

Full Length Research Paper

# Underutilized medicinal plants and spices: Chemical composition and phytochemical properties

M. A. Belewu\*, O. A. Olatunde and T. A. Giwa

Microbial Biotechnology and Dairy Science Laboratory, Department of Animal Production, University of Ilorin, Kwara State, Nigeria.

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Six plants and spices were examined for their possible efficacy as medicinal plants in a completely randomized design model. The proximate composition of the samples showed greatest crude protein content for *Vernonia amygdalina* and *Ocimum gratissimum*, followed by *Allium sativum* and *Citrus aurantifolia* and then *Khaya senegalensis* and *Zingiber officinale*. The higher ether extract content was reported for *V. amygdalina* and *O. gratissimum* while the least was recorded for *A. sativum*. The crude fibre content was highest for *V. amygdalina* followed closely by *O. gratissimum* and the least was *C. aurantifolia*. *Z. officinale* had the highest ash content compared to other samples. The phytochemical screening revealed the presence of some major groups of pharmaceutical compounds like alkaloids, tannin, saponin, polyphenols, flavonoids and sterols. Tannin, saponin and alkaloids were present in almost all the samples while flavonoids, polyphenols were found in *K. senegalensis* and *O. gratissimum*. Sterols were absent in all the samples except *O. gratissimum*, *K. senegalensis* and *V. amygdalina*. Flavonoids was founds strongly in *K. senegalensis*, *V. amygdalina* but mildly in *O. gratissimum* and *A. sativum*. Conversely, alkaloids were absent in *Z. officinale* and *A. sativum*. Conclusively, the values of the plants and spices in traditional medicine and the importance of the proximate composition and chemical compounds in the pharmaceutical, food and livestock industries were discussed.

**Key words:** Phytochemical, proximate composition, medicinal plants, spices.

## INTRODUCTION

The indigenous knowledge and practice of animal health in Africa was based on the traditional ways of treatment of various diseases using various medicinal plants. Edeoga et al. (2003, 2005) elucidated the importance of these medicinal plants and their importance in the pharmaceutical industry. However, these medicinal plants have been underutilized in the orthodox medicine but have now been recognized in ethno-medicinal preparation. The utilization of medicinal plants in traditional medicine was found to be effective, cheap and practical. Belewu (2006) in agreement with Ijeh et al. (2004) noted the growing interest on the medicinal properties of a number of common plants. The practice is fast developing due to poor economic situation, expensive and inadequate availability of drugs (Belewu, 2006).

Various ailments treated with medicinal plants include skin diseases, respiratory infections, diarrhoea, fever, eye infections, wound, external and internal parasites, poor milk secretion, poor weight gain, loss of appetite, fatigue among others (Hilow et al., 2002).

The various parts of the medicinal plants used for various treatments include the leaves, barks, tubers, roots, herbs and the plant extracts. These parts secrete various substances like alkaloids terpenes, phenolic compounds, basic metabolites, glycosides as well as secondary metabolites (Sofowora, 1982; Evans and Brighman, 1980). Various preparations formed with medicinal plants include decoction, emulsion, apozems, liniments, electroactives and powdered (Hilow et al., 2002). The medicinal plants are equally used in the cosmetic, perfumery and food industries (Heinrich, 2001). The pharmaceutical industry first extract the active ingredients before being used in the manufacturing of drugs hence, there is possibility of discovering the evolution of drugs in the medicinal plants (Trease and

\*Corresponding author. E-mail: milkyinka@yahoo.com. Tel: 08035817941, 08020594079.

Evans, 1983).

## Description and uses of the test medicinal plants and spices

### *Khaya Senegalensis*

It is a tree that belongs to the family Meliaceae. There are about five species and four (*K. anthoteia*, *K. senegalensis*, *K. ivoriensis* and *K. grandifolia*) are found in West Africa. The West Africa species are known as Africa mahogany. The wood of the plant has oleo-resin in their vessels and this makes it resistant to insect attack. The bark is commonly used in traditional medicine in West Africa mainly for the treatment of fever, lumbago, cough, rheumatism, stomach ache and gastric pain (Kercharo and Banques, 1950) in humans. It is also used in the treatment of worm infestation, ulcer and mucous diarrhoea in horses and camels (Dalziel, 1937).

### *Citrus aurantifolia* (Lime)

Lime requires tropical climate and it probably originated from southwest Asia, where many more related species grow widely. It has different names in different languages. These include Ma:nao (Thai), Tatli limoh B (Turkish), Limette, Limone (German) and many others. The fruits are almost always picked and consumed before it reaches the ripe state. The juice is sour as lemon juice but more aromatic. Lime pericarp contains essential oil (7%) whose main components are citral limonene, B pinene and fenchone (15%). Other aromatic compounds are terpinol, basabolence and some terpenoids.

### *Vernonia amygdalina* (Bitter leaf)

It is a shrub or small tree of between 2 and 5 m in height with petiolate leaf of about 6 cm in diameter which is elliptical in shape. The leaves are green with characteristic odour and a bitter taste (Anonymous, 2000). The leaves are used for human consumption as vegetable after washing. It stimulates digestive system as well as helps in reducing fever, it is used locally against leech. It is also used in making beer in Nigeria (Anonymous, 2000). The bitter taste of the leaf is due to the presence of some antinutritional factors like alkaloids, saponin, tannins and glycosides (Basu and Rastogi, 1967).

### *Ocimum gratissimum* (Scent leaf)

It is a perennial herb which is woody at base. The stem is between 1 and 3 m long. The leaves are broadly to narrow ovate in shape which are usually between 5 - 13 cm long, 3 - 9 cm wide with both surfaces being copiously

glandular punctate. The upper surface is glabrate to sparsely puberulent while the lower surface is puberulent on veins. The margins are serrate while the apex is acuminate with cuneate base. The petiole is between 1- 6 cm long. The plant is mostly a weed of roadsides and wasteland but is also vital in pastures. The plant prefers moist and fertile soils during growth but will tolerate drought at flowering.

### *Allium sativum* (Garlic)

It is part of the lily family and is closely related to shallots. The bulb is made of a series of bulblets known as cloves. The bulb has a papery exterior skin that varies in colour from white to purple. There are many varieties with the sativum or soft neck being the most common variety. Garlic medicinal uses include digestive stimulants, diuretic and antispasmodic. Its use in the prevention of cancer is well documented (Mercola, 2003). Garlic utilization was found to kill pathogenic bacteria, rotavirus infection as well as protozoa (*Cryptosporidium parvum*). Garlic was also found to be active against *Helicobacter pylori*. The presence of allicin in garlic helps in the disruption of cell membrane biosynthesis. It inhibits DNA polymerases and inhibits RNA synthesis, and as such disrupts the whole enzyme system that is responsible for cell replication. Allicin also destroys the SH groups in proteins. Presently, there are no resistant pathogens that have developed resistant to allicin found in garlic (Mercola, 2003).

### *Zingiber officinale* (Ginger)

Ginger is a perennial herb which grows from underground rhizomes. The rhizome has thick lobes coloured from tan to white. Fresh ginger contains "gingerols" and when exposed to air and heat changes to "shogaols". The nutritional content of ginger includes protein, lipids, carbohydrates, minerals and vitamins plus trace nutrients. Ginger also has capsaicin, curcumin and limonene as well as proteolytic enzymes. Additionally, it is one of the best carrier herbs and it could help in digestive absorption by up to 200% (Belewu, 2006).

The thrust of the study was to evaluate the potential of these medicinal plants and spices in terms of their chemical composition and active ingredients in preparation for their use in the treatment of various diseases in ruminant animals

## MATERIALS AND METHODS

### Collection and preparation of the plant materials

The plants samples were collected around the University of Ilorin, main campus or bought from the local market in Ilorin metropolis, Nigeria. The samples were identified at the Department of Plant

Science, University of Ilorin, Nigeria. The collected samples were washed in a running tap to remove soil and dust particles. It was later air dried on the laboratory bench for five days. The dried samples were milled each in the pestle and mortar into a powdery form. The powdered test samples were stored in a dry, clean container with lid for further analysis.

### Analyses

The samples were determined for their proximate composition of dry matter (DM), crude protein (CP), ether extract (EE) crude fibre (CF) and ash using the method of AOAC (1990) while the phytochemical properties (saponin, tannin, alkaloids, polyphenols, sterols, flavonoids) were determined by the methods of Sofowora (1982), Trease and Evans (1983) and Evans and Brightman (1980) (Table 1).

## RESULTS AND DISCUSSION

The highest crude protein content was recorded for *V. amygdalina* followed closely by *O. gratissimum*, *A. sativa*, *C. aurantifolia*, *Z. officinale* and *K. senegalensis*. Apart from the poor crude protein content of *K. senegalensis*, other samples had crude protein which was adequate for ruminant animals. This confirmed the assertion that ruminant diet should have a minimum of 7% crude protein (Zemmelink et al., 1972; NRC, 1978).

The crude fibre content was greatest for *V. amygdalina*, followed by *O. gratissimum* and then *A. sativa*. The crude fibre of *O. gratissimum* and *V. amygdalina* was adequate for better rumination and digestion in ruminant animals (NRC, 1978). Fibre also helps in the reduction of tracheal pressure which is beneficial in diverticular disease.

The ash content which is an indication of the mineral content was highest for *Z. officinale* and *V. amygdalina* while it was similar in other samples.

The results of the phytochemical screening (Table 2) showed that alkaloids, tannin, saponin and flavonoids were present in most of the samples. An interesting consequence is that these compounds are potent bioactive compounds that could be used for therapeutic purpose or which are precursors for the synthetic of useful drugs (Sofowora, 1993). The presence of these vital chemical substances supported the report of Pandey (1980) that plants have some vital chemical substances (alkaloids, carbon compounds, hydrogen nitrogen, glycosides, essential oil, fatty oils, resins, mucilage, tannins, gum and others).

### Alkaloids

Alkaloids were strongly present in *O. gratissimum*, *K. senegalensis* and *V. amygdalina* while it was mildly found in *C. aurantifolia*. The presence of alkaloids in most of these samples supported the reports of various authors (Edeoga et al., 2006). Alkaloids are known to play some metabolic roles and control development in living system

(Edeoga et al., 2006). The compound have protective role in animal and it is used in medicine especially the steroidal alkaloids which constitutes most of the valuable drugs. Additionally, plant extract showing active trypanocidal activity was found to contain alkaloids, flavonoids, phenolic and /or terpenes (Le Grand, 1986).

### Tannins

*K. senegalensis*, *V. amygdalina* and *O. gratissimum* have greatest quantity of tannins followed closely by *Z. officinale* and *A. sativum*. This confirmed the assertion of Ihekoronye and Ngoddy (1985) that tannins are rarely frequently encountered in food products of plant vegetable origin. The oxidation inhibiting activity of tannins have been known for a long time and it is assumed to be due to the presence of gallic and diagallic acids. Another point of note in this study is the styptic and stringer properties of tannic acid which was used in the treatment of inflammatory skin eruption and bowel conditions. The presences of tannins are responsible for the astringent flavour of tea.

### Saponin

It was strongly present in *O. gratissimum*, *k. senegalensis* *V. amygdalina* and *A. sativum* while it was mildly found in *Z. officinale*. The presence of saponin in most of the samples agreed with results reported by Edeoga et al. (2006). Saponins are glycoside of both triterpenes and sterols and are used as expectorant and emulsifying agent. Edeoga et al. (2006) in agreement with Akundu (1984) confirmed the presence of saponin in *O. gratissimum*. Hence, saponin as sugar derivatives may be steroidal or triterpenoids. The occurrence of steroidal saponins from numerous studies showed their importance and interest in pharmacy due to relationship with such compounds as sex hormones mostly in the development of female contraceptive pills. Additionally, saponin is equally used in medicine and pharmaceutical industries because of its foaming ability with the production of frothy effect. Saponin is used in the preparation of insecticides, various drugs and synthesis of steroid hormones (Okwu, 2003).

### Polyphenols

The compound was found to be strongly present in *O. gratissimum* and *K. senegalensis* but absent in other samples. Its present in *O. gratissimum* supported the report of Edeoga et al. (2006). The compound was found to be toxic to the growth and development of pathogens (Singh and Sawhney, 1988). It is enough to note that the compound has antimicrobial and antifungal effect and the compound had been used in disinfections while it remains the standards with which other bactericides are

**Table 1.** Proximate composition of the experimental medicinal plants and spices (%DM).

Parameter	Dry matter	Crude Protein	Ether extract	Crude fibre	Ash
<i>O. gratissimum</i>	93.33	20.78	11.75	14.90	3.58
<i>C. aurantifolia</i>	92.31	12.25	3.56	3.14	3.93
<i>K. senegalensis</i>	87.29	3.94	8.03	2.08	3.83
<i>V. amygdalina</i>	92.10	28.88	13.40	15.30	4.85
<i>Z. officinale</i>	93.60	8.21	5.59	3.95	6.22
<i>A. sativum</i>	94.99	16.85	1.80	4.45	3.82

Means of six determinations.

**Table 2.** Phytochemical screening of the experimental medicinal plants and spices.

Phytochemical	<i>O. gratissimum</i>	<i>C. aurantifolia</i>	<i>K. senegalensis</i>	<i>V. amygdalina</i>	<i>Z. officinale</i>	<i>A. sativum</i>
Alkaloids	++	+	++	++	-	-
Tannin	++	+	++	++	+	+
Saponin	++	-	++	++	+	++
Polyphenol	++	-	++	-	-	-
Flavonoids	+	-	++	++	-	-
Sterols	++	-	++	++	-	-

++ = Strongly present; + = mildly present; - = absent.

compared.

### Flavonoids

The compound was found strongly in *K. senegalensis* and *V. amygdalina* but mild in *O. gratissimum*. Its mild presence in *O. gratissimum* supported the report of Edeoga et al. (2006). However, Salisburg and Ross (1992) found the compound to be useful in disease resistance.

### Sterols

The presence of sterols in samples helps in the lowering plasma cholesterol and LDB cholesterol. Hence, its inclusion in ruminant diet will assist in reducing drastically the morbidity and mortality caused by cardiovascular disease. Another point of concern is that plant sterols could act as a natural preventive dietary product (Puurunen et al., 2000).

The aforementioned compounds have been shown to be present in the medicinal plants and spices reported herein. The spices (*A. sativum* and *Z. officinale*) were also reported to have antimicrobial activities, antitoxic probiotic support, antioxidant enzymes activity, anthelmintic, analgesic and cytoprotection (Conley, 1997) which may be added advantage to ruminant animals.

In conclusion, most of these under-utilized medicinal plants and spices have potent bioactive compounds which could be used for therapeutic purpose and /or as precursors for the synthesis of useful drugs. Also, the decoctions, emulsions, apozens or liquid extract or liniment or powders and others prepared from the medicinal plants and spices have being found to be very rich in nutrient composition and chemical substances needed by food and pharmaceutical companies.

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