Go et al., Afr., J. Complement Altern Med. (2020) 17 (1): 21-32
https://doi.org/10.21010/ajtcam.v17i1.3.

ETHNOBOTANICAL KNOWLEDGE OF THE MOST COMMONLY USED PLANTS IN THE MANAGEMENT OF GASTROINTESTINAL AILMENTS IN YOBE STATE, NIGERIA.

Muhammad Salihu Abdallah[*] Muskhazli mustafa.[**] and Meenakshii A/P Nallappan[**] and Rusea Go[**].

*Desert research monitoring and control centre, Yobe State University, KM 7, Sir Kashim Ibrahim way, P.M.B 1144, Damaturu, Yobe State, Nigeria. **Department of Biology, Faculty of Science, Universiti Putra Malaysia, Serdang 43400, Serdang, Selangor, Malaysia.

****Corresponding author Email: rusea@upm.edu.my**

Article History
Received: Feb. 20th, 2020
Revised Received: May 5th, 2020
Accepted: May 5th, 2020
Published Online: June 20th, 2020.

Abstract

Background: Rural and urban people in Nigeria made use of medicinal plants as their curative measures, based on their ancient belief that propounded the authenticity of these plants in treating ailments.
Materials and methods: Data were collected through semi-structured questionnaires across the study area (3senatorial districts),The collected plant species were authenticated and given voucher numbers, and the demographic data was subjected to Chi-square (x^2) comparisons using SPSS version 22.
Results: The major family among the surveyed plants, were Fabaceae (dominant), followed by Anacardiaceae and Combretaceae. Moreover, out of 97 respondents, 81 were male (83.5%) and 16 were female (16.5%). It was observed that respondents that were 41-50 years were many into practice (p = 0.13. The majority of the respondents as compared using chi-square across the parameters, were illiterates (p = 0.06), and very few had a formal training or exposed to workshops (p = 0.02), while the majority inherited and utilized herbal medicine practice as their main sources of income (p = 0.04). The fidelity levels ranged as follows: For diarrhea (18.5% -100%), dysentery (11.11- 45%), pile (11.11 – 50%) and, ulcer covered 9.1% -100%. The ailments were in the range of 0.69 – 0.75 factors of informant consensus. Plant species with RFC values of 0.34, 0.27 and 0.21 as well as those with 0.1, were regarded to have the highest RFC values..
Conclusion: Information collected were mainly on cases of gastrointestinal ailments and first of its kind on the use of medicinal plants in Yobe State, Nigeria.

Keywords: gastrointestinal, herbs, fidelity, consensus, medicinal plants, ailments

List of Abbreviations: AIDS: Acquired immune Deficiency syndrome; Dia = Diarrhoea, Dys = Dysentery; FL: Fidelity Level; FC: Frequency citation; ICF: Informant consensus factor; LGAs: Local government areas; NUC: number of used citations; NS: Number of used species for each citation; NANTMP: National Association of Nigerian Traditional Medicine Practitioners; Pl = Pile; RFC: Relative frequency of citation; SF: Specific frequency for a specific ailment; TF: Total number of citations of that very species and Ul = ulcer

Introduction

Plant species perform vital roles in both local and urban cities as sources of medicinal agents for resolving health problems . Different plant parts had served as medicines for so many ailments including gastrointestinal ailments, because of their several phytoconstituents that are medicinally active. (Abdallah *et al*., 2019). The bioactive compounds present in the plants parts have been shown to inhibit the growth of different microbes such as *S. aureus, E. coli, Salmonella spp, B. cereus, and B. subtili*; the most common bioactive substances were aromatic compounds which inhibit the growth of myriad of gastrointestinal microbes (Abdallah *et al*., 2019). Many plants in Nigeria have potentialities in curing various diseases and numerous research works have been conducted to scientifically confirm the ethnomedicinal uses of such plants. The use of orthodox medicine has a limitation in terms of cost implications when compared to herbal medicines, . Plants became useful being the reservoir of many compounds which can alter the actions of microbial pathogens (Madara *et al.*, 2017). Medicinal plants are used as primary sources of treating most of the disorders and ailments in Nigeria (Ezuruike *et al.*, 2014). Based on the many researches in the world of traditional medicine, African traditional systems of medication have come up with a model so as to cure diverse diseases at a more cose-effective rate (Mahomoodally, 2013). The ethno medicinal plants survey has been associated

with screening of the phytoconstituents for alternative medicines (Ashidi, *et al*., 2010). For example, screened compounds from the plants extracts have shown anticancer activities for more than forty years, (Ashidi, *et al*., 2010). The importance of medicinal plants in health care needs of the population was underscored by the Nigerian government that set aside US$1billion for the development of drugs from medicinal plants (Ashidi, *et al.*, 2010). Report has shown that many plants species get destroyed in search of medicine as well as for the fire wood. There will be a time the valuable medicinal plants will be scarce if care is not taken, with such actions on the plants, and so many diseases may lead to death of a larger number of both local and urban populace (Mohammed *et al*.,2015).

In Herbal medicinal plants formulation, there can be synergistic interactions between the phytochemicals (Mustapa *et al*., 2012). Rural and urban people make use of medicinal plants as their curative measures as well as raw materials for their day to day activities, more importantly, to combat various microbial and other disorders for their well-being (Elekwa, *et al*., 2017). In some cases, herbal formulations are combined with the conventional medicines (Ezuruike & Prieto, 2014) . Also, the specific constituents in most of the herbal formulations that are responsible for the observed efficacy of the products are not yet known (Ezuruike & Prieto, 2014).

A reasonable number of medicinal plants species belonging to about 128 genera have been reported to be active and very good in treating human ailments. Among the identified ones were: Family Asteraceae, Fabaceae, Lamiaceae, Curcubetaceae, Solanaceae, Ranunculaceae and Rosaceae while, Acanthaceae, Asclepiadaceae, Celasteraceae, Myrsinaceae, Oleaceae, Rubiaceae, Rutaceae and Euphorbiaceae were represented by three species each, whereas families Amaranthaceae, Apiaceae, Apocynaceae, Boraginaceae, Polygonaceae, Sapindaceae, Scrophulariaceae and Urticaceae were represented by 2 species each. Identified growth forms of medicinal plants indicated that herbs were more dominant than shrubs or trees and climbers (Lulekal *et al*., 2013). Moreover, some plant species have shown a larger portion of percentages for having the anti-gastrointestinal characteristics. The most common one include; Parasitosis, diarrhoea, constipation, colic, stomach ulcer, vomiting and lack of appetite (Ouachinou *et al.*, 2019). It has been well documented that plant species contain a myriad number of both primary and secondary metabolites with disparities in their actions on microbes and other disorders (Kumari *et al*., 2017).

Gastroenteritis as well as enteric ailments have become worrisome greatly all over the world, most especially in sub-Saharan Africa and Asia (Albertina, 2019). More than a billion people worldwide especially in the developing countries are affected by parasitic infections. The gastrointestinal tract infections leading to gastroenteritis, enteritis or enterocolitis result from the most common intestinal parasites such as *Giardia lamblia* (*Giardia duodenalis*, *Giardia intestinalis*), *Cryptosporidium hominis* or *Cryptosporidium parvum* as well as *Entemoeba histolytica* (Garcia *et al*., 2018). Infections caused by the parasitic organisms manifest with an abdominal pain, diarrhoea, dysentery or bloody stool (Garcia *et al.*, 2018). Ethnobotanical study of certain ailments have not been undertaken., Such a study has been done on antimalarial plants found in some part of Africa, as such knowledge also need to be documented by conserving reports of valuable resources contained in the plants for their medicinal values (Tefera & Kim, 2019).

Also, certain practices have to be controlled to avoid eradicating many important medicinal plants used traditionally (Tefera & Kim, 2019). The main aim of this study was to assess the medicinal plants most commonly used in curing gastrointestinal ailments across Yobe State, Nigeria.

Materials and Methods

Study Area

Yobe State, located at the North-eastern part of Nigeria (12.1871°N, 11.7068° E), has a population of about 3,294,100 million people which is divided into 17 local government areas (LGAs). A large number of traditional medicine practitioners practice in the state, some of which practiced independently while others practiced under the umbrella of a union called The National Association of Nigerian Traditional Medicine Practitioners (NANTMP) This Association is recognized by the Nigerian government and is registered by the Corporate Affairs Commission. Many workshops have organised for these practitioners through their association..

Data collection

Data were collected using semi structured questionnaires, through the month of July to September, 2019. Total number of ninety seven (97) respondents and traditional healers were interviewed randomly in an appropriate manner with a specific number as follows: zone A (29), zone B (31) and zone C (37) across the three (3) senatorial districts of Yobe State, Nigeria, as outlined in Table 1, Fig. 1.

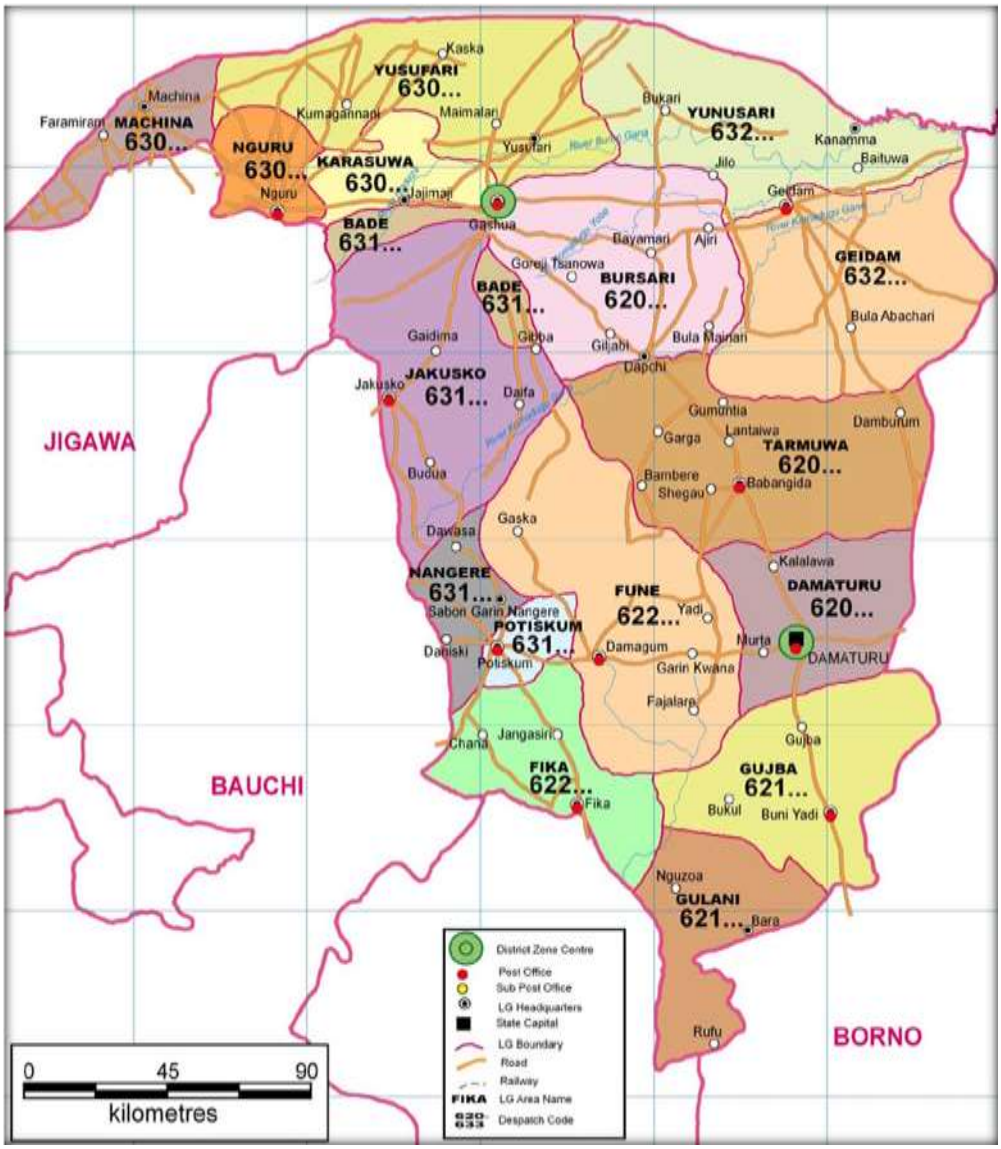


Figure 1: Map of Yobe State., where by Damaturu represents senatorial district A, Potiskum represents senatorial district B and Nguru represents senatorial district C.

Collection of plant Materials and identification

Plant species collected were organized as complete herbarium specimens by undergoing the process of pressing, drying, mounting and identification as outlined by the rules of herbaria. Auxiliary apparatus used from the collection to the preparation of the specimens include: collecting bags, cutter, hoes, knife, newspapers, and notebook.

Plant materials were identified and authenticated by a plant taxonomist, from the Department of Plant Biology, Bayero University Kano, Nigeria. All identified plant specimens were given voucher number each and deposited at the University Herbarium for reference purpose as outline in (Table 1).

Data organization

The collected data were quantified using some quantitative indices such as Informant consensus factor (ICF), Relative frequency of citation (RFC) and fidelity level as earlier used by (Faruque *et al*., 2018) and (Pirker *et al.*, 2012). The demographic data was subjected to Chi-square (x^2) comparisons using SPSS version 22, and appropriate formulae were used to assess the rate of citations among the collected plant species and to know how they were used as well as their potencies across the gastrointestinal ailments. Also, collected plant species were categorized based on their types as herbs, shrubs, and trees. Furthermore, , the parts used in preparing the formulations for gastrointestinal ailments were clearly identified as stem (bark), leaves, and pods .

Fidelity level

Fidelity level (FL) was calculated to assess the most important medicinal plants among the collected ones. The gastrointestinal ailments mainly resulted to diarrhoea, dysentery, pile and ulcer which were caused, among other

factors, by bacterial and parasitic organisms, as earlier stated (Hassan *et al*., 2017).
The fidelity level was calculated by using formula as; FL =SF/TF ×100/1

Where; SF = Specific frequency for a specific ailment.
TF=Total number of citations of that very species.
The FL calculations are presented in Table 3

Informant Consensus Factor (ICF)

It was used to measure the total plant species usage by the respondents against the prescribed ailments. This is in line with plant species with high informant consensus factor regarded medicinally active as compared those with low ICF, , (Hassan *et al*., 2017).

ICF= NUC- NS/ NUC-1,
Where ICF = Informant consensus factor,
NUC = number of used citations and NS = number of used species for each citation.

The results from this computation are as outlined in Table 4 and Fig. 3.

Relative frequency of citations (RFC)

It was used to authenticate the local benefit of each species in the study areas. Its index was determined by dividing the number of informants cited useful species (FC) by the total number of informants participated in the survey (N), i.e.: RFC = FC / N (Umair *et al.,* 2017). These have been presented outlined in Table 5, and Fig. .

Results

Table 1: Medicinal plant species collected from the survey area with their usage on different gastrointestinal ailments.

No.	Botanical Name	Family	Common Name	Local Name	Habit	Part(S) Used	Condition Managed	Herbal Formulation	Route of Administration	Dosage	Voucher No.
1.	*Adansonia digitata****	Malvaceae	Baobab Tree	Kuka	Tree	stem/ leaves	pile, diarrhoea	powder	Orally	thrice	MSA36
2.	*Anogieeossus leocarpa***	Combretaceae	African Birch	Marke	Tree	stem/ leaves	diarrhoea	powder	Orally	thrice	MSA29
3.	*Balanites aegyptiaca* *	Zygophyllaceae	Desert Tree	Aduwa	Tree	stem	pile	powder/ crushed	Orally	twice	MSA359
4.	*Cassia singueana* **	Fabaceae	White Or Winter Cassia	Runhu	Herb	leaves	pile	powder	orally	twice	MSA316
5.	*Citrus aurantafolia* **	Rutaceae	Lime	Lemon Tsami	Tree	leaves	diarrhoea, dysentery	powder/ decoction	orally/ external	twice/ thrice	MSA113
6.	*Detarium microcarpum* *	Fabaceae	Sweet Dear	Taura	Tree	leaves	dysentery	powder	orally	twice	MSA71
7.	*Ficus sycomorus* ***	Moraceae	Sycomore Fig	Baure	Tree	stem	pile	powder	orally	once	MSA109
8.	*Gueira senegalensis* ****	Combretaceae	Senegal Gueira	Sabara	shrub	leaves, root, goal	dysentery, diarrhoea, pile, ulcer	powder	orally	twice	MSA32
9.	*Khaya senegalensis* **	Meliaceae	Mahogany	Madaci	Tree	stem	pile, dysentery, diarrhoea	powder	orally	once	MSA116
10.	*Leptadania hastate* ***	Apocynaceae	Kayila	Yadiya	herb	leaves	ulcer	powder	orally	twice	MSA248
11.	*Mangifera indica* *	Anacardiaceae	Mango	Mangoro	Tree	leaves/ stem	ulcer	powder/ decoction	orally	thrice	MSA348
12.	*Momordica charantia* *	Cucurbitaceae	Bitter Apple	Garafuni	shrub	leaves	ulcer	powder/ decoction	orally	once	MSA654
13.	*Moringa oleifera* ***	Moringaceae	Horseradish Tree	Zogale	Tree	leaves	pile, diarrhoea, dysentery	powder/ decoction	orally	thrice	MSA11
14.	*Nymphaea lotus* **	Nymphaeaceae	White Water Lily	Bado	herb	leaves	ulcer	powder	orally	twice	MSA356
15.	*Piliostigma reticulata* ***	Fabaceae	Camel's Foot	Kargo	Tree	stem	pile, dysentery, diarrhoea	powder	orally	once	MSA72
16.	*Prosopis africana* ***	Fabaceae	Iron Tree	Kirya	Tree	stem	diarrhoea	powder	orally	once	MSA193
17.	*Psidium guajava* **	Myrtaceae	Guava	Goba	Tree	leaves	diarrhoea	powder/ decoction	orally	thrice	MSA336
18.	*Sclerocarya birrea* ****	Anacardiaceae	Marula	Danya	Tree	stem	dysentery, diarrhoea , pile	powder	orally	thrice	MSA435
19.	*Senna italica* ***	Fabaceae	Italian Thorn	Filasko	herb	leaves	pile, diarrhoea	powder	orally	twice	MSA68
20.	*Senna tora* **	Fabaceae	Sickle Wild	Tafasa	herb	leaves	ulcer	powder	orally	once	MSA307
21.	*Tamarindus indica****	Fabaceae	Tamarind	Tsamiya	Tree	stem/ leaves	diarrhoea	powder	orally	twice	MSA74
22.	*Vachellia nilotica* ****	Fabaceae	Arabic Gum	Bagaruwa	Tree	pods	ulcer, diarrhoea, dysentery and pile	powder	orally	twice	MSA186
23.	*Zizyphus mauritania* ***	Ramnaceae	Chinese Apple	Magarya	Tree	leaves	pile	powder/ crushed	orally	thrice	MSA233

Keys: **** = Most cited plants**;** *** = second most cited plants**;** ** = partially cited plants**;** * = least cited plants

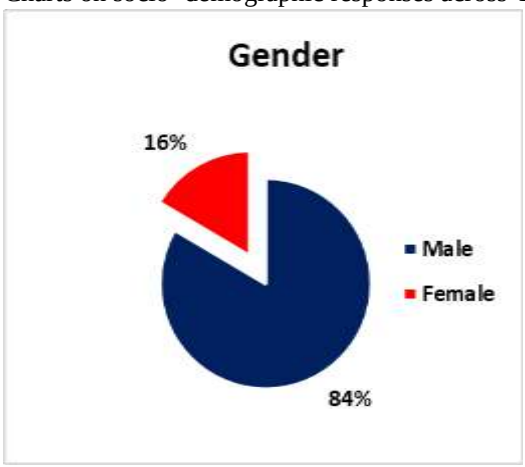
Table 2: Socio-demographic details of the respondents in Yobe State, Nigeria

Gender	**Potiskum**	**Damaturu**	**Nguru**	**df**	**x^2**	**p-value**
Total responses	31(32.0)	29 (29.9)	37 (38.1)	2	6.365	0.053
Male	28(34.6)	20(24.7)	33(40.7)			
Female	3(18.8)	9(56.3)	4(25.0)			
Age distribution				**df**	**x^2**	**p-value**
Total responses	31(32.0)	29(29.9)	37(38.1)	6	8.872	0.146
20-30	9(45.0)	5(25.0)	6(30.0)			
31-40	14(36.8)	8(21.1)	16(42.1)			
41-50	5(15.6)	13(40.6)	14(43.8)			
51 above	3(42.9)	3(42.9)	1(14.3)			
Educational level				**df**	**x^2**	**p-value**
Total responses	31(32.0)	29(29.9)	37(38.1)	4	14.313	0.006
None	22(37.3)	23(39.0)	14(23.7)			
Secondary	5(25.0)	4(20.0)	11(55.0)			
Post-secondary	4(22.2)	2(11.1)	12(66.7)			
Mode of training				**df**	**x^2**	**p-value**
Total responses	31(32.0)	29(29.9)	37(38.1)	2	11.960	0.002
Yes	9(24.3)	6(16.2)	22(59.5)			
No	22(36.7)	23(38.3)	15(25.0)			
Practice				**df**	**x^2**	**p-value**
Total responses	31(32.0)	29(29.9)	37(38.1)	2	14.315	0.000
Main practice	31(36.5)	20(23.5)	34(40.0)			
Others	0(0.0)	9(75.0)	3(25.0)			
Education/gender	**Male**	**Female**		**df**	**x^2**	**p-value**
Total responses	81(83.5)	16(16.5)		2	3.491	0.214
None	46(78.0)	13(22.0)				
Secondary	18(90.0)	2(10.0)				
Post-secondary	17(94.4)	1(5.6)				
Mode training/ gender				**df**	**x^2**	**p-value**
Total responses	81(83.5)	16(16.5)		1	3.055	0.081
Yes	34(91.9)	3(8.1)				
No	47(78.3)	13(21.7)				
Practice/ gender				**df**	**x^2**	**p-value**
Total responses	81(83.5)	16(16.5)		1	11.161	0.004
Main occupation	75(88.2)	10(11.8)				
Others	6(50.0)	6(50.0)				

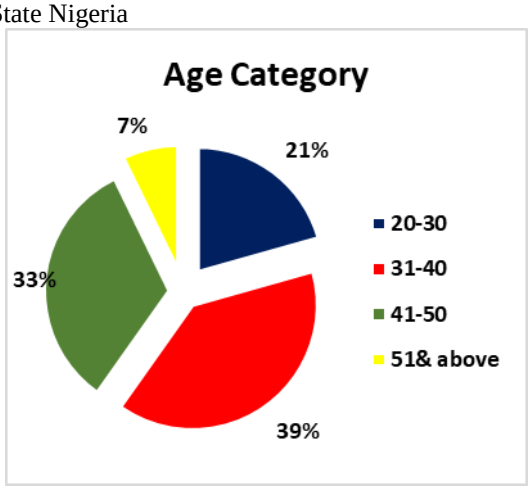
Education/ age	**20-30**	**31-40**	**41-50**	**51 above**	**df**	**x^2**	**p-value**
Total responses	20(20.6)	38(39.2)	32(33.0)	7(7.2)	6	54.322	0.000
None	3(5.1)	18(30.5)	31(52.5)	7(11.9)			
Secondary	13(65.0)	7(35.0)	0(0.0)	0(0.0)			
Post- secondary	4(22.2)	13(72.2)	1(5.6)	0(0.0)			
Mode of training/ age					**df**	**x^2**	**p-value**
Total responses	20(20.6)	38(39.2)	32(33.0)	7(7.2)	3	35.227	0.000
Yes	16(43.2)	19(51.4)	2(5.4)	0(0.0)			
No	4(6.7)	19(31.7)	30(50.0)	7(11.7)			
Practice / age					**df**	**x^2**	**p-value**
Total responses	20(39.2)	38(20.6)	32(33.0)	7(7.2)	3	10.631	0.013
Main occupation	18(21.2)	37(43.5)	26(30.6)	4(4.7)			
Others	2(8.3)	1(16.7)	6(50.0)	3(25.0)			

Value in bracket indicate %. Values in bold indicate significant associations at $p < 0.05$.

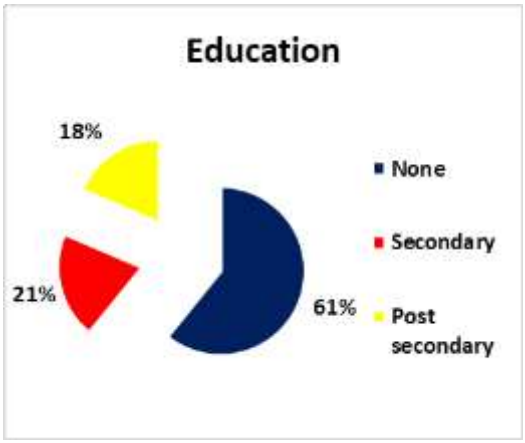
Charts on socio- demographic responses across Yobe State Nigeria



a.

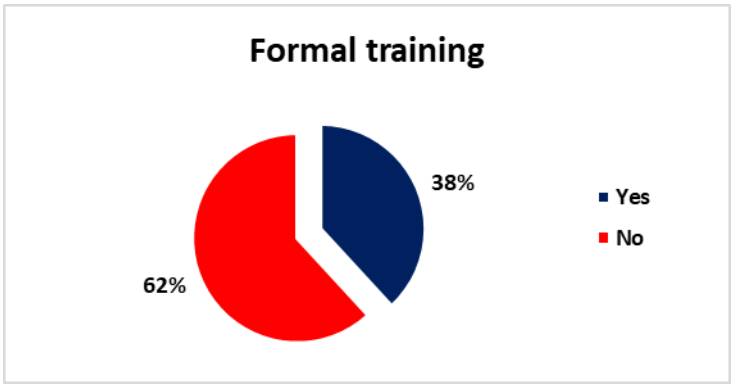


b.



c.

d.



d.

Figure 2: a. chart compared the distribution between male and female respondents;
b. explained the age distribution of the respondents
c. explained the literacy levels of the respondents
d. It shows how the practice was carried out among the respondents.
e. Indicates how formal training was undergone.

Table 3: Fidelity level values of most commonly used medicinal plants as remedy to gastrointestinal Ailments in Yobe State.

No.	**Species**	**Ailments**	**SF**	**TF**	**FL**
1.		Dia	9	33	27.3
		Dys	8	33	24.3
		Pl	13	33	39.4
	Gueira senegalensis	Ul	3	33	9.1
2.		Dia	5	27	18.5
		Dys	3	27	11.1
		Pl	4	27	14.8
	Vachellia nilotica	Ul	15	27	55.6
3.		Dia	4	17	23.5
		Dys	9	17	52.9
		Pl	4	17	23.5
	Sclerocarya birrea	Ul	0	17	0

4.		Dia	3	10	30
		Dys	4	10	40
		Pl	3	10	30
	Moringa oleifera	Ul	1	10	10
5.		Dia	3	9	33.3
		Dys	3	9	33.3
		Pl	1	9	11.1
	Piliostigma reticulata	Ul	2	9	22.2
6.		Dia	3	7	42.9
		Dys	2	7	28.6
		Pl	2	7	28.6
	Prosopis africana	Ul	0	7	0
7.		Dia	3	8	37.5
		Dys	3	8	37.5
		Pl	2	8	25
	Senna italica	Ul	0	8	0
8.		Dia	0	6	0
		Dys	1	6	16.7
		Pl	3	6	50
	Zizyphus mauritania	Ul	2	6	33.3
9.		Dia	1	4	25
		Dys	1	4	25
		Pl	2	4	50
	Adansonia digitata	Ul	0	4	0
10.		Dia	0	5	0
		Dys	0	5	0
		Pl	0	5	0
	Leptadania hastate	Ul	5	5	100
11.		Dia	1	2	50
		Dys	0	2	0
		Pl	0	2	0
	Tamarindus indica	Ul	1	2	50
12.		Dia	3	6	50
		Dys	1	6	16.7
		Pl	1	6	16.7
	Anogieeossus leocarpa	Ul	1	6	16.7
13.		Dia	0	3	0
		Dys	1	3	33.3
		Pl	1	3	33.3
	Cassia singueana	Ul	1	3	33.3
14.		Dia	1	4	25
		Dys	0	4	0
		Pl	3	4	75
	Ficus sycomorus	Ul	0	4	0
15.		Dia	2	3	66.7
		Dys	1	3	33.3
		Pl	0	3	0
	Citrus aurantafolia	Ul	0	3	0
16.		Dia	1	3	33.3
		Dys	1	3	33.3
		Pl	1	3	33.3
	Khaya senegalensis	Ul	0	3	0
17.		Dia	0	2	0
		Dys	0	2	0
		Pl	0	2	0
	Senna tora	Ul	2	2	100
18.		Dia	0	2	0
		Dys	0	2	0
		Pl	0	2	0
	Nymphaea lotus	Ul	2	2	100
19.		Dia	2	2	100
		Dys	0	2	0
		Pl	0	2	0
	Psidium guajava	Ul	0	2	0
20.		Dia	1	2	50
		Dys	1	2	50
		Pl	0	2	0
	Detarium microcarpum	Ul	0	2	0
21.		Dia	0	2	0
	Mangifera indica	Dys	0	2	0

		Pl	0	2	0
		Ul	2	2	100
22.		Dia	0	1	0
		Dys	0	1	0
		Pl	1	1	100
	Balanites aegyptiaca	Ul	0	1	0
23.		Dia	0	1	0
		Dys	0	1	0
		Pl	0	1	0
	Momordica charantia	Ul	1	1	100

Where: Dia = Diarrhoea, Dys = Dysentery, Pl = pile and Ul = ulcer, SF = Specific frequency for a specific ailments, TF=Total number of citations of that very species.

Table 4: Informant consensus factor values of medicinal plants used as remedy for gastrointestinal ailments in Yobe State Nigeria

Ailments	**NS**	**NUC**	**ICF**
Diarrhoea	13	40	0.69
Dysentery	11	41	0.75
Pile	11	41	0.75
Ulcer	11	39	0.74

ICF= NUC- NS/ NUC-1, as outlined in (Table 4 and Fig. 2).

Where ICF = Informant consensus factor, NUC = number of used citations and NS = number of used species for each citation.

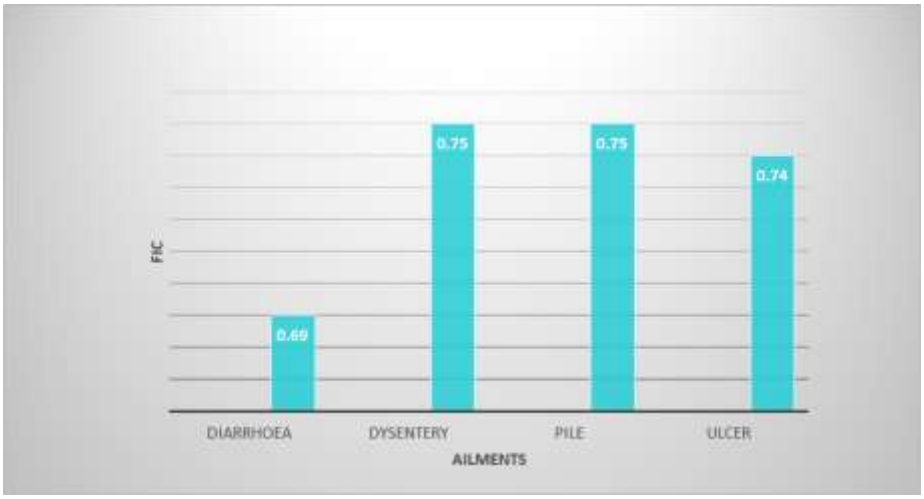


Figure 3: Informant consensus factor values of medicinal plants used as remedy for gastrointestinal ailments in Yobe State Nigeria

The ailments mostly treated were in range of 0.75 – 0.69 as shown in table 4.

Table 5: Relative frequency citations values of the surveyed medicinal plants in Yobe State, Nigeria

No.	**Species**	**Family**	**FC**	**RFC**
24.	*Gueira senegalensis*	Combretaceae	33	0.34
25.	*Vachellia nilotica*	Fabaceae	26	0.27
26.	*Sclerocarya birrea*	Anacardiaceae	20	0.21
27.	*Moringa oleifera*	Moringaceae	10	0.1
28.	*Piliostigma reticulata*	Fabaceae	9	0.09
29.	*Prosopis africana*	Fabaceae	9	0.09
30.	*Senna italica*	Fabaceae	8	0.08
31.	*Zizyphus mauritania*	Ramnaceae	6	0.06
32.	*Adansonia digitata*	Malvaceae	6	0.06
33.	*Leptadania hastate*	Apocynaceae	5	0.05
34.	*Tamarindus indica*	Fabaceae	5	0.05
35.	*Anogieeossus leocarpa*	Combretaceae	4	0.04
36.	*Cassia singueana*	Fabaceae	4	0.04
37.	*Ficus sycomorus*	Moraceae	4	0.04
38.	*Citrus aurantafolia*	Rutaceae	3	0.03
39.	*Khaya senegalensis*	Meliaceae	3	0.03
40.	*Senna tora*	Fabaceae	2	0.02
41.	*Nymphaea lotus*	Nymphaeaceae	2	0.02

42.	*Psidium guajava*	Myrtaceae	2	0.02
43.	*Detarium microcarpum*	Fabaceae	1	0.01
44.	*Mangifera indica*	Anacardiaceae	1	0.01
45.	*Balanites aegyptiaca*	Zygophyllaceae	1	0.01
46.	*Momordica charantia*	Cucurbitaceae	1	0.01

FC = the number of informants cited useful species and RFC = Relative frequency citations

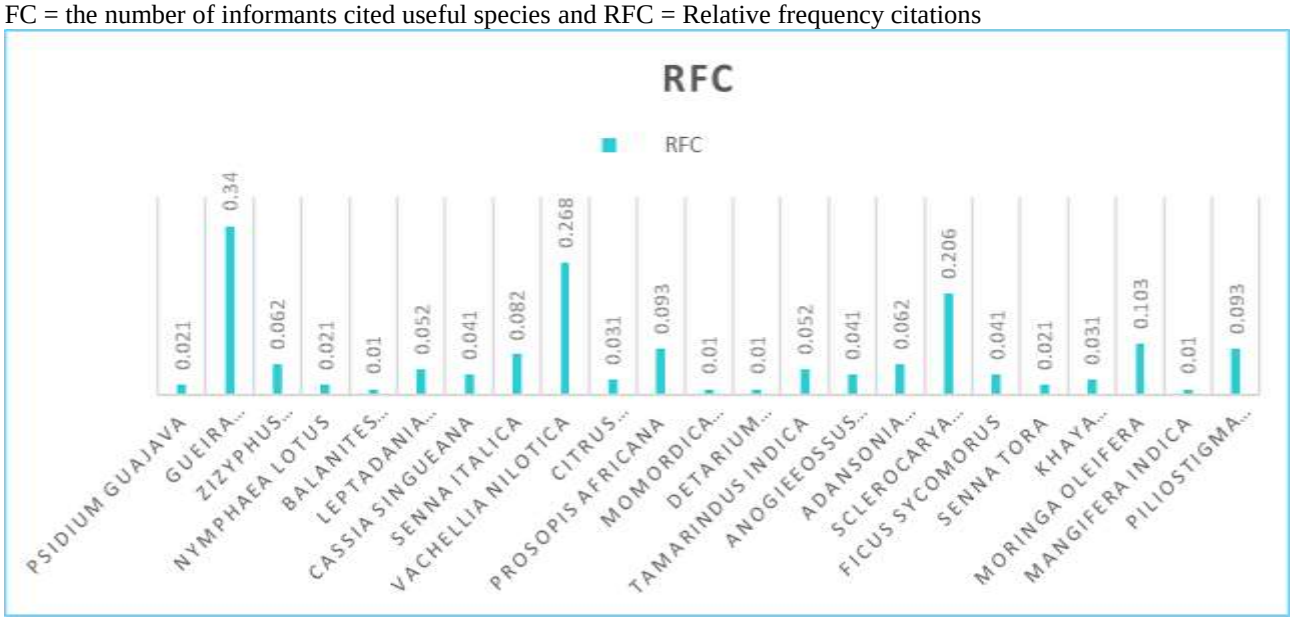


Figure 4: Relative frequency citations values of the surveyed medicinal plants in Yobe State, Nigeria

As indicated in table 5; 0.34 appeared to be highest RFC which was *G. senegalensis followed by V. nilotica, S. birrea and P. reticulata among the surveyed species* whereas, those with 0.01 appeared to be the least plants species.

Discussion

The most commonly used medicinal plants for the management of gastrointestinal ailments were 23 plant species classified as herbs, shrubs and trees, with their respective parts. The majority were trees followed by herbs and lastly shrubs. It could be due to the fact that, the trees were evenly distributed and their availability was all year round, due to the nature of the environment which is characterized by scarcity in rainfall, with associated negative impact on survival of the herbs and shrubs in the state. , The major family among the surveyed plants were; Fabaceae (dominant), followed by Anacardiaceae and Combretaceae, while the rest of the families appeared once (Table 1). The families were: Anacardiaceae, Apocyanaceae, Combretaceae, Cucurbitaceae, Fabaceae, Fabales, Malvaceae, Malvaceae, Myrtaceae, Moringaceae, Nymphaceae, Rutaceae, Rhamnaceae and Zygophyllaceae> The present survey is in conformity with that of Lulekal *et al* (2013) which stated that plants from these families were among the very active families in treating many ailments. Out of the 97 respondents, 81 were males (83.5%) and 16 were females (16.5%) across the 3 senatorial district. It was also observed that respondents of the ages between 41-50 years were the majority into practice while also the majority of the respondents were illiterates (P = 0.06), but very few of them had formal training and exposed to workshops with a (p = 0.02). Furthermore the majority inherited and utilized this herbal medicine practice as their main sources of income p = 0.04). These socio-demographic data were similar to those of reported by Albertina, (2019) and (Elekwa, *et al*., (2017), which highlighted different distinctions between the rural and urban settlers on the usage of medicinal plants against many ailments. Therefore, the survey showed that the people of the state used 23 different plant species for the cure of gastrointestinal ailments, and the most commonly attested ailments were diarrhoea, dysentery, pile and ulcer. Most of the mentioned ailments were as a result of enteric bacterial pathogens and parasites, as asserted by Ezuruike & Prieto, (2014). Diarrheal fidelity levels ranged from 18.5% - 100% among the surveyed plants and covered a higher proportion of the plants species On the other hand, the dysentery fidelity levels ranged from 11.11- 45% While the fidelity levels for pile and ulcer ranged from 11.11 – 50% and 9.1% - 100%, respectively (Table 3). These are categorical indications of the number of citations with regard to the individual ailments (Diarrhoea, dysentery, pile and ulcer). For the plant species with high fidelity level values, their bioactive phytochemicals need to be investigated with a view to using them as lead compounds for development of novel therapeutic agents for the bacterial and parasitic infections responsible for the gastrointestinal ailments (Hassan *et al*., 2017).

The ailments had Information Consensus Factor values in the range of 0.69 – 0.75 (Table 4) which were in conformity with that of (Cheikhyoussef *et al*., 2011), where it was reported that certain number of plant species have been identified and quantified in the treatment of many ailments and disorders, and their recorded average Informant consensus factor for the whole ailments was 0.75 It has also been reported that, the highest ICF value was 0.77 and the least was 0.28 from the quantified medicinal plants (Faruque *et al*., 2018). The relative frequency citations revealed

that plants species with values of 0.34, 0.27 and 0.21 as well as those with 0.1, were regarded to have the highest RFC values, which are in the range of the values recorded by (Faruque *et al.*, 2018), who reported RFC value of 0.25 for the gastrointestinal disorders among the studied medicinal plants.

The present study signifies the plant species had high fidelity level values indicating their potencies on the microbes that caused gastrointestinal ailments. The present study happened to be the first in the state on the gastrointestinal ailments. Thus, it could be of importance to the state through its board of traditional medicine under the ministry of health to have an authentic and compiled list of medicinal plants for curing gastrointestinal ailments.

Conclusion

The present study brings out the clear and profound knowledge on reasonable number of trees, shrubs and herbs identified in curing gastrointestinal ailments consisting of diarrhoea, dysentery, pile and ulcer. More so, gastrointestinal ailments were the major problems in some areas, due to the lack of good water supply and poor sanitation. The entire plants used by the inhabitants were authenticated. All the questions raised were asked in the majority local language (Hausa), for having valuable knowledge on the medicinal plants species used in curing ailments. The plants with high citation index could be of paramount importance in the discovery of new drugs specifically gastrointestinal ailments.

Recommendations

Authors do recommend future investigations on the surveyed plant species, more especially, those with high informant consensus factor against the ailments and high fidelity levels. Similar survey have to be put in place for the cases of other ailments like cancer which has become very deadly not only in Yobe State, Nigeria, and Africa but the world in general.

Conflict of interest: Authors declared no conflict of interest.

Acknowledgements

We do acknowledged the support given by the traditional healers across the state and Yobe State University through (**Tertiary Education trust fund, YSU/APU/INT/50/VI/I**), in the course of carrying out this research. The publication of this paper is supported by Universiti Putra Malaysia.

References

1. Abdallah, M. S., Mustafa, M., Nallappan, M. & Go, R. (2019). Review on Some Plants ' Therapeutic Effects against Gastrointestinal Microbes. *Annual Review And Research In Biology*; *31*(6), 1–8. https://doi.org/10.9734/ARRB/2019/v31i630066.
2. Albertina, M. N. Iikasha, Isaac, K. Quaye and Davis R. Mumbengegwi (2019). Evaluation Of Antibacterial Activity Of Medicinal Plant Extracts Against Clinical Isolates Of Pathogens From Children With Acute Gastroenteritis At Katutura State Hospital¸ Windhoek, Namibia. *Afr., J. Complement Altern Med*., 16 (2): 15-23 , https://doi.org/10.21010/ajtcam.v16i2.2.
3. Ashidi, J. S., Houghton, P. J., Hylands, P. J., & Efferth, T. (2010). Ethnobotanical Survey And Cytotoxicity Testing Of Plants Of South-Western Nigeria Used To Treat Cancer, With Isolation Of Cytotoxic Constituents From Cajanus Cajan Millsp. Leaves. *Journal of Ethnopharmacology*; *128*(2), 501–512. https://doi.org/10.1016/j.jep.2010.01.009.
4. Cimerman, S., Cimerman, B., & Lewi, D. S. (1999). Enteric Parasites And AIDS. *São Paulo Medical Journal = Revista Paulista de Medicina*; *117*(6), 266–273. https://doi.org/10.1590/S1516-31801999000600007.
5. Cheikhyoussef, A., Shapi, M., Matengu, K., & Ashekele, H. M. (2011). Ethnobotanical Study Of Indigenous Knowledge On Medicinal Plant Use By Traditional Healers In Oshikoto Region , Namibia. *Journal of Ethnobiology and Ethnomedicine*, *7*(1), 10. https://doi.org/10.1186/1746-4269-7-10.
6. Elekwa, I., Ugbogu, A., Okereke, S., & Okezie, E. A (2017). Review of Selected Medicinal Plants with Potential Health Benefits in South-Eastern. *International Journal of Pharmaceutical and Chemical Sciences*.; *6*(4), 162–171.
7. Ezuruike, U. F., & Prieto, J. M. (2014). The Use Of Plants In The Traditional Management Of Diabetes In Nigeria: Pharmacological And Toxicological Considerations. *Journal of Ethnopharmacology*,; *155*(2), 857–924. https://doi.org/10.1016/j.jep.2014.05.055.
8. Faruque, M. O., Uddin, S. B., Barlow, J. W., & Hu, S. (2018). Quantitative Ethnobotany of Medicinal Plants Used by Indigenous Communities in the Bandarban District of Bangladesh, *9* (February). *Frontiers in Pharmacology* | www.frontiersin.org 1 February 2018 | Volume 9 | Article 40 https://doi.org/10.3389/fphar.2018.00040.
9. Garcia, L. S., Arrowood, M., Kokoskin, E., Paltridge, G. P., Pillai, D. R., (2018). Procop, G. W., Visvesvara, G. Laboratory Diagnosis Of Parasites From The Gastrointestinal Tract. *Clinical Microbiology Reviews*; *31*(1), 1–81. https://doi.org/10.1128/CMR.00025-17.
10. Hassan, N., Wang, D., Zhong, Z., Nisar, M., & Zhu, Y. (2017). Determination And Analysis Of Informant Consensus Factor Of Medicinal Plant Species Used As Remedy In Northern Pakistan Institute Of Grassland

Science , And Key Laboratory Of Vegetation Ecology Northeast Normal University. *Journal of Biodiversity and Environmental Sciences*; (JBES) ISSN: 2220-6663 (Print) 2222-3045 (Online) Vol. 11, No. 2, p. 117-133, 2017 http://www.innspub.net.

11. Ijaz, M. K. (2013).Natural contamination of human hands with enteric parasites in Indian Subcontinent. *World Journal of Clinical Infectious Diseases*; *3*(2), 13. https://doi.org/10.5495/wjcid.v3.i2.13.
12. Kumari, P., Kumari, C., & Singh, P. S. (2017). Phytochemical Screening of Selected Medicinal Plants for Secondary Metabolites. *Int. J. Life. Sci. Scienti. Res*.; *3*(4), 1151–1157. https://doi.org/10.21276/ijlssr.2017.3.4.9.
13. Lulekal, E., Asfaw, Z., Kelbessa, E., & Van Damme, P. (2013). Ethnomedicinal Study Of Plants Used For Human Ailments In Ankober District, North Shewa Zone, Amhara Region, Ethiopia. *Journal of Ethnobiology and Ethnomedicine*, *9*(1), 63. https://doi.org/10.1186/1746-4269-9-63.
14. Madara, A. A., Abah, R. O., & Elkanah, O. S. (2017). The revelator. *Fudma Journal Of Sciences* -.; *ISSN: 2616-1370* (Vol. 2). Retrieved from http://journal.fudutsinma.edu.ng/index.php/fjs/article/view/203/pdf.
15. Mahomoodally, M. F.(2013).Traditional medicines in Africa: an appraisal of ten potent african medicinal plants. *Evidence-Based Complementary and Alternative Medicine*; *ECAM*, *2013*, 617459. https://doi.org/10.1155/2013/617459.
16. Mohammed Salisu, Muhammad Nuraddeen Danjuma & Ishaq Aliyu Abdulkarim (2015). Ethnobotanical Survey of Medicinal Plants in Metropolitan Kano,Nigeria, *International Journal of Public Health Research*; 3(6): 345-351 Published online October 22, 2015 (http://www.openscienceonline.com/journal/ijphr);(October), 1–8.
17. Mustapa, A. N., Martin, Á., Mato, R. B., Cocero, M. J., Mamun, M., Rashid, O.,Manuhara, Y. S. W. Traditional West African Pharmacopeia, Plants And Derived Compounds For Cancer Therapy. *Journal of Ethnopharmacology*. (2018) ;*3*(1), 1–5. https://doi.org/10.1016/j.bcp.2012.07.021.
18. National Population Commission of Nigeria (web), National Bureau of Statistics (web).
19. Ouachinou, J. M. S., Dassou, G. H., Idohou, R., Adomou, A. C., & Yédomonhan, H. (2019). National Inventory And Usage Of Plant-Based Medicine To Treat Gastrointestinal Disorders With Cattle In Benin (West Africa). *South African Journal of Botany* National inventory and usage of plant-based medicine to treat gastrointestinal disorders with cat. *South African Journal of Botany*.;(April). https://doi.org/10.1016/j.sajb.2019.03.037.
20. Pirker, H., Haselmair, R., Kuhn, E., Schunko, C., & Vogl, C. R. (2012). Transformation Of Traditional Knowledge Of Medicinal Plants : The Case Of Tyroleans (Austria) Who Migrated To Australia, Brazil And Peru. *Journal of Ethnobiology and Ethnomedicine* ,2012, 8:44 http://www.ethnobiomed.com/content/8/1/44.
21. Tefera, B. N., & Kim, Y. Ethnobotanical Study Of Medicinal Plants Used As Antimalarial And Repellent By Sidama People Of Hawassa Zuria District , Southern Ethiopia, *Journal of Ethnobiology and Ethnomedicine* (2019), *10*(1), 13–26.15:25 https://doi.org/10.1186/s13002-019-0302-7 (2019).
22. Umair, M., Altaf, M., & Abbasi, A. M . (2017). An ethnobotanical survey of indigenous medicinal plants in Hafizabad district, Punjab-Pakistan. *PLoS ONE*.; *12*(6), 1–22. https://doi.org/10.1371/*journal.pone*.0177912.