

Potential of Bay Leaves Extract Added Herbal Tea on Metabolic Disease

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Abstract

Different plants and plants extract have been studied to get the treatment of the metabolic diseases by avoiding the toxicity of drugs and their interaction with the nutrient absorption. One of them is the bay leaf (*L. nobilis*) which used as ingredient in the different value added products to get certain benefits such as spice cubes, soups and cake made from its leaf extract. The aim of this study to review the potential benefits of bay leaf extract on the metabolic diseases which are more common and risk factor of mortality worldwide by adding it in the herbal tea and brewed it with herbal tea.

Keywords: Bay leaf Extract; Herbal tea; Metabolic diseases; *L. nobilis*

Bay leaf lies in laurales order and Lauraceae family. Two species *L. nobilis* and *Laurus azorica* are found traditionally [6]. *L. nobilis* confused with many herbs of California, Indian, Spanish and Mexican bay leaf [7]. From other species some types of leaves are also mixed up with bay leaves on the basis of same vernacular names for instance *Cinnamomum tamala* as Indian bay leaf, *Litsea glaucescens* as Mexican bay leaf and *Syzygium polyanthum* as Indonesian bay leaf. These leaves have not same taste and aroma like true bay leaf [8]. It has also different names on the basis of local area Teej Pat in Bengali, in Urdu and specifically in Hindi called as Teej Patta, Marathi pronounced it as Tamalapattam, Telugu called it Bagharakku, it used as a herb for tea in Bhutan known as Tsheringma. Bay leaf or sweet bay in English, Waraq Ghaar known in Arabic, pronounced as Lorbeer in German, Greek called it as Dafni. It has varieties of species in range of 2400 to 2500. Some plant with their name has also laurel which outside the genus *Laurus* include either simple bay (*Pimenta racemosa*) or bay rum tree. It usually known as a "Rand" species in Tunisia.

Introduction

Tissues of adipose, islets of pancreas, muscles and liver having inflammation due to chronic state of diseases characterized as metabolic diseases [1]. For instance, insulin resistance, obesity, high blood pressure and blood sugar is collectively known as metabolic diseases which is the highest factor in occurrence of death [2]. In US metabolic diseases in adults had ranged of prevalence from 22% to 34%. Nearly adults in region of Asia Pacific having countries were affected was one with only by metabolic diseases and its prevalence was also escalating with the passage of years. According to 2011 survey on metabolic diseases prevalence in 1993 to 2008 in Taiwan which shows the percentage from 13.6% to 25.5% and 26.4% to 31.5% in women [3]. It is considered that therapeutically usage of single drug in metabolic diseases might not successful to provide desired results. On behalf of which extract of different plants and their isolated compounds may be considered as good option. Traditionally in metabolic disease many plants, its isolated compounds and extract have been used for their treatment.

Bay leaf from the Lauraceae family which is long lasting green shrub [4]. It has been used for different purposes. It is a valuable plant [5]. It is from aromatic spices. The commonly used cinnamon is the bay leaf bark as ingredient in spices. This bark is also called "Dalchini" (*Cinnamomum verum*).

Presumably bay leaf extends to whole world from its origin South Asia [9]. It domestically grown leather like dense green leaves both in Asia and area of Mediterranean. It was used as sign of distinction and wealth by ancient Romans and Greeks. As well as bay leaf use as herb in culinary due to medicinal significance it has. Greek and Romans wove the bay leaves and their berries into their crowns and festoons. They presented it to the scholars, officials, unmarried men "bachelors" those who were academics graduated as honor or for their accomplishments. Bachelor's term derived from the "bacco" which is Latin means a berry and Laureus means "of laurel" which means person who is unmarried and has college degree. Varieties are present on the basis of color of lower, stems, leaves, chemical composition and its habitat of cultivation. It grows on mountains, at the banks of rivers in Tunisia and damp cliffs. It cultivated mostly in humid climate particularly in Tabarka, Cap-Bon, Kef and Draham regions.

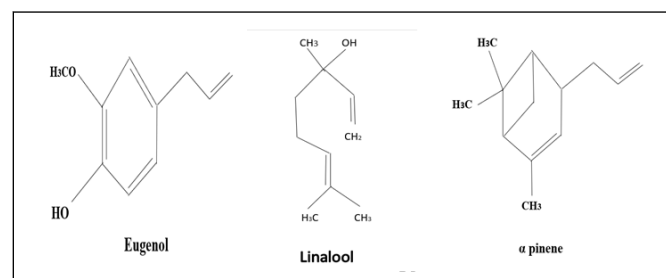
Extensively at 900-2500 m altitude of subtropics and tropic Himalayas it is distributed in hills of Nilgiri, Khasi, Manipur, Meghalaya and at the Sikkim Himalayas foot [10]. It is also grown in sandy soil that contains abundant water. In hot climate its leaves may burn that's why it needs moisture and preferred 4.5 to 8.2 Ph. But bay leaves at temperature below 28 F may kill. Its lower is white and yellowish color and bears black color fruit

in area of hot climate. About 10-25 kg production of leaves by the bay tree [11]. Domestically bay leaves also provide economic benefit to local communities. For instance, from states of India Meghalaya and Manipur maximum bay leaves 2800 MT reaches to the market annually on average rate of rupees 7 kg-1. It giving the growers about Rs 20 million cash [12]. Structurally bay leaf has slippery trunk of rounded shape and taproot. It is oval in shape has sharp base and tip with pointed end. Its edges are flat, skin of upper side imparting dark green color and lower show light green. Fruit of Bay tree is rough in taste. It is green in raw form after ripe show dark red color. Anatomically leaves of true bay are different from others for instance the thickness of *L. nobilis* laminae and *P. racemosa* is thicker than others about 400 μm . *C. Tamala* and *L. glaucescens* have their laminae thickness between 160-175 μm . A different technique by which bay leaves dried and check the treatment effect on its volatile compounds in the previous studies it is evaluated. Comparison was done Gas Chromatography (GC-MS) Mass Spectrometry with solid phase microextraction and Simultaneous Distillation Extraction (SDE) of volatile compounds of bay leaf. From which quantitative analysis of SDE result was better. There were done four methods from which two methods by oven at 45°C and air drying gave similar result and no loss of any volatile compounds than the fresh herb. Other two freezes drying and freezing cause losses of aroma of bay leaf and concentrated the eugenol, spathulenol, α -eudesmol and elemicin level.

Literature Review

Nutritional composition

Bay leaf bitter and sharp tastes due the presence of the essential oils in it and its parts. Flavonoids, eugenol, carbohydrates alkaloids, essential oils, citric acid, steroids, terpenoids and tannins are present in it. The component which is liquid glycoside is tannin which present in leaves. Tannin is polypeptide and ester polymer driven and easily hydrolyzed by glucose and bile secretion (3,4,5-ethylidene benzoic acid). This compound is also found in market by isolated it from plant in the form of Tanat acid or tannin. Because it is useful in skin and gastrointestinal track in the form of astringent. Precipitation of protein of cell membrane occurs due to it because it shows less activity of penetration and reason of changes of cell membrane permeability. In fat concentration it is less in these leaves which make it less caloric for instance 1 ounce bay leaves have 54 calories [13]. Chemically important compounds, essential oils, vitamins, minerals are present in bay leaves. Essential oils include chavicol, methyl eugenol, cineol which is 50% eugenol, terpineol, acetyl eugenol, phellandrene, α pinene, geraniol, β pinene and linalool. In Vitamins, vitamin C, A, B complexes and dietary fiber are present in fresh bay leaves. The vital ingredient of bay leaf vegetative parts is Alpha-tocopherol. Phenolic acids, lactones of cis terpenoids, alkaloids of isoquinoline and flavonoids present in its leaves. Flavonoids and tocopherol are also present in roots. Majorly other bioactive compounds for instance Penta and tetra hydroxy flavone, astragalol and different isomer of quercetin.



Uses

Different products were developed in a study with added of saffron with bay leaf 38%, basil, mint sparkle in bay leaf powder. Then sensory evaluation of these product done for comparison with the fresh bay leaf powder. For instance, antioxidant and nutrient composition. Resultantly, it was derived that ash content in bay leaf tea powder is very high about (18.67 \pm 1.21), contain content of protein (12.91 \pm 0.81) and cube made from the leaf of spice was enriched with crude form of fiber maximum concentration is (10.50 \pm 2.79). As compare to spice leaf cube more the content of flavonoids, phenols, proline amount, concentration of ascorbate and glutathione lower activity found in bay leaf tea powder. Bay leaf tea powder were also enriched with content of tannin and phytic acid. Form this it is indicated in results that bay leaf products and its self both are enriched with antioxidants, fiber proteins and minerals.

There are different products made from bay leaf powder for instance soup prepared with the addition of tomatoes, meat and vegetables. Sherbet of tomatoes with the addition of bay leaf, thyme and clove. cake with addition of bay leaf might be prepared. In vegetarian dishes like rice and salads its leaves are used.

It can provide economic benefit through creating the jobs opportunities in its processing units and it also provide food security.

Additionally, in different diseases bay leaves its bark and seed used for cure purpose for instance anemia, diarrhea, and rheumatism. In children its seeds are used to treat the cough and dysentery with sugars and honey.

In Pharmacology various studies found that bay leaves extract is very useful to treat high lipid level, diabetes, against inflammation and other metabolic diseases. The usage of bay leaves extracts in powder form against damage of oxidative stress. Evaluated study occurred which is experimented on rats' model by giving dose twice for 5 days in proportion of 50,100 and 100 mg/kg of bay leaves extract. Extract effectiveness against gastric ulcer causing chemicals, cold restrain stress is confirmed. Bay leaves extract also have application in increasing the shelf life of food. As study on the anchovy marinade which have low shelf life. In this oxidation of lipid is main problem which cause rancidity. So green tea and bay leaf extract which reduce the level of TBARS and TVB-N. In which green tea give brown color which is undesirable when green tea applied. No one show negative effect. In fresh fish, plant extract and marination solution number of biogenic amines is very low. Consequently,

the higher concentration applied of bay leaf extract on anchovy increased its shelf life and sensorial properties as well.

In metabolic diseases

Anti-lipidemic: According to literature it is assumed that most abundant or popular component in bay leaves which cause increase in the presence of total phenol, and also increase by alkaloids, flavonoids, cardiac glycosides, saponins presence with little effect. It is high in its molecular weight in all compounds that are belonging to phenolics group. Phenolic group contain the carbonyl and hydroxyl functional group. It is also shown that production of free radicals by the flavonoids and polyphenols which lower the oxidative stress. This activity is due to its properties of redox reaction, so that it donates hydrogen and quencher of singlet oxygen and chelate with metals. On the benzene ring hydroxyl group have the ability to release of hydrogen atom from the phenolic compounds and contributes in redox reaction with reagents. The potential of involving in the redox reaction of compounds depend on the presence of number of double bond and hydroxyl group in phenolic compounds. In a study of herbal tea in which green tea added with the bay leaves, cinnamon leaves and breadfruit leaves shown no rule out and possibility of interaction of mixture of cinnamon green tea leaves, breadfruit leaves or bay leaves hydroxyl functional group. This shows the reduction in donation of hydrogen atom. As a result of which study show that the green tea leaves phenolic component decreased with the increase in bay leaves/breadfruit and cinnamon mixture incorporation.

Globally cardiovascular diseases magnitude in increasing which stated by WHO that every year about 17.9 million people (31%) died with cardiovascular diseases. Mostly people from countries that are middle and low income died.

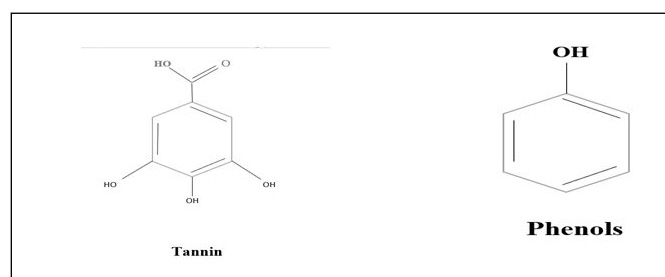
In bay leaves, concentration of total phenolic content was found as per 100 g have gallic acid 6.7 mg equivalents. Other phenolic compound presence shown in extract of bay leaves for instance vanillic, ferulic and caffeic acid. Those help in atherosclerosis prevention. It is revealed by that bay leaves have glycoside and flavonoids which is responsible for reduction of level of lipid biomarker. Consumption of bay leaf tea and its effect on the lipid profile of plasma was investigated in a study on healthy volunteers. People with age of 20-57 years, was given tea, once a day in duration of 10 days, prepared by 5 g of bay leaf added in 100 ml boiled water. After these results of lipid profile test by Beckman coulter were compared with result before bay leaf tea consumption. This showed that level of HDL (high density lipoprotein) increased by (D11 $\frac{1}{4}$ 1.42 \pm 0.29, D0 $\frac{1}{4}$ 1.34 \pm 0.25 pg/ml. p $\frac{1}{4}$ 0.01) significantly from the consumption of tea prepared by bay leaf.

Bay leaves incorporation to type 2 diabetic people in a study with dose of 1 g, 2 g and 3 g in the form of capsule per day for time period of 30 days. This gave result of significant reduction of 21-26% in level of serum glucose. Also, level of LDL and cholesterol reduced from 32-40% and 20-24%. Besides it, level of HDL significantly increased in 1 g and 2 g dose receiving people from 29-20% of bay leaf and reduction in level of triglyceride from 34-25% in the same group of people so

consequently 1-3 g/d of bay leaves decreased the risk of cardiovascular diseases as well as diabetes after 30 days.

The main compound which is present in bay leaves extract is the quercetin that inhibits the HMG CoA reductase oxidation and its activity. It also lowers the cholesterol and LDL level by stop the ApoB 100 secretions. In gut cholesterol absorption inhibition occurs due to presence of tannin in this extract.

In another study level of interleukin-10 determined to increase with the consumption of extract of bay leaf. With the feed of bay leaf extract to wistar mice with acute coronary syndrome show the increase in the serum interleukin-10 level which is only regulated by steroids and flavonoids which is present in the extract of bay leaf.



Anti-inflammatory

Traditionally and in folk remedies bay leaves are used for the treatment of the different diseases for instance in Iran it used to relieve the pain of rheumatism but scientifically still no any study done to test bay leaves anti-inflammatory and analgesic effect. Its essential oils phytochemical analysis done in which major compounds present include (2.74%) α -pinene, (2.05%) β -pinene, (15.16%) eugenol, (3.60%) 4-terpineol, (6.2%) of sabinene and (44.12%) of 1,8-cineol. In experiments those compounds which show the anti-inflammatory activity is the α pinene and sabinene and component which stop the inflammatory mediators' production from human monocytes is the 4-terpineol. Bay leaves extract effect in myocardial infraction as anti-inflammatory has been study in which level of (CRP) C reactive protein and (MPO) myeloperoxidase in heart was reduced by bay leaves extract. In which abundant compound is flavonoid which is phloretin and quercetin. In metabolism of arachidonic acid these compounds inhibit the cyclooxygenase [14,15].

Anti-inflammatory effect of bay leaf extract in a study on edema induced rat studied. It shows that with three different concentration 400 mg/kg BW, 300 mg/kg BW and 100 mg/kg BW of bay leaf extract after 24 hours give anti-inflammation effect.

Blend of spice and its effect on consumption of meal with high fat (HFM) having lipidemia which is cause of inflammation in model of human and animal studied. In blended mixture bay leaf, black pepper, cinnamon, basil, cumin, rosemary, ginger, red pepper, turmeric, oregano, coriander, parsley and thyme included give in 2 g and 6 g concentration. After 1 hour of consumption of this mixture the level of postprandial inflammation decreased due to lowering the IL-8, IL-6, and MCP-1 secretion.

Anti-hypertensive

In United States every fourth person have hypertension which is about 65 million in adults. In hypertension the pressure of blood in the arteries increased which leads to other reversible diseases like failure of heart, cardiovascular diseases and strokes. Hypertension adverse effect can be reversed reported in the study of Framingham by the medications.

In Malaysia bay leaf used in raw form and as fresh leaf for treatment of hypertension. In a study both aqueous and methanolic extract of bay leaf test done on hypertensive and normal rats because both have vasorelaxation effects. Yet in this study it was not enlightened which compound presence in bay leaf extract cause the reduction in hypertension. But flavonoids, carbohydrates, tannins, steroids, glycoside, triterpenoids (phytochemicals), group of phenolic compounds such as gallic acid and caffeic acid presence in the methanol extract is concluded from the studies done in past. But in a study comparison done between aqueous and methanol extract by HPLC to determine the content of gallic acids. In previous studies it is study that the Vaso-relaxation and vasoconstriction is due to quercetin by which nitric oxide restore and captopril which help in the vasoconstriction. It produces isoprostane that is sign for increase in the oxidative stress by reduction in oxidant level. It also lowers the endothelin and angiotensin II level. In short both extracts have the major phenolic content gallic acid.

Gallic acid exist in materials of plants which belongs to phenolic acid have different forms for instance esters, tannins which is hydrolysable, derivatives of catechins, and free acids. Mostly in study gallic acid link shown with hypertension or blood pressure. But the gallic acid ester which is butyl gallate in normotensive rat reduce the blood pressure after injections in intraperitoneal and significantly reduce when rats feed orally bay leaf extract. It is study in the previous literature that in diabetic rat its orally feeding for four weeks normal blood pressure in both systolic and diastolic range. Moreover, gallic acid cause vasorelaxation and inhibit the renin enzyme activity which responsible for angiotensin I from the breakage of angiotensinogen. Renin inhibition causes the lower of blood pressure due to the reduction of angiotensin II production which is vasoconstrictor. In this way vasorelaxation is done in which signaling pathway of nitric oxide/cGMP is act as mediator. Gallic acids also opens the potassium channel and block the channel of calcium for vasorelaxation. Consequently, decrease in total peripheral resistance decreased in blood pressure due to vasorelaxation.

Study was done on the hypertensive model of rat by giving the bay leaf methanolic extract of dose 70 mg/kg BW, 140 mg/kg BW and 280 mg/kg BW. From that study it is concluded that flavonoids present in the extract of bay leaf cause lower of blood pressure and also decrease the thickening of heart ventricle in a white male rat [16].

Further study on the anti-hypertensive effect of ethanolic extract of bay leaf was done. In which combination of bay leaf extract with the celery herb with dosage of 1.125; 2.25; 4.5; 6.25 and 12.5 has been used in wistar fatty mice as anti-hypertensive. As result oof which this combination of extract gave decrease in

the blood pressure of systolic level about ≥ 20 mmHg after consumption for 22 days [17].

In a study medicinal plant in which bay leaf is included used for treatment of lowering hypertension by consuming thrice, twice and once in a day [18].

Anti-diabetic

Every year globally number of cases of diabetes increases which was 382 million in 2013 and by 2035 will be 592 million according to data provide by international diabetes federation. There are many factors which involved in increase of its risk for instance diet have high fat, low fiber, high sugar and salt. Increase in oxidative stress creates by production of free radicals due to increase in blood sugar level. As a result of which body move to chronic complication such as neuropathy, vascular damage, nephropathy and retinopathy which is very difficult and crucial to handle? For the inhibition of the glucose absorption through minimizing the enzymes activity like α -glucosidase enzyme for process of digestion of carbohydrate. By oxidative metabolism free form to inhibit this process antioxidant are used which break the free radical chain to protect the cells of body from free radical. It is very useful for diabetic patient as study that level of glucose lower from its extract containing procyanidins, obtained by the ethanolic method, by escalating the level of insulin secreted from β -cells of pancreas. Inflammation on the cut and wounds healing process is slow in diabetic patient so it studied that phenolic compound presence in the extract may cause of speed up of the healing process of wound [19].

Wound healing is done better by bay leaf water extract than Allamanda extract shown by experiment. Certain factors were studied for this purpose like granulation tissue weights its histopathology; epithelization period wound closure rate and content of hydroxyproline. Resultantly, bay leaf extract treated animals show high contraction of their wounds, inflammatory cells and low collagen concentration which in comparison to Allamanda cathartica [20].

In another study antidiabetic effect of bay leave extract take from the water extraction method is noted when crude extract taken from extraction filtrate dried in oven at 50°C. This effect is measured by the α -glucosidase inhibition activity by method of Kim et al (2004) [21].

This was measured by the p nitrophenol amount which acts as substrate. Test done to measure the activity of antioxidant in the study in 1995 by yen and Chen method of assay for free radical scavenging which was DPPH (1,1-diphenyl-2-picryl-hydrazyl). In this sample was shaken after mix with solution of methanol with radicals of DPPH at 1 mM. After it putted in dark for 30 minutes and at 517 nm its absorbance was measured. This is done two times. Scavenging ability was calculated by the equation $(\%) = [(A_0 - A_1) / A_0] \times 100$. In which the control reaction absorbance indicated by A_0 and presence sample absorbance by A_1 . From the result of bay leaves sample at 50 μ g/ml concentration show antidiabetic α -glucosidase inhibition 41.4% and 49.94% of DPPH scavenging activities. It is shown that water of bay leaf can be used as drink for diabetes reduction [22].

Study on mice groups done to check the bay leaf extract potential to lower the blood glucose level. Effect of concentration of 75 mg/kg, 150 mg/kg and 300 mg/kg of Bay Leaf Extract (BLE) to 3 diabetic groups of rats as compared to metformin induce diabetic rat checked. From this experiment it is concluded that bay leaf extract significantly lowers the level of blood glucose than metformin drug having ability of increase protein GLUT4 level which help to increase cell and tissue intake of glucose [23].

In previous study cookies made by which response of glycemic lower and give palatable product at 60% (w/w) inclusion of bay leaf powder [24].

Bay leaf powder tea was prepared in study and its antidiabetic effect checked by measuring the blood glucose level. Tea bag prepared with bay leaves powder with different concentration 822.22 mg/g and 411.11 mg/g per body weight to rats. This lowers the 45.17% and 51.27% level of glucose in blood as compared to glibenclamide activity [25].

Liver disease

Disease of liver is also health problem of world. For its treatment synthetically prepared drugs used from which some have its side effects too. For this purpose, different medicinal preparation recommended in Ayurveda. Follow this different scientific research, and methodology used in herbal medicine which claims to have activity which protects the liver from diseases. Cells of liver have many functions including enzymes such as ALT and AST. These enzymes are the biomarker of liver functionality present in high concentration in cytoplasm. Outside the liver ALT have little function by which we able to predict the liver damage. So, when the hepatocytes damage its concentration elevated in serum. Because ALP and GGT enzymes not secreted by the bile and ALT direct release into the blood. One other factor is the increase level of bilirubin in serum which needs conjugation. In damaged hepatocytes liver bind it with glucuronic acid which released with bile. When disturbance in secretion level of bilirubin occurs diseases chances increased due to hemolysis.

In a study to check the effect of bay leaf extract on liver diseases, liver diseases induced by paracetamol toxicity. Bay leaf methanolic extract in 200 mg/kg and 400 mg/kg concentration increased the level of bilirubin and enzyme activity of serum to become normal because of plasma membrane stabilization. This study showed the hepatoprotective effect of methanolic extract of bay leaf (*Laurus nobilis*).

Kidney diseases

The active major organ kidney, which involve in the reabsorption of material and balance the homeostasis. Kidney damage major reason is consumption of alcohol. Their biomarkers are uric acid, creatinine and urea. The main product from the protein catabolism is urea and of purine is uric acid. Glomerular filtration is the indication has measured by the creatinine clearance which is produced endogenously. When the concentration of urea, uric acid and creatinine increased in study of paracetamol feed rat it showed the kidney dysfunction.

Increased in production of acetaldehyde and ROS cause damage of tissues leads too kidney dysfunction. After it treated with bay leaf methanolic extract which shown that its function back to normal level and prevent the kidney. So, bay leaf methanolic extract show kidney function preserves capacity [26].

Study of the bay leaf aqueous extract effect on the chronic diseases of kidney in hypertensive wistar Kyoto male rats. In that study different doses were applied as 2250 mg/kg, 1750 mg/kg and 1500 mg/kg of aqueous extract of bay leaf. Resultantly this extract showed the high antioxidant activity determined by antioxidant assays which prevent from the hypertensive induce chronic kidney diseases. This extract had shown the potential to increase level of superoxide dismutase and decrease malondialdehyde in the serum. By supplementation of extract of bay leaf improve the renal damage structure [27].

Anti-cancer

Risk of cancer by the continuous study of animals and human epidemiology may modify through dietary components. Phytochemical which are non-nutritive component that naturally occurring in fruits and vegetables may helpful in prevention from cancer? Along with other properties bay leaves posses' cytotoxic activities. Two types of cancers one in which cell involve in mechanism of destruction of itself called apoptosis and second in which process of cell metabolism collapse due to destruction of cell known as necrosis. Study has been done which show anticancer effect of hexane extract of bay leaves. This extract contain component which inhibit the cells of AMN3 mouse memory adenocarcinoma, REF rat embryo fibroblast and Hela cervical human carcinoma cells which is taken from Henrietta Lacks established 1951 with 0.054, 0.05 and 0.1 OD at 500 µg/ml of bay leaves extract when incubated for 24 hours. The rate of inhibition 80%, 77% and 69% respectively. Moreover, isolated compound of sesquiterpene from bay leaves, its ability of inhibition has been tested against T lymphoblastoid leukemia human tumor cell (Jurkat), promyelocytic leukemia (HL-60) and intestinal adenocarcinoma (LoVo). These revealed that anti-cancer properties can significantly show by the extract of bay leaves [28].

When bay leaves extract obtains from the ethyl acetate and hexane method it shows the cytotoxic activity. Santamarine and Reynosin compound found from this extract which are showing anticarcinogenic in COLO 320 colorectal and lung carcinoma cell line GLC4 [29].

Neuroprotective

In human neuroblastoma SH-SY5Y apoptosis due to intracellular induced reactive oxygen species by the dopamine effect bay leaf extract through n-hexane effect detected. When it is compared with apoptosis induced by DA and apomorphine applied in a positive control. There are two major components that inhibit the production of the ROOSS in DA induced apoptosis in SH-SY5Y cells are dehydrocostus lactone and costunolide. Hexane fraction effect on the 6-OHDA hydroxydopamine induced rat which show the neuroprotective effect of it when histochemical analysis done. Basically, it

reduces formation of α -synuclein (SYN) which is formed by DA in SH-SY5Y cells [30].

In biochemical pathways due to malfunctioning elderly people frequently got Alzheimer diseases. Instead of different method cholinergic hypothesis is the successful one. Drugs that used to treat this disease have mechanism to tackle the low level of acetylcholine. Because acetylcholine is one which is main in the process of synapsis for signal transfer after its acetylcholine give choline and acetyl group when hydrolyzed. Acetylcholinesterase catalyzed this reaction so to treat the Alzheimer diseases inhibitors of acetylcholinesterase used and also some drug show hepatotoxicity. That's why moving towards the therapeutic effects of plants, plants have been study in which recently an alkaloid galanthamine from snowdrop was used for the therapy of Alzheimer diseases. All these efforts or studies done to avoid the toxic effect of these drugs and derived new compounds recently studies pointed AD as disturbance in inflammatory process. It is founded that Senile plaque contains amilopeptides present in AD. Involvement off ROS in inflammatory process induced by brain which damage the cellular components and work as messenger secondarily in the process of inflammation. ROS scavenges by antioxidants which attenuate the pathway of inflammation and treat the Alzheimer diseases. In previous study when the dried leaf of many herbs and their essential oils, extract by different methods as by ethanolic method used for the treatment of Alzheimer diseases. Ten plant species checked according to their effect on Acetylcholinesterase (AChE) enzymes and antioxidant activity. In these 10 plants one was the bay leaf which showed the 64% (1 mg, 1 ml) Acetylcholinesterase (AChE) inhibitory activity by its ethanol fraction [31].

Antimicrobial

Certain mechanism by which plants extract inhibit the bacterial activity. It is suggested that in membrane phospholipid bilayer interference occurs. Due to this synthesis of certain component, cellular enzymes loss due to the inference in cell permeability [32].

Globally deaths and disease prevalence due to the one and only infections. Worldwide, deaths due infection was approximately 55 million in 2011 referenced to WHO report. Bay leaf is also used against microbes by including its extract essential oils in the drugs and pharmaceutical industries known as antimicrobial drugs. Its essential oil contains major antimicrobial component (36.71%) linalool, (7.39%) DL-limonene and (30.71%) cinnamaldehyde. After air dried of bay leaves those essential oils taken prove as anti *staphylococcus aureus*, anti-bacillus cereus which is the cause of certain diseases those associated with fungi such as *Candida albicans*. Essential oil activity against microbes through disc diffusion method was determined. With the help of study, the percentage of essential oils at which it inhibits the microbe's activity was determine as against *S. aureus* its concentration was 0.06%, for yeast 0.12% and 0.25% for *C. albicans* [33].

The different form of bay leaves extract with concentration of 0.5 mg/ml can also work to stop the growth of bacteria such as

dried form inhibit *staphylococcus aureus*, *E. coli*, *candida albicans* and *pseudomonas aeruginosa*. The study shows that bay leaves extract by methanolic method show inhibition zone of *staphylococcus* at 18 ± 0.8 mm that is more than the inhibition zone of phenol but in other bacteria that is tested no any detection of antibacterial inhibition is done. Inhibition of Growth of *E. coli* by dichloromethane detected in zone of 14 ± 0.6 mm while neither activity show by extract derived from n-hexane method nor on *candida albicans*. The main components that is present in extracts are (12.82%) of sabinene, (12.95%) of α -Terpinyl acetate and (44.72%) of 1,8-cineol determine from analysis of GC-MS [34].

Form the extract of other plants and bay leaves also effective or help to stop the food spoilage. In study water extract of *salvia officinalis* also called medicinal sage, *Foeniculum* fennel fruit, and Carbon dioxide extract of chaga, allspice and bay leaves of 10 g in 100 ml water used on chilled fish and chicken paste microflora. This show activity against bacteria at (MPC 0.62-0.87) mg/ml in all isolates by bay leaves more than other present in study [35].

Antivira

Covid corona virus is a single stranded RNA from the diverse family is enveloped virus. All human, avian species, livestock, mammals and companions' animals. Its replication initial step includes the binding of protein of corona spike to the receptor of entry include aminopeptidase N (APN; HCoV-299E), dipeptidyl peptidase 4(DPP4; MERS-CoV) and angiotensin-converting enzymes 2(ACE2; HCoV-NL63, SARS-CoV and SARS-CoV-2) in human. Entry receptor distribution and expression consequently enhance the pathogenicity and viral tropism. In life cycle inside the cell, it replicates and expresses its genomic RNA which formed the new virulent [36].

To inhibit the replication activity of SARS-CoV AND HSV-1 essential oils of bay leaf was study. The main component found in the bay leaf essential oil is alpha and beta pinene, beta-cimene and 1,8-cineol was founded. These essential oils have sensitivity index of 4.16 with IC 50 value of 120 mg/ml. Effect of bay leaf powder on immune system in respiratory diseases shown by the study in which for 21 days rainbow trout's given bay leaf powder diet. After the time period of 21 days when examine it effect the blood leukocytosis phagocytosis activity respiratory Brust activities in intracellular or extracellular, levels of protein and lysozymes which were all parameters of nonspecific immune and also show immune stimulant activity [37-40].

To treat the unicellular parasitic diseases (cutaneous Leishmaniasis) amphotericin B and glucantime compound used that are antiviral. In a study bay leaves extract by alcoholic method used as anti-leishmanial on stage of promastigote to avoid side effects of drugs. Treated with concentration 800 μ g ml⁻¹ of extract of bay leaf show the 63.044% apoptosis activity. Concentration of Bay leaf extract and Amphotericin B at which inhibition on promastigotes is 589.5 and 18.5 μ g ml⁻¹ which show the bay leaf extract effective for apoptosis [41].

Toxicity level

In amount in which we take by leaf in food is likely safe and reliable. If we take it in powder form this create no any disturbance in our digestive system like choking instead of whole form of leaf. Its texture is just like that it cannot be digested inn whole form so it remains same in digestive system. Information on the safe intake of this leaf in pregnancy or breastfeeding is not present. Control of blood sugar is might be controlled by bay leaf and it might be capable to slow the central nervous system. It also might be possible that its powder can too low the level of CNS central nervous system during surgery when given with combination of anesthetics. The use of bay leaf 2 week before surgery should stop it is recommended. In different studies bay leaf extract safety level measured or shown as up to 5 grams of 1 tablespoon powder of bay leaves which provide different health benefits in metabolic diseases.

Conclusion

In short bay leaf and its extraction from different type of methods hexane fraction, ethanoilc extract and water extract have potential to prevent from the metabolic diseases. Consequently, bay leaf component mechanized that it causes level of glucose lower from its extract containing procyanidins, obtained by the ethanolic method. The main compound which is present in bay leaves extract is the quercetin that inhibits the HMG CoA reductase oxidation and its activity. It also lowers the cholesterol and LDL level by stop the ApoB 100 secretions. Hepatoprotective effect of methanolic extract of bay leaf (*Laurus nobilis*). Bay leaf methanolic extract show kidney function preserves capacity. Moreover, gallic acid present in bay leaf which cause vasorelaxation and prevent form hypertension. Further anti-cancer, anti-microbial, and antiviral component present in bay leaf extract. In this study concluded that bay leaf can be used in an herbal tea with its safe dose level which provide metabolic benefits.

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