Original Article

Antimicrobial Activity Of New Synthetic Derivative Of Sesamol And Sesamum Indicum Seeds Extract Against Meningitis Causing Bacteria

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Abstract

The facts over *S. aureus* and *E. coli* to cause meningitis, and the antimicrobial potential of *Sesame seeds* and Sesamol were motivation for present study to compare the antibacterial potential of new synthetic derivativeof Sesamol (SDS) and *Sesamum indicum* seeds extract against meningitis causing bacteria (MCB). Present study involved synthesis of SDS and preparation of sesame seeds extract. The SDS was characterized using ATR-IR, 1H-NMR and Mass spectrometric data. Both SDS and sesame extract were tested for the inhibitory potential against MCB, namely: *S. aureus* and *E. coli*. Among both, the SDS exhibited higher inhibitory potential when compared with sesame extract. Based on the results present study concludes that SDS possess high inhibition potential against MCB and recommends that SDSmust be further evaluated for its clinical significance.

Keywords: Meningitis, Sesamol, Eesameextract, Antibacterial

INTRODUCTION

The acute bacterial meningitis (ABM) is known to be related with higher rates of unfavourable outcome and death. The commonly occurring causative pathogens such as *S. aureus* and *E. coli* should be considered while starting the empirical antimicrobial therapy for ABM [1]. Human microbiome is known to possess 1:1 bacteria and human cells. A little disturbance in such ratio activates the meningitis causing bacteria (MCB) [2-5]. Evidence suggests role of *S. aureus*) and *E. coli* in ABM [6]. Long-term administration of conventional antibiotics against various infections leads to multiple drug resistance and high mortality risk [7-17]. To combat such problem, one can use synthetic or phytoproducts. Literary evidence supports plants products as effective antibacterial agents [11-15], thereby can be used to combat MCB. Plants are known to possess numerous biological activities, so can be used in wide range of infections, disorders and diseases [18-40]. Several researches highlighted numerous biological activities of plants [41-98]. A large number of studies revealed increase in biological potential of plant products together when combined with nanotechnology [99-130]. Literary facts suggest several synthetic moieties to possess high antimicrobial potential [131-144]. Numerous patents on plants and their products have been granted attributed to their higher biological activities [145-185]. Therefore, present study was intended to determine the antimicrobial potential of *Sesame* extract (SE) and new synthetic derivative of sesame (SDS) derivative against meningitis causing bacteria (MCB).

MATERIAL AND METHODS

Materials

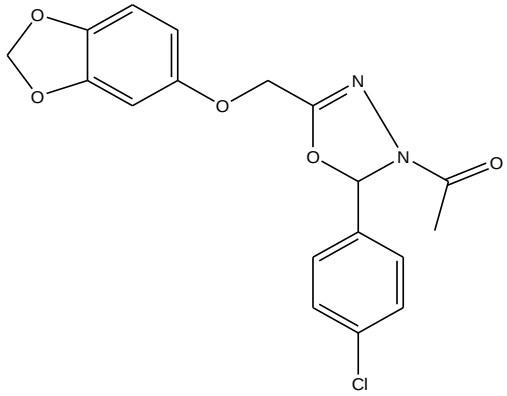
The melting point of synthesized compound was determined using Thomas Hoover apparatus. IR spectra were recorded ATR-IR, Perkin Elmer, ^{1}H-NMR on Bruker, DPX 300 and mass spectra on MASPEC (MSW/9629). Purity of synthesized compound was checked by TLC aluminium sheets – silica gel 60 F254 (0.2 mm). Plant material was collected from the local market of Sungai Petani, Malaysia. Chemicals and solvents were procured from the SD Fine, Sigma-Aldrich, and Merck Ltd.

Preparation of plant extract

The SE was prepared as per the standard procedure in the literature [15-25]. Briefly, sesame seeds free of decay were collected from the market of Sungai Petani, Kedah state, Malaysia and washed with tap water, followed by air drying, and macerated for 15 days using hydroalcoholic solvent (50:50). The mixture was filtered using double muslin cloth and a filter paper (Whatman No. 1) and the filtrate was dried to offer dark brown coloured SE. The obtained SE was stored at 4°C in refrigerator for further evaluation of its antimicrobial activity against MCB.

Procedure for the synthesis of SDS

The synthesis of SDS was done as per the standard protocol with slight modifications [8, 140-143]. Briefly, a mixture of 1-(5-((benzo[1,3]dioxol-5-yloxy)methyl)-2-(4-chlorophenyl)-1,3,4-oxadiazol-3(2H)-yl)ethanone (0.003 mol), was refluxed with acetic anhydride (10 mL) for 4 hours. After the reaction mixture attained room temperature, excess acetic anhydride was decomposed by adding water and the mixture was stirred for further 30 min. The separated product was filtered, washed with water, dried, and recrystallized from ethanol.



Response of SE and SDS against MCB

Preparation of bacterial culture

Bacterial strains of *S.aureus* and *E.coli* were used for the antimicrobial experiment. The prepared stock culture of microorganism was maintained at 4°C. Subcultures were prepared by transferring loopful of microorganisms' colonies from stock cultures into the nutrient broth and incubated for 24 hours at 37˚C in the incubator. The broth turbidity indicated the microbial growth [11, 12].

Well diffusion method

The inhibitory potential of the prepared SE and SDS against MCB was determined using well diffusion method-based zone of inhibition. The experimental protocol was followed as per the standard references with slight modifications [132-134]. Briefly, 20 µl of nutrient broth containing broth organism was poured into Muller Hinton agar plate that was spread uniformly using L-shape rod. The wells were made on the agar medium with cork borer of 5 mm in diameter which was previously sterilized using autoclave at 121ºC for one hour. Each 50 µl of SE and SDS were pipetted separately into the cup made on the agar plate. In the agar plate a few wells for SE, SDS, standard and control. These plates contained the antibiotic streptomycin (standard) and tween 80 (control) solutions for the purpose of comparison with the SE and SDS. All the plates were incubated for 24 hours at 37ºC. The diameter of zone of inhibition around wells was measured in millimetres (mm) in triplicate and average values were calculated.

Preliminary phytochemical screening of SE

The SE was subjected to preliminary phytochemical screening for the detection of various plant constituents. The prepared extract was screened for the presence of alkaloids, carbohydrates, flavonoids, glycosides, proteins, tannins, and phenols as per the procedure given in standard references [58, 59].

RESULTS

Synthesis of SE

White crystals; Yield 79%; mp 189-190 ºC; ATR-IR: 3046, 2924, 1720, 1613, and 1257 cm^{-1};^{1}H-NMR δ (ppm): 2.04 (3H, s, CH_3), 4.08 (2H, s, O-CH_2), 5.96 (2H, s, O-CH_2-O), 6.62 (1H, s, O-CH-N), 6.12-6.54 (3H, m, Ar-H), and 7.11-7.22 (4H, m, Ar-H); MS: m/z: 374 (M^+).

Response of SE and SDS against MCB

In present study, the prepared SE and evaluated for their inhibitory potential against MCB such as *S. aureus* and *E. coli* using agar well diffusion for measurement of zone of inhibition. The prepared SE and SDS were evaluated for their antimicrobial potential against bacterial strains of *S. aureus* and *E. coli*. The results so obtained are given in table 1.

Table 1: Zone of inhibition of SE and SDS

Compound	Microorganism	Zone of inhibition			
		Reading 1	Reading 2	Reading 3	Average Value
SE	E. coli	09	09	12	10
	S. aureus	14	12	13	13
SDS	E. coli	22	22	2	22
	S. aureus	18	18	18	18
Streptomycin	E. coli	24	24	24	24
	S. aureus	25	25	25	25
Tween 80	E. coli	-	-	-	-
	S. aureus	-	-	-	-

Preliminary phytochemical screening of SE

The SE was subjected to qualitative testing as per the procedure given in standard references [18,20]. The group of compounds identified in SE are given in table 2.

Table 2: Phytoconstituents of the SE

S. No.	Tests	Phytoconstituents
1	Alkaloids	+
2	Flavonoids	+
3	Glycosides	+
4	Proteins	-
5	Tannins and Phenolic compounds	+
6	Sterols	+

Where, (+) positive represent presence, and (-) negative represent absence

DISCUSSION

The preliminary phytochemical screening of prepared SE revealed presence of alkaloids, flavonoids, glycosides, sterols, tannins, and phenolic compounds. The IR,1H-NMR, and mass spectral data of SDSwas found to be in agreement with its structure. The characteristic 1H-NMR signal at 6.62 for O-CH-N, appearance of IR band at 1257cm^{-1} and m/z value at 374supported the successful synthesis of SDS. These spectral values were also further confirmed based on the literary facts [153]. Evidence reports *S. aureus* and *E. coli*, to trigger meningitis. The growing incidences of microbial resistance towards conventional antibiotics raise the demand for evaluation of new antimicrobials [7-10]. A report suggests use of *Sesamum indicum* plant in the treatment of various diseases and to possess strong antimicrobial potential. As per the literature available over different parts of *Sesamum indicum* plant and yet much more has to be explored for this plant. Hence, investigators of present study planned to evaluate the in-vitro inhibition potential of *Sesamum indicum* seeds extract against MCB (*S. aureus* and *E. coli*) using well diffusion method. The SE was prepared using hydroalcoholic extract 50%. The prepared SE was investigated for anti-microbial activity (using well diffusion method) and phytochemical screening. The SE showed good inhibitory effect overgrowth of *S. aureus* and *E. coli*. On the other hand, the SDS was prepared by amination of ester derivative of eugenol, and when tested against MCB (*S. aureus* and *E. coli*) exhibited high inhibitory potential study revealed that synthetic derivative (SDS) possesses high potential when compared with SE. The results of the present study were also supported my many other studies [155-183]. However, further preclinical, and clinical studies are required to further support the antimicrobial potential of SDS.

CONCLUSION

The results of the present study over inhibitory potential of SDS and SE against MCB, it is here by concluded that synthetic derivative SDS possess high antimicrobial potential against MCB especially *S. aureus* and *E. coli*. Present study recommends that highly potent SDS should be further evaluated based on the preclinical and clinical data.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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