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REVIEW ARTICLE

WILD HIMALAYAN FIG: A NUTRACEUTICAL UNDER EXPLOITED FRUIT OF WESTERN HIMALAYAN REGION – A REVIEW.

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Abstract

Wild fig is an under exploited fruit having several health benefits. Its importance is not known to common people, therefore either not used for food purposes or very limited. However, several research paper and researchers reported that figs are an excellent source of minerals, vitamins A, B1, B2 and C, dietary fibre, carbohydrates, essential amino acids as well as phenolic substances. It shows very good sensory acceptability due to its taste, color and aroma. Figs are used as medicine and also used in reducing the risk of cancer and heart disease. It is rich in polyphenolic compounds, anthocyanin and flavonoids mainly Kaempferol. It shows potent antioxidant potential. The *figus palmata* plant is used in various diseases, e.g. gastrointestinal disorders, hypoglycemia, tumour, ulcer, diabetes, hyperlipidemia and fungal infections. It also showed antiproliferative activity. Very rare processing has been carried out on fig, therefore several future prospects of fig in food and medicine industry.

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Introduction:-

Ficus palmata commonly known as 'Phegra or fig' is a deciduous, moderate-sized tree, 6 to 10 meters in height and belongs to family *Moraceae* (16). The species growth is confined to rock and outcrop sites of the valley habitat types, slopes and cliffs particularly in mountain escarpment (4). Fruit are fig type with fleshy receptacle and small one-seeded drupelets. Fully ripened fruit of wild fig is one of the tastiest fruits found growing wild in the Mid-Himalayan region, so also named as Wild Himalayan fig (31). Mature fruits are deep purple in colour (4). Ipgri and Ciheam, (14) differentiated figs onto 5 categories on the basis of colour viz. green, yellow, purple, black, and brown. It is distributed in Asian countries mainly Nepal, Somalia, South Egypt, Peninsula and India (18). In India, it is commonly distributed in Northwestern India from the plains to an altitude of 1550 m above the sea level in the Himalayas with a maximum concentration in lower and hot areas of Himachal Pradesh, Punjab, Rajasthan, Uttarakhand and Uttar Pradesh (39). Fully ripe fresh or partially dry fruits are edible and used by local inhabitants for treatment of constipation. Latex is added to milk to make yoghurt. Fig is delicious, nutritive fruit and has medicinal properties such as reducing risk of cancer and heart disease (42). Solomon et al. (38) reported that fig fruit skin was richest source of anthocyanin and polyphenol in comparison to other parts of fig fruit. (40). Goncalves et al. (8) reported that fig is a good source of flavonoids mainly Kaempferol. Vallego et al. (40) reported that fig have higher phenolics content than red wine and tea.

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Figure 1:-Wild Fig tree



Figure 2:-Wild Fig twigs



Figure 3:-Ripe and unripe fruits



Figure 4:-Cross-sectional view

Flowering and fruiting period:-

In the month of March flowering starts and continues up to the month of April. From the second fortnight of June fruiting season starts and continues till the first half of July. During one season fully grown wild fig tree yields about 25 kg of ripe fruits (31). Fresh fig fruits weight, length and breadth ranged between 11.6-36.8 g, 16.7-28.6 cm and 17.3-31.0 cm, respectively (36).

Chemical Composition:-

The previous studies with figs indicated that they are an excellent source of minerals, vitamins A, B1, B2 and C, dietary fibre, carbohydrates, essential amino acids as well as phenolic substances (37, 38). Table 1 describes the proximate composition and mineral elements of fruits of wild fig (16, 34). Hegazy et al. (12) determined the nutritional composition of wild fig. They reported that the wild fig contains 67.82 % moisture, 0.89 % ash, 2.88 % fibers, 2.17 % protein, 1.12 % lipids, 28.74 % total carbohydrate and 565.67 kcal/100g fresh wt. energy. They further reported that the mineral content as 17.33, 208.67, 65.00, 37.67, 3.13, 0.14, 0.37 and 32.76 mg/100g fresh wt. for sodium, potassium, calcium, magnesium, iron, zinc, copper and phosphorus, respectively. Genna et al. (7) reported that cultivated fig are the good source of minerals and sugars mainly fructose and glucose.

Aroma is one of the essential attributes for the determination of fig quality (29). Grison-Pige´ et al. (9) published the first comparative study on fig volatile compounds; they investigated twenty different figs and identified 99 different compounds, mainly terpenoids, aliphatic compounds and products from the shikimic acid pathway. Riu-Aumatell et al. (32) identified eighty volatile compounds using HS-SPME and GC-MS in the fig samples and categorised into alcohols, aldehydes, esters, acids, terpenes and terpenic compounds and other compounds. Qualitative and quantitative information about volatile compounds that occurred in fresh and dried fig fruit is required to evaluate aroma quality that is formed by a complex group of different chemical substances (32). The volatile profile of fresh white and dark varieties of Portuguese figs was characterised by HS-SPME and GC-IT-MS (29).

Leaves, bark, and heartwood of *F. palmata* contain β -sitosterol and a new tetracyclic triterpene-glaunol acetate. Besides, cerylbehenate, lupeol, and α -amyrin acetate are reported from the stem bark of *F. palmata* (44). Hegazy et al. (12) determined total phenolic compounds tannins, anthocyanin, carotenoids, vitamin C as 12.72, 2.77, 0.169, 9.67 mg/g and 37.00 mg/100g, respectively. Yemis et al. (47) characterized anthocyanin present in 3 fresh fig varieties cultivated in Turkey. Four different anthocyanins, cyaniding-3-glucoside, cyanidin-3, 5-diglucoside, Cyanidin 3-rutinoside and pelargonidin 3- glucoside were identified in fig samples.

Table 1:-Proximate composition of wild fig

| Parameters | Values |
|----------------------|---------------------------|
| Protein content | 1.70% |
| Moisture | 80.50% |
| Total soluble solids | 12.10% |
| Total sugars | 6.00% |
| Titration acidity | 0.71% |
| Pectin content | 0.20% |
| Total phenol | 3.16-5.00 mg/100g of pulp |
| Vitamin C | 3.30 mg/100g of pulp |
| Ash content | 0.90% |
| Crude fat | 0.77% |
| Crude fibre | 17.65% |
| Total Carbohydrate | 15.68% |
| Phosphorus | 0.034% |
| Potassium | 0.296% |
| Calcium | 0.071% |
| Magnesium | 0.076% |
| Iron | 0.004% |

Utilization of wild fig:-

Fig fruits are sweet, juicy and delicious consumed as raw and also used for making various products such as squash, jam and jelly. It also shows astringency, which is due to the presence of white latex just beneath the epicarp. The astringency can be removed by keeping the fruits immersed in water for about 10 to 15 minutes before eating (31). It is also offered for sale at certain places. Fresh figs are very sensitive to microbial spoilage, even in refrigerated conditions (10), and therefore limited shelf-life. Fig fruit is consumed fresh, dried, preserved, canned and candied (27). The overall fruit quality is excellent. The unripe wild fig fruits and young growth are cooked and eaten as a vegetable. They are boiled, the water is removed by squeezing and they are then fried (16).

Research on fig processing is limited (45, 46) especially drying of pre-treated figs. The pre-treatments of figs viz. sulphuring and immersion in a solution of citric acid and ascorbic acid decreased drying time significantly (13). In Mediterranean region, it is used for alcohol and wine production while in Europe for fig coffee preparation. Being highly perishable, fig cannot be stored for longer period at ambient condition. The dried figs can be stored for 6–8 months (Venkataratnam 1988). Ibrahim et al. (13) reported that figs pre-treatment with sulphur dioxide resulted in higher abundance of volatile compounds compared to non-treated dried figs. Yemis et al. (47) reported that around 80 % of carotenoids were degraded in fig after 7 days of sun drying. Great changes in carotenoids composition and surface colour were observed at ripening stage of tree.

Naikwadi et al. (27) worked on dehydration of fig. Ripe figs were steam treated at 90 °C/10 psi/5 min in autoclave. Steamed fruits were dipped in sucrose, glucose, fructose and invert sugar syrups at 50 °B for 24 h for getting desired total soluble solid content. The treated fruits were dried to 20 % moisture in a cabinet dryer at 50-55 °C. Invert sugar treated figs showed good quality dried figs.

Medicinal uses of fruit:-

Iqbal et al. (15) reported that *Ficus palmata* Forsk extract had significant antioxidant activity, genoprotective property, enzymatic activity of HMG-CoA reductase and hence has its role in combating various oxidative stress-related diseases, including atherosclerosis. A number of fig species are used in folk medicine as anti-tumor, anti-inflammatory and tonic medicament (23, 22). Microbial diseases such as epilepsy and jaundice (28, 3), bronchitis, influenza whooping cough, tonsillitis, toothache, bacillary dysentery, enteritis and bruises were also reported to be treated by fig extracts. The fig fruits contain chiefly sugars and mucilage and also acts as a demulcent and laxative (31). The raw figs of *F. palmata* subsp. *virgata* are used as vegetable and ripened as fruit generally by tribal and local people in hilly and forest areas. They are principally used as an item of diet in the treatment of constipation and diseases of the lungs and bladder (21, 6). They are also used as a poultice (43, 20, 6). The twigs are used as fodder. The latex is said to be employed in curdling of milk and sap in the treatment of warts (25, 11). Fig is also used in various disease e.g. gastrointestinal, hypoglycemic, anti-tumour, anti-ulcer, anti-diabetic, lipid lowering and

antifungal activities (34). It is used for digestive disorders and to control bleeding wounds (30). Roasted figs are taken for diarrhea and dysentery (26). Wild fig is used traditionally in the treatment of constipation and diseases of the lungs and bladder (15).

Saklani and Chandra (35) reported that Bark, root, leaves fruit and latex of this plant are also frequently used for the treatment of various illnesses.

Pharmacological activity of fig:-

The *Ficus palmata* fruits showed significant antioxidant potential using free radical scavenging and ferric reducing activities (35).

Antioxidant activity:-

Antioxidant activities were also reported for *Ficus* extracts (1, 5). Alqasoumi et al. (2) demonstrated the ethyl acetate fraction (Table 2) was able to reduce the stable free radical DPPH, to yellow-colored DPPH at low concentrations (50 and 100 g/ml). The effect was almost similar to that of the standard ascorbic acid. The higher concentrations (500 and 1000 g/ml) of the crude extract and chloroform fraction were able to reduce the DPPH although the lower concentrations showed only weak activity. Saklani and Chandra (35) reported that *Ficus palmata* is a rich source of polyphenolic compounds, flavonoids, which are responsible for strong antioxidant properties that help in prevention and therapy of various oxidative stress related diseases such as neurodegenerative and hepatic diseases.

Hegazy et al. (12) determined that 1.1 mg/ml concentration of fig showed 40 % inhibition of DPPH. However, 45 % inhibition was shown in hydrogen peroxide scavenging assay. Caliskan and Polat (5) analysed phytochemicals and antioxidant capacity of green, yellow, purple and black fruited fig. They reported that antioxidant capacity of fig was correlated with the polyphenols and anthocyanin content of fruit. Black fig showed 2 fold greater antioxidant capacity, 15 fold greater total anthocyanins and 2.5 fold greater phenolics than green and yellow figs whereas fructose, glucose and sucrose is higher in brown and purple figs. Fructose (56 %) was the main sugar along with glucose (43 %). Kamiloglu and Capanoglu (17) reported 9.26 and 1.22 % of the initial total antioxidant capacity of the whole yellow and purple fig, respectively after in vitro digestion.

Table 2:-Free radical-scavenging activity (DPPH-assay)

| Treatment | Radical scavenging activity (%) | | | | |
|----------------------------|---------------------------------|------|------|------|------|
| | 10 | 50 | 100 | 500 | 1000 |
| Total ext. | 26.1 | 27.0 | 40.9 | 93.8 | 94.5 |
| Pet. ether | 2.7 | 7.8 | 11.7 | 22.8 | 47.8 |
| CHCl₃ | 6.0 | 22.1 | 48.1 | 92.3 | 92.1 |
| EtOAc | 30.2 | 80.9 | 97.3 | 97.0 | 96.5 |
| n-butanol | 8.9 | 11.4 | 37.0 | 83.0 | 92.5 |
| Water | 11.1 | 18.8 | 23.2 | 28.3 | 50.8 |
| Ascorbic acid (STD) | 41.0 | 86.4 | 95.5 | 98.1 | 98.3 |

Source:Alqasoumi et al. (2014)

The antioxidant activities of *Ficus palmata* fruit were determined using DPPH scavenging activity and found to be 104.9 mg Catechin equivalents/100 g in methanol extract while 146.9 mg Catechin equivalents/ 100 g in acetone extract. The ABTS cation scavenging activity was found to be 557.09 mg Butylated hydroxyl anisole/100 g in the methanol extract, while, in acetone extract, it was 729.45 mg Butylatedhydroxyanisole /100 g. Ferric reducing activity was found to be 77.6 mg Ascorbic acid /100 g in the methanol extract while in acetone extract, it was 146.67 mg Ascorbic acid /100 g (33, 2). Total phenolics (463.00 mg GAE/ 100g of fresh weight), flavonoids (45.60 mg CE/ 100g) and anthocyanins (27.30 mg/ 100g) of fig were found in methanol/ HCl solvent quantified by spectrophotometric measurement (38).

Vinson et al. (42) reported significant antioxidant activity in dried fruits of *Ficus carica* Linn. These findings suggest that dried fruits should be a greater part of the diet as they are dense in phenol antioxidants and nutrients, most probably fibre.

Antiproliferative activity:-

The antiproliferative activity of the fruit extract was analyzed against cervical cancer cell lines, namely C33A, HeLa and one normal Peripheral Blood Mononuclear (PBM) cells using colorimetric 3-(4,5-Dimethylthiazol-2-yl)-2,5-Diphenyltetrazolium Bromide (MTT) assays. C33A and HeLa cells were cultured with an extract concentration equivalent to 0.667, 1.66, 3.33, 5.0 and 6.67 mg/ml of fruit while primary culture of PBMCs was incubated with 5.0 and 6.67 mg/ml fruit extracts. All the extracts demonstrated potent antiproliferative activity against C33A cells. The extracts did not show antiproliferative activity against HeLa cells. Acetone extract showed highest antiproliferative activity while it was low for methanol extract (33). The high anticancer effects of acetone extracts of *Ficus palmata* were supported by its relatively higher ellagic acid content as revealed by RP-HPLC analysis. Ellagic acid was earlier shown to possess antiproliferative activity against cervical cancer cells (24).

Khodarahmi et al. (19) reported that extracts of different species of *Ficus* are cytotoxic to some human cancerous cell lines. Therefore, fruit, leaf, with ethyl acetate and dichloromethane and latex extracts were prepared through percolation and after 24 h incubation at 37°C, the cells were treated with different concentrations of the extracts or latex. The viability of the cells was determined by the reduction of 3-(4, 5- dimethylthiazol- 2-yl)-2, 5-diphenyl tetrazolium bromide (MTT) from formazan following 48 h incubation and the latex and different extracts of *Ficus carica* values of the ethanolic, ethyl acetate and dichloromethane extracts of the leaves and fruits.

Conclusion:-

Wild Himalayan Fig is an excellent fruit with lots of functional and nutraceutical compounds. There are several health benefits of wild fig. However, its utilization is limited due to lack of awareness about wild fig in common people. Its processing and value addition is very limited. Therefore, lots of work is required for utilization of wild fig.

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