the route for Hepatitis A virus.

**Jaundice:**
Jaundice is a general condition that results from abnormal metabolism or retention of bilirubin. It can occur when there is an obstruction in the bile duct, or if there is destruction of the red blood corpuscles. When a person has jaundice, their skin becomes yellow in color. This characteristic yellowness is seen even in the eyes and the fingernails. Stools and urine also get colored. The yellow color is an indication that the circulation of bile is in excess. Along with the yellowness of the skin, there are other symptoms associated with jaundice. Indigestion occurs and the person becomes very weak. Jaundice may also cause the body to itch.

The three principle types of jaundice are prehepatic, hepatic and post hepatic:

1. Prehepatic jaundice: This is the result of acute and chronic hemolytic anemia.
2. Hepatic jaundice: This includes disorders of bilirubin metabolism and transport defects. Levels of unconjugated bilirubin are elevated in this disorder.
3. Post hepatic jaundice: It is also known as cholestatic and obstructive jaundice. This is generally caused by biliary obstructive disease resulting from spasms of the biliary tract, ductal occlusions by stones or compression by neoplastic disease. The major increase is in the conjugated fractions.

Cirrhosis:
Cirrhosis of the liver is a chronic, diffuse degenerative liver disease in which the parenchyma (the functional organ tissue) degenerates, the lobules are infiltrated with fat and structurally altered, dense perilobular connective tissue forms, and areas of regeneration often develop. In most cases, though, there is a loss of liver cell function, and an increased resistance to blood flow through the damaged liver tissue (a condition known as portal hypertension) leading to oesophageal varices. Severe cirrhosis leads to ammonia toxicity, hepatic coma, gastrointestinal haemorrhage, and kidney failure.

Traditional Herbal Plant Treating Liver Disease
For treating liver complaints, an herbal decoction that consists of multiple herbs that may individually have a tremendous variety of properties is commonly used. The majority of herbs such as those...
listed below are reported to work on multiple biochemical pathways capable of influencing several organ systems simultaneously. The benefit of an herbal decoction is that one can nourish the body as a whole by supporting various organ systems, yet its main focus will be on support of the liver.\(^9,10,11,12\)

**Andographis Aerial Parts**
(Andographis paniculata):
Traditionally used for a variety of ailments including liver disorders and has also been shown to protect against toxin - induced hepatotoxicity. The diterpenes of andrographis were shown to increase glutathione (GSH), which may decrease susceptibility of the tissue to oxidative damage.

**Hellebore Root (Picrorhiza Kurroa):**
Used traditionally in Ayurveda for centuries as a general liver tonic and for liver cleansing, hepatitis, biliousness, fevers and poisoning. In a randomized, double-blind, placebo-controlled trial in patients with acute viral hepatitis, hellebore root(375 mg/3 times daily for 14 days) led to rapid fall in serum bilirubin levels toward normal range and quicker clinical recovery with no side effects. Current evidence also indicates hellebore root protects against alcohol-induced hepatotoxicity.

**Ginger Rhizome (Zingiberofficinale):**
Traditionally used to promote digestion. Ginger has been found to have a stimulatory effect on gastric secretions and has a metabolic circulatory enhancing effect which reinforces the therapeutic activity of other herbs.

**Embelia Fruit(Embeliaribes):**
Traditionally used for hepatic conditions and liver rejuvenation.

**Trailing Eclipta Leaf and Root (Ecliptaalba):**
Traditionally used as a cholangal (aids bile secretion) and deobstruent (removes functional obstructions in the body) in hepatic enlargement, for jaundice, and other ailments of the liver and gall bladder. Two coumestans, wedelolactone and demethyl-wedelolactone, were isolated as the main active principles present in trailing eclipta. Both constituents showed anti-hepatotoxic activity in assays using liver enzyme-induced cytotoxicity in cultured rat hepatocytes. These constituents also showed a significant stimulatory effect on liver cell regeneration.
Indian Gall Fruit (Terminalia chebula):
Traditionally used in chronic diarrhea and dysentery, flatulence, vomiting, colic, and enlarged spleen and liver. In a study conducted on rabbits, Indian gall fruit had a hypocholesterolemic effect on cholesterol-induced hypercholesterolemia.

Chicory Seed (Cichorium intybus)
Traditionally used for hepatic conditions and liver rejuvenation and has shown protective effects in mice with high levels of liver damaging enzymes. Chicory is one of the most useful herbs in treatment of liver problems. Almost all parts of the herb are important – flowers, seeds and roots. The juice of the chicory plant promotes the secretion of the bile. Hence it is used in different ways in treating liver problems such as biliary stasis, sluggishness of the liver, bile obstruction, jaundice and enlargement of the spleen.

Long Pepper Fruit (Piper longum):
Piperine, an active alkaloid constituent, has been shown to exert a significant protection against liver toxicity induced by tert-butyl hydro peroxide and carbon tetrachloride by reducing in both vitro and vivo lipid peroxidation by decreasing the reduction of GSH.

Arjuna Myrobalan Bark (Terminalia arjuna):
The powdered bark is traditionally used as a diuretic and general tonic in cases of cirrhosis of the liver.

Amla Fruit (Emblica officinalis):
Traditionally used for enlarged liver and for liver revitalizing.

Spreading Hog Weed Whole Plant (Boerhaavia diffusa):
Traditionally used for hepatic disorders and for internal inflammation.

Phylanthus Aerial Parts (Phyllanthus niruri):
The fresh root is traditionally given in jaundice.

Berberis (Berberis vulgaris):
Berberis is nicknamed as the jaundice berry for its beneficial effects on the treatment of jaundice. It is a bitter tonic which is made from the bark of the berberis tree. It is taken in amounts of quarter teaspoon when jaundice strikes.

Dandelion (Taraxacum officinale):
Dandelion stimulates the liver and the
gall bladder for the proper utilization of fats within the body. It also helps in the detoxification of the liver. Its juice is used in treatment of most liver problems. Even for people with hepatitis, dandelion tea is very beneficial.

**Gokulakanta (Hygrophila spinosa):**
This herb is used for treatment of several liver problems including jaundice, hepatitis and derangement of the liver. Its root is prescribed in such conditions. A specially prepared decoction of the root (60 grams root powder mixed in half a liter of water and boiled for about half an hour) is given in doses of 30 to 60 milliliters twice or thrice daily.

**Henna (Lawsonia inermis):**
The cooling effect of the henna is also beneficial in the treatment of liver problems. Its bark is effective in the treatment of liver problems such as jaundice and enlargement of the liver.

**Indian Aloe (Aloe barbadensis):**
The Indian aloe stimulates the liver into carrying out its functions normally. It is used in the treatment of jaundice and enlargement of the liver.

**Indian Sorrel (corniculata):**
Indian sorrel is used in the treatment of jaundice. It is taken in the form of fresh juice mixed with buttermilk made from cow’s milk. It is to be taken once daily during jaundice.

**Trailing Eclipta (Eclipta alba):**
The trailing eclipta has beneficial results in several liver problems. It can be used for the treatment of catarrhal jaundice and liver enlargement. A decoction of the juice of the herb is prescribed in doses of one teaspoon twice a day. To make the juice more effective, it can be added with essences of cardamom and cinnamon. The herb is also beneficial if there is mucus discharge accompanied with the catarrhal jaundice. In that case the juice of a few leaves is mixed with crushed peppercorns and taken with curds early in the morning for seven successive days.

**Turpeth (Operculina turpethum):**
Treatment of jaundice is usually started in Ayurveda with the medication of turpeth. It is given in the form of a powder in quantities of one to two teaspoons in hot water twice a day.

**Liquorice (Glycyrrhiza glabra):**
Liquorice root and root powder use for hepatitis, Demulcent, expectorant, antiulcer; tonic; antiviral,
antiinflammatory and show hepatoprotective activity from ancient time.

**Focus towards Herbal Medicine**

In the last few decades there has been an exponential growth in the field of herbal medicine. It is getting popularized in developing as well as in developed countries owing to its natural origin and lesser side effect. In olden times, vaidyas used to treat patients on individual basis, and prepare drug according to the requirement of the patient. But the scenario has changed now; herbal medicines are being manufactured on the large scale in Pharmaceutical units, where manufacturers come across many problems such as availability of good quality raw material, authentication of raw material, availability of standards, proper standardization methodology of single drugs and formulation, quality control parameters.

Ayurveda emphasis the relationship between man and plants throughout the development of human culture. The use of herbal medicine due to toxicity and side effects of allopathic medicines, has led to sudden increase in the number of herbal drug manufactures. Herbal medicines as the major remedy in traditional system of medicine have been used in medical practices since antiquity. The practices continue today because of its biomedical benefits as well as place in cultural beliefs in many parts of world and have made a great contribution towards maintaining human health.

Herbal medicines often complement the conventional modern treatments providing safe, well-tolerated remedies for many chronic diseases like liver disorder, rheumatoid arthritis, diabetes, obesity cardiovascular and neurological disorders and asthma. The ability of herbal medicines to affect the body systems depends on the chemical constituents they contains. Research into the isolated plant constituents is of great importance. Many of today’s medicines are either obtained directly from a natural source or were developed from a lead compound originally obtained from a natural source.

The use of traditional medicine has increased in developed countries also, mainly due to the failure of modern medicine to provide effective treatment for chronic diseases and emergence of
multi-drug resistant bacteria and parasites. The adverse effects of chemical drugs, questioning of the approaches and assumptions of allopathic medicine, their increasing costs and greater public access to information on traditional medicine has also led to an increase in interest in alternative treatments (WHO 2002). Plant extracts have become a source of hope as a wide group of medicinal plant preparations are available that have been used over the centuries almost exclusively on the basis of empirical evidence. Hence, it has become necessary to revisit the importance of these herbal medicines. Increasing interest by multinational pharmaceutical companies and domestic manufacturers of herbal-based medicines is contributing to a significant economic growth of the global medicinal plants sector. It is generally believed that standardization of the plant material is not required when used by the rural communities for their primary health care. But, regardless of whether the medicinal plant is to be used by local communities or by industry, a systematic approach is required for a plant identified from traditional medicine, as is done in modern medicine. It is necessary to focus on all aspects of medicinal plant research: from cultivation, ethno-pharmacology, utilization, isolation and identification of active constituents to efficacy evaluation, pharmacology, safety, standardization, formulation and clinical evaluation. Animal toxicity studies are required to establish the potential adverse effects. With the tremendous increase in the global use of medicinal plants, several concerns regarding the efficacy and safety of the herbal medicines have also been raised. Hence it has become necessary to standardize the efficacy and safety measures so as to ensure supply of medicinal plant materials with good quality.15.

For exploring traditional knowledge of herbal medicinal plant government of India should focus on3.

1. Government and non government organization through various media increase awarness and acceptability among the major population of the country.

2. Government should increase awarness about herbal medicine plant by various development programs.
3. In every state of India, there should be quality control laboratories and research center facilitate for carrying out chemical and biological testing of crude drug along with their finish product and arrange training program Farmers should in courage to participate in training programme.

4. The government organization and research should maintain complet documentation and record of such crude drug s, which will help in conserving and preserving indigenous knowledge of the medicinal flora of our country.

5. In educational institutions, awareness should increase among the students regarding significance of the medicinal plant in safe guarding restoring overall health of the people and nation and research benefit to nation.

6. Government of India encourages research in the field of medicenal and herbal drug development by appreciating appropriate fund so as to nature and foster countries economy at the international level.

CONCLUSION
The knowledge of valuable herbal plant remedies have not been documented and were orally dissipated by the triable populations. But these tribal possessed remarkably accurate knowledge about the medicinal use of the herbal plants around them government should take any action and documented. Herbal medicines often complement the conventional modern treatments providing safe, well-tolerated remedies for many chronic diseases like liver disorder, rheumatoid arthritis, diabetes, obesity cardiovascular and neurological disorders and asthma.

The use of traditional medicine has increased in developed countries also, mainly due to the failure of modern medicine to provide effective treatment for chronic diseases and emergence of multi-drug resistant bacteria and parasites.

Government should increase awareness about herbal medicine plant by various development programs and encourage about herbal drug treatment as it is
safety and effective and familiar with treatment treat.

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CAPPARIS DECIDUA EDGEW- A WILD MEDICINAL PLANT
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ABSTRACT:
Medicinal herbs are the local heritage with global importance. World is endowed with a rich wealth of medicinal herbs. The different variety of plants with therapeutic properties is quite astonishing. In general, natural drug substances offer four vital and appreciable roles in the modern system of medicine thereby adequately justifying their legitimate presence in the prevailing therapeutic arsenal, namely: Serve as extremely useful natural drugs, Provide basic compounds affording less toxic and more effective drug molecules, Exploration of biologically active prototypes towards newer and better synthetic drugs, Modification of inactive natural products by suitable biological/chemical means into potent drugs. Capparis decidua has widely medicinal uses like as analgesic, anthelmintic, laxative and cardiac troubles etc.

Key words: napti, Capparis decidua, phytochemistry, traditional and modern uses.

INTRODUCTION:
On a recent survey conducted by the world Health Organization (WHO) globally, around 20,000 medicinal plants are being used profusely either in pharmaceutical industry or in folk medicine. Interestingly, about 1.4% do possess well established, widely-proven and broadly accepted unequivocally active constituents\(^1\). The world health organization (WHO) estimates that about 80% of the populations living in the developing countries rely almost exclusively on traditional medicine for their primary health care needs. In almost all the traditional medicine the medicinal plant include the fresh or dried herb part, whole, chopped or powdered, or an advanced form of the herb usually made via extraction by a solvent such as water, ethanol or an organic solvent (eg. acetone), play a major role and
constitute the backbone of the traditional medicine\textsuperscript{2}.
A large genus of about 270 species of trees and erect, climbing shrub, distributed throughout warm regions of the earth. About 40 species occur in the India of which a few are of economic importance\textsuperscript{3,4}.

**Taxonomy:**
Current name: - Capparis decidua
Authority: - (Forssk) Edgew
Family: - Capparidaceae

**Synonyms:** (S)
Capparis aphyla (Heyne) Roth
Capparis sodada R.Br.
Sodada decidua Forssk.

**Other names:**

**Occurrence and Distribution:**
History of cultivation: -
Capparis decidua is one of the important multipurpose tree species of desert and arid regions of the Indian subcontinent. It provides vegetative cover in dry, hot, sandy desert areas where little else grows and is an extremely hardy species.

**Geographic distribution:**
Native: Chad, Egypt, Ethiopia, India, Iran, Jordan, Mauritania, Niger, Nigeria, Pakistan, Senegal, Somalia, South Africa, Sudan and In India from Punjab to South Karnataka, Gujarat, Maharashtra and Tinnervelly.

**Biophysical limits:**
Altitude range: 300-1200m, Mean annual rainfall: 100-750mm, Mean annual temperature: 25-31°C, Soils: it prefers alkaline, sandy and gravelly soils, thriving on shallow, hard soils and rocky outcrops.

**Reproductive biology:**
Flowering occurs at the beginning of dry season\textsuperscript{5}.

**Description:**
A climbing shrub with vine- like branches hanging in bundles. Bark: The bark is greenish- yellow and smooth. The thorns are paired, pale brown, straight or hooked and to 0.5 cm. Leaves: there are only leaves on young shoots that are small and narrow and soon fall off. Leaves only appear during short rain. Flowers: flowers are pink-red, single or in threes beside leaves and about 1cm across. Flowers appear at the
beginning of the dry season. Fruits: fruits are red and rounded, about 1cm across, black when ripe and dry. Seeds: seed numerous embedded in the pulp.\(^6\)

Androecium- stamens many, polyandrous, attached on a disc at the gynophore base, dithecous, dorsifixed, introrse. Gynoecium- bicarpellary, syncarpous, superior, unilocular, parietal placentation, develop on a long gynophore, style short, stigma bifid.\(^7\)

fruits eaten locally.\(^8\) Sodad (arab) fruits are consumed by the sudanes. Buds are cooked when fresh as pot herb. Young flower buds are preserved as pickles or condiment.\(^9\)

**Phytochemistry:**
Some species of Capparis appears have been investigated chemically and the isolation of Stachydrine, \(\beta\)-carotene, Rutin, Isothiocynate, Glucosides, Hydrocarbons and Fatty acids. The bark of Capparis decidua (Forssk) Edgew contains Capparisine, Codonocarpine, Cadabicine and Isocodonocarpine (a new spermidine alkaloid).\(^10\)

Two sterols (Capparisterol, Capparideciduasterol), one diterpene alcohol (Capparisditerpenol), two aliphatic constituents (Butyl-3-oxoeicosanoate, Aliphatic hydroxyl ketone) and one diterpinic ester (Capparisditerpenyl ester). All the new compounds have been reported for the first time from the alcoholic extract of C.decidua. Also \(\beta\)-sitosterol, indole bases, and oxygenated heterocyclic compounds have been reported from the root bark of the Capparis decidua.\(^11\)

Capparis decidua fruit is of high nutritional value. The edible fruits are rich in protein and minerals and have a high seed fat content. Seed contents 20% oil, 1.7% sugar and 8.6% protein.\(^12\)
Figure of chemical constituents:

1 : R=beta-OH, H
1a: R=beta-OAc, H
1b: R=O

Capparisterol

2 : R=alpha-OH, H
2a: R=alpha-OAc, H
2b: R=O

Capparideciduasterol

3

Capparisditerpenol
Butyl-3-oxoeicosanoate

Aliphatic Hydroxy Ketone

Capparis diterpenyl ester
Isocodonocarpine

Codonocarpine

Traditional Medicinal uses of this plant:
All parts of the plant like leaves, fruits and root bark are used to relieve a variety of ailments such as cough, asthma, intermittent fever and rheumatism. Traditionally in Ayurveda, this plant was mentioned as analgesic, diaphoretic.
(increase in sweating), laxative, anthelmintic, good in cough and asthma, ulcers and boils, vomiting, piles and all inflammation urinary troubles, antidote to poison, cardiac troubles, and infections of joints.

Traditionally in Unani, this plant has a bad smell and taste; carminative, tonic, emmenagogue, aphrodisiac, improves the appetite; good for rheumatism, lumbago, hiccough, cough and asthma.\textsuperscript{14}

Plant used in heart diseases, colicky pain and loss of appetite and scurvy. Root bark in powder form is used in rheumatism, gout, dropsy, palsy, and haemostatic. Externally the powder is applied to malignant ulcers. Juice of the fresh plant is dropped into ear to kill worms.\textsuperscript{15}

Young shoots used as plasters for boils and swellings. Powdered plant parts are useful in toothache. Bark is useful for cough and asthma. Root bark is given in intermittent fever.\textsuperscript{16}

\textbf{Modern uses of this plant:}

The plant has been reported as it is an unripe fruit of Capparis decidua is a xerophytic bush. It contains 15.1\% protein and 42.88\% fibre. Being a rich source of fibre, the process for preparation of fruit powder and other recipes were standardized for feeding hyperlipidemic subjects. The diet of 15 hyperlipidemic adults (40-60 yrs.) was supplemented with fruit for three months and plasma triglycerides, total lipids and phospholipids were analyzed before and at the end of the experiment. Significant reductions in plasma triglycerides, total lipids and phospholipids concentration were noticed.\textsuperscript{17} The fruit of Capparis decidua was found to be the richest source of beta carotene and vitamin C.\textsuperscript{18,19} Antidiabetic treatment with powered fruit of Capparis decidua decreased alloxan induced lipid peroxidation (LPO) significantly in erythrocytes, kidney and heart. Erythrocyte superoxide dismutase (SOD) activity decreased while the kidney and heart (SOD) increased in diabetic animals. These alterations in Superoxide dismutase were counteracted by insulin as well as with powdered fruit of C.decidua. Increased Catalase (CAT) activity in erythrocytes, liver, kidney and heart with powdered fruit of Capparis decidua treatment indicate that the treatment may neutralize H\textsubscript{2}O\textsubscript{2} toxicity by its increased decomposition by CAT.
Result shows that treatment with Capparis decidua lowers alloxan induced LPO and alters SOD and CAT enzymes to reduce oxidative stress\textsuperscript{20,21}. The Capparis decidua fruit contains dietary fiber foods like hemicellulose. Capparis decidua has the most pronounced hypocholesterolemic effect which appeared to operate through increased fecal excretion of cholesterol as well as bile acids\textsuperscript{22,23}. The ethanolic extract of root bark of Capparis decidua possesses significant anti-inflammatory activity against carrageenan induced edema in rats\textsuperscript{24}.

**CONCLUSION:**
Most people know the uses of medicinal plant over the years. The nature is true wealth of man and has many mysteries to its credit. For every problem of man and disease there is a cure in the beautiful and wonderful nature. With the passage of time, man is exploiting nature to the utmost.

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ADDITIONAL TRUNK TRAINING IMPROVES SITTING BALANCE FOLLOWING ACUTE STROKE: A PILOT RANDOMIZED CONTROLLED TRIAL

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Background: One of the primary goals of physical therapy during the early phases of stroke rehabilitation is to facilitate static and dynamic sitting balance. There is convincing evidence that trunk performance is an early predictor of functional outcome and also activities of daily living after stroke. Sitting balance and selective trunk movements are remain impaired after stroke. Hence selective trunk training early in the rehabilitation process may result better improvement in sitting balance and functional mobility.

Objective: To investigate whether provision of additional trunk training improves sitting balance following acute stroke.

Design: A pilot randomized controlled trial.

Setting: Department of Physiotherapy, Kasturba Medical College, Mangalore

Participants: Twenty subjects having first ever unilateral stroke and who can able to sit on a stable surface independently for 30 seconds were recruited for the study.

Intervention: Each participant was randomly allocated into a control (conventional physiotherapy) or experimental group (conventional therapy plus an additional session of trunk training). In addition to conventional physiotherapy subjects in the experimental group received a total 10 hours of individual and supervised trunk exercises for 45 minutes with adequate rest periods, 6 times a week, for 3 weeks.

Outcome measures: Trunk Impairment Scale (TIS) and Brunel Balance Assessment (BBA) were used on admission to the study and at 3 week
intervals following intervention by an blinded observer.

Results: Following three weeks of intervention subjects in both groups had higher scores in Trunk Impairment Scale and Brunel Balance Assessment. Compare to control group participants completing additional trunk training in the experimental group had statistically significant difference in TIS and BBA scores (p< 0.05).

Conclusions: This pilot study concludes that additional trunk training in acute phase of stroke rehabilitation improves sitting balance and mobility.

Introduction
Stroke is one of the most common neurological conditions that results in impairment of both sensory and motor processes of postural control systems. Postural control deficits are presented with more posture sway, asymmetric weight distribution, impaired weight – shifting ability and decreased stability capability which leads to diminished balance in stroke. Poor sitting ability is a common problem after stroke. Impairment of posture and balance in sitting affects the ability to perform the activities of daily living. Recovery of sitting ability is important because independent sitting is a prerequisite for most functional activities and a determinant of functional recovery following stroke. Stability and dynamic stability are two important aspects of the sitting position. Stability reduces the body’s motion or sway. In the sitting position, the body, without trunk support, is unstable and its configuration must be controlled through muscle activity. When weight is shifted in any plane, the trunk responds with a movement to counteract the change in the center of gravity (COG). Maintaining a stable seated position requires good trunk control and sitting balance. Trunk control is the ability of the body to maintain the trunk stable and to the basic movement patterns of the body and the extremities. Impairment of trunk control in hemiplegic or paretic patients has been documented and characterized by asymmetry in performance of rotatory and side bending activities. This loss of selective trunk activity could result from a reduction in the strength and amplitude of trunk movements, especially on the
paretic side. Several studies have identified deficits of trunk muscle strength and poor trunk control in unihemispheric stroke patients. 4-7 One of the primary goals of physical therapy during the early phases of rehabilitation is to facilitate static and dynamic sitting balance. Thus, accurate and reliable measures of sitting balance, along with appropriate treatment program to gain sitting ability should be implemented in early phase of rehabilitation. In a recent systematic review of clinical utility of measures of balance activity in people with neurological conditions has recommended that scales with hierarchical order of items with established lack of redundancy are advantageous and feasible to use in clinical practice. 8

Sitting balance and selective trunk movements are remain impaired after stroke. There is convincing evidence that trunk performance is an early predictor of functional outcome and also activities of daily living after stroke. Hence selective trunk training early in the rehabilitation process may result better improvement in sitting balance and in long-term functional mobility. Therefore, it was the aim of this study to investigate the effect of additional trunk exercises on sitting balance after stroke.

Material and method

Subjects:

Participants are stroke subjects who were admitted for a comprehensive rehabilitation program in Kasturba Medical College and Hospital, Mangalore. The clinical diagnose of Stroke was confirmed by the consultant appointed at the hospital on the basis of neurological examination and Computed Tomography or Magnetic Resonance Imaging. Subjects were included if they met the following criteria 1) first onset of unilateral supra-tentorial stroke (ischemic or hemorrhagic) who are stable and referred by physician for rehabilitation 2) post stroke duration less than 1 month duration 3) Mini Mental Status Scale score ≥24 4) subject can able to sit unsupported on a bed with their feet touching the ground for 30 seconds. Subjects were excluded from the study if they were 1)70 years of age or older 2) subjects who were not able to understand the instructions 3) subjects with non-stroke related sensory or motor
imperfections which affecting their motor performance.

**Design**

The design of this study was an assessor-blinded randomized controlled trial. After screening, eligible participants completed an initial assessment are then randomized into an experimental or control group by block randomization. 5 blocks made with 4 subjects in each block were made to ensure equal number of participants in both groups. A total of 10 subjects were allotted to both experimental and control group. To reduce bias, pre and post outcome measures were collected by the blinded assessor who was blinded to group allocation.

**Procedure**

Ethical committee clearance was obtained from the institution to conduct the study. A briefing regarding the purpose of study and the procedure were given to all the participants and a signed informed consent was taken from the interested participants. Over a 12-month period (January 2009 to December 2009), 53 patients were attending the stroke rehabilitation program and total of 26 subjects were interested and eligible for inclusion criteria, with 6 drop outs because of early discharge, recurrent stroke and musculoskeletal complaints, 10 subjects were assigned to control group (conventional rehabilitation program) and the experimental group (conventional rehabilitation program and 10 hours of additional trunk exercises over a period of 3 weeks). Variables collected to describe our sample were age, gender, time since stroke onset, type of stroke, paretic side, and the primary outcome measures Trunk Impairment scale (TIS) by Verheydan et al and Brunel Balance Assessment (BBA) was assessed by blinded assessor, a qualified physical therapist. At the end of 3 weeks of intervention period, the same blinded assessor reevaluated participant’s performance in BBA and TIS scores. All the participants were evaluated before discharge from the hospital and included in the analysis.

**Intervention**

During the study period participants in the experimental and control group received the conventional multidisciplinary stroke rehabilitation program. This program is patient-specific with main emphasis on the neurodevelopmental concept and on
motor relearning strategies. In addition to the conventional treatment, patients from the experimental group received 45 minutes of extra trunk training with adequate rest periods, 6 times a week, for 3 weeks. In total, 10 hours of additional training were given to the experimental group. This additional exercise consisted of selective movements of the upper and lower part of the trunk in supine and sitting.

The exercise protocol for trunk training on therapeutic mat as follows:

**Supine exercises**

1) Bridging: this is done with the legs bent and the feet resting on the mat, included selective anterior-posterior movements of the pelvis and extension of the hips. The weight bearing is at the shoulders and the feet.

2) Unilateral pelvic bridging: done with one foot resting on the mat and lifting the pelvis of the mat with the other leg raised in the air for about 60 degree of hip flexion and with knee in extension. Weight bearing is on the shoulder and on the foot of the leg which is placed on the mat.

3) Trunk rotations:

Upper trunk rotation: the subject is in crook lying and is asked to rotate the upper trunk with the two hands clasped together around his chest.

Lower trunk rotation: the subject is in crook lying and is asked to rotate his lower trunk by turning his knees to the either sides. And is progressed by asking the subject to flex his hips and knees and bring the knees to the opposite shoulder.

**Sitting exercises**

1) Static sitting balance: the subject is made to sit with his hips and knees in 90 degree flexion position, and then his body alignment is corrected by giving verbal feedback to maintain proper position.

2) Trunk flexion:

The subject flexes and extends the trunk without moving the trunk forwards or backwards (i.e slouch to straight)

Flexion and extension of the lumbar part of the spine: This involves selective anteflexion and retroflexion of the lower part of the trunk.

3) Trunk lateral flexion: lateral flexion of the trunk initiated from the shoulder and pelvic girdle (from the shoulder girdle means that the patient touches the exercise table with one elbow and returns
to the starting position, from the pelvic girdle means that the patient lifts one side of the pelvis and returns to the starting position).
4) Trunk rotations:
   Upper Trunk Rotation: the subject clasps his hands around his chest moves each shoulder forwards and backwards alternatively keeping his lower trunk stable.
   Lower Trunk Rotation: the subject while sitting in the upright position, maintaining his upper trunk erect moves each knee forwards and backwards alternatively.
5) Weight shifts: subject shifts the weight from one side to the other both in anteroposterior and mediolateral directions i.e moves forwards and backwards and side to side on the mat.
6) Forward reach: subject in sitting position attempts to reach destined object by forward flexing the trunk.
7) Lateral reach: subject attempts to reach a destined object by lateral flexing his trunk to both sides.
8) Perturbations: subject while in sitting position on mat, is given perturbations in all directions.

Exercises were gradually introduced and the progression of the exercise was determined based on patient’s performance and by increasing the repetitions and hold time of the exercises.

Outcome measurement

The primary outcome measures used in this study was Brunel Balance Assessment (BBA) and Trunk Impairment Scale (TIS). Both Scales are found to be good psychometric properties to measure balance in stroke.

The BBA consists of a hierarchical series of functional performance tests that range from supported sitting balance to advanced stepping tasks. There are three sections to the assessment: sitting, standing and stepping. Each section can be used either individually or together. The sections are divided into several levels each of which increase the demand on balance ability, ranging from assisted balance to moving within the base of support, and changes of the base of support. For each test there is a minimal level of performance required for the patient to ‘pass’ at that level. The score also reflects how well the individual is functioning within that section e.g. sitting, standing or stepping.
For TIS, a standardized sitting position is used throughout the assessment. Movements are performed in the sagittal, frontal and horizontal plane. Quality of movement is taken into account by observing whether or not the task is performed with compensations. The TIS assesses static sitting balance, dynamic sitting balance, and trunk coordination on a scale ranging from 0 to 23 points, a higher score indicating a better trunk performance. The subscale static sitting balance evaluates if a patient can maintain a sitting posture with both feet on the floor and with the legs crossed. Furthermore, the patient is asked to cross the nonaffected leg over the hemiplegic leg while keeping the trunk upright and stable. The dynamic sitting balance subscale evaluates lateral flexion initiated from the upper and lower part of the trunk. Adequate movement and possible compensations are scored on a dichotomous scale. Finally, trunk coordination is assessed by asking the patient to selectively rotate the upper and lower part of the body. Again adequate rotation and compensations are evaluated. The maximum score on the subscales of the TIS are 7, 10, and 6 points, respectively.

Data analysis
Data analysis was performed using SPSS for windows version 14.0 and the level of significance for all analyses was set at p <.05. Descriptive statistics were generated in order to obtain frequency tables for all independent variables. Mann-Whitney U Test was used to test difference between the scores of control group with that of the experimental group. Wilcoxon Signed Rank Sum test was used to test the within group difference in pre and post intervention scores.

Results
Of the 20 subjects included, 10 were randomly allocated to control group, and the remaining to experimental group. Table 1 indicates the group means and Standard Deviations (SDs) for age and duration of time post stroke and frequency counts for sex and hemiparetic side. There were no statistically significant differences between groups for age, stroke onset, sex, and hemiparetic side.
Table 1: Demographic Variables of the Participants

<table>
<thead>
<tr>
<th>Variables</th>
<th>Control (n=10)</th>
<th>Experimental (n=10)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yrs)</td>
<td>57.8± 13.49</td>
<td>59.5 ± 12.09</td>
<td>0.715(NS)</td>
</tr>
<tr>
<td>Post Stroke Duration in days</td>
<td>15.8± 10.69</td>
<td>15.0 ± 6.16</td>
<td>0.749(NS)</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male (n)</td>
<td>7</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>%</td>
<td>70</td>
<td>50</td>
<td>0.650(NS)</td>
</tr>
<tr>
<td>Female (n)</td>
<td>3</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>%</td>
<td>30</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Hemi-Paretic Side</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right (n)</td>
<td>6</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>%</td>
<td>60</td>
<td>30</td>
<td>0.178(NS)</td>
</tr>
<tr>
<td>Left (n)</td>
<td>4</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>%</td>
<td>40</td>
<td>70</td>
<td></td>
</tr>
</tbody>
</table>

*NS- Non Significant

Table 2 show pre and post results of outcome measures with mean and standard deviations of scores for control and experimental group. A highly significant difference in both the groups following intervention in all measures was observed as denoted by the p values <0.05 (Graphs 1-5).
Table 2: Pre and Post outcome measures in Control and Experimental Group

<table>
<thead>
<tr>
<th>Outcome Measures</th>
<th>Control Group</th>
<th>Experimental Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre</td>
<td>Post</td>
</tr>
<tr>
<td>TIS (range 0-23)</td>
<td>11.07±1.95.</td>
<td>14.20±1.5</td>
</tr>
<tr>
<td>Static Sitting (0-7)</td>
<td>40±.63</td>
<td>6.63±.31</td>
</tr>
<tr>
<td>Dynamic Sitting (0-10)</td>
<td>4.03±1.2</td>
<td>6.83±.88</td>
</tr>
<tr>
<td>Coordination (0-6)</td>
<td>1.47±.51</td>
<td>2.64±.61</td>
</tr>
<tr>
<td>Brunel Balance Assessment Score</td>
<td>3.40±.07</td>
<td>7.80±1.15</td>
</tr>
</tbody>
</table>

Values presented as mean±SD

*: Highly Significant
Graph 1- represents TIS Scores between Control and Experimental Group

Graph 2- represents Static Sitting Balance between Control and Experimental Group
Graph 3- represents Dynamic Sitting Balance Score between Control and Experimental Group

Graph 4- represents Coordination Scores between Control and Experimental Group
Graph 5- represent Brunel Balance Assessment Scores between Control and Experimental Group

Table 3 shows there was a statistical significant difference between groups in all the outcome measures (Graph 6). However there was no statistical difference in static sitting balance item of TIS between the groups.

Table 3: Mean Scores of TIS and BBA between Control and Experimental groups

<table>
<thead>
<tr>
<th>Outcome measure</th>
<th>Control</th>
<th>Experimental</th>
<th>p value(&lt;.05)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TIS score</td>
<td>3.13±1.24</td>
<td>6.96±1.28</td>
<td>&lt;.000(HS)</td>
</tr>
<tr>
<td>Static sitting balance</td>
<td>1.23±.67</td>
<td>1.27±.59</td>
<td>.612(NS)</td>
</tr>
<tr>
<td>Dynamic sitting balance</td>
<td>2.80±.98</td>
<td>4.07±1.22</td>
<td>&lt;.002(HS)</td>
</tr>
<tr>
<td>coordination</td>
<td>1.17±.51</td>
<td>2.23±.31</td>
<td>&lt;.001(HS)</td>
</tr>
<tr>
<td>Brunel Balance Assessment score</td>
<td>4.40±.82</td>
<td>7.20±.09</td>
<td>&lt;.000(HS)</td>
</tr>
</tbody>
</table>

Values presented as mean±SD

HS: Highly Significant   NS: Not Significant
Graph 6: Represent mean difference in outcome measures between groups

Discussion

It was the aim of the study to evaluate the effects of additional trunk exercises on sitting balance after stroke. Our results suggest that compared to the control group, additional trunk exercises in the experimental group aiming to improve sitting balance resulted in short-term improvement on Brunel Balance Assessment and also the dynamic sitting balance and coordination subscale of the Trunk Impairment Scale.

Experts in the field of neurological rehabilitation have addressed the trunk as the central key point of the body and proximal stability of trunk is a prerequisite for distal head and limb movement and therefore expected to be related to functional ADL. The purpose of this therapy program was to treat the trunk as functional and in line with the daily rehabilitation setting.

Both control and experimental group has shown improvement pre and post TIS and BBA scores following intervention. This improvement may be the selected
samples in this study are acute stroke subjects who were less than one month post stroke duration and this time course has striking potential for spontaneous motor recovery and functional performance. Thus effects may attributable to spontaneous recovery and conventional training.

Significant within group differences were found for the total trunk impairment scale indicating improvement in trunk performance as a whole. After 2 weeks of intervention the total TIS mean score changed from 11.47 to 18.43 in experimental group and from 11.07 to 14.20 in control group. That is an improvement of 69% in experimental group and 32% in control group. This shows that the experimental group almost has improved almost 2 times than that of the control group after intervention. Significant improvement of TIS scores in experimental group may be argued that the additional treatment was similar to some of the items measured in the TIS and therefore better results are no surprise. However, the TIS are a scale designed on the basis of stroke literature, existing scales, and opinion of experts in the field of neurological rehabilitation. Therefore, items of the TIS are indeed related to clinical practice. It is our opinion that this is one of the strengths of this study, which presents an interaction between a therapy approach and a scientific tool applicable in clinical practice.

Static sitting balance evaluates ability to sit upright in sitting position with normal base of support and when the base of support has been reduced. Results showed significant improvement in both groups following intervention. The mean score improved from 5.53 to 6.80 in experimental group while the control group improved from 5.40 to 6.63 following intervention. Experimental group and control group improved 12.7% and 12.3% respectively suggests no statistically significant improvement between them (p value .612). At the beginning of the study, the included patients could sit independently without support for 30 secs. This suggested that patients had already attained a sub maximal score in static sitting balance subscale of TIS. Since both the groups showed good static sitting balance at the time of inclusion, the scope of further improvement was not likely.
The dynamic sitting balance subscale evaluates selective lateral flexion of upper and lower part of the trunk. Stability during selective trunk movements, appropriate shortening and lengthening of the trunk, and eventual compensations are evaluated. The study showed better dynamic balance improvement in experimental group when compared to control group (p=0.002). Over a 2 week period, the mean scores of the dynamic sitting balance subscale in the experimental group improved from 4.23 to 8.30 while the control group from 4.03 to 6.83, indicating experimental and control group improved 41% and 28% respectively.

The co-ordination subscale evaluates the upper and lower trunk rotation separately and the symmetry in the rotations. Post intervention the mean scores of coordination in experimental group changed from 1.67 to 3.90 and 1.47 to 2.64 in control group. The percentage of improvement seen is 22% in experimental group and 11% in control group. The improvement in experimental group is twice that of control group after intervention.

A study by Verhedyan et al who has concluded that 10 hours of additional trunk exercises on ground level results change in dynamic sitting balance and not coordination subscale in TIS. A recent study on posturographic assessment of sitting balance recovery has shown that lateral balance control which depends on trunk muscles is most crucially affected than Anterior-Posterior direction in stroke and also suggested to improve lateral postural instability. This present study we found significant change in both dynamic sitting balance and coordination subscale of TIS in the experimental group. The change in coordination subscale may be additional trunk training programme in acute phase of rehabilitation may result in better recruitment of trunk muscles and also stress the anticipatory postural control system.

After 2 weeks of intervention the mean scores of BBA changed from 3.37 to 10.57 in experimental group and from 3.40 to 7.80 in control group. That is the improvement of 72% in experimental group and 44% in control group. The improvement in the control group may be that all participants were receiving...
standing up training as part of their multidisciplinary rehabilitation program. Significant improvement in experimental group compare to control may be the carry over of biomechanical similarities between reaching in sitting and the pre extension phase of standing up. During trunk training, subjects practiced moving their trunk forward rapidly over their centre of mass whilst loading their legs. Although these components were practiced with the intention of improving sitting ability, they are also critical biomechanical components of the early phase of sit-to-stand.12

Implications
Although several studies reported the importance of trunk performance after stroke as a predictor of functional outcome, evidence concerning the beneficial effect of trunk training after stroke is sparse. The results of the present study indicate that additional trunk exercises have a positive effect on sitting balance and trunk performance following acute stroke. Future work is needed with regard to functional implications of our results. This could be examined by means of functional scales or 3-dimensional measurements of functional movements such as forward reach, lateral reach, or turning.

Limitations
There are limitations that warrant caution when generalizing the results of our study. First, this study included only a small number of participants. Future studies with a larger number of participants are therefore needed to confirm our results. Furthermore, our study only analyzed the results between pretreatment and post treatment assessment. We did not perform a follow-up assessment. Future studies should evaluate long-term effects of additional exercises. Finally, our control group did not receive placebo therapy and therefore received less therapy in comparison to the experimental condition. However it is suggested that including a group of patients who receive 10 hours of additional but usual physiotherapy exercises as a control group would be favorable for a next study.

References
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TRIAZOLES: A VERSATILE THERAPEUTIC AGENT

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ABSTRACT

The five membered heterocyclic rings containing at least one nitrogen atom are Azoles, important like Isoxazole, Thiazole, Pyrazole, Triazole, and Tetrazole. 1,2,4-Trizoles, which contains three nitrogen in five membered heterocyclic ring are of importance possessing high medicinal value and reported various pharmacological activities such as anticancer, hypoglycaemic activity, antifungal, antimicrobial, antiinflammatory, anticonvulsant, antitubercular and antidepressant activity. The present attempt is to review the importance of medicinal aspects of 1, 2, 4-Triazole ring.
Keywords: Heterocyclic ring, Azoles, 1, 2, 4-Triazole, Pharmacological activity, antifungal.

INTRODUCTION

Azoles are five membered Heterocyclic compounds with two or more heteroatoms in which at least one is nitrogen. Azoles are found widely in natural sources and there are several drugs available which contain azole ring discussed in Table 1.

Introduktion

Azoles are five membered Heterocyclic compounds with two or more heteroatoms in which at least one is nitrogen. Azoles are found widely in natural sources and there are several drugs available which contain azole ring discussed in Table 1.

Here we will focus on 1,2,4-Triazoles, which are by far the best-known class of triazoles five membered heteroatoms with three nitrogen atoms in the ring and consist wide variety of medicinal activity. The action of azole on mycotic biochemistry and physiology has been studied extensively. At high concentrations (micromolar) the azoles are fugicidal and at low concentrations (nanomolar), they are fungistatic 1-3,6.


Constitution and chemistry of Triazoles:

Triazoles ring is basically of two types i.e. 1, 2, 3 and 1, 2, 4-Triazole. The derivatization of Triazole ring is based on the phenomenon of bioisosterism in which replacement of oxygen of oxadiazole nucleus with nitrogen atom yields triazole analogue. Out of the two triazoles 1,2,4- triazole have wide variety of activity4. 1,2,4-Triazole is one of a pair of isomeric chemical compounds with molecular formula C2H3N3 called triazoles, which have a five membered ring of two carbon atoms and three nitrogen atoms. 1,2,4-Triazole is a basic aromatic heterocycle. 1,2,4-Triazoles can be prepared using the Einhorn-Brunner reaction or the Pellizzari reaction5. 1, 2, 4-Triazoles are cyclic hydrazidines with
hydrogen atom (or substituent) on either hydrazide nitrogen or on amide nitrogen. Parent 1, 2, 4-triazole (1-H form) is in tautomeric equilibrium with 1, 3, 4-triazole (4H form). The interconversion of two tautomeric forms occurs rapidly and their separation is difficult.  

1, 2, 4-triazole tautomer is preferred over 1, 3, 4-triazole tautomer (less symmetrical 1H form is favoured over symmetrical 4H- form)  

1, 2, 4-Triazole  

1, 3, 4-Triazole  

1, 2, 4-Triazoles undergo nucleophilic substitution, if substituted with electron withdrawing substituents, the reactivity of 1,2,4-triazole ring towards nucleophile is enhanced in 1,2,4-triazolium cations and mesoionic 1,2,4-triazoles.

**Need for the study**

Various Triazole heterocyclic ring containing derivatives are known but its practical applications have been hitherto very little. The most of triazoles are easily prepared with good stability. But the starting materials are quite expensive or sensitive intermediates appear which depressed industrial synthesis and its wide applications. The Literature reviews suggests the synthesis of triazole derivatives and their remarkable antifungal, antibacterial, anticancer, anti-tubercular and antidepressant, hypoglycemic activities.
Medicinal utilities of Triazole derivatives promote to synthesize new potential triazole derivatives and evaluate its possible pharmacological activities like antifungal, antibacterial, anti-HIV, anticancer, antituberculine, antiviral etc.

**Importance of Triazoles in Phytochemicals:**

According to survey 1,2,4-Triazoles also show some activity like 1,2,4-Triazole shows fungicides activity against some fungus that are responsible for follicular disc are in “Vinca minor Z”. Thus it shows activity in plants also.

**Importance of Triazoles as Analytical Reagents:**

Substituted 1,2,4, triazoles find many useful applications. Some of them are used as analytical reagents for determination of boron\(^8\), antimony\(^9\) and cobalt\(^10\), other triazoles find many synthetic uses as halogenating agents\(^11\) or as activating polymeric reagents\(^12\). Now 1,2,4-triazoles derivatives are widely used as biocides and as antifungal agents\(^13\). Several 1,2,4-triazoles derivatives find applications as photographic reagents.

**Importance of Triazoles containing compounds:**

Literature survey of 1,2,4-Triazoles reveals different biological activity. Important activity of them is discussed here.

**A) Antimicrobial agents**

Schiff bases of Triazole(s) show antibacterial as well as antifungal activity\(^13\) like-5-phenyl, 4-(substituted)amino, 3-mercapto 1,2,4-triazoles show antimicrobial activity\(^14\). 4-Amino-5—Aryl-1, 2,4-triazole-3- thione and their derivatives show antimicrobial activity\(^15\).
B) Anti-inflammatory activity

Anti-inflammatory activity has been shown by [(4-Amino 5-Disubstituted-4-H-1, 2,4-triazole-3yl) thio] alkanoic acids.\(^{16}\)

4-Amino-3-Aryloxy alkyl, 5-Mercapto-1, 2,4-Triazoles also show this activity.\(^{17}\)

Here

\[ R_1 = H, \quad R_2 = H, \text{CH}_3, \text{Cl} \]
\[ R_3 = H, \text{CH}_3 \quad R_4 = H, \text{Cl} \]

Some new 3-substituted-4-Amino-5-mercapto- (4H)-1,2,4-Triazoles.\(^{18}\)

1-acyl triazoles also act as anti-inflammatory agents.\(^{19}\)

Some 5- Aryl-2-H-tetrazole, 2-aryl-2H-tetrazole-2 acetic acids and [(4-phenyl-5-aryl-4H-1,2,4triazole-3yl) thio] acetic acid as possible super oxide scavengers and anti-inflammatory agents.\(^{20,21}\)
C) Hypoglycaemic agents:

Substituted-1, 2,4-Triazoles also show hypoglycemic activity like 5-(substituted aryl), 4-(alkyl, 3-mercapto) 1,2,4-Triazole show hypoglycemic agents\(^{22}\).

D) Antidepressant agents

Some substituted triazoles also acts as antidepressant like 2,4-Dihydro-3H-1, 2,4-triazole-3-thiones potential antidepressant agents\(^ {23}\).

\[
\begin{align*}
\text{Ar} &= \text{C}_6\text{H}_5 \quad R_1 = R_2 = \text{CH}_3 \\
\text{Ar} &= \text{C}_6\text{H}_5 \quad R_1 = R_2 = \text{CH}_3
\end{align*}
\]

E) Antifungal activity

Substituted 1,2,4-Triazoles also show good antifungal activity like. Some 5-substituted, 4-(substituted aryl), 3-mercapto 1,2,4-triazole show antifungal activity\(^ {24}\). Similarly 5(p-Sec.-amyl benzene) methoxy-, 3-mercapto 1,2,4-Triazole show good antifungal activity\(^ {25}\).

\[
\begin{align*}
\text{Ar} &= \text{C}_6\text{H}_5 \quad R_1 = R_2 = \text{CH}_3
\end{align*}
\]
1,2,4-triazole and 3-(4′-nitrophenyl)-4-(4″-methyl benzenesulphonamido)-5-substituted phenyl)-4H-1,2,4-triazole have been synthesized and shown significant antifungal activity against C. albicans and C. krusei²⁶.

Various novel Mannich bases derived from 3-(4,6-disubstituted -2-thiomethyl)3-amino-5-mercapto-1,2,4-triazoles showed good antifungal activity²⁷.

F) Anti Tubercular agents

Substituted 1,2,4-triazoles also show anti tubercular activities like-α-[5-(2-furyl)-1,2,4-triazoles-3yl thio] acehydrazide and related compounds show anti-tubercular activities²⁸.

G) Anti Convulsant agents

Some substituted triazoles also found as possible anticonvulsants like, new-substituted Mercapto-triazoles and thiazolidiones and their MAO Inhibitory
and anticonvulsants. Also some 2,4-Dihydro-3H-1,2,4-triazoles-3-ones as anticonvulsant agents.

Some new unsymmetrical 3, 5-Diaryl-4H-1, 2, 4-triazole derivatives and were tested for anticancer activity, compound chosen for its higher anticancer activity in the preliminary tests with the cancer cell lines, exhibited remarkable anticancer potential.

**H) Anti tumor agents**

Some 1,2,4-triazole derivatives as potential anti-tumor agents.

**Marketed Formulations Which Contain 1,2,4-Triazole Ring**

**i. Terconozole, U.S.P.**

It is a triazole derivative that is used exclusively for the control of valvo-vaginal moniliasis caused by candida albicans and other candida species.
ii. Itraconazole, U.S.P.

Itraconazole is an orally active, broad-spectrum antifungal agent that has become an important alternative to ketoconazole. The primary indications for itraconazole are for the treatment of systemic fungal infection including blastomycosis, histoplasmosis (including patients infected with HIV virus) and sporotrichosis\(^2\).

iii. Fluconazole, USP

It is a water-soluble bis-triazole with broad-spectrum antifungal properties that is suitable for both oral and intravenous administration as the free base\(^{30,2}\).
iv. Trazodone

It is a triazolopyridine antidepressant, which selectively inhibits central serotonin uptake\(^2\).

v. Triazolam

It is used as sedative and hypnotic\(^{31,2}\).

vi. Bittertanol

It is used as broad-spectrum fungicide\(^{32,2}\).

**CONCLUSION**

So, from above study it is predictable that 1,2,4-triazoles is an important pharmacophore and have a wide range of therapeutic properties. It plays vital role as medicinal agents due to different biological activities. At present several-marketed preparation of triazoles are available like Flutrox, Zocon, Fluzone, Trazadone, Trazonil, Trazalon
etc. Thus we can conclude that 1,2,4-triazole is an important emerging moiety in pharmaceutical study and a lot of work can be carried out by integrating 1, 2, 4-triazole moiety with other heterocyclic ring systems like oxadiazole, imidazole, azatidinone, thiazolidone etc. to obtain better pharmacological activity.

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REFERENCES


Table 1: Name of drugs having azole ring

<table>
<thead>
<tr>
<th>Azole</th>
<th>Drugs</th>
<th>Category</th>
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<tr>
<td>Isoxazole</td>
<td>Cycloserine</td>
<td>Antibacterial</td>
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<tr>
<td></td>
<td>Sulfisoaxazole</td>
<td>Antimicrobial</td>
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<tr>
<td>Thiazole</td>
<td>Thiabendazole</td>
<td>Anthelmintic</td>
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<td></td>
<td>Thiamizs</td>
<td>Vitamin B&lt;sub&gt;1&lt;/sub&gt;</td>
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<td>Clotrimazole</td>
<td>Antifungal</td>
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<td>Cholinarsia</td>
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