Physico-chemical and Pharmacognostic Investigation of Fruit Pulp of Mangifera Indica Linn.

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ABSTRACT:

Fruit pulp of Mangifera indica Linn. is an important Ayurvedic medicine which is useful in gastric disorders, dyspepsia, loss of appetite, urine incontinence, uterine diseases, heat apoplexy, pharyngitis, ulcer, dysentery, sun stroke etc. The present study for the first time attempts to investigate physico-chemical and pharmacognostic properties as per WHO guidelines of this drug. Detailed account of physico-chemical and microscopic analysis have been given in the paper.

Key words: Physico-chemical, pharmacognostic and Ayurveda

INTRODUCTION

Mangifera indica Linn (Sank-Amra, Eng-Mango) belongs to family Anacardiaceae. Mango is a plant of Ayuredic as well as economic importance. It’s unripe fruit is sour, acrid, refrigerant, digestive, carminative, appetizer and it is used in gastric disorder, dyspepsia, loss of appetite, urine incontinence, uterine diseases, heat apoplexy, pharyngitis, ulcer, dysentery and sun stroke (Sharma et al., 2001).

Reported literature on the chemical composition of fruit pulp shoes the presence of Mangiferin (1,3,6,7 tetrahydroxyxanthone – 2 – glucopyranoside), amino acids, gallotanin, gallic and m-digallic acids, ethyl gallate, isoquercetin, quercetin and β sitosterol,(+) and (±) epicatechin, β – carotene and α-xanthophyll, citric, ellagic, malic and m-trigallic acids, β – glucogallin, meso-inositol, polysaccharides, riboflavin and vitamin C, isoamyl alcohol, α and β-pinenes, myrcene, limonene and fenchone, carophyllene epoxide (Chatterjee and Pakrashi, 1994).

As per our knowledge no reports are available on systematic physico-chemical properties as per WHO guide lines and pharmacognostic studies of M. indica fruit pulp. However, Wealth of India (1962) had reported few physical constants. Therefore, present study attempts to fill this void. Moreover, physico-chemical and pharmacognostic investigation of this drug may help in the identification and establishing the pharmacopoeial standards.

MATERIAL AND METHOD

The unripe fruits of M. indica were collected from the garden of RRI (Ay), Pune. The
material was macerated and powdered for physico-chemical tests. These tests were performed as per WHO (1998) guidelines. Powdered drug was successively extracted with petroleum ether, acetone and ethyl alcohol using soxhlet apparatus. Obtained extracts were used for preliminary phytochemical tests and fluorescence analysis.

Free hand sections were cut, stained with phloroglucinol followed by concentrated HCl and iodine solution and mounted in glycerine as per the method described by Khandelwal (1998). The line drawing related to anatomical structures and cellular elements in powder were drawn with help of Camera Lucida mirror type under pathological microscope (GETNER-BIOLUX-CXT 1).

RESULTS AND DISCUSSION

PHYSICO-CHEMICAL STUDY

Powder of *M. indica* (fruit pulp was analysed for determining the physico-chemical standards, which are given in Table 1. Qualitative inorganic analysis of ash reveals the presence of potassium, calcium, iron, copper, chloride, phosphate and sulfite. Solubility of the drug in water is higher than alcohol. Successive extraction of 10g drug with petroleum ether, acetone and alcohol gave 1.7%, 11.8% and 7.2% extractives, respectively.

Thin Layer Chromatographic (TLC) study

The above successive extracts were loaded on silica plate (MERCK- Aluminum sheet-silica gel 60 F254). Separation was achieved using upper layer of Butanol-Aceticacid-Water (4:1:5) as solvent system. Alcoholic and acetone, each extract gave five spots while only one sport was seen in petroleum ether extract. The TLC plate was kept in iodine chamber for 10 minutes and observed Rf values and color were noted immediately. The Rf values (Rf × 100) and their color under UV light is given in Table 2.

Preliminary Phytochemical tests

Characteristic phytochemical tests indicate the presence of terpenoids, fatty acids, tannin and other phenolic compounds, carbohydrate and amino acids in the obtained extracts.

Fluorescence Analysis

The fluorescence analysis of petroleum ether, acetone and alcoholic extracts was carried out under short (254nm) and long (360 nm) ultraviolet light. The obtained results are given in Table 3.

PHARAMACOGNOSTIC STUDY

Microscopic study of fruit Pulp

Transverse section of the pericarp shows the outer most epicarp (Fig 1A), wide mesocarp (Fig. 1A’) and hard woody endocarp. The epicarp is composed of outer most single layer comprising of rounded tin walled epidermal cells having thick cuticle externally. Below it, there are 10-15 layer of compactly arranged rounded to oval shaped chlorenchymatous cells. Many resin canals arranged in ring are present in chlorenchymatous region only; these canals are rounded to oval shaped possessing 3-4 layers of thin walled epithelial cells. Next to the region of chlorenchyma, there is a wide zone constituting the pulp of the fruit or mesocarp comprising of 20-25 layers of oval to round parenchymatous cells containing abundant simple as well as compound starch grains. Simple grains are mostly spherical while compound starch grains consist of 2-5 components. Many
vascular bundles are found to be scattered throughout the mesocarp, most of which are longitudinally cut and show groups of spiral as well as annular vessels with lignified narrow fibres. Phloem elements are few. Resin canals are absent in the inner and middle mesocarp region. The endocarp (Fig.1B) is quite woody and consists of lignified elongated thick walled longitudinally cut fibres and groups of lignified sclerenchymatous cells with patches of rounded to rectangular sclereids at some places. The fibres extend towards the periphery making the fibrous outer most region of the endocarp. Few conducting elements are also present in this region.

**Microscopic Study of Powder**

Fine powder of the fruit pulp is yellowish white in color, characteristic and pleasant in odour and sour or acidic in taste. It shows the following characters in microscopy (Fig2.):

**I** Group of parenchymatous cells containing few sphaeraphides of calcium oxalate.

**II** Many loose simple starch grains which are round to oblong in shape measuring 10.8 to 28.8 μ dia.

**III** Large number of compounds starch grains loose as well as in groups of parenchymatous cells.

**IV** Isolated pitted round, oval rectangular shaped stone cells measuring 7.2-21.6 μ in length and 10.8 – 25.2 μ in width.

**V** Groups of fragmented vessel elements bearing spiral as well as annular thickening.

**VI** Group of fragmented phloem elements associated with sclerenchymatous fibres.

**CONCLUSION**

Physico – chemical analysis reveals that solubility of the drug in water is higher than alcohol. Ash analysis confirmed the presence of K, Ca.Cu, Fe, Cl, I, PO4 and SO3. TLC study shows the presence of number of compounds with their specific Rf values and color in UV light. Transverse section of the pericarp shows the outer most epicarp, wide mesocarp and hard woody endocarp. Many resin canals are present in chlorenchymatous region of epicarp but absent in the inner and middle mesocarp region. Most of the vascular bundles in mesocarp are longitudinally cut and show groups of spiral as well as annular vessels with lignified narrow fibres. The fibres extending towards the periphery make the fibrous outer most region of the endocarp. Few conducting elements are also present in this region. Observed results may help in the identification and establishing the pharmacopoeial standards of this drug.
Table 1. Physico-chemical constants of Mangifera indica (Fruit pulp)

| Parameters                      | Average values in % with standard deviation |
|---------------------------------|----------------------------------------------|
| Ash content                     | 2.35 ± 0.11                                  |
| Water soluble ash               | 1.37 ± 0.06                                  |
| Acid insoluble ash              | 0.07±0.02                                    |
| Loss on heating                 | 10.31 ±0.9                                   |
| Fibre content                   | 24.70±3.2                                    |
| Foaming index                   | <100                                         |
| Swelling index                  | 3mm/g                                        |
| Volatile oil                    | 10.0±0.8                                     |
| Water extract                   | 31.6±7.2                                     |
| Alcohol extract                 | 17.8±3.1                                     |
| pH value (2%w/v)                | 3.2                                          |
| Petroleum ether 40-60oC         | 1.7±1.1                                      |
| Acetone                         | 11.8±1.5                                     |
| Alcohol                         | 7.2±1.0                                      |
| Total bacterial count           | 6x10⁴ CFU/g                                  |
| Total fungal count              | 3x10³ CFU/g                                  |

Table 2. TLC data, Solvent system –Upper layer of Butanol-Acetic acid –water (4:1:5).

| Extractives | No.of spot | Rf x100 | Day light | Long UV          | Short UV              |
|-------------|------------|---------|-----------|------------------|-----------------------|
| Petroleum ether | One       | 81      | Grey      | Greenish yellow  | Light citrine         |
| Acetone     | Five       | 23      | Brown     | Citrine green    | Light olivaceous      |
|             |            | 37      | Grey      | Yellowish        | Yellowish green       |
|             |            | 59      | Grey      | Yellowish        | Yellowish green       |
|             |            | 66      | Grey      | Yellowish        | Yellowish green       |
|             |            | 80      | Green     | Yellowish green  | Greenish Olivaceous   |
| Alcoholic   | Five       | 22      | Yellowish | Citrine green    | Light olivaceous      |
|             |            | 51      | Grey      | Yellowish        | Yellowish green       |
|             |            | 67      | Grey      | Yellowish        | Yellowish green       |
|             |            | 73      | Grey      | Yellowish        | Greenish Olivaceous   |
|             |            | 88      | Grey      | Yellowish        | Yellowish green       |
Table 3. Fluorescence behaviour of different extracts

| Extracts          | Day light | Short UV | Long UV      |
|-------------------|-----------|----------|--------------|
| Petroleum ether   | Green     | Green    | Scarlet      |
| Acetone           | Brown     | Brown    | Yellowish green |
| Alcohol           | Greenish  | Green    | Yellowish green |

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