

The antibacterial activities of *Sesamum indicum* Linn. leaf extracts

Ogunsola O.K and Fasola T.R

Department of Botany, University of Ibadan, Ibadan, Nigeria

Correspondence: tr.fasola@ui.edu.ng

ABSTRACT

The antimicrobial activities of a neglected indigenous vegetable plant, *Sesamum indicum* Linn. were investigated. Ethanol and aqueous leaf extracts were screened for anti-microbial activities on some pathogens: *Klebsiella pneumonia*, *Salmonella typhi*, *Escherichia coli* and *Staphylococcus aureus* using different concentrations (100mg/ml, 200mg/ml and 400mg/ml). The ethanolic extract (400mg/ml) strongly inhibited the growth of *E. coli* while it mildly inhibited the growth of *K. pneumonia* and *S. typhi*. *Staphylococcus aureus* growth was not inhibited or restricted from growing as the extract had no activity against the microorganism. The aqueous extract had no inhibition on the micro-organisms tested.

Key words: Antimicrobial activities, *Sesamum indicum*, Pathogenic bacteria, indigenous vegetable

INTRODUCTION

Plants contain diverse groups of phytochemicals such as tannins, terpenoids, alkaloids, and flavonoids that possess enormous antimicrobial potentials against bacteria, fungi and other microorganisms. These are much safer than synthetic drugs and show lesser side effects (Ravi, 2011). The search for components with antimicrobial activities has gained increasing importance in recent times, due to growing worldwide concern about the alarming increase in the rate of infection by antibiotic-resistant microorganisms (Davis, 1982; Shittu *et al.*, 2007a). Many plants have the potentials as potent remedies for treating different diseases, especially those used by indigenous people. It is therefore pertinent to provide scientific ground for such medicinal plants regardless of their habit, distribution, economic input and the use for which they are employed.

Vegetables are important sources of protective foods, which are highly beneficial for the maintenance of good health and prevention of diseases (Sheela *et al.*, 2004). The genus *Sesamum* is a member of the Pedaliaceae, which contains 16 genera and 60 species. The number of sesame species is not clear; however, about 40 species have been described, and 36 are mentioned in the Index Kewensis where almost all of the wild species are prevalent in Africa. *Sesamum indicum* is cultivated; although, a few other species: *S. augustifolium*, *S. calycium*, *S. Baumii*, *S. malabaricum*, and *S. radiatum* are harvested and eaten occasionally, particularly during famine or food shortage (Ashri, 2007).

Sesame is an important source of high quality oil and protein. Roughly half of the seeds weight is oil, which has excellent stability due to the presence of natural antioxidants such as sesamol and sesamin (Brar and Ahuja 1979; Kamal-Eldin 1993). The fatty acid composition of sesame oil varies considerably among different cultivars worldwide (Yermanos *et al.*, 1972).

In Togo, the young leaves of *S. indicum* are eaten as vegetable and used as medicine for respiratory diseases. Also the oil from the seeds is considered soothing for chest complaints and is purgative (Burkill, 1997). Sawabe (1994) reported that seeds of *S. indicum* contain phenols and lignan glycosides while Matsumura *et al.*, (1995) reported the antihypertensive effect of sesamin (a lignan from *S.indicum* oil). Seeds of both *S. alatum* Thonn. and *S. radiatum* Schum. & Thonn. are edible (Burkill, 1997) while Vincenzi *et al.*, (1994) reported that *S. indicum* is used as food flavour.

Sesamum indicum is a major constituent of an herbal preparation named Somina which has sedative, hypnotic and anxiolytic activities (Azmat *et al.*, 2008). Kumar *et al.*, (2011) reported the anticonvulsant activity of *S. indicum* using various animal models. Sesame oil contains carboxylic acids having a thioether, a sulphoxide or sulphon which function in dermatological and cosmetic compositions promoting skin exfoliation in stimulating epidermal regeneration. They are also useful for controlling intrinsic and extrinsic skin ageing (Maignan, 1998).

The seeds and oil of sesame and its related species have received a lot of attention from researchers owing to the economic values of its parts; but the leaves have attracted only the locals who use it mostly as vegetable and in treating some diseases. It is however of concern that the species is gradually being relegated as some other vegetables have since been used as substitute to this highly valued green leafy species. Therefore the aim of this work was to bring to focus the antimicrobial value of the leaf extracts.

METHODS

Cultivation, Harvesting, Authentication and Drying

The cultivation was carried out on farm inside the University of Ibadan which falls within the Southern Guinea Savanna ecological zone of Nigeria. Two plants were grown per stand in each plot at a spacing of 50cm between and within rows. Three weeks after planting, 8g of NPK20-10-10 was applied per plant, an equivalent of 100g of N/ha, 50kg K/ha recommended for the crop (Bakare, 1987 and Fasakin 2004). A broad spectrum fungicides (KAPTAF 75SD) and an insecticides (Karat 2.5EC) were also applied as foliar spray respectively against seedling damping off and leaf eating insect larvae. The plots were hoe-weeded, supplemented with hand pulling within the rows to ensure uncontaminated healthy growth of the plants. Also, the plants were watered in the absence of rain.

The plant leaves were harvested at maturity and authenticated at the Forestry Research Institute of Nigeria's Herbarium and assigned a voucher number; *S. indicum* (#109576). The drying of this plant was carried out at room temperature for 2 weeks and grinded into powder.

Anti-microbial screening

The test organisms used were collected from the stock cultures of the Medical Microbiology and Parasitology Department, University College Hospital, Ibadan, Nigeria. The micro-organisms are: *Eucherichia coli*, *Staphylococcus aureus*, *Klebsiella pneumonia* and *Salmonella typhii*.

Solvent extraction

A quantity of 80g plant powder was extracted in 200ml of ethanol (95% w/v) for 24hours, strained and the extract was concentrated to dryness at 50 °C. The same procedure was used for aqueous extraction. The extracts were then refrigerated at 4 °C prior to use. A measure of 4grams, 2grams and 1gram respectively of the extract were reconstituted in 10ml of sterile distilled water to obtain solution of different concentrations used for the antimicrobial screening.

Preparation of media

Nutrient agar – 2g of the nutrient agar was homogenised in 1 litre of distilled water using water bath at 100 °C. This was then autoclaved at 121 °C for 15 minutes. The medium was cooled to 45 °C after autoclaving before pouring into plates and used for subsequent bacteria plating.

Sensitivity test

Bacteria seeded on prepared Nutrient Agar were poured into sterile dishes at 45 °C. The plates were then allowed to be colonized by the pathogenic organism. Using a flamed cork borer of 8mm, wells were punched into the seeded plates. Different concentrations of the plant extracts were then poured and left for 24hours. The diametric zones of inhibition were measured in millimetre. The Minimum inhibition Concentration (MIC) for each microorganism used was determined using micro dilution method by Eloff (1998) as the least concentration/dilution of extract that inhibited the growth of the tested pathogenic micro-organisms.

RESULTS

The diametric zones of inhibition measured and minimum inhibitory concentrations are shown in Tables 1 and 2 respectively. The raw extract (400mg/ml) inhibited all the micro-organisms at different rates and degrees. *Escherichia coli* had the highest diameter of inhibition followed by *S. aureus* and *K. pneumonia* while *S. aureus* recorded zero diameter of inhibition as no activity was observed. The least zone of inhibition was observed against *S. typhii*. Though, *S. typhii* was mildly inhibited at 200mg/ml with 100mg/ml, it did not show inhibitory activity on all the tested microorganisms. The aqueous extracts have unnoticeable activity on all the organisms tested at various concentrations.

Table 1: Average diametric zones of inhibition of some bacteria caused by *Sesamum indicum* extracts

Test organism	Solvent extract	Control	Plant extract (400mg/ml)	1 st Dilution (200mg/ml)	2 nd dilution (100mg/ml)
<i>Klebsiella pneumonia</i>	Ethanol	-	4	-	-
	Aqueous	-	-	-	-
<i>Staphylococcus aureus</i>	Ethanol	-	-	-	-
	Aqueous	-	-	-	-
<i>Escherichia coli</i>	Ethanol	28	40	-	-
	Aqueous	-	-	-	-
<i>Salmonella typhii</i>	Ethanol	0	3	2	-
	Aqueous	-	-	-	-

Table 2: Minimum inhibitory concentration of ethanol and aqueous extracts of *Sesamum indicum* on some bacteria

Test organism	Solvent extract	Raw extract (400mg/ml)	1 st dilution (200mg/ml)	2 nd dilution (100mg/ml)
<i>Klebsiella pneumonia</i>	Ethanol	4	-	-
	Aqueous	-	-	-
<i>Staphylococcus aureus</i>	Ethanol	-	-	-
	Aqueous	-	-	-
<i>Escherichia coli</i>	Ethanol	12	-	-
	Aqueous	-	-	-
<i>Salmonella typhii</i>	Ethanol	3	2	-
	Aqueous	-	-	-

DISCUSSION

The various MIC(s) as presented in the results showed that the ethanolic extracts of *S. indicum* had a very strong antimicrobial effect on *E. coli* and mildly effective against *Klebsiella pneumonia* and *Salmonella typhii* at 400mg/ml while it had no effect on *S. aureus* using the same concentration. However the aqueous extract had no antimicrobial effect on the organisms screened. A mild inhibition was also observed using 200mg/g of the extract on *S. typhii*.

Some studies have shown that relationship exists between the chemical structures of the most abundant compounds in the tested extracts or essential oils and the antimicrobial activity (Farags *et al.*, 1989; Deans and Svoboda, 1989). The seed oil of *Sesame spp* was also reported to contain certain natural antibacterial agents that were effective against common skin pathogens, such as *Staphylococcus* and *Streptococcus* bacteria, as well as common skin fungi including the athlete's foot fungus as Shittu *et al.*, (2007a) observed.

The comparative studies of the crude extracts of *Sesame spp* against some common pathogenic micro-organisms carried out, Ahmed *et al.*, (2009) reported a high level of inhibition for most of the micro-organisms except *S. aureus*, which corroborates the findings in this present work. They however reported a strong antimicrobial

action against *S. aureus* and another organism, *Candida albican* using combination of aqueous extracts of both *S. indicum* and *S. radiatum*. Also in their study, antimicrobial activities of methanolic extracts of a related species, *S. radiatum* was observed.

Aftab (1995) reported that *Sesamum indicum* reduces the blood pressure and heart rate, it is also suggested that *S. indicum* contain tryptophan (Morris, 2002) which had a beneficial effect on memory functions (Levkovitz *et al.*, 2003). A related species, *S. radiatum* was found to stimulate spermatogenic activity and improve sperm quality in adult male Sprague Dawley Rat Testis (Shittu *et al.*, 2007b). This could also be possible for *S. indicum*. Minimum inhibitory concentration (400mg/ml) of the extract was obtained using ethanol as extractive solvent for the sample since aqueous extract showed no inhibition for the various concentrations used. This was found to be more effective with the raw extract of *Sesamum indicum*. Medically, 6mm zone of inhibition is regarded as the Minimum Potency Concentration (MPC) for any drug. Therefore, for this extract; MPC is 400mg/ml and was active only on *E. coli*. Based on this result, the ethanolic leaf extract of *S. indicum* could be used in the treatment of diseases caused by the named pathogenic organisms tested and its associated diseases. It may therefore be concluded that the plant extract is only bacteriostatic in properties and mildly bacteriocidal. The present work has shown that the ethanolic leaf extract was more antimicrobial than the aqueous extract. This finding confirms the importance of the traditional method using local gins for extracting biologically active ingredients of medicinal plant parts. Therefore, the ethanolic leaf extract of *S. indicum* could form a good antibacterial agent.

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