

A Comprehensive Review on *Cynodon dactylon* in Management of Diabetes & Cardiovascular Diseases

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Submitted: 10-07-2022

Accepted: 21-07-2022

ABSTRACT:

Cynodon dactylon (L.) Pers. (family- Poaceae), is a long-lived herb found in various regions of India and this is a perennial grass. In Ayurveda *Cynodon dactylon* belongs to the 'Dasapushpam' group. *Cynodon dactylon* is a native grass of Africa and this is the most important southern grass. In Indian language it has different name such as Durva (Marathi), Durba (Bengali), Garichgaddi (Telugu), Dhro (Gujarati), Arukampillu (Tamil) etc. *Cynodon dactylon* contained flavonoids, alkaloids, glycosides, terpenoids, saponins, resins, tannins, reducing sugar, phytosterols, proteins, carbohydrates, volatile oil and fixed oils.

KEYWORDS: *Cynodon dactylon*, Ayurveda, Poaceae, chemical constituents, Diabetes, Cardiovascular diseases.

I. INTRODUCTION

The mother earth is invested with a rich wealth of medicinal plants [1]. *Cynodon dactylon* may be applied both externally as well as internally due to its various medicinal value [2]. Durba contains the whole dried plant of *Cynodon dactylon* (L.) Pers, (Family: Poaceae), an elegant perennial, creeping grass, tenacious growing available in the country [3]. Different parts of the plant are used to get different phytochemical components such as leaves, roots, stems, fruits, seeds and plants [4]. Medicinal plant extracts are used to treat various health problems such as various disease. bacterial infections. [5-8]. As a

medicinal plants more than 3500 plant species are being used in traditional and racial medical way round the world. The plant is such as mineral constituents, β -sitosterol, carbohydrates, proteins, glycosides and triterpenoids [1]. *Cynodon dactylon* has great medicinal value and can be applied both externally and internally [9]. The Plant Obtain antiviral and antimicrobial activity [10]. The plant is a person provide for snake bites, gout and rheumatic affection [11]. It also possesses anthelmintic activity [12] and anti-inflammatory activity [13]. This Plant root is used in Secondary syphilis and irritation of urinary organs [14]. The Plant is sweet, haemostatic, cooling, constipating, vulnerary, diuretic and tonic is helpful in condition of Kaph and pitta, burning sensation, hyperdipsia, haematuria, leprosy, bronchitis, piles, asthma, enlargement of the spleen, tumors, dysentery, diarrhoea, conjunctivitis, vomiting etc.[15] In Homeopathic medicine it is used to treat bleeding and skin troubles [16,17]. All over the world between 45° south and North area *Cynodon dactylon* is put in warm climates. It is attainable omni the year [18,19]. it is grew totally the topics and subtopics. Completely herb and its root stalk is used in medicine [20].

II. PLANT PROFILE

Taxonomical classification of *Cynodon dactylon*
Kingdom-Plantae
Division-Magnoliophyta
Class-Liliopsida

Order-Cyperales
Taxonomical classification of Cynodon dactylon
Kingdom-Plantae
Division-Magneliophyta
Class-Liliopsida
Order-Cyperales
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Order-Cyperales
The Systemic classification of Cynodon dactylon
[21-23]

Domain	Eukaryota
Kingdom	Plantae
Sub Kingdom	Trcheobionta
Division	Magneliophyta
Super division	Spermatophyte
Class	Liliopsida
Subclass	Commelinidae
Order	Cyperales
Family	Poaceae
Genus	Cynodon N
Species	Cynodon dactylon
Botanical name	Cynodon dactylon

Table I: Systemic classification of Cynodon dactylon



III. COMMON NAMES

The Plant is recognized by way of exclusive synonyms in the one-of-a-kind area by the local human mentioned in Table-II [24-26]

Sl. No.	Language	Synonyms
1.	Tamil	Aruvaumpullu
2.	Hindi	Doob
3.	Kanada	Garikehullu
4.	Marathi	Dhoorva
5.	Telugu	GarikeandThellagariki
6.	English	Bermuda and Bahama.
7.	Sanskrit	Durva
8.	Other	Weed
9.	German	Bermundagrass, Hundezahngras
10.	Italian	Gramina
11.	Portuguese	Capim-Bermuda
12.	Spanish	Garmarastera
13.	Swedish	Hundtandsgras
14.	Chinese	Gou ya gen
15.	Afrikaans	Gewonekweek, Kweekgrss
16.	Arabic	Thaiel, Najeel, Tohma
17.	French	Chieendent pied-de-poule

Table II: Common name of Cynodon dactylon

IV. PLANT DESCRIPTION [22, 25, 27]:

Plant Parts	Description	Image
Root	<p>Cynodon dactylon is a creeping, stoloniferous, prostrate, perennial herb with rhizomes-rooting every nodes. Mature roots show piliferous layer (hair-bearing) which is made up of a single layer of thin walls, radially extending into the cube cell. The hypodermis is thin-walled consisting of 1 or 2 layers of tangentially lengthy cells. Cortex is separated into two zones (i) thin walled, lignified, polygonal and sclerenchymatous zone and (ii) parenchymatous zone containing 4to 6 layered elongated cells. Vascular bundles consist of xylem and phloem arranged in a ring shape.</p>	
Stem	<p>The stem is oval in shape with a slight depression on oneside. It shows single layer in a presence of cells arrangement. Hypodermis I composite of 1or 2layers of sclerenchymtous cells. Cortex made of 3 to 5 layers of round to oval thin walled parenchymatous cells. The stem is creeping, slightly flattened, 1to 30 cm long. And stem colour is purple. It has a sweet mucilaginous taste.</p>	



<p>Leaf</p>	<p>Cynodon dactylon's the leaf blades are gray-green, 2-15cm long and 4mm broad. Leaf lamina is characterized by outer wall of the epidermis, almost square to oval. On dorsal side the bulliform cells present which are grouped together and the veins lie at the bottom of a precise groove. These are extends deep nto the mesophyll which re thin walled and lack chlorophyll. Cynodondactylon'sleafs are flat to slightly keeled, tip sharp and glabrous. And the round shape of leaf sheath.</p>	
<p>Flower</p>	<p>These are flower spikelets with a perfect floret; lanceolate, glumes 2 mm long, acute at the apex, 3-nerved, anthers 1.3mm long, yellow; styles purple; The seeds are oval and about 1.5mmlong yellow to reddish.</p>	

Table III: Plant Parts of Cynodon dactylon

V. ACTIVE PHYTOCHEMICALS OF CYNODON DACTYLON

A Cynodon dactylon reported lots of active Phytochemicals found from different parts of the plant like Proteins, minerals, carbohydrates, vitamin C, terpenoids, alkaloids and palmitic acid [28]. Flavonoids: apigenin, orientin, letuolin, and vitexin [29,30]. Extractive Value (water: 18.88, petroleum ether: 3%, alcohol;8% and benzene: 1.34 % w/w of crude drug). Volatile Oil: 1% [31], fiber content: 30.46% and tannin content: 0.80%. Total Ash: 9.1%, water insoluble ash: 7.9%, acid insoluble ash: 3.7% [32, 33] Green grass (dry 10.47% crude protein,11.755 total ash, 28.17% fiber [34]. Leaves glycerin (38.49%), 9, 12-octadecadienoyl chloride, (Z,Z)- (15.61%), ethyl ester (9.50), hexadecanoic acid, phytol (4.89%) and ethyl (5.32%) [35]. Phenolic extracts: furfural

(6.0%), hydro quinone (69.49%) and levoglucosenone (2.72%) [36]. Carotenoids: neoxanthin, beta-carotene, Phenolics [37]. Phytosterols, saponins, glycosides [38,39]. Essential oil triticin12.4% [40], Cuticular wax contains octacosanol, docosanol, hexacosanol, tetracosanol, docosanoic acid & eicosanic acid [41,42].

VI. PHARMACOLOGICAL ACTIVITY OF CYNODON DACTYLON

Cynodon dactylon shows great pharmacological activity and it is being used from ancient times. Traditionally the extract from whole plant is beneficial for different types of pharmacological activities listed below

Sl. No.	Pharmacological activity	References
1	Antidiabetic	43-47
2	Antioxidant	48,49
3	Antidiarrheal	50
4	Immunomodulatory	51,52
5	Antiulcer	53
6	Antiarrhythmic	54,55
7	CNS depressant:	56
8	Hepatoprotective	57
9	Cardioprotective	58,59
10	Effect on nephrolithiasis	60
11	Anticonvulsant activity	61,62
12	Anticancer activity	63
13	Diuretic activity	64,65
14	Anti-inflammatory	66
15	Anti-inflammatory	67
16	Antimicrobial	68
17	Antibacterial	69
18	Antipyretic, analgesic	70
19	Anthelmintic	71
20	Anticataleptic	72

Table IV: Pharmacological Activity of Cynodon dactylon

VII. ANTI-DIABETIC ACTIVITY

Hypoglycemic and hypolipidemic effects was significantly observed in the aqueous extract of Cynodon dactylon. Aqueous extract of C. dactylon decrease Total Cholesterol Level (TCL), Low Density Lipoprotein (LDL) and triglyceride level (TGL) in severely diabetic rats up to 35, 77 and 29% respectively and increase high density lipoprotein level (HDL) up to 18%.⁴³Very remarkable antidiabetic potential was shown by C. dactylon at doses of 250, 500 and 750 mg/kg body weight when administered orally to normal as well as streptozotocin-induced diabetic rats. The most significant result was shown at dose of 500 mg/kg body weight lowered the blood glucose level normal by 42.12% and of diabetic by 43.42% during fasting blood glucose and glucose tolerance test respectively [44]. Aqueous and non-polysaccharide fraction of C. dactylon shows antihyperglycemic activity significantly. hypoglycemia produced in fasted normal rats due to non-polysaccharide fraction [45]. Ethanollic and aqueous extract of C. dactylon significantly increase in the liver glycogen and decrease the fasting blood glucose and glycosylated hemoglobin levels [46]. C. dactylon leaves extract able to reduce oxidative stress in diabetic rats as well as hyperglycemia and hyperlipidemia risk [47].

VIII. ANTIARRHYTHMIC ACTIVITY

C. dactylon extract shows significant result against ischemia/reperfusion induced arrhythmias in isolated rat heart. C. dactylon extract reduce the number, duration and incidences of ventricular tachycardia during ischemia at 25 and 50 $\mu\text{g mL}^{-1}$ and also decrease ventricular tachycardia from 100% to 13% and 33% at reperfusion phase [54].

The ethanollic extract of C. dactylon was showed significant antiarthritic activity at all the dose levels (100, 200 and 400 mg/kg when administered orally and no mortality was found up to dose 5000 mg/kg body weight but at a dose 400 mg/kg shows more effective result and improve haematological level and CRP and also reduce TNF alpha level [55].

IX. CARDIOPROTECTIVE ACTIVITY

Hydro alcoholic extract of Cynodon dactylon rhizomes shows very less signs of fatigue, peripheral cyanosis and dyspnea and the survival rate was near about 90% in hydroalcoholic extract treated groups. Result concluded that the hydro alcoholic extract of Cynodon dactylon rhizomes have a strong protective effect on right heart failure [58].

X. DIURETIC ACTIVITY

C. dactylon extract shows significant Diuretic activity when administered orally in different concentration like 0.125, 0.250, and 0.500 g/kg of body weight to hydrated male Wistar rats and 0.500 g/kg dose shows more significant result [64].

root stalk of C. Dactylon was extracted by aqueous extract method and administered orally at different dosage like 100, 250, 500 and 750 mg/kg

body weight shows significant diuretic activity with increased sodium, potassium, and chloride ions from body [65].

Different types of pharmacological activities are performed by using the Cynodon dactylon extract collected from whole plant or different parts of the plant by using different kinds of solvents and different types of extraction methods are mentioned below.

Plant Parts	Solvents	Pharmacological Activity	References
Whole plant	Aqueous	Antipyretic and analgesic	70
		Anthelmintic	71
		Anticataleptic	72
		Anti-inflammatory	68
	Aqueous and non polysaccharide fraction	Anti-diabetic	45
	Chloroform-methanolic	Anti-inflammatory	73
	Ethanollic	Anticonvulsant	62
	50% ethanollic	Anti-inflammatory	67
Aerial parts	Aqueous and ethanollic	Wound healing	74
		Anti-diabetic	43,44,46
	50% aqueous-ethanollic	Reduce kidney stone	75
	Ethanollic	Gastoprotective	50
		Central Nervous system	56
	Ethyl acetate fraction	Antioxidant	49
Hydroalcoholic	Antioxidant	76	
Rhizome	Aqueous	Anti-diuretic	65
	Hydroalcoholic	Anti-arrhythmic	54
		Cardio-protective	58
Leaves	Aqueous	Antimicrobial	68
		Anti-diabetic	47
	Aqueous and ethanollic	Antiepileptic	77
	Ethyl acetate fraction	Antioxidant	49
		Immunomodulatory	78
Phospate buffered saline	Antilipidperoxidative	79	
Roots	Methanollic	Anticancer	63

Table V: Pharmacological properties of Cynodon dactylon used different solvent extraction method [80]

XI. CONCLUSION

Cynodon dactylon is extremely useful in ayurvedic, unani and siddha medicine. It has significant role in wide variety of disease and disorder. It is found all over the year and very easily. Different types of therapeutic action shows the medicinal value of Cynodon dactylon. Cynodon dactylon have significant role in management of diabetics and cardiovascular disease. Different types of phytochemical like proteins, minerals, carbohydrates, vitamin C, terpenoids, alkaloids and palmitic acid, Flavonoids: apigenin, orientin, letuolin, and vitexin found from different parts of the plant. The most significant result was shown at dose of 500 mg/kg body weight lowered the blood glucose level in diabetes when administered orally. In arrhythmia 400 mg/kg shows more effective result and improve haematological level and CRP and also reduce TNF alpha level. Hydro alcoholic extract of Cynodon dactylon rhizomes shows 90% survival rate and 0.500 g/kg dose shows more significant diuretic activity on hydrated male Wistar rats. The review shows Cynodon dactylon is very important medicinal herbs, easily available cheap and very negligible and abundant in respect of pharmaceutical field.

Conflict of Interest: Nil

REFERENCES

- [1]. Nagori BP, Renu S; Cynodon dactylon (L.) Pers.; a Valuable Medicinal Plant; Research Journal of Medicinal Plant; 2011; 5(5): 508-514;
- [2]. Shendye NV, Gurav SS; Cynodon dactylon: A Systemic Review of Pharmacognosy, Phytochemistry and Pharmacology; Int J Pharm Pharm Sci; 2014; 6(8): 7-12.
- [3]. Animesh DK, Rita P, Aninda M; An updated overview on Cynodon dactylon (L.) Pers.; Int J Res Ayurveda Pharm; 2012; 3(1): 11-14.
- [4]. Rai PK, Rai NK, Rai AK, Watal G; Role of LIBS in elemental analysis of Psidium guajava responsible for glycemic potential; Inst Sci Tech; 2007; 35: 507-522.
- [5]. Solanki R; Some medicinal plants with antibacterial activity; Int J Comp Pharm; 2010; 1(4): 1-4.
- [6]. Shah BN, Seth AK, Maheshwari KM; A review on medicinal plants as sources of anti-inflammatory agents; Res J Med Plant; 2011; 5(2): 101-115.
- [7]. Patwardhan S, Bodas KS, Gundewar S; Coping with arthritis using safer herbal options; Int J Pharm Pharmol Sci; 2010; 2(1): 1-11.
- [8]. Wandre RA, Bhagwat GB, Solunke RS, Yadav MB, Shaikh AM; A review on medicinal plants with antiulcer activity; J Pharmacog Phytochem; 2013; 2(1): 235-240.
- [9]. Ninad SV, Shailendra GS; Cynodon dactylon: A systemic review of pharmacognosy, phytochemistry and pharmacology; 2014; 6(8); 7-12.
- [10]. Dhar ML, Dhwan JT, Melhorta M; Screening of Indian Plants For Biological activity; Ind J exp Biol; 1968; 6(4): 232-247.
- [11]. Chopra RN, Nayer SL, Chopra IC; CSIR, New Delhi: Publication and Information Directorate; J Glossary of Indian Medicinal plants; 1999-88.
- [12]. Dilipkumar P, Koushik P; Evaluation of anthelmintic activities of aerial parts of Cynodon dactylon Pers.; J ancient sci life; 2010; 30(1): 12-3.
- [13]. Garg VK, Pailwal SK; Anti-inflammatory activity of aqueous extract of Cynodon dactylon; Int J pharmacol; 2011; 7(3): 370-375.
- [14]. Auddy B, Ferreira M, Blasina F, Lafon L, Arredondo F, Dajas F; Screening of antioxidant activity of three Indian medicinal plants, traditionally used for the management of neurodegenerative diseases; J Ethnopharmacol; 2003; 84(2-3): 131-8.
- [15]. Vijayalakshmi K, Jananie RK, Priya V; Determination of bioactive components of Cynodon dactylon by GC-MS analysis; N Y Sci J; 2011; 4: 16-20.
- [16]. Ghosh N.C. Comparative Materia Medica. Hannemann Pub., Co. Pvt. Ltd.; 1998; pp: 855.
- [17]. Oudhia P, Joshi BS, Kosta VK; The possibilities of preparing homeopathic drugs from the obnoxious weeds of Chhattisgarh; Bhartiya Krishi Anusandhan Patrika; 1998; 13: 53- 57.
- [18]. Kaup SR, Nayantara AK, Bernhardt LK, Vasavi RG, Shetty SS, Pai SR; Arun KB; Antihyperlipidemic activity of Cynodon dactylon extract in high-cholesterol diet fed Wistar rats; J Genom Med Biom Health Sci; 2011; 3(3-4): 98-102.
- [19]. Chandra MD, Shama S, Satish C; Overview of Cynodon dactylon in modern medicine as

- antidiabetic herb; Journal of drug delivery & Therapeutics; 2013, 3(6), 117-120.
- [20]. Kritikar, KR, Basu BD; 1980; Indian medicinal Plants, 2nd Edn.; International book distributors, Dehradun; pp. 2650.
- [21]. Kumar A, Sawarkar HA, Deshmukh VS, Mishra KK, Singh M, Verma T and Kashyap P; Cynodon dactylon (L.) Pers: Pharmacological actions and medicinal applications; International Journal of Herbal Drug Research; 2011; 1(1): 1-7.
- [22]. Shendye NV, Shailendra S; Cynodon dactylon: A systemic review of pharmacognosy, phytochemistry and pharmacology; International Journal of Pharmacy and Pharmaceutical Sciences; 2014, 6(8); 7-12.
- [23]. Chandra MD, Shama S, Satish C; Overview of Cynodon dactylon in modern medicine as antidiabetic herb; Journal of drug delivery & Therapeutics; 2013; 3(6): 117-120.
- [24]. Asthana A, Anil K, Sumit G, Jyotsna D; Pharmacological perspectives of Cynodon dactylon; Res J Pharma Biol Chem Sci; 2012; 3(2): 1135-1147.
- [25]. Chandra MD, Chandra SS; Overview of Cynodon dactylon in modern medicine as antidiabetic herb; Journal of drug delivery & Therapeutics; 2013; 3(6): 117-120.
- [26]. Singh SK, Rai PK, Mehta S, Gupta RK, Watal G; Curative effect of Cynodon dactylon against STZ induced hepatic injury in diabetic rats; Ind J Clin Biochem; 2009; 24(4): 410-413.
- [27]. Wallis TE; Text book of Pharmacognosy; Plant profile for Cynodon dactylon (Bermudagrass) USDA Plants. html; 5th ed.; Vol.-II; pp. 243-244.
- [28]. Solanki R, Nagori BP; Physicochemical and phytochemical investigation of whole plant of Cynodon dactylon; Int J Comp Pharm; 2012; 3(10) :1-4.
- [29]. Nair GA; Flavonoids of Cynodon dactylon; J Med Ethnobot Res; 1995; 16(3-4): 153-157.
- [30]. Avvarai SK, Kattamanchi G, Doni K, Anugu MR, Raju C; Anti-diabetic activity of ethanolic extract of Cynodon dactylon root stalks in streptozotocin induced diabetic rats; Int J Adv Pharm Res; 2011; 2(8) :418-422.
- [31]. Chapman GW, Burdick D, Higman HC, Robertson JA; Steam volatiles from coastal Bermuda grass; J Sci Food Agric; 1978; 29(4): 312-316.
- [32]. Singh V; Anatomical and phytochemical study on Durva (Cynodon dactylon Linn, Pers)-An ayurvedic drug; International Ayurvedic Medical Journal; 2013; 1(5): 1-7.
- [33]. Snafi-Al Dr Ali Esmail; Chemical constituents and pharmacological effects of Cynodon dactylon-A Review; IOSR Journal Of Pharmacy; 2016; 6(7): 17-31.
- [34]. Paranjpe P Durva; Indian Medicinal Plants: Forgotten Healers; 1st Edn., Chaukhamba Sanskrit Pratishtan, Delhi; 2001; pp. 75-76.
- [35]. Jananie RK, Priya V, Vijayalakshmi K; Determination of Bioactive Components of Cynodon dactylon by GC-MS Analysis; New York Sci J; 2011; 4(4): 16-20.
- [36]. Mohamed SM, Gayathri K, Venkatalakshmi R, Sasikala C; Chemical Constituents of hydro alcoholic extract and Phenolic fraction of Cynodon dactylon; Int J Chem Tech Res; 2010; 2(1): 149-154.
- [37]. Chou CH, Young CC; Phytotoxic substances in twelve subtropical grasses; J Chem. Ecol; 1975; 1(2): 183-193.
- [38]. Avvarai SK, Kattamanchi G, Doni K, Anugu MR, Raju C; Anti-diabetic activity of ethanolic extract of Cynodon dactylon root stalks in streptozotocin induced diabetic rats. Int J Adv Pharm Res; 2011; 2(8): 418-422.
- [39]. Chandel E, Kumar B; Antimicrobial activity and phytochemical analysis of Cynodon dactylon: A review; World Journal of Pharmacy and Pharmaceutical Sciences; 2015; 4(11): 515-530.
- [40]. Chandra MD, Shama S, Satish C; Overview of cynodon dactylon in modern medicine as antidiabetic herb; Journal of drug delivery & Therapeutics; 2013; 3(6); 117-120.
- [41]. Trease and Evans; Textbook of Pharmacognosy; Elsevier; 15th ed.; pp. 204-205, 479.
- [42]. The wealth of India 2nd supplement series; Raw materials; CSIR, Vol. 1; page no. 331-332.
- [43]. Singh, SK, Kesari AN, Gupta RK, Jaiswal D, Watal G; Assessment of antidiabetic potential of Cynodon dactylon extract in streptozotocin diabetic rats; J Ethnopharmacol, 2007; 114: 174-179

- [44]. Singh SK, Rai PK, Jaiswal D, Watal G; Evidence-based critical evaluation of glycemetic potential of *Cynodon dactylon*; Evidence-Based Complementary Alter Med; 2008; 5(4): 415-420.
- [45]. Jarald, EE, Joshi SB, Jain DC; Antidiabetic activity of aqueous extract and non polysaccharide fraction of *Cynodon dactylon* Pers; Indian J Exp Bio; 2008; 46(9): 660-667.
- [46]. Mahesh N, Brahatheeswaran D; Anti-hyperglycemic activities of aqueous and ethanolic extracts *Cynodon dactylon* (Linn) streptozotocin-induced diabetic rats; Asian J Biochem; 2007; 2(1): 66-72.
- [47]. Karthik S, Ravikumar A; Study on the protective effect of *Cynodon dactylon* leaves extract in diabetic rats; Biomedical and Environmental Science; 2011; 24(2): 190-199.
- [48]. Santhi R, Kalaiselvi K, Annapoorani S; Antioxidant efficacy of *Cynodon dactylon* leaf protein against ELA implanted swiss albino mice; J Pharm Res; 2010; 3: 228-230.
- [49]. Saradha DKM, Annapoorani S, Ashokkumar K; Hepatic antioxidative potential of ethyl acetate fraction of *Cynodon dactylon* in Balb/c mice; J Med Plant Res; 2011; 5(6): 992-996.
- [50]. Babu, DSR, Neeharika V, Pallavi V, Reddy MB; Antidiarrheal activity of *Cynodon dactylon* pers; Pharmacog Magazine; 2009; 5(19): 23-27.
- [51]. Santhi R, Annapoorani S; Efficacy of *Cynodon dactylon* for immunomodulatory activity; Drug Invention Today; 2010; 2(2): 112-114.
- [52]. Mangathayaru K, Umadevi M, Reddy CU; Evaluation of the immunomodulatory and DNA protective activities of the shoots of *Cynodon dactylon*; J Ethnopharmacol; 2009; 123(1): 181-184.
- [53]. Patil MB, Jalalpure SS, Prakash NS, Kokate CK; Antiulcer properties of alcoholic extract of *Cynodon dactylon* in rats; Acta Hort; 2005; 680: 115-118.
- [54]. Najafi, M, Nazemiyeh H, Ghavimi H, Gharakhani A, Garjani A; Effects of hydroalcoholic extract of *Cynodon dactylon* (L.) pers. on ischemia/reperfusion-induced arrhythmias; DARU; 2008; 16(4): 233-238.
- [55]. Jitendra B, Sanjeev RA; Antiarthritic activity of *Cynodon dactylon* (L.) Pers; Indian journal of experimental biology; 2014; 52(3): 215-222.
- [56]. Pal DK., Mandal M., Senthilkuma GP., Padhiary A; Evaluation of CNS activities of aerial parts of *Cynodon dactylon* Pers. in mice; Acta Pol Pharmaceutica; 2008; 65(1): 37-43.
- [57]. Surendra V, Prakash T, Sharma UR, Goli D, Fadadu SD, Kotresha D; Hepatoprotective activity of aerial parts of *Cynodon dactylon* against CCl₄-induced in Rats; Pharmacog Magazine; 2008; 4(16); 195-201.
- [58]. Garjani A, Afrozziyan A, Nazemiyeh H, Najafi M, Kharazmkia A, Maleki-Dizaji N; Protective effects of hydroalcoholic extract from rhizomes of *Cynodon dactylon* (L.) Pers. on compensated right heart failure in rats; BMC Complementary & Alternative Medicine; 2009; 9: 1-9.
- [59]. Shabi MM, David RC, Sasikala C, Gayathri K, Joseph J; Negative inotropic and chronotropic effects of phenolic fraction from *Cynodon dactylon* (L.) on isolated perfused frog heart; J Sci Res; 2012; 4(3): 657-663.
- [60]. Surendra V, Prakash T, Sharma UR, Goli D, Dayalal S, Kotresha F. Hepatoprotective activity of aerial plants of *C. dactylon* against CCl₄-induced hepatotoxicity in rats. J Pharmacogn Mag 2008;4:195-201
- [61]. Mousa-Al-Reza H, Rad AK, Rajaei Z, Sadeghian MH, Hashemi N, Keshavarzi Z; Preventive effect of *Cynodon dactylon* against ethylene glycol-induced nephrolithiasis in male rats; Avicenna J Phytomed; 2011; 1: 14-23.
- [62]. Pal DK; Determination of brain biogenic amines in *Cynodon dactylon* L. (Pers) and *Cyperus rotundus* L. treated mice; Int J Pharm Pharm Sci; 2009; 1(1): 190-197.
- [63]. Garg VK, Paliwal SK; Anticonvulsant activity of ethanolic extract of *Cynodon dactylon*; Der Pharmacia Sinica; 2011; 2(2): 86-90.
- [64]. Albert-baskar A, Ignacimuthu S; Chemoprotective activity of *C. dactylon* L. (Pers) extract against DMH induced colon carcinogenesis in experimental animals; Exp Toxicol Pathol; 2010; 62(4): 423-431.
- [65]. Sadki C, Atmani F; Acute diuretic activity of aqueous *Erica multiflora* flowers and *Cynodon dactylon* rhizomes extracts in

- rats; *J Ethnopharmacol*; 2010; 128(2): 352-356.
- [66]. Shivalinge GKP, Satish S, Mahesh CM, Vijay K; Study on the diuretic activity of *Cynodon dactylon* root stalk extract in Albino rats; *Res J Pharm Tech*; 2009; 2(2): 338-340.
- [67]. Garg VK, Paliwal SK; Anti-inflammatory activity of aqueous extract of *Cynodon dactylon*; *Int J Pharmacol*; 2011; 7(3): 370-375.
- [68]. Dhande SR; Anti-inflammatory and analgesic properties of the 50% ethanolic extract of *Cynodon dactylon*; *Int Res J Invent Pharm Sci*; 2013; 1: 8-16.
- [69]. Suresh K, Deepa P, Harisaranraj R, Vaira Achudhan V; Antimicrobial and Phytochemical investigation of the leaves of *Carica papaya* L., *Cynodondactylon* (L.) Pers., *Euphorbia hirta* L., *Melia azedarach* L. and *Psidium guajava* L.; *J Ethnobotanical Leaflets*; 2008; 12: 1184-91.
- [70]. Chaudhari Y, Mody H, Acharya B; Antibacterial activity of *Cynodondactylon* on different bacterial pathogens isolated from clinical samples; *Int J Pharm Studies Res*; 2011; 2(1): 16-20.
- [71]. Garg VK, Khosa RL; Analgesic and anti-pyretic activity of aqueous extract of *Cynodon dactylon*; *Pharmacologyonline*; 2008; 3: 12-18.
- [72]. Abhishek B, Anita T; Anthelmintic activity of *Cynodon dactylon*; *Journal of Pharmacognosy and Phytochemistry*; 2012; 1(3): 1-3.
- [73]. Sharma N, Rana AC, Bafna P; Effect of aqueous extract of *Cynodon dactylon* on reserpine induced catalepsy; *Int J Pharm Pharm Sci*; 2011; 3(4): 424-426.
- [74]. Yogesh HS, Kidchadi SCK, Muchandi IS, Gopalakrishna B; Evaluation of Anti-Inflammatory activity of *Cynodondactylon* Pers. On carrageenan induced paw edema in rats. *Indian Journal of National Product and Resources* 2013; 4(2): 151-154.
- [75]. Dande P, Khan A; Evaluation of wound healing potential of *Cynodon dactylon*; *Asian Journal of Pharmaceutical and Clinical Research*; 2012; 5(3): 161-164.
- [76]. Hajzadeh MR, Fatemeh BR, Abolfazl K, Alireza M; The Effects of N-butanol Fraction and N-butanol Phase Remnant From 50% Aqueous-Ethanolic Extract of *Cynodon dactylon* on Calcium Oxalate Kidney Stones in Rat; *Pharmacognosy Research*; 2009; 1(6): 431-434.
- [77]. Jananie RK, Priya V, Vijayalakshmi K; Invitro assessment of free radical scavenging activity of *Cynodon dactylon*; *Journal of Chemical and Pharmaceutical Research*; 2011; 3(4): 647-654.
- [78]. Venkateswarlu G, Edukondalu K, Chennalakshmi BGV, Sambasivarao P, Raveendra G, Ramnarayana V; Evaluation of Antiepileptic activity of leaf extract of *Cynodon dactylon* (L.) Pers. in validated animal models; *International Journal of Current pharmaceutical Research*; 2012; 2(3): 571-579.
- [79]. Saradha DKM, Annapoorani S, Ashokkumar K; Evaluation of the immunomodulatory activities for ethyl acetate fraction of *Cynodondactylon* in Balb/c mice; *Journal of Agricultural Science*; 2011; 3(3): 182-185.
- [80]. Santhi R, Kalaiselvi K, Annapoorani S; Anti-lipid peroxidative activities of *Cynodondactylon* and *Moringa oleifera* against ELA induced mice; *Pharmacologyonline*; 2009; 3: 544-549.
- [81]. Kaliyaperumal AK, Kumarakurubaran S, Muthukrishnan SD; *Cynodon dactylon* (L.) Pers.: An update review of its phytochemicals and pharmacology; *Journal of Medicinal Plant Research*; 2013; 7(48): 3477-3483.