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Phytochemical Screening and Anti-microbial Properties of Herbal Medicines used for Treatment of Typhoid and Bacterial/Viral Infection in Kaduna State

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Abstract: *There are current trends in information flow between traditional and conventional medical sciences, especially in the applications of herbs for the treatment of some diseases. Given this challenge, the present study was designed to screen the phytochemicals and anti-microbial activities of herbal medicines commonly used for the treatment of typhoid and bacterial/viral infection in Kaduna state. Samples collected were dried and extracted by maceration using distilled water. The Phytochemical screening of the herbal extracts was carried out using the method described by Sofowora, (2008). Agar well diffusion and agar dilution methods were used for the anti-microbial analysis. The result of the phytochemical screening reveals the presence of some important phytochemicals; Tannin (17.78%), Glycoside (15.56%), Polyphenol (15.56%), Flavonoids (13.33%), Saponi n (13.33%), Terpenoid (8.89%), steroids (8.89%), alkaloids (6.67%) respectively. some of the herbal extracts showed a broad spectrum of anti-bacterial activities with zones of inhibition ranging from 14 – to 26 mm. The MIC and MBC values ranged from 80mg/ml to 100mg/ml respectively. The results of this research provide the baseline scientific proof that some herbal medicines with phytochemicals exert antimicrobial activities and hence justify the traditional use of some herbal medicines in the treatment of typhoid and infections.*

Keywords: *Phytochemical, Antimicrobial, Herbal medicines, Typhoid, Bacterial Infections*

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1.0 Introduction

Herbal medicine is the oldest healthcare system known to mankind and the practice has been in existence dates back before the written human history. Hippocrates in the late fifth century BC mentioned about 300 -400 medicinal plants (Tim 2004). World Health Organization (WHO) describes traditional herbal medicines as herbs, herbal materials, herbal preparations, and finished herbal products that contain parts of plants or other plant materials as active ingredients that are used for the prevention or treatment of different ailments (WHO 2011, Tilburt and Kaptchuk 2008). Traditional herbal medicines have impacted significantly the lives of the majority of people by providing an effective and cheap alternative to conventional drugs. The rapid spread of bacterial and viral infections has become a subject of concern to developed and developing countries, causing a high cost of treatment (Tsobou *et al.*, 2015). The prevalence of typhoid and other microbial infections and the increasing prices of medicine have resulted in the demand for herbal medicine. Traditional herbal medicines provide

overall natural and holistic healing, a source of livelihood, and income (Adefolaju, 2011). Medicinal Plants are embedded with many phytochemicals which exhibit a pronounced biological activity in living organisms and they are responsible for their pharmacological and medicinal values such as anti-viral, antimalarial, antibacterial, anti-inflammatory, anti-cancer, antioxidant and detoxifying ability (Sadat *et al.*, 2017, Harborne, 1973). Investigations into the antimicrobial activities of indigenous medicinal herbs and plant products have exposed plants as potential sources of therapeutic agents. Many people consume herbal medicines without object understanding the efficacy, dosage and chemical constituents responsible for the relief action. Most of the herbal medicines sold in the markets do not undergo scientific testing and their efficacies are poorly understood. Therefore, the present study seeks to investigate the activities of some commonly encountered herbal products used in the treatment of typhoid and infections in Kaduna State.

2.0 Materials and Methods

2.1 Sample collection and extraction

A total of ten (10) herbal samples (a concoction of plant parts) acclaimed to treat typhoid and microbial infection were purchased from some herbal shops within Zaria, Kaduna Central and Kafanchan. The Crude forms of herbal samples were milled into powder form. 50 g of each of the samples was extracted by maceration using distilled water and evaporated to dryness.

2.2 Phytochemical analysis of extract

The qualitative p screening of the extract or phytochemical constituents was carried out using the method described by Sofowora, (2008) Investigated phytochemicals included saponins, tannins, terpenoids, flavonoids, alkaloids, glycosides steroids and phenols.

2.3 Antimicrobial screening

2.3.1 Test organisms

Five clinical bacterial isolates (*Salmonella typhi, Bacillus subtilis, Staphylococcus aureus, Escherichia coli, Candida albican and Aspergillus niger*) were obtained from the Department of Microbiology, Faculty of Life Science Ahmadu Bello University Zaria for the antimicrobial screening of the samples extracts.

2.3.2 Sensitivity test (zone of inhibition measurement)

Screening for in vitro antibacterial effectiveness of herbal medicines extract *against S.typhi, E.coli, S.aureus, B sublitis C.albican* and *A. niger* were carried out using agar diffusion method. The Sensitivity Antimicrobial test was determined by measuring the diameter of inhibition zones in millimetres produced against the test bacterial isolates (Garba *et al*, 2019).

2.3.3 MIC and MBC determination

The minimum bactericidal concentration/minimum fungicidal concentration (MBC)/(MFC) were determined by sub-culturing all tubes that showed no visible bacterial growth from the MIC on fresh solid media and incubated for 24 hours at 37 ^{o}C (Garba *et al*, 2019).

3.0 Results and Discussion

The phytochemical screening of traditional herbal medicines was carried out and the results were recorded. All the herbal extracts were qualitatively screened to indicate the presence or absence of some important phytochemicals such as alkaloids, flavonoids, tannins, terpenoids, anthraquinones, phenolic compounds and saponins as shown in Table 1. From Tables 1 and 2, it is indicative of the presence and frequency distribution of phytochemical constituents of the analyzed traditional herbal medicines used in the treatment of malaria, typhoid, and bacterial and viral infections in Kaduna state. Most of the analyzed herbal medicines contained medicinally important phytochemicals as shown in Table 1. The % and frequency

distribution of these phytochemicals in the samples as shown in Table 1 are; 8 (17.78%) tannin, 7 (15.56%) glycoside, 7 (15.56%) polyphenol, 6 (13.33%) flavonoid, 6 (13.33%) saponin, 4(8.89%) terpenoids, 4(8.89%) steroids and 3(6.69%) alkaloid. Carbohydrates and anthraquinone were absent in all the samples. The presence of the phytochemical in some of the herbal extracts indicates the extracts have antimicrobial potential, which confirms the use of these medicines by the locals in the treatment of g typhoid fever and microbial infections. The presence of flavonoids and alkaloids and other phytochemicals were also detected in a similar research by Umar and Mohammad (2016) on some herbal medicines sold in Kano state.

Table 1: Phytochemical test on the herbal medicine extracts

		Herbal medicine extracts									
S/N	**Phytochemicals**										
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1	Alkaloids	++	++	-	-	-	-	-	-	-	++
2	Flavonoid	+++	-	+++	+++	+	-	-	+++	-	++
3	Saponin	+++	-	-	+	+++	-	-	++	+++	+++
4	Tannin	++	+++	+++	+++	+++	-	+++	+++	-	+++
5	Terpenoids	++	-	+++	+++	-	-	+++	-	-	-
6	Glycoside	++	++	+++	++	+++	-	++	++	-	-
7	Steroids	++	++	-	-	+	-	-	+	-	-
8	Polyphenol	+++	-	++	+++	+++	-	++	++	-	+
9	Carbohydrate	-	-	-	-	-	-	-	-	-	-
10	Anthraquinone	-	-	-	-	-	-	-	-	-	-
	Percentage	80	40	50	50	60	0.0	40	60	10	50

** +++ = strongly positive, **++ =** moderately positive , + = slightly positive , - = absent

Table 2: Distribution and frequency of phytochemicals in the herbal samples

		Number and % distribution		
S/N	**Phytochemical**	**Typhoid**	**Infection**	**Total**
1	Alkaloids	1 [3.45]	2[12.5]	3[6.67]
2	Flavonoids	4 [13.79]	2[12.5]	6[13.33]
3	Saponins	3[10.34]	3[18.75]	6[13.33]
4	Tannin	5[17.24]	3[18.75]	8[17.78]
5	Terpenoids	3[10.34]	1[6.25]	4[8.89]
6	Glycosides	5[17.24]	2[12.5]	7[15.56]
7	Steroids	3[10.34]	1[6.25]	4[8.89]
8	Polyphenol	5[17.24]	2[12.5]	7[15.56]
9	Carbohydrates	0[0]	0[0]	0[0]
10	Anthraquinone	0[0]	0[0]	0[0]
	Total	29[100%]	16[100]	45[100]

Table 3: Sensitivity test (zone of inhibition (mm))

Test Microorganism	conc	Samples extract 1	2	3	4	5	6	7	8	9	10	Control CPX/F
S. typhi	100	18	-	15	-	-	-	-	15	-	-	33
	50	9	-	12	-	-	-	-	11	-	-	
B. subtilis	100	15	14	16	15	13	-	13	18	-	-	40
	50	-	-	10	10	-	-	9	14	-	-	
E.coli	100	17	-	18	-	-	-	-	23	-	-	25
	50	14	-	14	-	-	-	-	18	-	-	
S.aureus	100	19	14	23	18	13	10	19	26	-	-	35
	50	14	10	20	15	12	-	15	23	-	-	
C.albican	100	-	-	-	-	-	-	15	22	-	-	34
	50	-	-	-	-	-	-	-	16	-	-	
A.niger	100	-	-	-	-	-	-	-	-	-	-	40
	50	-	-	-	-	-	-	-	-	-	-	

Key:CPX = Ciprofloxacin for bacteria, F = Econozole for fungi, - = no zone of inhibition

Table 4: Minimum inhibitory concentration and minimum bactericidal concentration

Organism	MMC	Sample Extracts 1	2	3	4	5	6	7	8	9	10
S.typhi	MIC	90	-	80	-	-	-	-	80	-	-
	MBC	100	-	100	-	-	-	-	100	-	-
B.subtilis	MIC	90	90	90	90	90	-	90	80	-	-
	MBC	100	100	100	100	100	-	100	90	-	-
E.coli	MIC	80	-	80	-	-	-	-	80	-	-
	MBC	100	-	100	-	-	-	-	100	-	-
S.aureus	MIC	90	90	90	90	80	90	90	90	-	-
	MBC	100	100	100	100	100	100	100	100	-	-
C.albican	MIC	-	-	-	-	-	-	80	80	-	-
	MBC	-	-	-	-	-	-	100	90	-	-
A.niger	MIC	-	-	-	-	-	-	-	-	-	-
	MBC	-	-	-	-	-	-	-	-	-	-

Key: MMC= minimum microbial concentration, MIC = minimum inhibitory concentration MBC = minimum bactericidal concentration, - = No activity

Extracts of the herbal sample were evaluated for sensitivity against pathogens of (2) gram-positive, (2) gram-negative bacterial strains and (2) fungi. The results of the antimicrobial activity are shown in Table 3 which indicates the diameter of the zone of inhibition of the test microorganism at different concentrations (100 mg/ml to 50 mg/l) of the extracts. 80% of the extract showed remarkable activity against S.*aureus* with a zone of inhibition ranging from 10-26 mm, 70% of the extract also showed activity against *B.subtilis*, while 30% of the

herbal medicines showed activity against *Salmonella typhi* and *E.coli*. Sample 8 exhibited the highest activity against *B. sutilis, E.coli, S.* aureus and *C. albicans* followed by sample 3 against *B.subtilis, E.coli, S. aureus;* samples 4 and 5 had activity only against B.*sublitis* and E.*coli*. Samples 8 and 7 were the only samples that showed activity against *C. albicans*. No inhibitory activities were recorded for samples 9 and 10 extracts. Similarly, there was no observable fungal activity displayed by all the against *A. niger*. The results of the study revealed that some of the herbal extracts demonstrated antibacterial properties against *S.typhi, E.coli, S. aureus, B. sublitis and C.albican* that may be useful in further ethno-medicinal and pharmacological aspects. However, the zones of inhibition formed by ciprofloxacin and econozole (positive control) were higher (25mm – 40mm) than those formed by the extract. The minimum inhibitory concentration MIC and the minimum bactericidal concentration MBC of different herbal extracts against the test microorganisms were determined using the broth dilution method and the results is shown in Table 4. The MIC of the extract ranged from 80 – 90mg/ml. sample 8 extract showed the lowest values of MIC of 80mg/ml against *S.typhi, B. cerus, E.coli and C.albican* followed by sample 3 against *S.typhi and E.coli*. The finding of this study is in agreement with other works that some herbal medicines possess antimicrobial efficacy (Pipi *et al*., 2020, Ya'aba *et al*., 2020)

4.0 Conclusion

Traditional Herbal medicines used for the treatment of typhoid fever, and bacterial and viral infections in major Kaduna cities were analyzed for their phytochemical, and antimicrobial activity. Most of the samples contained medicinally important phytochemicals which are responsible for their relief action. . The results of the study revealed that some of the herbal extracts demonstrated antibacterial properties that may be useful in further ethno-medicinal and pharmacological aspects.

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Compliance with Ethical Standards

Declarations

The authors declare that they have no conflict of interest.

Data availability

All data used in this study will be readily available to the public.

Consent for publication

Not Applicable

Availability of data and materials

The publisher has the right to make the data public.

Competing interests

The authors declared no conflict of interest.

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Authors' contribution

Main Author procure samples, pretreat, carry out extraction and Phytochemical test, design and compile the result, while the co-author participate in the experimental aspect of the research.