Original Article

An Ethno-Botanical Survey of Plants Used in Rheumatoid Arthritis Treatment: A Case Study of Gusau in Nigeria

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Abstract

Background and Aim: Rheumatoid arthritis (RA), an autoimmune disease, is known as the most prevalent type of polyarticular inflammatory arthritis with a variety of features, including continual synovial inflammation, bony erosions, and progressive destruction with varying physical disability and degrees of pains. The aim of this study is to provide the knowledge about plants used in rheumatoid arthritis treatment by people residing in Gusau, Zamfara State, Nigeria.

Materials and Methods: The survey was carried out using an electronic questionnaire to obtain information about plants used in the treatment of rheumatoid arthritis. The plants that were used, part of the plant(s), mode of preparation, and transferability of knowledge were documented.

Results: About 12 plant species, i.e. *Allium sativum* Linn.*, Curcuma longa* Linn.*, Xylopia aethiopica* (Dunal) A. Rich.*, Zingiber officinale* Roscoe.*, Telfairia occidentalis* Hook.f.*, Moringa oleifera* Lam.*, Eleusine indica* (L.) Gaertn.*, Vernonia amygdalina* Del.*, Momordica charantia* Linn.*, Persea americana* Mill.*, Vitellaria paradoxa* C.F.Gaertn.*, and *Nigella sativa* Linn. Were reported in a different frequency, with 16.83% of the respondents reporting herbal mixtures without a knowledge source of the plants. The plant parts used in rheumatoid arthritis treatment were roots, leaves, bulbs, fruits, and stems prepared in different forms like grinding, decoction, infusion, herbal mixture, and blending.

Conclusion: There is a great level of transfer of these medicinal plants' knowledge to friends and family members. This ethnobotanical survey has shown these plants' local uses in treating rheumatoid arthritis (RA) in Gusau, Zamfara State, Nigeria.

Keywords: Ethnobotanical survey, Gusau, Medicinal plants, Nigeria, Rheumatoid arthritis

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Introduction

Rheumatoid arthritis (RA), an autoimmune disease is the most prevalent type of polyarticular inflammatory arthritis characterized by continual synovial inflammation, bony erosions, and progressive destruction with varying physical disability and degrees of pains (1).

The whole body, including internal organs such as the lungs, heart and eyes, might be affected by this disease. Hence, it could be considered a systemic disease.

Although, quantities of manufactured medications are being utilized as standard remedies for rheumatoid arthritis, they have antagonistic impacts that can reduce the efficacy of the therapeutic treatment (2).

Ethnobotany depends on the information on plants by native people, and their efficacy as perceived by the members of a particular ethnic group since data concerning a specific plant fluctuates starting with one ethnic gathering then onto the next (3, 4).

Unfortunately, no effective restorative treatment capable of fixing rheumatoid arthritis has been developed to date as current medications can just get the disease side effects to soothe or relieve pain and aggravate the joints (1).

Several researchers have carried out ethnobotanical investigations among several tribes of the African continent and other parts of the world (5-11).

Herbs and plants could be utilized in different forms to relieve the pain and inflammation in the joints. Several medicinal herbs have exhibited anti-rheumatoid arthritis properties. Examples of such plants include *Acteae racemosa, Zingiber officinale* Roscoe (1), *Asimina triloba* (L.) Dunal*, Citrus aurantiifolia* (Christm.) Swingle, and *Psidium guajava* Linn. (12). These plants are used for the treatment of rheumatoid arthritis.

In an ethnobotanical study by Ogbole *et al.* (2010) (13), the decoction of *Garcinia kola* Heckel, *Zingiber officinale* Roscoe.*,* and *Allium sativum* Linn. with water/ soda has been reported for the treatment of rheumatoid arthritis inflammation. In the same study, decoction or concoction of *Alstonia boonei* De Wild. bark, *Citrus aurantiifolia* (Christm.) Swingle, *Citrus paradise* fruit, *Zingiber officinale* Roscoe., *Allium sativum* Linn.*,* and *Allium cepa* Linn. have been reported to relieve rheumatoid arthritis inflammation.

This comprehensive study would provide more information about medicinal herbs that could relieve rheumatoid arthritis pain or possibly treat the disease. The long-term advantage of ethnobotanical research may lead to modern drug production with no or less adverse effects.

This research seeks to find answers to research questions such as (i) How much do people know about medicinal plants? (ii) Which plants are used to treat rheumatoid arthritis in Gusau LGA?, (iii) What parts of these plants are being used?, (iv) How available are the plants used in treating rheumatoid arthritis in Gusau, Zamfara State, Nigeria?, (v) Are residents with this knowledge (of the medicinal plants) ready to transfer it to another person and whom they are ready to transfer? Therefore, this study contributes to the advancement of knowledge about medicinal plants used in the treatment of rheumatoid arthritis in Gusau, Zamfara State, Nigeria.

Materials and Methods

Study Area

The study area is Gusau located in Gusau Local Government Area of Zamfara State in the Northwestern region. The majority of the residents speak the Hausa language. The town lies between latitude 12.1628° N and longitude 6.6745° E with an area of 3,364km. According to the 2006 census, the population of the town is 383,162 (14). Gusau site is just north of a line attracted from Kebbi to Kano, and its populace is generally Hausa with certain Fulani, Yoruba, Igbo, Igala, and Nupe likewise lives there.

Study Design, Population, and Sample Size

The study design used in this study is a cross-sectional descriptive method. The population comprises male and female people residing in Gusau, Zamfara state, and the population of the study area is about 383,162 people. This study enrolled 101 respondents in this survey ranging from younger than 30 years to 75 years of age.

Ethical Consideration

Individual consent was obtained from the respondents before completing the questionnaire. The respondents' right was protected by informing them about the purpose of the study and not forcing them to participate.
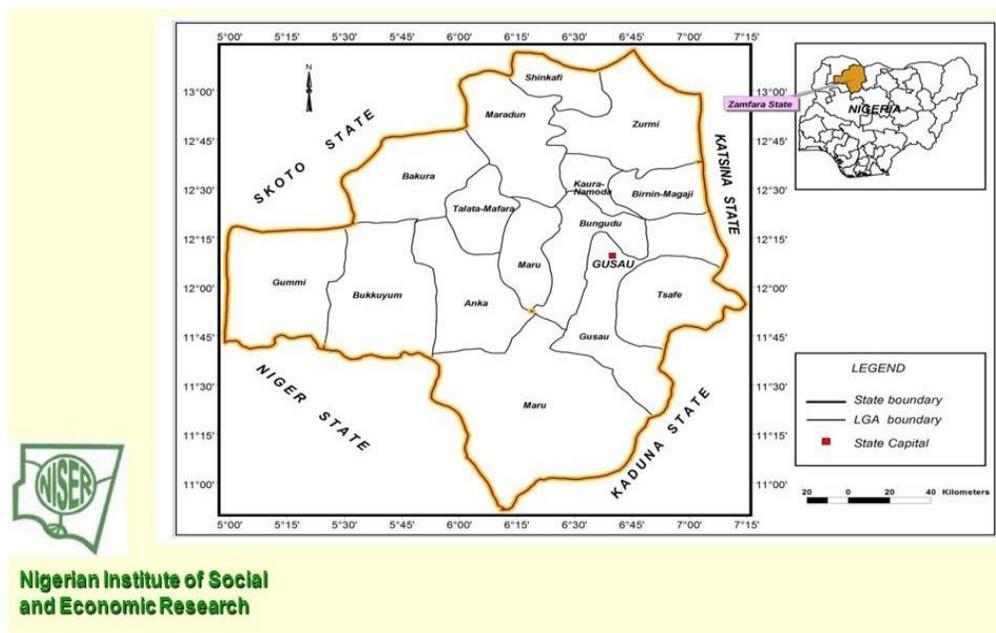
Figure 1. A map showing the study area.

Anonymity was ensured by the fact that identifying information about the individual subjects was not collected. All the information was required merely for research purposes and was kept confidential, not disclosing the identity of respondents during and after the research.

Data Collection Technique

Various methods available for collecting ethnobotanical data on medicinal plants were documented (15). However, an electronic questionnaire designed via Google Form was used to ease the one-on-one data collection for this study to obtain the relevant ethnobotanical data. The questionnaire contains information such as sex, age, educational background, the plant used in treating rheumatoid arthritis, the plant's part, method of preparation, source of knowledge, and many others.

Results and Discussion

Analysis of Socio-Demographic Data of the Respondents

The results collected from the respondents' biodata have been presented in Table 1, displaying their gender, age group, highest education background, and Gusau residency. To conduct this study, about 101 responses were reported through the use of an electronically designed questionnaire. 56.4% of the respondents were male, representing about 57 respondents, and 43.6% were female, representing about 44 respondents (Table 1). The majority of these respondents fall within the age range 46-60 years and 30-45 years with 49.5% and 33.7% respondents respectively (Table 1).

Responses from respondents with MSc/Ph.D. educational backgrounds (7 respondents i.e. 6.9%) were the lowest, while respondents with BSc/BEng/BEdu (29 respondents i.e. 28.7%) had the highest value (Table 1). The majority of the respondents (99%) reside in the study area (Table 1). The investigation of the data collected from this survey provides noticeable information on the sex, age, and educational background of the respondents.

The Survey of Plant Used by the Residences of Gusau LGA in the Treatment of Rheumatoid Arthritis Disease Evaluating its Abundance, Preparation Methods, and Effectiveness

The results collected for this survey have been presented in Table 2, showing the plant's part, the plant abundance (in terms of availability), and preparation methods for treating the illness.

According to the respondents, the survey shows that 36 (35.6%) of them use the root of the medicinal herb, 30 (29.7%) respondents use the plant's leave, while 16

(15.8%), 13 (12.9%), and 6 (5.9%) respondents use the bulb, fruit, and stem, respectively (Table 2). According to (Table 2), most of the respondents (97%) claimed that the plants used are abundant. A larger percentage of the respondents (75.2%) reported that the herbs' preparation method is grinding (Table 2).

In this study, the reason for using a particular plant by the respondabts varies. The majority of the respondents (74 respondents) use the plant(s) because it is effective (Figure 2). Other respondents use the plant(s) because of either failure of other methods of treatment (22 respondents) or high cost of modern

drugs and facilities (4 respondents), or because the plant(s) used has/have no side effects (1 respondent).

According to Figure 2, 25 (24.7%) respondents use the root because it is effective, 23 (22.8%) respondents use the leave because of its effectiveness, while 13 (12.9%), 10 (9.9%), and 3 (3%) respondents use the bulb, fruit, and stem respectively because of their effectiveness.

Out of the 101 respondents, about 36 (35.6%) respondents within the age range 46-60 use the plant(s) because it is effective, while 28 (27.7%) respondents within the age range 30-45 also use the plant because of its effectiveness (Figure 2). The 23 (22.8%)
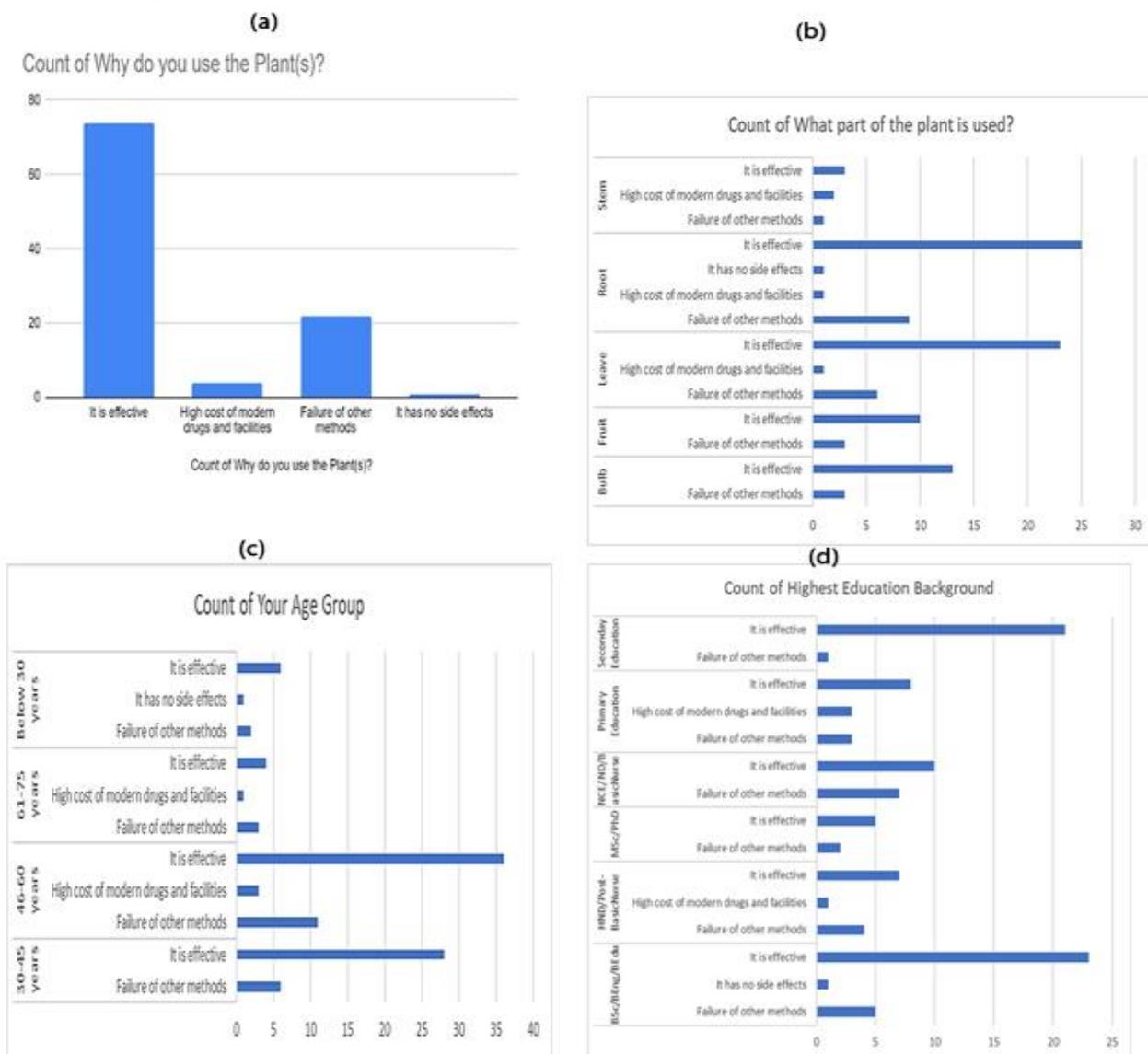

Figure 1. (a) Effectiveness of the plants used by residences, (b) Relationship between the part of the plant used & the reason, (c) Relationship between age and the effectiveness report from the residences, and (d) Relationship between education and the effectiveness report from the residences.

Table 1: Respondents' biodata (N=101).

Factor	Class	N (%)
Gender	Male	57 (56.4%)
	Female	44 (43.6%)
Age Group	Below 30 years	9 (8.9%)
	30-45 years	34 (33.7%)
	46-60 years	50 (49.5%)
	61-75 years	8 (7.9%)
Education Background	Primary education	14 (13.9%)
	Secondary education	22 (21.8%)
	NCE/ND/Basic Nurse	17 (16.8%)
	HND/Post-basic nurse	12 (11.9%)
	Bsc/BEng/BEdu	29 (28.7%)
	Msc/PhD	7 (6.9%)
Residence	Yes	100 (99.9%)
	No	1 (0.01%)

respondents with BSc/BEng/BEdu use the plant(s) because it is effective, while 21 (20.8%) respondents with secondary education background use the plant(s) for the same reason (Figure 2).

Evaluation of the Knowledge Source, Its Management, and Sustenance

The data collected for evaluating the knowledge source, its management, and sustenance have been presented in Figure 3 and Table 5. In this study, 40 (39.6%) respondents reported having learned about the medicinal plant from neighbors/friends. Other sources of information include doctors/traditional healers (22 respondents i.e. 21.8%), media (19 respondents i.e. 18.8%), ancestor's/family members (18 respondents i.e. 17.8%), with only 2 (2%) respondents reported to have gotten the knowledge of the medicinal herbs from self-experience (Figure 3c). The majority of the respondents representing about 99% of them are transferring the knowledge of the medicinal herbs used in treating rheumatoid arthritis

(Figure 3b). Many respondents (about 64.4%) are transferring the knowledge to family/friend, 22 respondents to only family members, and 14 (13.9%) respondents to only friends (Figure 3a). There should be an increase in medicinal plants' knowledge in treating rheumatoid arthritis in Nigeria with this development.

The age range with the highest frequency of respondents (46-60years) shows the highest frequency of transferability of the knowledge about medicinal herbs used in treating rheumatoid arthritis, accounting for 50 respondents. Thirty-six of the 50 respondents transfer the knowledge to family members/friends, 9 respondents transfer the knowledge to only family members, and 5 respondents to only friends (Table 5).

The 34 respondents within the age range 30-45 show transferability. In addition, 17 respondents under this age range transfer the knowledge to family/friends, 11 respondents to family members, and 6 respondents to only friends (Table 5).

Table 2: Plant part used, method of preparation and abundance of the plant part (N=101).

Factor	Classes/Types/Methods	N (%)
Part of the plant used	Bulb	16 (15.8%)
	Fruit	13 (12.9%)
	Leave	30 (29.7%)
	Root	36 (35.6%)
	Stem	6 (5.9%)
Method of preparation	Grinding	76 (75.2%)
	Herbal mixture	4 (4.0%)
	Decoction	16 (15.8)
	Blended	4 (4.0%)
	Extraction by squeezing	1 (1.0%)
Plant abundance (in terms availability)	Yes	98 (97%)
	No	3 (3%)

Table 3: Some of the plant/plant part used in the treatment of rheumatoid arthritis.

Local Nigerian name	Botanical name	Family	Common name	Part(s) used/Freq.	%
Ayu	*Allium sativum* Linn.	Amaryllidaceae	Garlic	Bulb (14)	13.86
Ata-ile pupa	*Curcuma longa* Linn.	Zingiberaceae	Turmeric	Root (14)	13.86
Barkono, eeru	*Xylopia aethiopica* (Dunal) A. Rich.	Annonaceae	Negro pepper	Stem (1)	0.99
Chita, atale, jinga.	Zingiber officinale Roscoe.	Zingiberaceae	Ginger	Root (20), leaves (1), bulb (2)	22.77
Ugu, ikong-ubong	*Telfairia occidentalis* Hook.f.	Cucurbitaceae	Fluted pumpkin or fluted gourd	Leaves (6)	5.94
Ewe ile, zoogale	*Moringa oleifera* Lam.	Moringaceae	Moringa	Leaves (9), fruit (2)	10.89
Isoketu	*Eleusine indica* (L.) Gaertn.	Poaceae	Stubborn grass	Leaves (1)	0.99
Ewuro, shiwaaka	*Vernonia amygdalina* Del.	Asteraceae	Bitter leaf	Leaves (6)	5.94
Kakayi	*Momordica charantia* Linn.	Cucurbitaceae	Bitter gourd	Leaves (1)	0.99
Pia	*Persea americana* Mill.	Lauraceae	Avocado pear	Leaves (1)	0.99
Ori, kadee	*Vitellaria paradoxa* C.F.Gaertn.	Sapotaceae	Shea butter	Fruit (1)	0.99
Asofeyeje	*Nigella sativa* Linn.	Ranunculaceae	Miracle seed or black seed	Fruit (5)	4.95
-	-	-	Herbal mixtures without a knowledge source of plant	Fruit (5), leaves (5), root (2), stem (5).	16.83

There were about 29 respondents with Bsc/BEng/BEdu education background. Eighty respondents with this educational background are transferring the knowledge mostly to family/friends, 8 respondents to only family members, and 3 respondents to only friends (Table 5). Among 22 respondents with secondary education background, 14 respondents are transferring the knowledge to family/friends, 5 respondents to only friends, and 3 respondents to only family members (Table 5).

This study indicated that probably a higher percentage of respondents transferring the knowledge to family/friends (65 respondents i.e. 64.4%) would increase the sustainability of knowledge and usage of medicinal plants used in treating rheumatoid arthritis.

An extensive literature review on some of the plants mentioned in this study indicates the ethnobotanical usage and their scientific/biological investigation in every part of the world to determine their constituents and trials on animal and human subjects.

The plants with the highest frequency of response were ginger (22.77%), garlic (13.86%), turmeric (13.86%), moringa (10.89%), bitter leaf (5.94%), and fluted pumpkin (5.94%).

Kiuchi *et al.* firstly proved scientifically an anti-inflammatory effect of ginger in 1982 (16). In another study, Kiuchi *et al.* in 1992 found that ginger showed anti-inflammatory activity (17). Several other researchers have researched anti-inflammatory activities, rheumatoid arthritis pain reduction potential, and antiarthritic activities of *Zingiber officinale* Roscoe (18-24).

In a systematic review of turmeric coupled with the meta-analysis by Daily *et al.* 2016, report shows that turmeric (*Curcuma longa* Linn.) extract (typically 1000mg/day) can decrease arthritis indications, principal pain and inflammatory-related symptoms (25). Dai *et al.* in an extensive research also provided evidence for the anti-arthritic properties of curcumin and established its potential use for the treatment of rheumatoid arthritis (26). In an ethnomedicinal survey by Shyamala *et al.* 2016, the rhizome (root) of turmeric (*Curcuma longa* Linn.) was reported to be used in treating rheumatoid arthritis by tribal people of Visakhapatnam district, India (27). Ogunmefun and Gbile, 2012, in an ethnobotanical survey, reported negro pepper (*Xylopia aethiopica* (Dunal) A. Rich.) to have anti-rheumatic properties (28).

A study likewise showed that *Nigella sativa* Linn. was able to improve aggravation and diminish oxidative

Table 4: Distribution of the plants used in rheumatoid arthritis treatment, preparation method, count of the plants used, and the plants' parts used.

The plant used in rheumatoid arthritis treatment	Method(s) used	Count of What plant is used in its treatment?	Route of administration	What part of the plant is used?
Avocado pear	Grind and mix with honey to form a paste	1	Topical	Leaves
Bitter leaf	Blended	1	Oral	Leaves
	Decoction	4	Oral	Leaves
	Grinding	1	Oral	Leaves
Black seed	Grinding	3	Oral	Fruit
Negro pepper	Infusion	1	Oral	Stem
Bitter gourd leaf	Mix leaf extract with coconut oil	1	Topical	Leaves
Fluted pumpkin	Extraction by squeezing	1	Oral	Leaves
Garlic	Grinding	14	Oral	Bulb
Ginger	Decoction	4	Oral	Root
	Grinding	19	Oral	Root(16),bulb(2), leaves(1)
Herbal mixture	Decoction	6	Oral	Root(2), stem(4)
	Grinding	8	Oral	Fruit(4), leaves(4),
	Herbal Mixture	3	Oral	Stem(1). Fruit(1), leaves(1)
Stubborn grass	Decoction	1	Oral	Leaves
Miracle seed	Grinding	2	Oral	Fruit
Moringa	Grinded moringa leaves mixed with menthol and shea butter to form a cream	1	Topical	Leaf
	Grinding	9	Oral	Leave(8), fruit(1)
	Powdered moringa seed mixed with honey	1	Topical	Fruit
Shea butter	Herbal Mixture	1	Topical	Fruit
Turmeric	Grinding	14	Oral	Root
fluted pumpkin	Blended	3	Oral	leaf
	Decoction	1	Oral	Leave
	Grinding	1	Oral	Leave
Total		101		

stress in patients with rheumatoid arthritis (29). Moringa leaves extract has been viewed as a truly encouraging pain-relieving and rheumatoid arthritis prescription (30). Also, oral administration of *Curcuma longa* Linn. can reduce the effect of inflammatory response in arthritic rats (31).

It is apparent that several scientific and biological types of studies already conducted on plants that have been recorded in this report are responsible for the effectiveness of the plants used in treating (RA) in Gusau, Zamfara State, Nigeria.

Progressively, individuals have employed the use of plant-based natural medicines which they recognized to be more secure and accessible to cure and control diseases. Traditional knowledge on the utilization of these plants has been significant in the quest for medication leads, as its utilization has led to the discovery of significant therapeutic agents, including anti-cancer, anti-infective, anti-inflammatory, and cardioactive drugs. Consequently, it still presents a significant way to deal with drug discovery and development. Medicinal plants have been investigated as a source of anti-inflammatory agents, and certain plants have exhibited valuable impacts in pre-clinical and clinical examinations (32-34).

For instance, a comprehensive review elucidated several medicinal plants utilized against different inflammatory biomarkers for controlling of rheumatoid arthritis (35). Moreover, *Terminalia avicennioides* Guill. & Perr. (Family: Combretaceae), used in North-West Nigeria to manage arthritis (36) was concluded to have the ability to alleviate peripheral pain (37).

Table 5: Evaluation of the knowledge source, its management, and sustenance.

Relationship between age and the transferability of the knowledge		
Below 30 years	Family members/friends	4 (3.9%)
	Friends	3 (3%)
	Family members	3 (3%)
30-45 years	Family members/friends	17 (16.8%)
	Friends	6 (5.9%)
	Family members	11 (10.9%)
46-60 years	Family members/friends	36 (35.6%)
	Friends	5 (4.9%)
	Family members	9 (8.9%)
61-75 years	Family members/friends	7 (6.9%)
Relationship between education and the transferability of the knowledge		
Primary education	Family members/friends	11 (10.9%)
	Friends	1 (1%)
	Family members	2 (1.9%)
Secondary education	Family members/friends	14 (13.9%)
	Friends	5 (4.9%)
	Family members	3 (3%)
NCE/ND/Basic Nurse	Family members/friends	9 (8.9%)
	Friends	4 (3.9%)
	Family members	4 (3.9%)
HND/Post-basic nurse	Family members/friends	8 (7.9%)
	Friends	1 (1%)
	Family members	3 (3%)
BSc/BEng/BEdu	Family members/friends	18 (17.8%)
	Friends	3 (3%)
	Family members	8 (7.9%)
MSc/PhD	Family members/friends	5 (4.9%)
	Family members	2 (1.9%)

Furthermore, plant remedies are getting progressively pursued in the treatment of many illnesses and disorders due to both their view of better safety than numerous synthetic drugs and the disappointment of the present drug regimens to efficiently cure many diseases. This is particularly valid for rheumatoid arthritis (38). In a study, 34 extracts from 13 South African plant species with a background marked by ethnobotanical use in the treatment of inflammation were examined for their capacity to control two microbial triggers for RA (Proteus mirabilis and Proteus vulgaris). Twenty-nine of the extracts (85.3%) hindered the development of P. mirabilis and 23 of them tested (67.7%) hindered the development of P. vulgaris. Moreover, all the extracts capable of exhibiting Proteus inhibitory activity were either non-poisonous or were characterized by low toxicity in the Artemia nauplii bioassay (38). Also, Saleem *et al.* 2019 documented several medicinal herbs that have been used to cure rheumatoid arthritis (39).

Interestingly, herbal medicines are nowadays characterized by a remarkable degree of publicity and
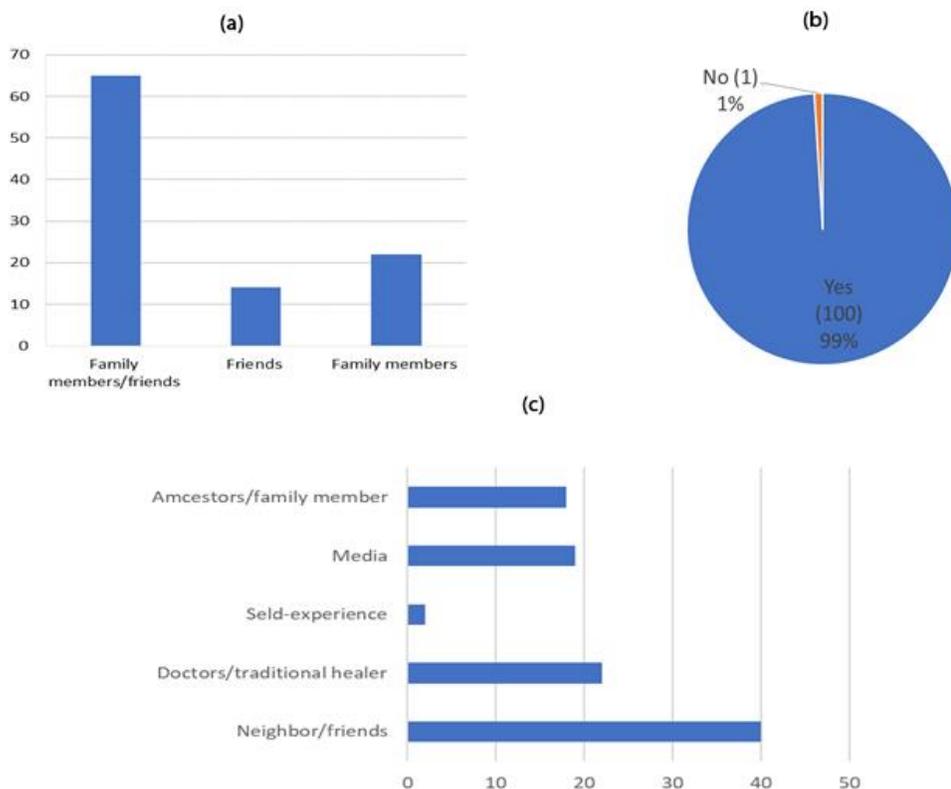
Figure 3. (a) Evaluation of the category of these people plan to transfer the knowledge to, (b) readiness to transfer knowledge to other people, (c) sources of their knowledge.

acceptability. The present research which has been conducted on the development of drugs from medicinal plants involves an interdisciplinary approach simultaneously utilizing botanical, phytochemical, biological, and molecular techniques. Further studies can consider the search for insight into the determination of chemical constituents present in the identified plants currently used by the residents in treating the disease. This study would go a long way in unfolding the key constituents promoting the understanding and recommendations of better treatments for such a kind of illness. Other works can also look into the safety of consuming the other chemical constituents present in the plant currently consumed. Furthermore, pharmaceutical and chemical engineering research works can consider the commercialization of the products.

Conclusion

This study showed absolute knowledge on the use of plant(s) to treat rheumatoid arthritis by residents of Gusau in Zamfara state, Nigeria. It is apparent that the transferability of the knowledge of the plants being used in treating rheumatoid arthritis in Gusau, Zamfara is on the high side, which would help increase the number of people with knowledge about medicinal plant(s). This ethnobotanical study has examined and recorded several plants used in the treatment of rheumatoid arthritis in Gusau, Zamfara state, and has identified ginger, garlic, turmeric, moringa, bitter leaf, and fluted pumpkin to be the predominant plants used by residents for the treatment of RA in the study area. This study has dealt with and presented several plants that could potentially serve as anti-rheumatoid arthritis agents for scientific rationalization.

Acknowledgment

Conflict of Interest

The authors declare that they have no conflict of interest.

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