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Research Article

Ethnobotanical study of medicinal plants used in the treatment of gastroenteritis and urinary tract infections in children aged 0–5 in the city of Guelendeng and its surroundings

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Abstract

In recent years, there has been growing interest in researching and developing new molecules with antimicrobial properties from various natural sources, with the aim of combating antibiotic resistance. This study was conducted with the aim of identifying medicinal plants used in the treatment of gastroenteritis and urinary tract infections in children under five in the city of Guelendeng and its surroundings. Ethnobotanical surveys were conducted using questionnaires with 33 traditional practitioners. Fieldwork allowed samples of the four most frequently cited plants for the two infections to be collected for identification and testing on bacterial strains. A total of 13 plants indicated for the treatment of gastroenteritis and 11 for the treatment of urinary tract infections were identified, distributed respectively among 7 and 6 families. The Fabaceae family is dominant (38.48% and 36.37%). Most of the respondents were women (55%), and most were not literate (48.49%) or had a primary education (39.39%). The floral diversity constitutes a natural resource for traditional medicine. Studies of this kind should encourage everyone to protect the flora.

Keywords: medicinal plants, gastro-intestinal and urinary infections, children under 5.

Introduction

According to the World Health Organization, infectious diseases are the leading cause of mortality and morbidity in developing countries[1,2]. Gastro-enteritis and urinary tract infections are among the most common of these diseases and cause significant human and economic losses. Children and the elderly are most at risk. Infectious gastroenteritis in children is a public health concern, undoubtedly due to the presence of certain pathogenic bacteria, particularly *Escherichia coli, Salmonella non typhi* and *Shigella* [3,4,5]. These bacteria are normally present in the digestive flora of humans and warm-blooded animals. Certain *Escherichia. coli* strains are pathogenic because they have acquired virulence factors[6]. They are associated with a high risk of morbidity and mortality in children under [5], particularly in developing countries[7.S]

Urinary tract infections are among the most common bacterial infections in paediatrics[8]. In children, it is a significant daily issue in clinical practice: its prevalence varies according to the study, reaching up to 7.8% of girls and 1.6% of boys. In developed countries, it accounts for around 5% of hospitalisations in general paediatric wards. In Africa, studies indicate frequencies ranging from 8.3% to 30% in paediatric hospitals[9]. In Ouagadougou (Burkina Faso), it is 18.67%, compared to 25% in children in Côte d'Ivoire. At the Centre Hospitalier Universitaire de Yopougon in Côte d'Ivoire, the prevalence of this condition is 53.6% in girls[1]. Urinary tract infection is a concern for paediatricians, regardless of the country in which they practise[8]. It is a severe condition in children due to the possibility of cortical renal involvement with a risk of renal insufficiency or hypertension in the long term. Furthermore, in recurrent

forms, it often indicates an underlying uropathy or condition such as haemoglobinopathy, diabetes or immunodeficiency[9]. The most frequently implicated germs are *Escherichia coli and Klebsiella pneumoniae*, which belong to the Enterobacteriaceae family, as well as *Staphylococcus aureus*[10]. Diagnosis of urinary tract infection is based on cytobacteriological examination of urine (ECBU)[9]. Factors that favour the persistence and propagation of the strains responsible for these infections include the consumption of food and water of poor hygienic quality, a lack of environmental sanitation and contact with animals, which is favoured by their transhumance in certain cities, as well as urban and peri-urban farming[11].

In recent years, there has been growing interest in researching and developing new molecules with antimicrobial properties from various natural sources, with the aim of combating antibiotic resistance. Consequently, great attention has been given to medicinal and aromatic plants and their secondary metabolites, such as terpenes, alkaloids and phenolic compounds[12].

In Chad, certain institutions such as the University of N'Djamena have conducted pharmacological research on medicinal plants with anti-radical and antibacterial properties, such as *Anogeissus leiocarpus*[13]. *Acacia amythestophilla* has been used in urinary tract treatment in Chad[14].

In order to promote our plants and, above all, to propose a traditional alternative to the management of these infections, this study was conducted to compile a list of medicinal plants and traditional therapeutic knowledge related to their use in the management of gastroenteritis and urinary tract infections in children under five.

1. Materials and methods

1.1. Description of the study area

The ethnobotanical survey of gastroenteritis and urinary tract infections was conducted in the Republic of Chad, specifically in the city and villages of the Mayo-Lémié Department, Mayo-Kebbi Est Province. The town of Guelendeng is the administrative centre of the Mayo-Lémié department. Its geographical coordinates are: Latitude North: 10° 9' 45.8", Longitude East: 15° 55' 0.3", Altitude: 321 metres. Its population is estimated at 31,578 according to recent data from the ADREM-Tchad.

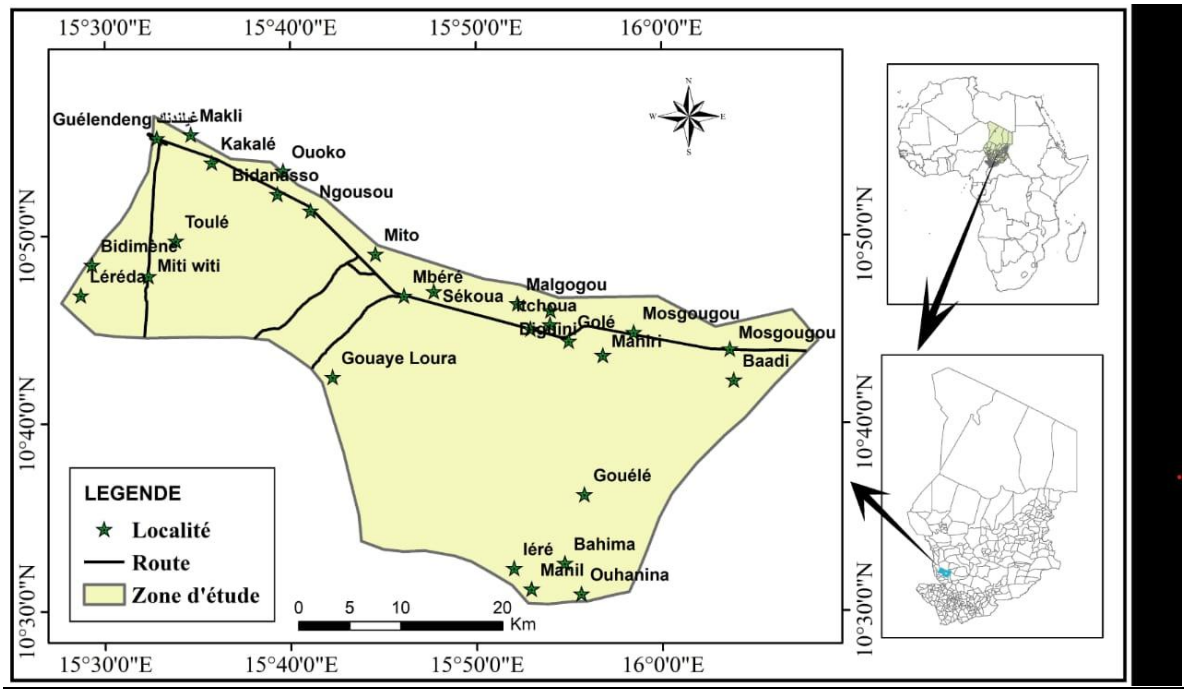

Figure 1: the study area map

1-2. Methods

1-2-1. Types and period of study

This is a prospective, cross-sectional and descriptive study taking place from 16 to 23 November 2025.

1-2-2. Study population

The study population consisted of traditional practitioners and herbalists in the city of Guelendeng and its surroundings.

1-2-3. Inclusion criteria

The study included tradipraticians and herbalists of both sexes, aged over 20, from the Mayo-Lémié department and surrounding areas.

1-2-4. Sociodemographic characteristics of master traditional practitioners

The variables studied are: sex, age category, experience and level of education.

1-2-5. Sampling

A total of thirty-three (33) traditional practitioners and herbalists were included in the study.

1-2-6. Survey

The study was conducted using a series of ethnobotanical surveys involving direct interviews based on a pre-established questionnaire in the various districts of the city of Guelendeng and its surroundings.

1-2-7. Sampling and herbarium preparation

After collecting information from traditional practitioners and herbalists on medicinal plants, a field trip was made to the habitats of the four most commonly cited medicinal plants for these two infections. Samples of each plant were collected and taken to N'Djamena for botanical identification. The herbariums were identified or confirmed using reference specimens by a botanist at the Faculty of Exact and Applied Sciences.

1.2.8. Data analysis

The graphs were created using Excel and the results were presented as percentages in the form of graphs and tables.

Table 1: Distribution of traditional practitioners and herbalists surveyed

Localities	Number of traditional practitioners and herbalists surveyed
Guelendeng	1
Kakalé campement	3
Kakalé Gama	14
Kakalé Mbeuri	12
Boudanassa	3

2. Results

2.1. Characteristics of the traditional practitioners and herbalists surveyed

The survey was conducted with thirty-three people, comprising two ethnic groups: thirty-two (32) Ngambaye and one (1) Massa.

2.1.1 Distribution of respondents by sex

The traditional practitioners and herbalists surveyed are made up of men and women, the distribution of which is as follows:

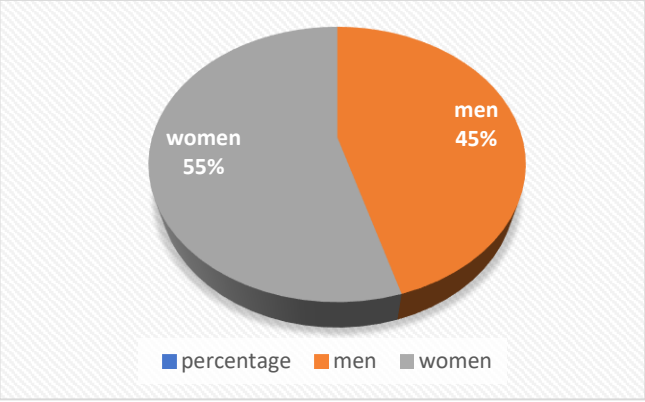

Figure 2: Distribution of respondents by sex

It was observed in this figure a slight dominance of women, at 54.55%, compared to men, at 45.45%.

2.1.2. Distribution of respondents by age group

The distribution was made over 10-year intervals and is presented as follows:

Table 2: Distribution of respondents by age group

Age groups (AN)	Number of respondents	Percentage (%)
20-30	5	15,15
31-40	4	12,12
41-50	10	30, 30
51-60	5	15,15
More than 60	9	27,28
Total	33	100

High frequencies were observed in the age groups 41–50 (30.3%) and over 60 (27.28%). The 20–30 and 51–60 age groups had an equal frequency. The 31-40 age group had the lowest frequency.

Their years of experience range from 3 to 20 years.

2.1.3. Distribution of respondents by level of education

Respondents did not have a high level of education. Their level is between primary and secondary; the rest are not educated.

Table 3: Distribution of respondents by level of education.

Level of education	Number(s)	Percentages
Out-of-school	16	48,49%
Primary	13	39,39%
Secondary	4	12,12%
Total	33	100%

The majority of respondents had no formal education (48.49%); 39.39% had completed primary education, whilst those who had completed secondary education were in the minority (12.12%).

2.2. Diversity of plants used in the treatment of gastroenteritis

The survey identified 13 plant species, belonging to 7 botanical families, used in the traditional treatment of gastroenteritis. The Fabaceae family is the most common, with 5 species (38.48%). The Combretaceae family is represented by 2 species (15.38%). The Rhamnaceae family is represented by 2 species (15.38%). The Malvaceae, Anacardiaceae, Annonaceae and Moraceae families are each represented by 1 species (7.69%).

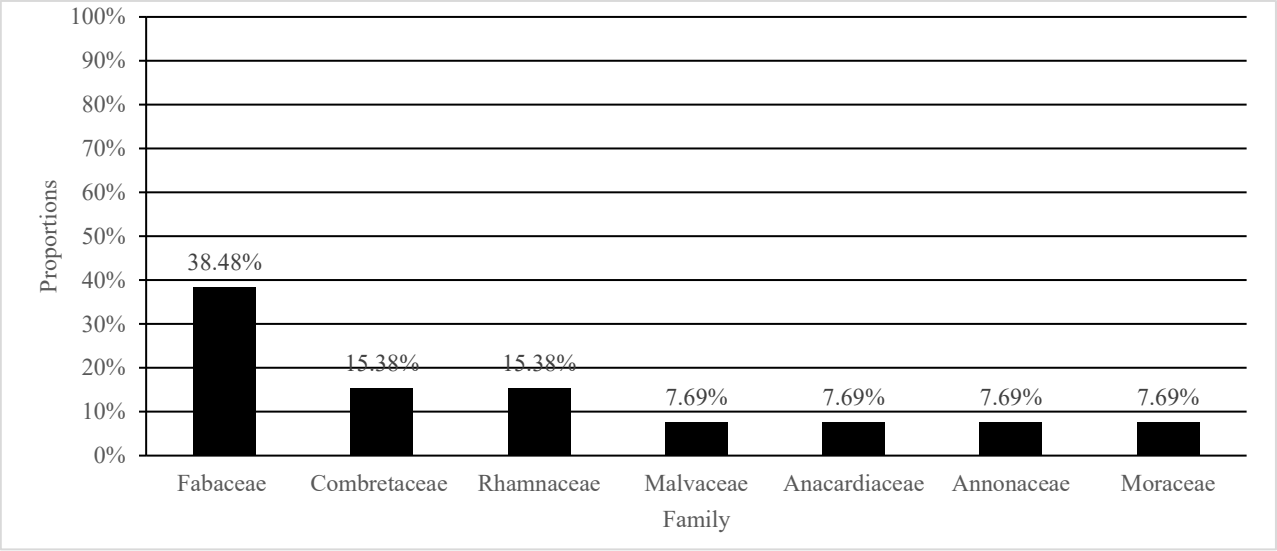

Figure 3: Distribution of plant families identified in the treatment of gastroenteritis. With regard to growth habit, 8 out of 13 (61.63%) of the species identified are trees; 5 (38.37%) are shrubs; With regard to citation rates, the most frequently cited plants for the treatment of gastroenteritis are: *Terminalia avicennioides* Guill. et Per. (57.58%) and *Detarium microcarpum* (51.52%) (Table 4). The list of species, the parts used, the methods of preparation and administration, and their citation frequencies (CF) are summarised in Table 4.

Table 4: Species used, parts used, methods of preparation and routes of administration in cases of gastroenteritis

N°	Scientific names	Local name	Plant type	Family	Parts used	Form of the drug	Methods of preparation	Methods of administration	Dosage	Total citations	Fréquency (%)
1	*Piliostigma reticulatum* (DC.) Hochst.	Karoum (arabe)	shrub	Fabaceae	bark	fresh or dried	decoction or infusion	Oral	1 glass 3 times a day	2	6,06
2	*Detarium microcarpum* Guill. & Perr.	Gasta (massa)	shrub	Fabaceae	bark	fresh or dried	decoction or infusion	Oral	1 glass 3 times a day	17	51,52
3	*Ficus platyphylla* Delile	Kob (ngambaye)	tree	Moraceae	leaf	fresh or dried	decoction	Oral	variable	4	12,12
4	*Anogeissus leiocarpa* (DC.) Guill. & Perr.	Ida (ngambaye)	tree	Combretaceae	bark	fresh or dried	decoction	Oral	variable	8	24,24
5	*Ziziphus mauritiana* Lam.	Ngogro (Ngambaye)	shrub	Rhamnaceae	bark	fresh or dried	decoction	Oral	variable	10	30,3
6	*Faidherbia albida* (Delile) A. Chev.	Diri (Ngambaye)	tree	Fabaceae	bark	fresh or dried	decoction	Oral	variable	2	6,06
7	*Ziziphus mucronata* Willd.	Ngogro-bichi (Ngambaye)	shrub	Rhamnaceae	Bark, roots	fresh or dried	decoction	Oral	variable	15	45,45
8	*Terminalia avicennioides* Guill. et Perr.	Rho (Ngambaye)	tree	Combretaceae	bark	fresh or dried	decoction	Oral	variable	19	57,58
9	*Acacia nilotica* (L.) Willd. ex Delile	Garat (arabe), Madjirang (Ngambaye)	tree	Fabaceae	bark	fresh	decoction	Oral	variable	3	9,09
10	*Prosopis juliflora* (Sw.) DC.	soussoubane (arabe)	tree	Fabaceae	leaf	fresh	decoction	Oral	variable	2	6,06
11	*Annona senegalensis* Pers.	Mboro (ngambaye)	shrub	Annonaceae	bark	fresh	decoction	Oral	variable	1	3,03
12	*Sclerocarya birrea* (A. Rich.) Hochst.	Ngolobe (ngambaye)	tree	Anacardiaceae	bark	fresh	decoction	Oral	variable	1	3,03
13	*Sterculia setigera* Delile	Da(ngambaye)	tree	Malvaceae	bark	fresh	decoction	oral	variable	3	9,09

2.3. Diversity of plants used in the treatment of urinary tract infections

During this study, 11 plant species, belonging to 6 botanical families, used in the traditional treatment of urinary tract infections were identified. The Fabaceae family is the most widely represented, with 4 species (36.36%). The Euphorbiaceae and Rhamnaceae families are each represented by 2 species (18.18%). The Moraceae, Olaceae and Poaceae families are each represented by one species (9.09%)

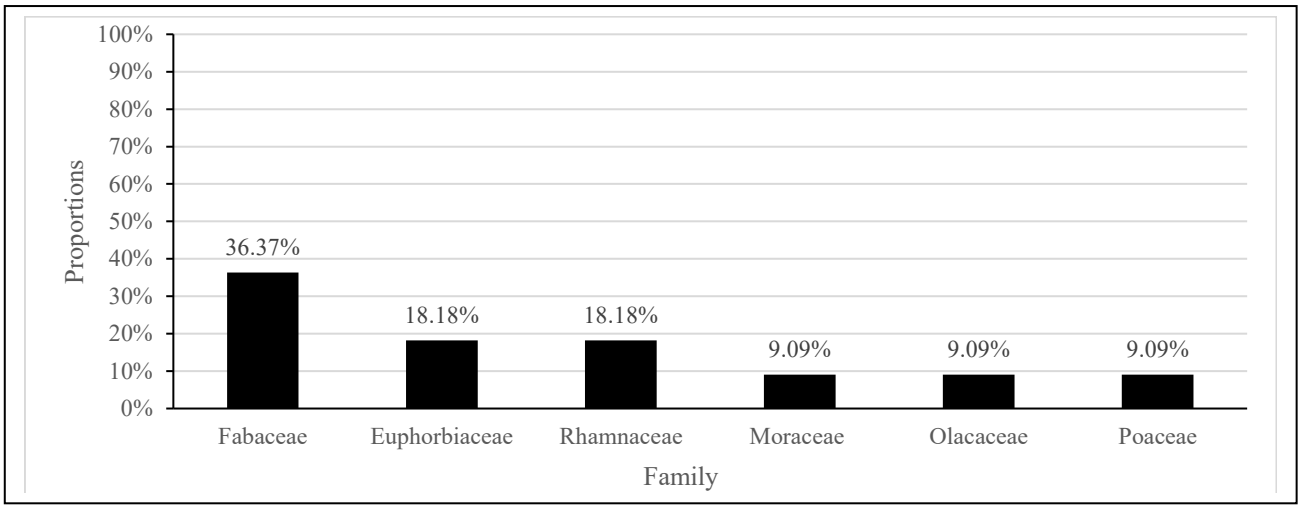

Figure 4: Distribution of plant families recorded

In terms of growth habit, 7 out of 11 (63.63%) of the species recorded are shrubs; 2 out of 11 (18.19%) are shrubs; 1 out of 11 (9.09%) is a herb; and 1 out of 11 (9.09%) is a subshrub.

With regard to citation rates, the most frequently cited plants for the treatment of urinary tract infections are: *Cassia sieberiana* DC, with 18 citations (57.58%), and *Bridelia ferrugineana* Mull et arg, with 17 citations (51.52%) (Table 5).

The list of species, the parts used, the methods of preparation and administration, and their citation frequencies (CF) are summarised in Table 5.

Table 5: Species used, parts used, methods of preparation and routes of administration for urinary tract infections

N°	Scientific names	Local name	Plant type	Family	Parts used	Form of the drug	Methods of preparation	Methods of administrati	Dosage	Number of	Frequency
1	*Ficus platyphylla* Delile	Kob (ngambaye)	Tree	Moraceae	Leaves	Fresh or dried	Decot ion	Oral route	Variable	1	3,0 3
2	*Faidherbia albida* (Delile) A. Chev.	Diri (Ngambaye)	Tree	Fabaceae	Bark	Fresh or dried	Decot ion	Oral route	Variable	1	3,0 3
3	*Ziziphus mucronata* Willd.	Ngogro-bichi (Ngambaye)	Shrub	Rhamnac eae	Root or bark	Fresh or dried	Decot ion	Oral route	Variable	1 1	33, 33
4	*Eleusine indica* (L.) Gaertn.	Tchoumdaita (Massa)	Crass	Poaceae	Whote plant	Fresh or dried	Decot ion	Oral route	1 glass 3 times a day	1	3,0 3
5	*Cassia sieberiana* DC.	Alala (Ngambaye)	Shrub	Fabaceae	Root	Fresh	Decot ion	Oral route	unchanged	1 8	54, 55
6	*Bauhinia rufescens* Lam.	Koulkoul (arabe)	Shrub	Fabaceae	Leaves	Fresh	Decot ion	Oral route	unchanged	1	3,0 3
7	*Senna occidentalis* (L.) Link	Kinkéliba	Semi-woody	Fabaceae	Root	Fresh or dried	Decot ion	Oral route	unchanged	1	3,0 3
8	*Ziziphus mauritiana* Lam.	Ngogro (Ngambaye)	Shrub	Rhamnac eae	Bark	Fresh or dried	Decot ion	Oral route	unchanged	1	3,0 3
9	*Ximenia americana* L.	Tidi (Ngambaye)	Shrub	Olacacea e	Root	Fresh or dried	Decot ion	Oral route	unchanged	1	3,0 3
10	*Flueggea virosa* (Roxb. ex Willd.) Voigt	Kassi (Ngambaye)	Shrub	Euphorbi aceae	Root	Fresh or dried	Decot ion	Oral route	unchanged	1	3,0 3
11	*Bridelia ferrugenea* Müll. Arg.	Sibian (Ngambaye)	Shrub	Euphorbi aceae	Bark	Fresh or dried	Decot ion	Oral route	unchanged	1 7	51, 52

Discussion

This ethnobotanical field survey involved interviewing 33 people, 55% of whom were female and 45% male. Both sexes are interested in traditional medicine. However, women use medicinal plants much more than men. As the study focused heavily on children, this high percentage among women can be explained by the fact that, as women have more contact with children, they develop greater knowledge of plants in order to care for them. These findings confirm the results of other ethnobotanical studies conducted in Morocco[15], which found 56.70% women and 43.30% men; Nguinambaye et *al.,* in Chad, found 54% women and 46% men[16]. However, they differ from those of Goumou et *al.,* in Guinea, who found a higher proportion among men (58%) than among women (42%)[17].

the field, it was found that practitioners range in age from 21 to 90 years old. The most represented age group is 41–50 years old (30.30%), followed by those aged over 60 (27.28%). The 21–30 and 51–60 age groups are equally represented (15.15%). The 31–40 age group brings up the rear with 12.12%. These results effectively explain why older people are more familiar with traditional herbal medicine compared to other age groups. This trend can be explained by the fact that traditional knowledge has been accumulated over generations. These results are similar to those of Nguinambaye et *al*., in Chad[16]. The overexploitation of plant resources and the growing reliance on modern medicines among younger generations may lead to a loss of knowledge about medicinal plants. These findings are consistent with those of Elhassan et *al*.,[15] and Goumou et *al.*,[17]. The study showed that traditional practitioners have between 3 and 20 years' experience. Years of experience provide some assurance of knowledge of plants, as the more one uses them, the more one's knowledge increases. These findings are also reported by Goumou et *al*.,[17] and Mbaihougadobé et *al.*,[18]

The study found that the profession is practised by people who do not have a very high level of education. Those with no formal education accounted for the largest proportion (48.49%), followed by those with primary education (39.39%), whilst those with secondary education were under-represented. This high proportion of those with no schooling explains why knowledge of medicinal plants is passed down from parents to children and from master to apprentice. Certain ancestral and cultural practices occupy children from a young age and prevent them from attending school or progressing far in their studies. This was the case for the traditional practitioners in this study. These findings are reported by Nguinambaye et *al*.,[16], Mbaihougadobé et *al*.,[18] and Goumou et *al*.[17]. These data show that throughout Chad, the profession is practised much more by people with no schooling or very little schooling.

Of the two diseases covered by this study, it was found that many plants are used in their treatment. For the management of diarrhoea in children, thirteen (13) plants from seven (7) families are used; this figure demonstrates that floral diversity is also a valuable asset in the field of healthcare in Chad. The most represented families are: Fabaceae (38.48%), followed by Combretaceae and Rhamnaceae (15.38%). The species with the highest frequency of mention are: *Terminalia avicennioides* Guill. et Per. (57.58%) and *Detarium microcarpum* (51.52%). The study found, through these citations, that knowledge in this field is passed down from one generation to the next and through the sharing of experiences among practitioners in the locality covered by this study. These plants were cited by Lawaly et al. in Niger[19] and Foutse et *al.* in Cameroon[20] in their ethnobotanical studies on plants used to treat gastrointestinal infections.

In the management of urinary tract infections in children, the survey identified eleven medicinal plants belonging to six families. The most common families were the Fabaceae (36.36%), the Euphorbiaceae and the Rhamnaceae (18.18%) each. The most frequently cited species are: *Cassia sieberiana* DC (54.55%) and *Bridelia ferrugenea* Mull. et Arg. (51.52%). Whether for gastrointestinal infections or urinary tract infections, the Fabaceae family is dominant; this family contains species with significant antibacterial activity. Studies evaluating the antioxidant and antibacterial activities of all these plants in countries such as Burkina Faso by Ali et *al*.,[21] Cameroon by Foutse et *al*.,[20], Côte d'Ivoire by Ambe et *al*.,[22] Nigeria by Mubo et *al*.,[23] and Senegal by Elhadji et *al*.,[24] have demonstrated high efficacy and are used as alternatives in the treatment of certain bacterial infections.

The Chadian population as a whole is predominantly poor and relies heavily on medicinal plants for primary healthcare. This has enabled them to acquire a good knowledge of medicinal plants. The study involved interviewing a total of 33 traditional healers in the town of Guelendeng and the surrounding area. The respondents were predominantly women (55%), the majority of whom had no formal education or had only completed primary school. Thirteen plants from seven families were identified for the treatment of gastroenteritis, and 11 plants for the treatment of urinary tract infections. Terminalia avicennioides Guill & Perr (57.58%) and Detarium microcarpum Guill & Perr (51.52%) were the most frequently cited for gastroenteric infections. For the treatment of urinary tract infections, Cassia sieberiana DC (54.55%) and Bridelia ferrugenea Müll. Arg. (51.52%) were frequently cited. Further surveys on the same conditions should be conducted in other towns across Chad to gain a comprehensive understanding of the plants used in the treatment of these infections.

Conflicts of Interest: For this article, the authors declare that they have no conflict of interest.

Authors' Contributions: RD contributed to the literature search, field data collection, data analysis and first draft. MAD, MY and DA contributed to the first draft and data analysis. NN contributed to the correction, scientific orientation of the draft and coordinated all the work.

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