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STUDIES ON THE CONSTITUENTS OF *ACACIA ARABICA* PREMATURE PODS

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Chemical analysis of *Acacia arabica* premature pods have been investigated. The analysis of the pods showed that they obtained in term of dry weight 47.75% carbohydrate, 1.67% protein, 1.41% lipid, 6.37% crude fibre and 8.55% ash. The moisture content was found to be 34.26% in term of wet weight. The mineral elements were found to be 126.97 mg sodium, 14.96 mg potassium, 159.54 mg calcium, 307.80 mg magnesium and 342.0 mg phosphorus.

The chromatographic analysis of ethylalcohol-water (90:10 v/v) extract showed that it contains glucose/galactose, fructose, maltose, aspartic acid, glutamic acid, glycine, alanine, proline, leucine and threonine.

Key words: Premature *Acacia arabica* pods, Minerals, Free sugars and amino acids.

INTRODUCTION

Acacia arabica belongs to eguminosae family consisting of about 800 species and differing mainly in pods characteristics are recognized. Locally *Acacia arabica* is known as Babar or Kikar. The *Acacia arabica* plants can grow under the most severe conditions of temperature, soil and climate. The plant is widely distributed in Pakistan, India, Burma, Sri Lanka, west ward through Arabica in tropical and southern Africa [1, 2]. *Acacia arabica* bear flowers and fruits in the month of October-July. The pods (fruits) are straight or trap-shaped (1.3-1.6 by 7.5-15.0 cm long). Pods are distinctly stalked and contains 8-12 seeds [3, 4]. The young leaves and the pods of the tree are largely utilized as fodder for farm animals and the wood of the tree is used by farmers for different purposes. Different parts of the plant are being used by the traditional healers (Hakims) as additives in the treatment of various diseases [5].

Further it is reported [6] that the bark and the pods of the plant are used as a tanning material in India and Africa. Literature survey reveals that only fatty acid composition of seed fat have been studied in detail [7, 9]. The abundant availability, multiple applicability and therapeutic properties of the *Acacia arabica* inspired us to study the chemical composition of premature pods in detail.

MATERIAL AND METHODS

The premature pods (fruits) of *Acacia arabica* were collected between February-April from the trees grown at the University Campus. All the reagents used in this study were of analytical reagent grade.

Analysis of sample. The moisture level was determined by drying the wet sample to a constant in an oven at 105°. The ash content was determined by incineration of known weight of the sample in a furnace at 700°. The lipid content was determined by exhaustively extracting a known weight of the sample with diethylether (boiling point 35° using soxhlet apparatus. Protein (Nx6.25) was determined by the macro Kjeldhal method. Total carbohydrates were calculated by indirect method [10], by subtracting the total crude protein, lipid, ash and moisture values from the weight of sample. The soluble carbohydrates (available) present in the sample were estimated according to the method as reported by Alexander and Block [11] and the insoluble carbohydrates (fibre) content was calculated by subtracting the soluble amount of carbohydrate from the total carbohydrate.

The elementary composition was determined according to the procedure of Encrement and Burelli [12]. Calcium and magnesium were determined by atomic absorption spectrophotometry (Hitachi Model No. 180-50); sodium and potassium by flame photometric method and phosphorous was determined by colorimetric method [13].

Diethylether insoluble portion of the sample was extracted with 90% ethyl alcohol at 85° for four to six hours and filtered through saintered glass funnel. The filtrate was concentrated at 70 to 80° [14] and used for the identification of free sugars and amino acids by paper chromatographic method. 10 µl of above concentrated sample and authentic samples as a marker were chromatographed on Whatman No. 1 filter paper using butanol: acetic acid: water (4:1:5 v/v) as a solvent. After dying the chromatogram was developed with aniline phthalate and dried in oven.

Two dimensional paper chromatography was also performed for the identification of free amino acids in the

above concentrated sample according to the method of Wolfson *et al.* [15]. The solvents used were isopropanol: acetic acid: water (5:1:4 v/v) and phenol: water (4:1 w/v). After drying the chromatogram was sprayed with ninhydrin solution and dried in oven for 5 minutes at 80°.

RESULTS AND DISCUSSION

Table 1 show that the *Acacia arabica* premature pods contain higher amount of carbohydrate (47.75%) but less of crude protein (1.41%) and lipid (1.66%). However, the crude protein level of *Acacia arabica* premature pods was found comparable with the protein content reported for *Betavulgaris* (1.8%) and *Alliumcepa* (1.8%) [16]. Similarly, the lipid content compared favourably with *Cassia nodosa* (1.0%) and *Antiaris africana* (2.2%) [17]. The crude fibre content (6.37%) of the *Acacia arabica* premature pods corresponds well with the values of (5.6%); (7.1%) and (7.2%) reported respectively for *Amphimas pterocarpoides; Cassia sieberiana* and *Antiaris africana* [17].

Table 1. Approximate composition of the premature *Acacia arabica*

Pod	
Food energy kcal	215.10
Moisture (wet weight)	34.26%
Ash	08.55%
Crude fat	01.41%
Carbohydrate	47.75%
Crude protein	01.66%
Crude fibre	06.37%

Mean of three determinations.

The mineral elements of *Acacia arabica* premature pods are shown in Table 2, which shows that pods a good source of minerals. The pods are found to contain large amount of phosphorus, magnesium, calcium and sodium but the level of potassium is low.

Table 2. Mineral composition of the premature *Acacia arabica* pod. (mg/total ash weight).

Sodium	126.97
Potassium	14.96
Calcium	159.54
Magnesium	307.80
Phosphorous	342.00

Average of two determination.

Free sugars identified in *Acacia arabica* premature pods are shown in Table 3. A total of four spots developed, three were identified as glucose/galactose, fructose and maltose. A fourth sugar with RF value 0.78 was also found to be present but its identity could not be established in the present studies.

Table 3. Free sugar composition of *Acacia arabica* premature pod.

Sugar	RF values of sample	RF values of standard
Glucose	0.309	0.304
Galactose		0.295
Maltose	0.081	0.077
Fructose	0.60	0.58
Unknown	–	0.78

The presence or the absence of certain amino acids is the most reliable parameter for judging the quality of food sample and the analysis of free amino acids is shown in Table 4 and Fig 1. The amino acid profile of *Acacia arabica* premature pods may be used as a tool for quality assurance. A total of seven amino acids were detected in *Aca-*

Table 4. Free amino acid composition of *Acacia arabica* premature pod.

Amino acid	RF values of sample	RF values of standard
1. Aspartic acid	0.12	0.123
2. Glutamic acid	0.25	0.24
3. Threonine	0.28	0.327
4. Glycine	0.401	0.403
5. Alanine	0.56	0.548
6. Proline	0.725	0.753
7. Leucine	0.86	0.856

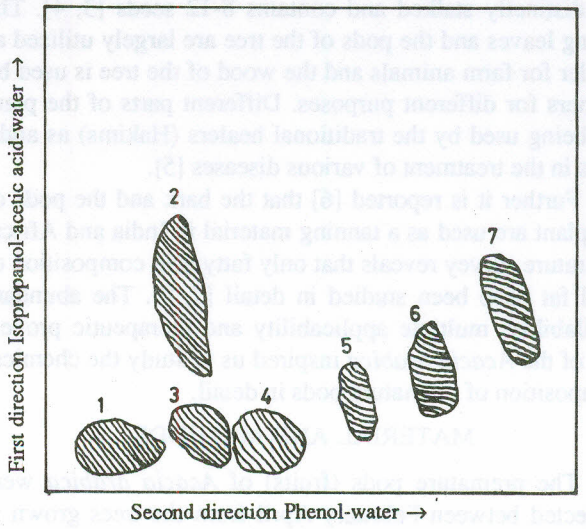

Fig. 1. Free amino acids map of *Acacia arabica* premature pod extract separated by two dimentional paper chromatography in isopropanol-acetic acid-water 5:1:4 v/v followed by phenol-water 80-20 w/v

(1) Aspartic acid, (2) Glutamic acid, (3) Threonine, (4) Glycine, (5) Alanine, (6) Proline, (7) Leucine.

cia arabica premature pods i.e. aspartic acid; glutamic acid; threonine; glycine; alanine; proline and leucine. It is reported that the content of free amino acids change during ripening and senescence of fruits [18, 19]. There is a need for animal feeding experiments to assess biologically, the nutritive value of *Acacia arabica* premature pods.

No detail studies have untill now been reported on the chemical composition of *Acacia arabica* premature pods and the present investigation is probably the first attempt in this direction. On the whole it appears that the premature pods of *Acacia arabica* can serve as a good source of some nutrients and hence may be used to supplement farm animal foods deficient in some minerals, sugars and amino acids. It is reported that certain amino acids are supplemented in medicines and foods as a food acidulant [20].

We are presently engaged in separation of sugars from amino acids and their quantitative analysis work and hope to report our findings later.

REFERENCES

1. S.M.H. Jafri, *The Flora of Karachi* (The Book Corporation, Karachi, 1960), pp. 150.
2. *Tropical Legumes Resources for the Future* (National Academy of Sciences, Washington D.C., 1979), pp. 141 and 165.
3. J.D. Hooker, *The Flora of British India* (L. Reeve & Co. Limited, London, 1879) Vo. II, pp. 193 and 292.
4. R.N. Chopra, *Indigenous Drug of India* (U.N. Dhur and Sons Private Ltd., 15 Bankim Chattergee Street, Calcutta-12, 1958), pp. 429, 595 and 616.
5. K.R. Kritikar, B.D. Badu and I.C.S. An; *Indian Medical Plants* edited by E. Blatter, J.F. Caius and K.S. Maskar (1984), 2nd ed., Vol. II, pp. 922.
6. M.S. Olivannan, R. Selvangan and Y. Nayudamma, Tanner (Bombay) **21**, 107 (1966).
7. B. Mandal, W.B. Hooghly, S.G. Majumdar and C.R. Maity, J. Am. Oil. Chem. Soc., **61**, 1447 (1984).
8. A.R. Chowdhary, R. Banergi, G. Misra and S.K. Nigam, J. Am. Oil. Chem. Soc., **61**, 1893 (1983).
9. S. Zaka, B. Asghar, M.Y. Raie, S.A. Khan and M.K. Bhatty, Pak. j. sci. ind. res., **29**, 427 (1986).
10. Albanese, *Newer Method of Nutrition Biocheimstry* (Academic Press, New York, 1963), Vol. I, pp. 307.
11. P. Alexander and R.G. Block, *Analytical Methods of Protein Chemistry* (Pergamon Press, London, 1980), Vol. 2, pp. 5.
12. F. Ecrement and F.P. Bruelli, Emission Spectrometry and Atomic Absorption Spectrometry for the Determination of Major and Trace Elements in Vegetables, Italy (1973).
13. K. Ohashi, Y.K. Kumileo, C. Suzuki and K. Yamamoto, Bull. Chem. Soc. Japan, **50**, 3220 (1977).
14. A.B. Mustafa, M.Sc. Thesis, The Queen's University of Belfast (1983), pp. 71.
15. W.Q. Wolfson, C. Chohn and W.A. Devancy, Science, **109**, 541 (1949).
16. A.N. Memon, M. Umar Dahot, G.M. Memon, S. Memon and A.W. Sohag, Pak. j. sci., **35**, 119 (1983).
17. F.O. Amubode and B.L. Fetuga, Fd. Chem., **12**, 67 (1983).
18. M.S. Shashirekha and M.V. Patwardhan, Lebens. Wiss Technol., **9**, 369 (1976).
19. W.A. Gortner and V.L. Singleton, J. Fd. Sci. **30**, 24 (1965).
20. P.S.J. Cheetham, *Handbook of Enzyme Biotechnology*, edited by A. Wiseman (John Wiley & Sons, New York, 1987), 2nd ed., pp. 352.