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A Survey Of Plants Used By Traditional Healers In The Management Of Non-Insulin Dependent Diabetes Mellitus

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A survey to evaluate the knowledge and ability of traditional healers to recognise and manage patients with non-insulin dependent diabetes mellitus was done in Handeni district Tanga region, Tanzania. Among 169 traditional healers interviewed 53.2% were treating one or more symptoms related to diabetes. Only 3% understood what diabetes mellitus is, but did not know plants used to treat any of the symptoms. Overall, 66 plant specimen, representing 31 families, 54 genera and 61 species were collected. Among these 26% are reported in literature as being used for the treatment of symptoms such as impotence or as aphrodisiacs and one is reported to have hypocholesterolemic activity. Only 2, *Securinega virosa* and *Phyllanthus amarus,* out of the 27 plants tested, improved glucose tolerance. They both lowered area under the oral glucose tolerance curve dose-dependently at doses between 0.1 - 1.0 g/kg body wt. Four plants, *Croton macrostachys, Maytenus putterlickioides, Albizia versicolor* and *Lannea stuhlmannii* worsened glucose tolerance. Further studies are required to determine other properties of these plants that may be useful in the management of diabetes mellitus.

Key words: *Securinega vinosa, Phyllanthus amarus*, diabetes, traditional healers.

INTRODUCTION

Non-insulin dependent diabetes mellitus (NIDDM) is a growing problem among the developing countries. It has become a serious problem as a result of changes in socio-economic factors which consequently affect dietary patterns and living habits, as has been reported among the Australian Aborigines [1], the Polynesians and Amerindians of Canada [2]. In some countries the prevalence has reached 5 times that in the West [3]. Amidst this crisis, resources to manage diabetes and its complications, among developing countries continue to dwindle.

In recent years there has been massive cuts on health budgets resulting in the shortage of drugs in hospitals leaving most of the poor population without medical care. This is more evident in the rural areas where people are increasingly becoming dependent on traditional healers for their day to day health care [4]. Similarly, according to a recent unpublished survey done by the authors, there is a growing population of people in urban areas who are now consulting traditional healers for the treatment of diabetes, hypertension, impotence and other diseases. Given the extent of the diabetes problem as correctly indicated in the 1991, WHO report [3], it is very likely that traditional healers are going to be called upon to play a greater role in the management of diabetic patients. However, the competence of the healers in this area is still an issue of debate.

In Tanzania some traditional healers claim to have plant preparations for treating diabetes. While these claims still remain unproven, they have quite an impact on patients. In a number of cases patients visit the Institute of Traditional Medicine of the Muhimbili University College of Health sciences to ask for plant preparations for treating diabetes. This demand from the

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patients prompted us to begin a search for plants with hypoglycaemic activity. In this study we present a case study of the experience from the Wazigua of Handeni District (Tanga). Information collected from interviews, published literature on plants and laboratory testing of the collected plants have been used to evaluate their claims on the management of NIDDM.

MATERIALS AND METHODS

Materials

D-(+)-Glucose was bought from Unilab (Nairobi, Kenya). Carboxymethlycellulose (CMC), chlorpropamide, sodium fluoride and potassium oxalate were bought from BDH (UK) and hypodermic needles from B. Braun Melsungen AG (Germany).

Study setting

The study was conducted in Handeni district, Tanga Region (northeastern Tanzania) between October, 1995 and October 1996. The study involved interviewing traditional healers and testing their knowledge on the management of NIDDM.

Knowledge on diabetes

Traditional Healers from 8 Handeni villages reputed for their knowledge of traditional medicine participated in the study. Healers in each village were given prior information about the visit and on the appointed date they all assembled in one area (primary schools or local government offices). The symptoms of diabetes mellitus namely polyuria, polydipsia, excessive thirst, sweating and general body weakness were described to the healers. The healers who recognized or had attended patients with these symptoms were enrolled for a detailed interview.

Interview Methodology

During the interview each healer was interviewed alone. During the interview, healers who recognize the symptoms of diabetes were asked to name the disease presenting with those symptoms. Those healers who mentioned diabetes (kisukari in Kiswahili) were asked to mention the plants they used for treatment. Similarly, for those who could not recognize diabetes, an expanded list of symptoms presented in diabetes were given to them and they were asked to mention the plants they used to treat each of the symptoms. Such symptoms included general body weakness, pain or fatigue, headache or back pain. Lack of strength/vitality, numbness, cramping of feet/legs or hands/arms, fainting spells or dizziness, chest pain or heart disease. Also impotence, thirst, diarrhoea at night, excessive sweating, chronic infected skin sores and ulcers, gangrene of toes or feet; fungal infection (candida infection of vagina, feet, hands, nails), chronic foot sores that do not heal, round, brown slightly raised, painless lesions on sheens or back of hand and passage of urine which attracts insects. Similarly, case presentations, with and without photographs, were made to the healers and they were required to identify the conditions described or shown in photograph and mention the treatment used for each condition. If any 3 of the list of symptoms in the expanded diabetes diagnostic criteria were treated by the same plant or if a plant was mentioned 3 or more times for the treatment of the same symptom, this plant was recorded as potentially useful in diabetes management.

Detailed information, including ethnobotanical, ethnomedical and economical uses for the selected candidate plants were recorded. Plant specimen for each of the selected plants were collected, dried and taken back to the Institute of Traditional Medicine for identification, literature search and screening for hypoglycaemic activity.

Plant Collection

Both plant materials for laboratory work and vouchers were collected for every selected

plant. The plants were identified at the Institute of Traditional Medicine. All the vouchers (vouchers no MJ 10 - MJ 75, ACM 16 and TMRU 3156) have been kept in the herbarium of the Institute.

Selection and Prioritisation Of Plants For Testing

Literature search was done on all the plants identified to be potentially useful in the management of diabetes mellitus. Plants which are used by traditional healers to treat diabetes or as aphrodisiac in other countries were given priority.

Similarly plants with scanty information in literature were also ranked as priority plants for testing for hypoglycaemic activity. A total of 27 plants were earmarked for laboratory testing.

Preparation of Plant Extracts

Two types of extracts were used to test for the effect on blood glucose. Aqueous extracts were used for *Syzygium guineense, Securinega virosa, Phyllanthus amarus, Croton macrostachys and Centella asciatica.* To prepare aqueous extracts, 100gm of the powdered dry plant material was soaked overnight with 500ml of distilled water. The following day, the mixture was boiled in a water bath for 5 minutes and then filtered using clean gauze. The filtrate obtained was freeze-dried and the powder obtained was stored in a freezer (-20°C) until the day of the experiment. When needed for use the extracts were re-constituted with distilled water to the required concentrations. *Caesalpinia bonducella* seeds were tested in the form of seed powder which was suspended in 1% carboxymethylcellulose (CMC). Extracts of the remaining plants were made by soaking a 1kg of the powdered plant material in 80% aqueous ethanol for 2 days.

The extract was then removed and the solvent was dried off using a rotar vapor. The remaining water was dried off using a freeze drier. The dry powders were also stored in a freezer until when needed for animal studies. The aqueous ethanolic extracts were suspended in 1% CMC for administration to animals.

Animal experiments

Male and female healthy albino rabbits weighing 1.2 - 2.2 kg were used for the study. The rabbits were used only once. If the rabbits had to be re-used they were allowed a resting period of two or more weeks.

Collection and measurement of blood glucose

The rabbits were held in a wooden rabbit holder and blood collected from the marginal ear vein after wiping the ear with xylene [5]. Volumes of 0.5 ml were then collected into universal bottles containing sodium fluoride and potassium oxalate as an anticoagulant and anti-glycolytic mixture. After blood collection, the pricked side of the ear was rubbed with cotton wool soaked with absolute alcohol to protect the rabbit against infection [5]. Blood glucose was measured using a YSI glucose analyser model 23 AM (Yellow Springs Instruments Co. Inc, Yellow Springs, Ohio 45387, USA).

Oral Glucose Tolerance Test (OGTT)

The rabbits were starved for 20 hr following which they were divided into 3 random groups each containing 12 rabbits. Blood was collected, pre-dose, from each rabbit for the determination of fasting blood glucose. The rabbits in-group 1, the controls, were given orally 2 ml/kg body wt distilled water or 1% carboxymethylcellulose (CMC). Those in group 2 were given an oral dose of 0.2 g/kg body wt of the plant extracts in distilled water or as a suspension in 1% CMC. Rabbits in-group 3 was given 0.1-g/kg-body wt chlorpropamide in distilled water [6]. Rabbits in the 3 groups were given an oral glucose load of 1 g/kg body wt [7], 30 min after dosing with either solvent or the extract. Blood was collected from rabbits in both groups at 0.5, 1, 2, 3 and 4 hr, after the oral glucose load, for the measurement of blood glucose.

Effect on fasting blood glucose (FBG)

Rabbits starved for 20 hr were randomly divided into three groups each containing 12 rabbits. Blood samples were collected for measurement of FBG. The rabbits in group 1 were dosed orally with 2 ml/kg body weight of distilled water or 1% CMC in water. Those in group 2 and 3 were given plant extracts as suspensions in 1% CMC or solutions in distilled water at a dose of 0.2 g/kg body weight and 0.1 g/kg body weight chlorpropamide [6], respectively. Blood samples were collected at 1, 2, 3, 4 and 6 hours, after dosing with plant extract or solvent, for the measurement of blood glucose.

Data analysis

The data for OGTT and FBG were analysed using one way analysis of variance for repeated measurements. The Neuman-Keuls range test was used to determine differences at each point. Differences at each point were considered significant when $P \leq 0.05$.

RESULTS

Knowledge about diabetes

A total number of 169 traditional healers in Handeni were interviewed. Among these healers 53.2% (90 healers) recognised and were treating one or more symptoms related to NIDDM. None of these healers related the symptoms they were treating with diabetes mellitus. About 3% were conversant with and understood diabetes mellitus as described in modern medicine. Most of these were the young healers who know how to read and write and might have acquired the knowledge by reading booklets on diabetes education. However, none of them showed convincing knowledge of plants used for the treatment of diabetes mellitus.

Table 1: A list of plants used for treating diabetes related symptoms in Handeni District

Botanical name (family)	Vernacular name
Acacia brispica Harms (Mimosaceae)	Msewa
Acacia mellifera (Vahl) Benth (Mimosaceae)	Msasa
Acacia polyacantha Willd. (Mimosaceae)	Mgunga
Albizia anthelmintica Brogn (Mimosaceae)	Mfuleta
Albizia petersiana (Bolle) Chiv. (Mimosaceae)	Mchala
Albizia versicolor Wew.ex.Oliv (Mimosaceae)	Mkingu/Mchingu
Anthrobostrys petersiana (KL)Pierre (Apocynaceae)	Mpira
Boscia salicifolia Oliv. (Capparidaceae)	Mguruka
Bridelia cathartica Bertol (Euphorbiaceae)	Kikwindile kwima
Caesalpinia bonducella (L.) Flem. (Caesalpiniaceae)	Msoro/mkomve
Cassia singueana Del. (Caesalpinaceae)	Mkwizingu
Catharanthus roseus (L.) G.Don (Apocynaceae)	Ua la bustani
Centella asiatica Urban (Umbelliferae)	Kidadaishi cha mtoi
Cissus quadrangularis (L). (Vitaceae)	Kihindihindi
Chasalia umbratiidor vetke (Rubiaceae)	Mhufya
Clausena anisata (Willd.) Oliv (Rutaceae)	Mkunguni/mjavikali
Combretum molle (R.Br)G.Don (Combretaceae)	Mnama
Conyza pyrrhopappa Sch. Bipex R.Rich (Compositae)	Mhasu /Mnenga
Crossandra subacaulis C.B.Cl. (Acanthaceae)	Kanyangamalo
Croton macrostachys A.Rich (Euphorbiaceae)	Mbiha
Cussonia zimmermanii Harms (Araliaceae)	Mntindi
Cyphosterma adenocaulis Stend ex A.Rich (Vitaceae)	Mwengere

Table 1: Contd..

Dalbergia melanoxylon Guilla Perr (Papilionaceae)	Mhingo
Deinbolia borbonica Schweinff (Sapindaceae)	Mbwakabwaka
Dicrostachys cinerea (L.) Whit & Arn (Mimosaceae)	Mkeregembe
Diospyros usambarensis Gurke (Ebenaceae)	Mgoto
Dombeya rotundifolia Harv. (Sterculiaceae)	Mnuwati
Ehretia amoena Klotzx H (Boraginaceae)	Mvungaliza
Euclea natalensis A.DC (Ebenaceae)	Mdala /muwana/mkambi
Ficus capensis Thumb. (Moraceae)	Mkuyu
Ficus exasperata Vahl. (Moraceae)	Mshasha
Grewia bicolor Juss (Tiliaceae)	Mkole
Heteromopha trifoliata (H.L.Wendl.) Eckl.& Zeyh. (Umbeliferae)	Mgombokela
Hibiscus micrantha L.Fil (Malvaceae)	Mhalasha mbuzi
Hibiscus sabdariffa L. (Malvaceae)	Kiwaro
Hoslundia opposita Vahl (Labiateae)	Mmolwe
Katunaregan obovata (Stapf)Keay (Rubiacea)	Mdasha
Kigelia africana (Lam)Benth. (Bignoniaceae)	Miegea
Lannea stuhlmannii (Engl.) (Anacardiaceae)	Mumbu
Makhamia obtusifolia Bak Sprague (Bignoniaceae)	Myuyu
Maytenus putterlickioides(Loes) *Excell & Mendonca* (Celastraceae)	Mtulavuha
Milletia dura Dunn (Papilionaceae)	Mhafa
Ocimum basilicum L. (Labiateae)	Kivumbasi
Pappea capensis Eckl & Zeyl.(Myritaceae)	Mnange
Psorospermum febrifugum Spach (Guttiferae)	Msakame
Phyllanthus amarus (Schum) Thonn (Euphorbiaceae)	Mzalia nyuma
Rumex usambarensis Dam. (Polygonaceae)	Nywanywa
Saba florida Pichon (Apocynacea)	Lubungu
Securidaca longepedunculata Fresem (Polygalaceae)	Masuke mengi
Securinega virosa (Roxb.ex.Willd.) Baill (Euphorbiaceae)	Mkwamba
Strychnos spinosa Lam. (Loganiacea)	Mtonga
Syzygium guineense (Willd) DC (Myritaceae)	Zambarau
Tephrosia densiflora Hook F. (Papilionaceae)	Mkinangu
Tragia brevipes Pax (Euphorbiacea)	Pupula
Triumpheta rhomboides Jaql (Tiliaceae)	Usosokole
Uvaria acuminata Oliv (Annonaceae)	Msofu
Vangueria tomentosa Hochst (Rubiaceae)	Mvilu
Watheria indica L. (Sterculiacea)	Suntang'andu
Ximenia americana L. var. cafra sond (Olaceae)	Mtundwi
Zanha africana Radlk Excell. (Sapindaceae)	Mdaula

Identification of plants for treatment of diabetes

A total number of 68 plant specimen, representing 31 families, 54 genera and 61 species, were collected. Table 1 shows the list of the plants collected. Table 2 shows plants with ethnomedical and proven biological activity reports, documented by other groups that is related to the alleviation of symptoms of

diabetes mellitus such as impotence, aphrodisiacs, treatment of sores, stimulants, hypocholesterolemic and antifungal activity [8-41]. Two of these examples are *Boscia salicifolia* Oliv (Capparidaceae) which contains a sweetening agent [19] and *Albizia anthelmintica* Brogn (Mimosaceae) which has hypocholesterolemic activity [12]. Both isolated substances are potentially benefitial to diabetic patients.

Table 2: Plants reported in literature for similar traditional uses or confirmed biological Activity

Plant name	Documented traditional uses/biological activity
Acacia mellifera	Stimulant [8]
Acacia polyacantha	Stimulant, aphrodisiac[8, 9, 10, 11]
Albizia anthelmintica	Hypocholesterolemic activity [12], aphrodisiac, Treatment of impotence [8, 13, 14]
Albizia versicolor	Treats headache[8, 15, 16] but it is neurotoxic[17]
Boscia salicifolia	Aphrodisiac, has sweetening effect [18, 19, 20]
Catharanthus roseus	Hypoglycaemic[21]
Cissus quadrangularis	Backache, body pain[22, 23, 24]
Clausena anisata	Treats sores, analgesic, antifungal [25, 26, 27, 28]
Croton macrostachys	Aphrodisiac, antifungal [20, 29]
Dalbergia melanoxylon	Treats headache, joint pains [30]
Deinbolia borbonica	Treats headache, antifungal [20, 22]
Dichrostachys cinerea	Aphrodisiac, headache, antifungal [8, 18, 31, 32]
Ficus capensis	Aphrodisiac [33, 34, 35]
Lannea stuhlmannii	Treatment of headache and sores [36]
Maytenus putterlickioides	Aphrodisiac [37]
Securidaca longepedunculata	Aphrodisiac and treatment of impotence [38, 39, 40]
Securinega virosa	Aphrodisiac and treatment of impotence [41]

The effect on blood glucose

Table 3 shows the list of plants tested for effect on blood glucose. A total of 27 plants species out of the 61 collected were tested for effect on blood glucose. Two plants, *Securinega virosa* and *Phyllanthus amarus* lowered area under the OGTT curve dose-dependently between doses of 0.1 and 1.0 g/kg body wt. The results from these two plants have already been published [42, 43]. Four plants, *Croton macrostachys, Maytenus putterlickioides, Albizia versicolor* and *Lannea stuhlmannii* increased the area under the OGTT curve significantly at the dose of 0.2 g/kg body wt ($P \leq 0.05$). Two types of extracts of *Croton macrostachys*, aqueous and chloroform extracts, were used and both increased area under the OGTT curve ($P \leq 0.05$), but did not have any effect on fasting blood glucose. The remaining plants did not have any effect on OGTT. There were no significant differences in the area under the OGTT curve between extract and solvent treated rabbits. Also all the plants tested did not have any effect on FBG. On the other hand, 0.1 g/kg body wt chlorpropamide which was used as a positive control caused an expected decrease of area under the OGTT and FBG Curves ($P \leq 0.05$).

DISCUSSION

The Handeni study shows that traditional healers have some knowledge about the symptoms of diabetes mellitus and in some

cases they may be the source of therapeutically useful compounds. However, there was no evidence that any of these healers have enough knowledge on diabetes and how to manage it. This is supported by the fact that only 3% of

Table 3: List of plants tested for effect on blood glucose

Name of plant	Part studied	Effect on AUC
Acacia mellifera	S	No effect
Acacia polyacantha	S	Increased ($P \leq 0.05$)
Albizia petersiana	S	Increased ($P \leq 0.05$)
Albizia versicolor	S	Increased ($P \leq 0.05$)
Boscia salicifolia	SL	No effect
Bridelia cathartica	S	No effect
Caesalpinia bonducella	Sd	No effect
Centella asiatica	AP	No effect
Cissus quadrangularis	S	Increased ($P \leq 0.05$)
Croton macrostachys	S, R	Increased ($P \leq 0.05$)
Dalbergia melanoxylon	S	No effect
Deinbolia borbonica	L	No effect
Dichrostachys cinerea	S	No effect
Dombeya rotundifolia	S	No effect
Ehretia amoena	S	No effect
Ficus exasperata	S, R	No effect
Hibiscus subdariffa	AP	No effect
Lannea stuhlmannii	S, R	No effect
Kigelia africana	Sb	No effect
Maytenus putterlickioides	S	No effect
Milletia dura	S	No effect
Phyllanthus amarus	AP	Decreased ($P \leq 0.05$)
Rumex usambarensis	AP	No effect
Securinega virosa	S	Decreased ($P \leq 0.05$)
Syzygium guineense	Sb, L, F, Sd	No effect
Ximenia americana var. caffra	S	No effect

Key: Sb = stem bark; S = whole stem; F = fruit pulp; Sd = seeds; AP = aerial parts; R = roots; L = leaves; AUC = area under the OGTT curve

those interviewed recognised the disease, and they consisted largely, of young healers who may have had exposure to educational booklets on diabetes mellitus. None of the younger healers, who knew exactly what diabetes mellitus is, also knew plants used for treatment. Impotence, which is one of the manifestations of autonomic disorders of diabetes, is one of the symptoms they recognised. Among the 169 healers interviewed, 17 (10%) had treated patients with impotence. It is interesting to note, in table 2, that some of the plants identified in Handeni are mentioned for the same use by other people elsewhere or have already been tested and confirmed to have biological activities that may help NIDDM

patients. Similarly it is noted in table 2 that *Securidaca longepedunculata, Boscia salicifolia, Securinega virosa, Albizia anthelmintica, Acacia polyacantha, Dichrostachys cinerea and Ficus capensis* have been reported by other researchers to be aphrodisiac. On the other hand *Catharanthus roseus* is reported to have a hypoglycaemic activity [21]. This is a very good consistency that would rationalise the screening of all these plants for any activity that may be potentially useful for managing NIDDM and its associated complications such as hypercholesterolemia. *Albizia anthelmintica* is already known to have hypocholesterolemic activity [12], so it is definitely a useful plant to use in diabetes.

Among the 27 plants which were tested for effect on blood glucose, only *Securinega virosa* and *Phyllanthus amarus* decreased area under the OGTT curve but did not show a hypoglycaemic activity. The mechanism by which they lowered area under the OGTT curve remains unknown, but it appears they may be useful in preventing escalation of postprandial blood glucose. Four others worsened glucose tolerance and the rest had no effect on blood glucose.

It can be concluded that some traditional healers recognise plants that may be useful in alleviating symptoms related to diabetes mellitus, but careful analysis of their knowledge is needed. Further studies are required to determine other properties of these plants that may be useful in the management of diabetes mellitus.

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REFERENCES

[1] K. O'dea. *Diabetes* 33 (1984) 596 - 603.

[2] T.K. Young. *Am. J. Human Biol.* 5 (1993) 399 - 413.

[3] WHO press release. *WHO/36*, 21st June 1991.

[4] M.C Gessler, D.E Msuya., M.H.H Nkunya., A. Schar., M. Heinrich, and M. Tanner. *J Ethnopharmacol* 48 (1995) 145-160.

[5] M.S Akhtar, M.A Athar and M.Yaqub *Planta Med.* 42 (1981) 206-212.

[6] S.R Naik, J.M.B Filho, J.N Dhuley, and V.Deshmukh, *J. Ethnopharmacol.* 33 (1991) 37-44.

[7] M.Perfumi., N.Arnold., and R.Tacconi,. *J. Ethnopharmacol.* 34 (1991) 135-140.

[8] I. Hedberg, O. Hedbrerg., P.J Madati., K.E. Mshigeni, E.N. Mshi and G Samuelsson. *J Ethnopharmacol* 9 (1983) 105-127.

[9] J..M. Watt, M.G Breyer-brandwijk,. In *Medicinal and poisonous plants of Southern and Eastern Africa.* 2nd Ed, 1962. E. & S. Livingstone, Ltd., London Pp549.

[10] A. Amico. *Fitoterapia* 48 (1977) 101-139.

[11] A.Z Almagboul, A.K Bashir, A. Karim, M. Salih, A. Farouk, and S.A Khalid, *Fitoterapia* 59 (1988) 393-396.

[12] T. Johns, R.L.A. Mahunnah, P. Sanaya, L. Chapman and T. Ticktin. *J. Ethnopharmacol* 66 (1999) 1-10.

[13] P.R.O Bally. *Bull Misc Information Roy Bot Gard* 1 (1937) 10-26.

14] Merker, M. In *Die Masai*. Second edition. Dietrich Reimer, Berlin, 1910. P 196.

[15] J.M. Watt, M.G. Breyer-brandwijk, In *Medicinal and poisonous plants of Southern and Eastern Africa*. 2nd Ed, 1962. E. & S. Livingstone, Ltd., London Pp 557-558.

[16] S.C. Chhabra and F.C. Uiso. *Fitoterapia* 62 (1991) 499-503.

[17] B. Gummow, S.S. Bastianello, L. Labuschagne, and Erasmus, GL. *Onderstepoort J Vet Res* 59 (1992) 111 - 118.

[18] F. Haerdi. Native medicinal plants of Ulanga District of Tanganyika (East Africa). Dissertation, Verlag fur recht und gesellschaft AG, Basel. Dissertation-Ph.D.-Univ Basel: - (1964).

[19] R.A Hussain, Y.M. Lin, L.J. Poveda, E. Bordas, B.S. Chung, J.M. Pezzuto, D.D. Soejarto and A.D. Kinghorn. *J. Ethnopharmacol.* 28 (1990) 103-115.

[20] AN. Sawhney, M.R. Khan, G. Ndaalio, M.H.H. Nkunya and H. Wevers. *Pak. J. Sci. Ind. Res.* 21 (1978) 193-196.

[21] R.J. Marles and N.R. Farnsworth. *Econ Med. Plant Res*. 6 (1994) 149 - 187.

[22] R.B. Bhat, E.O. Eterjere and V.T. Oladipo. *Econ Bot* 44 (1990) 382-390.

[23] S.P. Jain. *Int J Crude Drug Res* 27 (1989) 29-32.

[24] N. Nagaraju, and K.N. Rao. J Ethnopharmacol 1990; 29: 137-158.

[25] K..A. Woode, I. Addae-mensah, and F.A. Kufuor. X-ray structural studies on constituents of African medicinal plants. *Abstr Internat Res Cong Nat Prod Coll Pharm Univ N Carolina Chapel Hill NC July 7-12 1985*: Abstr-209.

[26] S.K. Adesina, and E.I. Ette. Fitoterapia 53 (1982) 63-66.

[27] B.S. Aswal, D.S. Bhakuni, A.K. Goel, K. Kar, B.N. Mehrotra, and K.C. Mukherjee. *Exp Biol* 22 (1984) 312-332.

[28] S.K. Adesina, and C.O. Adewunmi. *Fitoterapia* 56 (1985) 289 - 292.

[29] B. Desta. *J Ethnopharmacol* 39 (1993) 129-139.

[30] I. Hedberg, O.Hedbrerg, P.J. Madati, K.E. Mshigeni, E.N. Mshiu, and G. Samuelsson. *J. Ethnopharmacol.* 9 (1983) 237-260.

[31] L. Angenot. *Plant Med Phytother* 4 (1970) 263.

[32] B. Vasileva. *In Plantes medicinales de guinee. Conakry, Republique de Guinee*. 1969. Moscow Univ Moscow USSR.

[33] A. Bouquet, and M. Debray. *Trav Doc Orstom* 32 (1974) 1-.(Serv cent document orstom bondy 93140).

[34] J. Kerharo, and A. Bouquet. In *Plantes medicinales et toxiques de la Cote-d'Ivoire - Haute- Volta.* 1950. Vigot Freres, Paris. Pp 29.

[35] T. Johns, J.O. Kokwaro, E.K.. *Econ Bot* 44 (1990) 369-381.

[36] J.O. Kokwaro. In *Medicinal plants of East Africa.* East Afr Literature Bureau, Nairobi. (1976) Pp 52.

[37] H.J. Arnold and M. Gulumian. *J. Ethnopharmacol.* 12 (1984) 35-74.

[38] J.F. Azevedo, L. Medeiros. *Bull Soc Pathol Exot* 56 (1963) 68-76.

[39] J. Berhault. In *Flore illustree du Senegal.I. Dicots (Acanthaceae - Avicenniaceae)* Govt Senegal, Dakar. Book : - (1971).

[40] M.J. Moshi, F.C. Uiso, R.L.A. Mahunnah, S.R. Malele and A.B.M. Swai. *Int J Pharmacog* 37 (1997) 169 - 173.

[41] M.J. Moshi, Z.H. Mbwambo, F.C. Uiso, M.C. Kapingu and R.L.A. Mahunnah, (2000). *Pharmaceut. Biol* 38 (2000) 214-221.