Review Article

A Review on Ingredients of Anti-diabetic Siddha Preparation *Naaval Kottai Mathirai*

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ABSTRACT

Diabetes mellitus comprises a group of common metabolic disorders that share the phenotype of hyperglycaemia which leads to serious complications over time. Traditional Medicines derived from medicinal plants are used for the management of diabetes and its complication by world's population. Many more herbal based traditional Siddha preparations are used for diabetes by Siddha physicians. *Naaval Kottai Mathirai* is an herbal preparation prepared from the seeds of *Syzygium cumini* and Leaf juice of *Aristolochia bracteolata*. The current study is aimed to review the anti-diabetic effect of ingredients of *Naaval Kottai Mathirai*. The proven anti-diabetic studies and related beneficial effects of ingredients of *Naaval Kottai Mathirai* are compiled. This work stimulates the researchers for further research on the potential use of *Syzygium cumini* and *Aristolochia bracteolata* having anti-diabetic potential.

Keywords: *Naaval Kottai Mathirai*; *Syzygium cumini*; *Aristolochia bracteolata*; anti-diabetic potential.

INTRODUCTION

In developing and developed countries the usage of herbal medicine is tremendously increased in last few years because of its high medicinal value and less side effects. Herbals, minerals and organic matter have been used in many traditional system of medicine.[1] Around the world, 21,000 plants have been used for medicinal purposes stated by World Health Organization (WHO). Among these 2500 species are in India, out of which 150 species are used commercially on a fairly large scale. India is the largest producer of medicinal herbs and is called as botanical garden of the world.[2] In Siddha system of medicine, the drug *Naaval Kottai Mathirai* is a traditional herbal preparation which is being used for the management of Diabetes and its complication. The ingredient of this formulation is seeds of *Syzygium cumini* and *Aristolochia bracteolata* leaf juice. The present study is aim to review the anti diabetic effect of *Naaval Kottai* and *Aadutheenda paalai* which are the ingredient in the preparation of NKM.

MATERIALS AND METHODS

Preparation of *Naaval kottai mathirai*: [3, 4]

Ingredients

Naaval Kottai (seeds of *Syzygium cumini*) - 500mgm

Leaf juice of *Aadutheenda paalai* (*Aristolochia bracteolata)* - 4000ml

Procedure

500 gms of seed powder of *Syzygium cumini* was grounded in the stone mortar. To this, 4000ml leaf juice of *Aristolochia bracteolata* was added little by little over the seed powder simultaneously during grinding and triturated well for 24 hours continuously to attain waxy consistency without sticking in the finger. Then, it was made into small pills of 500 mg (*Pattany size*), and preserved in an air tight container.

Dose

One tablet two times a day with warm water.

Indication:

Madhumegam (Diabetes Mellitus)

Scientific Review - *Syzygium cumini*

This study was performed to assess the anti-diabetic effect of ethanol extract of *Eugenia jambolana* seeds using alloxan induced mid diabetic (MD) and severely diabetic (SD) rabbits. The extract when subjected to purification gives hypoglycaemic principle (SIII). This yielded an active compound LH II on further purification by sephadex LH 20. The phytochemical analysis of LH showed the presence of Δ^5 Lipid, saturated fatty acid and sterol. The anti diabetic activity was evaluated by the oral administration of LH II to MD and SD at a dose of 10 mg/kg b.w showed significant fall in fasting blood glucose at 90min (21.2% MD; 28.6 %SD), 7th day and 15th day 35.6% MD and 59.6 % SD respectively. Plasma insulin values were increased significantly ($p < .001$). After 15 days treatment HBA_1C level showed significant fall of 50.5% in SD. In- vitro studies on pancreatic β - cells showed 3 times rise in insulin level than the untreated group. In addition to this, LH II resulted in significant rise in the key enzymes involved in glycolysis and fall in the

key enzymes involved in gluconeogenesis. There was an elevation of liver and muscle glycogen by 52 % and 47 % for SD 36.6% and 30% for MD respectively. These findings concluded that the LH II has significant anti diabetic activity in both MD and SD rabbits.[5]

Godwin Selvaraj Esther et al studied the effect of ethanol extract of seeds of *Eugenia jambolana* (SEEJ) by using in vitro and in vivo models to assess the anti- diabetic activity with its protective effect on diabetic nephropathy. To determine the anti diabetic effect, in vitro study was carried out in lymphocyte culture by glucose uptake assay which showed marked increase in glucose uptake when compared with control rats. In vivo study was carried out in male albino wistar rats to determine the anti diabetic effect and protective effect on diabetic nephropathy by induction of type II DM using streptozotocin (STZ) - nicotinamine, when compared to diabetic control group resulted in significant fall in the blood glucose level. In addition to that, there was a marked reduction in the renal enlargement, HbA_1C, urea, Blood Urea Nitrogen, uric acid, serum creatinine, volume of urine and micro albumin values than the diabetic control group. There was a profound increase in body weight in diabetic rats treated with SEEJ compared to diabetic control rats. The histopathological analysis of kidney tissues firmly suggested the protective effect of SEEJ in diabetic nephropathy. The results of this study strongly concluded that SEEJ has both anti- diabetic activity and significant protective effect in diabetic nephropathy.[6]

Pragati Baghel et al Studied the anti oxidant effect and in-vitro Sun Protection Factor value of *Eugenia jambolana*. In this study the phytochemical analysis showed the presence of glycosides, alkaloids, tannin, saponin, flavanoids, herbal dyes in *Eugenia jambolana*. The anti-oxidant property was determined by spectrophotometric method by using a reagent 1, 1 Diphenyl 2 picrylhydrazyl (DPPH). The result of absorption inhibition range was found 91.59 ±0.25 %. The Sun Protection factor value was determined by using UV- Visible spectrophotometer, the results of SPF value are 2.278±0.127. Finally this study concluded that the extract of *Eugenia jambolana* have good anti-oxidant as well as significant SPF value.[7]

Stanely Mainzen Prince et al did a study to prove the reduction of tissue damage in the brain of diabetic rats by the seed extract of Syzigium cumini. They stated that jamun seed has been used in different parts of India for the treatment of diabetes and there is a marked reduction in lipids thiobarbiteric acid reactive substances (TBARS) and the catalase and superoxide dismutase has been increased in the brain tissue of diabetic induced rat, after an oral administration of aqueous jamun seed extract for six weeks. They also stated that both alcoholic and aqueous extract had better action than glibenclamide and they reduce tissue damage in the brain of diabetic rats.[8]

A study was conducted by R. Bhaskaran Nair et al. to screen the antidiabetic activity of seed kernel of Syzygium cumini at the dosage of 1g, 2g, 4g and 6 g / kg body weight. The result showed that there was a maximum hypo glycemic effect (42.64 %) in rabbits at the dose of 4g/kg, 3 hours after medication. This drug might promote endogenous release of insulin like Tolbutamide. And it produced a significant reduction in blood sugar level is 17.04% in the diabetic rats induced by Alloxan.[9]

Stanley.P et al. studied that the effect of extract of Syzygium cumini seeds on Glucose -6- phosphatise and hepatic hexokinase in alloxan induced experimental diabetic rats. The aqueous extract of seeds of Syzygium cumini at a dose of 2.5 g/kg of b.w was given to alloxan diabetic rats for one month. The results showed a significant elevation in hexokinase activity and depletion in glucose -6- phosphatase activity. It also decrease the leakage of serum alkaline phosphatise, Lactate dehydrogenase and acid phosphatise.[10]

SB Sharma, A.Nasir et all had a study in diabetic rats induced by alloxan to prove the hypoglycemic and hypolipidemic effects of ethanolic seed extract of Eugenia jumbolana. The hypoglycemic effect was monitored by decrease in fasting blood glucose level (FBG) in 90 min and fall in the peak blood glucose level in (GTT) glucose tolerance test in the mild (MD) and sub -diabetic rats (AR) and by decrease in FBG at 90 min in severe diabetic (SD) rabbits. There was a significant reduction in FBG at 90min (12% AR, 18.9% MD and 29% SD) and 16.9% reduction in peak blood glucose in AR and 21% in MD rabbits during GTT when ethanol extract (100mg/kg body weight) was given orally to sub-diabetic (AR) for 1 day, MD for 7 days and SD for 15 day. It showed a significant reduction in FBG (41.3% MD, 31.6% SD) and GHb (glycosylated haemoglobin) values (23.3% MD, 26.6% SD), while showed significant upgradation (32.8% MD, 26.9% SD) in serum insulin level When the extract was administered daily for 15 days to MD and SD rabbits. There was an increase in liver and muscle glycogen content. There was a reduction in total serum cholesterol (TC)/high density lipoprotein cholesterol (HDL-c) ratio, serum LDL cholesterol levels and the activity of HMG-CoA reductase was reduced. This proves its hypolipidimic effect and there was a normal appearance of liver, pancreas and aorta in histopathological studies.[11]

Singh N, Gupta M. reported that, the ethanol extract of the powder of Syzygium cumini seeds in alloxan induced diabetic rats has the effect of lowering the blood glucose level on the islets of pancreas. It also caused increase in body weight.There was a significant result in lowering the blood glucose level in the rats after feeding with that extract. The sugar level which had been dropped to normal, has not been elevated even after the withdrawal of the extract feeding and this is the peculiar finding of this study.[12]

P. Stanley Mainzen prince et al. studied the Hypoglycaemic effect of Jamun seeds, effect of antioxidant on lipid peroxidation in alloxan induced diabetic rats. In this study, the aqueous seed extract of

Eugenia jambolana was orally administered for 6 weeks at a dose of 2.5 and 5.0 b.w showed marked increase in blood haemoglobin level and decrease in blood glucose level but there was no significant effect at a dose of 7.5 g/kg b.w. The result of this study showed that the aqueous extract of Jamun seed possess hypoglycaemic action. In addition to this, decrease in body weight was also prevented. The elevation of reduced glutathione (GST), catalase and superoxide dismutase and depletion of free radical formation in tissues, thiobarbituric acid reactive substances (TBARS) strongly shows the antioxidant activity of seed extract of *Eugenia jambolana*. It showed the significant anti oxidant activity in animals given with Jamun seed extract at a dose of 5.0 g/kg b.w when compared to glibenclamide. From this study, it was concluded that the seed extract of *Eugenia jambolana* posses significant hypoglycaemic effect and good antioxidant property.[13]

Pandey M and Khan A gave the study report of hypoglycaemic effects of defatted seeds and water soluble fibre from the Syzygium cumini seeds in diabetic rats induced by alloxan. In this study, the effect of oral administration of different fractions of S.cumini seeds was tried in glucose tolerance and fasting blood glucose in normal and diabetic rats. It was determined that 40% of water soluble gummy fibre and 15 % of water insoluble neutral detergents fibre (NDF), were present in the Syzygium cumini seeds. This study was proved that 21 days feeding with the diets having 15 % unextracted seed powder containing water soluble gummy fibre, 15% defatted seed powder from which lipid and saponins were removed and 6 % gummy fibre which is soluble in water, significantly reduced the blood glucose level and improved oral glucose tolerance but feeding with 15% powdered degummed seeds from which the gummy fibre soluble in water was removed but has the neutral detergent fibre and 2.25% of water insoluble neutral detergent fibre isolated from the seeds , had no effect in the lowering blood glucose or increase the oral glucose tolerance in both normal and diabetic rats. This showed that the seeds of S.cumini had the hypoglycaemic effect and it was due to water soluble gummy fibre and water insoluble neutral detergent fibre.[14]

Prince PS and others had a study report Syzygium cumini seeds which act in alloxan induced albino rats to check the Properties of hypolipidimic and hypoglycaemic effect. In this study, first the rats were induced by single intra peritoneal injection of alloxan (150mg, kg (-1) b.w 0 to cause diabetes. There was a significant reduction in blood and urine sugar level, lipids in serum and tissues showed a marked change when alcoholic Jambolona seed extract (JSEt) was administered orally at the dose of 100mg kg (-1) body weight. This extract had increased the total Haemoglobin level. The effect of alcoholic JSEt was equivalent to insulin and all the altered parameters became normal.[15]

Antidiabetic activity and Pharmacognostic standardization of the barks of Syzygium cumini on Streptozotocin induced diabetic rats, Tripathi et al, did the phytochemical and pharmacological screening of the Syzygium cumini barks. As per the OECD guidelines, the acute oral toxicity was done and the dose of the bark was made as 300-500mg/kg.b.w. A dose of Streptozotocin 50 mg/kg was administered through intra peritonealy and the rats were made diabetic. In the fasted diabetic and normal rats, the effective dose of postprandial was determined as 500 mg/kg. In the OGTT study after glucose administration, the glucose levels in blood was measured at 0, 30, 90 min. The chronic study was carried by administering the bark extract for 21 days at dose 500 mg/kg to compare its activity; Glibenclamide (2.5 mg/kg) was used. The result of this study shows that, the significant reduction of postprandial blood glucose ($p < 0.001$) when Syzygium cumini extracts were taken orally, ½ an hour before meals when compared to control and less significant than the standard drug glibenclamide.[16]

Rachel Melo Ribeiro et.al studied the antihypertensive effect of hydroalcoholic extract of Syzygium cumini leaves (HESC) in normotensive and spontaneously hypertensive wistar rats (SHR) as well as its in vitro effect vascular reactivity of resistant arteries. HESC was administered orally at a dose of 0.5 g/kg/day for 8 days to SHR and the heart rate, mean arterial pressure and vascular activity were evaluated. Continuous administration of HESC showed a time dependent reduction in the blood pressure of maximum 62% in SHR. HESC treated endothelium deprived arterial ring showed a maximum reduction of 40% induced by NE. The results showed that the antihypertensive effect of Syzygium cumini leaves extract was probably due to the inhibition of arterial tone and extracellular calcium influx.[17]

Faiyaz Ahmed et.al reported that the radical scavenging and anti lipid peroxidative effects of *Eugenia jambolana* aqueous extracts using 3 in vitro methods – DPPH free radical scavenging assay, lipid peroxidation inhibition and reducing power in which rat liver homogenate was used as substrate. In addition to that heat treatment on antioxidant activity was also studied. When compared to synthetic anti oxidant (Butylated hydroxyl toluene) both heat treated and untreated extracts showed significant radical scavenging activity. Both the extracts exhibited similar reducing power which was significantly lower than that of ascorbic acid. Both the extracts significantly inhibited the lipid peroxides formation and restored the glutathione content in the liver in anti lipid peroxidation assay. These findings concluded that E. jambolana possesses a strong antioxidant activity.[18]

Jamun seed fortified cookies were prepared by fortifying jamun seed powder in different ratios 20%, 30%, 40% to the cookies flour whereas cookies without adding jamun was kept as control. The cookies were analyzed for chemical, sensory and self life evaluation after baking. Among these 3 ratios 30% jamun powder showed highest

score for organoleptic characters such as colour, appearance, crispiness, flavor and overall acceptability even up to 30 days of storage. Protein and fat content were increased in the jamun seed powder cookies. As well as in shelf life study both control and jamun seed powder cookies showed best shelf life of 30 days but after 30, 45,60 days they showed sudden increase in the moisture content. These findings suggested that jamun seed powder cookies can be recommended to diabetic patients because of its high jamboline content.[19]

Sahana D.A et.al studied an open labeled randomized clinical trial was conducted in 30 freshly diagnosed type 2 diabetic patients to validate the Effect of E. jambolana seed based drug *Madhuhara churna.* In this study patient were enrolled in three groups they have no significant difference in their baseline characteristic - Group 1 received *Madhuhara churna,* Group 2 received metformin; Group 3 were on diet restriction and exercise only for 6 months. The results showed a significant reduction in the fasting blood glucose level at 3rd and 6th and a highly significant rise in the high density lipoprotein level at 3rd month in group 1.The results concluded that the *madhuhara churna* has a beneficial effect in improving glycemic profile within 6 months of treatment in freshly diagnosed type 2 diabetes patients.[20]

Bhavana Srivastava et.al carried out a research study to determine the hypoglycemic effect of *Eugenia jambolana* pulp and seed extract in streptozotocin induced diabetic albino rats. In albino rats diabetes was induced by intraperitonial injection of streptozotocin 50mg/kg. The animals were divided into 5 groups – Group 1 – control; Group 2 received vehicle; Group 3- received ethanolic pulp extract of 200mg/kg; Group 4 received ethanolic seed extract of 200mg/kg and Group 5 received standard anti diabetic drug glibenclamide. The biochemical analysis such as blood sugar, lipid profile blood urea and glycosylated hemoglobin levels were estimated on 0,7,14 and 21st day of the study and also effect on the body weight also observed. The results showed a significant increase in the body weight of diabetic rats and significant reduction in the blood glucose, blood urea and lipid profile in E. jambolana pulp and seed extract treated diabetic rats (200mg/kg.bw). Therefore this investigation concluded that E.jambolana pulp and seed extract possesses hypoglycemic and hypolipidemic effect.[21]

Shivani Sidana et.al. had an attempt to validate the dyslipidemic effect of Syzygium cumini seed powder in patients with type 2 diabetes in which both patient and investigators were blinded about the treatment. Patients were randomly divided into 2 groups- Group A was provided with 10 gms/day jamun seed powder and Group B was given with placebo powder. The lipid profile was estimated at baseline and 30th, 60th and 90th day of the treatment. The results showed a significant reduction in the cholesterol levels by 10.55% and 15.79%, LDL levels by 10.29% and 14.50% and mean triglyceride levels by 8.28% and 13.66% at 30th and 60th day respectively. Statistically significant reduction in VLDL levels was noted at 30th,60th,90thday by 9.38%,12.90% and 20.69% respectively.HDL level increased significantly after 30 and 60 days of supplementation with S.cumini seed powder by 11.1% and 13.89% in males and 10.81% and 16.21% in females respectively. By the above reports it was concluded that supplementation of S. cumini to type 2 diabetic patients improved their lipid profile.[22]

Ravi.K. et.al carried out a research study to determine the antioxidant defense system of *Eugenia jambolana* seed kernel in streptozotocin induced diabetic rats. A significant increase in the plasma glucose, vitamin E, lipid peroxides, ceruloplasmin and decrease in vitamin c level and reduced glutathione were observed in pancreatic tissue in diabetic rats compared to control group. Histopathological studies showed protective effect of E. jambolana seed extract on pancreatic β cells. This study shows decreased oxidative stress in diabetic rats which may be due to its hypoglycemic activity.[23]

Anwesa Bag et.al had an attempt to determine the in vitro antibacterial potential of *Eugenia jambolana* seed extracts against multidrug- resistant human bacterial pathogens. Anti bacterial susceptibility was determined by agar well diffusion method and microbroth dilution assay. Rate and extent of bacterial killing was determined by kill-kinetics study. Phytochemical analysis and TLC were performed in ethyl acetate fraction to determine the putative compounds responsible for antibacterial activity which shows the presence of phenols as major active components. Acute toxicity study was done in mice and cytotoxic potential was determined by hemolytic assay method. The ethyl acetate fraction does not possess hemolytic activity as well as no toxic effect at recommended dosage. The ethyl acetate fraction obtained from ethanol extract possesses maximum antibacterial effect against all the test isolates.[24]

Ravi et.al had an attempt to analyze the inorganic trace elements in *Eugenia jambolana* seed on streptozotocin–induced diabetes in rats. E.jambolana seeds were reduced to ash and the inorganic elements were analyzed. The hypoglycemic activity was assessed by glucose tolerance test on streptozotocin– induced diabetic rats. Elements possessing hypoglycemic activity such as zinc, potassium, chromium, vanadium were present in the E. jambolana seed. *Eugenia jambolana* seed ash treated diabetic rats exhibited normoglycemia and better glucose tolerance. From the results of this study it was concluded that the inorganic elements plays a major role in the hypoglycemic nature of the seed kernel E. jambolana.[25]

Tehzeeb-ul-Nisa et.al carried out a research study to evaluate the hypoglycemic activity of flower extracts as well as ash obtained from the flowers of *Eugenia jambolana*. Flower extract of about 100 mg/kg b.w was orally administered to streptozotocin induced diabetic rabbits and ash content of about 4.8 mg/kg b.w to nicotinamide- streptozotocin induced diabetic rabbits to detect whether the organic or inorganic constituent in the

extract was responsible for its hypoglycemic activity. The results showed that the alcoholic and the aqueous extract of E. jambolana have no effect on fasting blood glucose level in streptozotocin induced diabetic rabbits. However the alcoholic extract of the flower showed significant reduction in fasting blood glucose level in nicotinamide-streptozotocin induced diabetic rabbits and also a highly significant reduction in fasting blood glucose level of ash treated rabbits. The results concluded that the alcoholic extract of E. jambolana flowers possesses hypoglycemic effect on nicotinamide- streptozotocin induced diabetic rabbits because of the presence of inorganic metals in it.[26]

Muhammad Shahnawaz et.al was carried out a study, to determine the anti oxidant effect and total phenolic compounds in various products of 2 jamun fruit cultivators endogenous to the tropical region of sindh. Cultivars are V1- improved and V2- indigenous. Jam ,squash, ready to drink, juice, pulp powder and seed powder were the 5 products made from cultivars and Folin-Ciocalteu colorimetric method was used to analyze total phenolic compounds whereas the anti oxidant effect was analyzed by DPPH assay. The results showed a highest phenolic content of about 42 and 40mg gallic acid equivalent (GAE)g-1 (DW) while lowest content was found in squash in both cultivars. The highest antioxidant capacity was found in seed and lowest in squash.[27]

Prakash R. Patel and T.V.Ramana Rao, Studied the antibacterial activity of Syzygium cumini fruits against gram positive and gram negative bacterial strains. Highest zone of inhibition against Bacillus cereus was obtained using extract of diethyl ether. Diethyl ether extract of preripened fruit was effective against Bacillus cereus at a lowest minimum inhibitory concentration of about 0.25 mg/ml. Zone of inhibition were obtained for all bacterial strains except salmonella paratyphi using ethyl acetate and diethyl ether and Micrococcus luteus against ethyl acetate fractions. The study revealed that jamun fruit possess a rich bioactive compound which was responsible for its anti microbial activity.[28]

Adelia F.et.al. determined the phenolic compounds and carotenoids from the jambolana fruits by HPLC-DAD-MS/MS. All-trans- lutein 43.75% and all- trans- b carotene (25.4%) were the 2 carotenoids found in the fruits of jambolana. The anthocyanin composition was characterized by the presence of 3, 5 diglucosides. This pattern was also observed for other flavanoids identified such as diglucosides of dihydromyricetin, methyl dihydromyricetin and dimethyldihydromyricetin, a galloyl glucose ester and myricetin glucoside. In addition to that the antioxidant capacity of the extract was evaluated by ABTS scavenging assay, peroxyl radical and protective effect against singlet oxygen. The TEAC values indicated that the quinonoidal and hemiacetals species possess higher radical scavenging capacity compared to flavylium cation. The functional extract exhibited 60% of dimethylanthracene protection against 102 and 16.4 l mol Trolox/g of ORAC.[29]

Jamaludin, M.et.al studied the effect of homeopathy remedy Syzygium jambolanum on glucose level, lipid profile and histology of pancreas in streptozotocin induced SD diabetes rat (32 male rats) divided into 4 groups with body weight 250-300g. STZ injection was given to 2 groups at a dose of 45mg/kg intravenously and on the 3rd day diabetes was confirmed by measuring the blood glucose level. Homeopathy remedy Syzygium jambolanum was administered for 28 days through force feeding. The results showed significant reduction in the mean plasma glucose level, total cholesterol, triglyceride and LDL cholesterol level in treated diabetic rats compared to non treated diabetic group rats and also significant increase in the plasma HDL level in treated diabetic rats compared to non treated diabetic group rats. The histological study revealed the presence of larger islet of Langerhans and denser beta cell distribution in treated diabetic rats compared to non treated diabetic group rats.[30]

Rabiea Bila et.al conducted a randomized control study on 75 male albino rats and compared the effect of fruit extract from E. jambolana with simvastatin on liver enzymes such as aspartate aminotransferase, alanine transferase, and creatinine phosphokinase in diet induced hyperlipidaemic rats. The animals were divided into 5 groups of 15 each, Group A – kept as control; Group B,C,D and E were provided with hyerlipidaemic diet for 6 weeks and then Group B kept as toxic control; Group C- received ethanolic extract of E. jambolana; Group-D- received simvastatin; Group E- received the combination of both for 8 weeks. Total cholesterol, LDL, HDL, TGL, AST, ALT and CPK were measured at 0,6,14 weeks of treatment. At 14th week there was a significant reduction in the serum AST, ALT and CPK levels in group C compared to group B, D and E. serum ALT level returned to normal level after 8 weeks in Group C, which is considered as most important marker of hepatotoxicity. From the investigation reports it was concluded that ethanolic extract of E. jambolana caused a reduction in ALT, AST, CPK levels when compared to simvastatin.[31]

Das S, and Sarma G. evaluated the hepato protective activity of ethanolic pulp extract of E. jambolana on paracetamol induced hepatotoxicity in albino rats. Albino rats of either sex weighing 100-150 gm were divided into 5 groups of 6 animals in each group. Group A- normal control ; Group B – paracetamol treated control received 3% gum acacia 5ml/kg; Group C and D –received E. jambolana pulp extract 100 mg/kg and 200mg/kg respectively, and Group E- received Silmymarin 100 mg/kg for 10 days. On the 8th day of the study a single dose of paracetamol 2gm/kg was given to Group B, C, D and E to induce hepatotoxicity. At the end of the study liver function test and histo pathological examinations were done and the reports revealed a significant reduction in total protein and significant increase in all

serum biomarkers in Group B compared to Group A. when compared to Group B, Group C & D showed significant increase in total protein and reduction in liver enzymes and total bilirubin. In histopathological studies fatty changes, fibrosis and necrosis were observed in Group B whereas it was normal in Group C, D, E. Thus the results concluded that E. jambolana possesses significant hepatoprotective activity at a dose of 100 and 200 mg/kg/day.[32]

Ahmad Raza et.al. carried out this study and investigated the antihyperlipidaemic effect of ethanolic seed and fruit extract of Syzygium cumini in hypercholesterolemic rats. High cholesterol diet (1.5% cholesterol) was given to normal rats to raise their lipid profile. Then diet containing 3% of Syzygium cumini extract was given. The results showed a maximum reduction in triglycerides, cholesterol, LDL up to 7.09%, 9.32%, 11.46% and a significant increase in HDL level up to 2.62%. From this research it was concluded that Jamun SE possesses anti hypercholesterolemic effect.[33]

Akansha Mishra, A.K. Jaitly and Arvind Srivastava studied the anti hyperglycaemic efficacy of 6 edible plants –dried fruit powder of Momordica charantia and Coccinia indica, dried seed of Syzygium cumini, seed oil of Aegle marmelos, dried powder of root and rhizome of Curcuma longa and seeds of Trigonella foenum graecum in normoglycaemic and STZ induced diabetic rats. The results showed that the aqueous extract of Momordica charantia, Syzygium cumini, Aegle marmelos, Curcuma longa produced significant hypoglycaemic activity at a dose of 250-500 mg/kg in both normal and diabetic animals.[34]

Kasiappan Ravi, et.al. Evaluated the anti hyperlipidemic efficacy of E. jambolana seed kernel in STZ induced diabetic rats. Ethanolic seed kernel extract (EJs – kernel) was administered at a dose of 100mg/kg b.w and were monitored for biochemical analysis. The plasma lipoprotein and free fatty acid level came back to normal in animals treated with EJs extract. These results suggest that the hypolididemic effect of E. jambolana seed kernel may be due to the presence of triterpenoids, flavonoids and saponins in the extract.[35]

b. *Aristolochia bracteolata*

S. Ramachandran et al studied the effect of anti diabetic activity of poly herbal extract which consists of ethanolic extract of Madhuca lotifolia (iluppai), Aristolochia bracteata (Aaduthinda paalai), Aristolochia indica (Echuramooli) in rats by alloxan induced diabetic method. In this study the anti diabetic effect was compared with standard oral anti diabetic drug Glibenclamide. The result of this study, the decreased level of blood glucose was significantly found in twelfth and twenty fourth hours than that of initial. Finally this study concluded that, the poly herbal extract of above said plant combination possessed good potential anti diabetic activity.[36]

P. Bharathajothi et al studied the anti inflammatory and anti pyretic activity and phytochemical screening for the plant extract of *Aristolochia bracteolata*. The above studies were done as per the standard procedure. The result of this study, the plant *Aristolochia bracteolata* shows the significant effect of anti inflammatory and anti pyretic action when compared with standard drug Paracetamol and the phytochemical screening also done to identify the presence of phyto constituents. The result indicates the presence of tannin and flavonoid in rich status.[37]

Alagesaboopathi. C studied the effect of anti microbial properties of acetone, ethanol and petroleum ether extract of *Aristolochia bracteolata* against selected human pathogens, Escheria coli, Bacillus aureus, Pseudomonas aeruginosa and Klebsiella pneumonia by the method of agar well diffusion. The results of this study, the petroleum ether extract possess highest anti microbial effect when compared with other samples. Conclusion of this study, the three extracts of *Aristolochia bracteolata* possess significant inhibitory effect against tested pathogenic microorganism. This study, recommended that the plant *Aristolochia bracteolata* can be used as novel broad spectrum anti bacterial traditional medicine.[38]

Trayee Sarkar Das et al, studied the ∞ Glucosidase inhibition effect of methanol, Ethyl acetate and hexane extract of *Aristolochia bracteolata*. The inhibitory effect was studied by the method of Dahlqvist with slight modification. The inhibition effect was studied for the three extracts with the concentration of 200 - 1000 µg/ml and compared with the standard acarbose. The results of this study reveal that the methanol extract possessed 78.27% of alpha - Glucosidase inhibition. Finally concluded that the plant *Aristolochia bracteolata* showed significant effect of Glucose inhibition activity.[39]

D.Kavitha and R. Nirmaladevi, studied the bio therapeutic potential of *Aristolochia bracteolata* through the anti bacterial assay by agar well diffusion method and the anti fungal activity by radial growth inhibition assay method. The anti bacterial activity was performed for the aqueous, methanol and chloroform extract of *Aristolochia bracteolata* against the selected pathogens of Escherichia coli, Bacillus subtilis, salmonella typhimurium, klebsiella pneumonia, shigella flexneri, staphylococcus aureus, salmonella typhi, Proteus vulgaris, and pseudomonas aeurginosa. The results of this study, the methanol extract show the significant effect while chloroform extract possess moderate activity. Aqueous extract didn't show any anti bacterial. Anti fungal activity also done against the Aspergillus niger, Aspergillus terreus, Penicillium notatum and Rhizopus. In this study the water extract are more susceptible followed by methanol and chloroform extracts. Rhizopus pathogen was inhibited only by the methanol extract of *Aristolochia bracteolata*. The chloroform extract had the significant effect against only the Aspergillus terreus fungus. Finally this study

concluded that the plant Aristolochia bracteolate possessed good potential of anti bacterial and anti fungal effect.[40]

CONCLUSION

Plants have always been an important source for finding new remedies for human diseases. The ingredients of *Naaval Kottai Mathirai* described in this paper had some pre-clinical evidence for its anti-diabetic effects. Therefore, it seems that physicians can rely on this Siddha preparation *Naaval Kottai Mathirai*, at least as complementary therapeutics, along with current hypoglycemic drugs to improve management of diabetic patients.

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