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SPECTRUM OF ANTIBACTERIAL ACTIVITY OF AQUEOUS EXTRACTS OF "TRIPHALA" AND CONSTITUENT PLANTS

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The emergence of antimicrobial resistance in commonly encountered pathogens requires search for new antibiotics. The use of plant products including those used in traditional systems of medicine such as Siddha and Ayurvedic medicine is ancient and widespread and may provide material for development of non-toxic antibiotics. Triphala is one of several plant based non-toxic drugs used in the traditional system of medicine and consists of equal parts of dried pericarp of fruits of three plants – *Terminalia chebula*, *T. bellirica* and *Phyllanthus emblica*. The objective of the study was to determine the spectrum of antibacterial activity of Triphala and its component plants.

Aqueous extracts were prepared by boiling a sample of Triphala or constituent plants in distilled water to 1/8th the initial volume, meeting the conditions of traditional drug preparation. The antibacterial activity of the extracts was examined up to a dilution of 1/160, using the cut well and agar dilution methods against methicillin-sensitive (MSSA) and resistant (MRSA) *Staphylococcus aureus* including *S aureus* ATCC 25923, *Escherichia coli* ATCC 25922 and 35218, *Moraxella* spp., *Listeria* spp., *Pseudomonas aeruginosa*, *Burkholderia pseudomallei*, *Stenotrophomonas maltophilia*, *Bacillus* spp., *Citrobacter* spp., *Salmonella typhi*, *Salmonella typhimurium*, *Enterobacter cloacae*, *Klebsiella pneumoniae*, *Acinetobacter* spp., *Shigella sonnei*, *Shigella flexneri*, *Shigella dysenteriae*, *Streptococcus pyogenes*, *Streptococcus pneumoniae* and *Enterococcus faecalis*. All tests were performed in triplicate.

In the cut well method, all the aqueous extracts of Triphala, *T. chebula*, *T. bellirica* and *P. emblica* showed zones of inhibition against all tested bacteria with the exception of the aqueous extracts of *T. bellirica* which did not inhibit *B. pseudomallei*, *E. cloacae* and *K. pneumonia.* In the agar dilution method, the aqueous extracts of the Triphala and 3 constituent fruits demonstrated activity against *S. aureus* ATCC 25923 at >1/160 dilutions and *E. coli* ATCC 25922 and 35218 at 1/10 dilutions. The activity against MSSA, MRSA, *S. pyogenes*, *S. pneumoniae* and *E. faecalis* (Gram positive cocci) ranged from 1/40 to >1/160. Activity against Gram positive bacilli (*Listeria* spp., *B. cereus)* and Gram negative cocci (*Moraxella* spp.*)* was seen at >1/160 dilution. Activity against enterobacteria (*Citrobacter* spp., *K. pneumonia* and *E. cloacae)* ranged from 1/10-1/20 dilution. Activity against non lactose fermenting bacilli (*S. sonnei*, *S. flexneri*, *S. dysenteriae*, *S. typhimurium* and *S. typhi)* ranged from 1/10-1/80 dilution. Activity against other Gram negative bacilli tested (*S. maltophilia*, *P. aeruginosa*, *Acinetobacter* spp. and *B. pseudomallei)* ranged from 1/20-1/160 dilution.

The results show that the aqueous extracts of Triphala, *T. chebula*, *T. bellirica* and *P. emblica* have strong antibacterial activity against both Gram positive and negative cocci and bacilli, indicating that potent broad-spectrum antibacterial formulations can be derived from these extracts.

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