USE OF INDIGENOUS MEDICINAL PLANTS FOR HEALTHCARE BY SMALL RUMINANT FARMERS IN IMO STATE, NIGERIA

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M. Sc. THESIS PRESENTED TO THE

DEPARTMENT OF AGRICULTURAL EXTENSION

FEDERAL UNIVERSITY OF TECHNOLOGY, OWERRI

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF SCIENCE (M.Sc.) IN AGRICULTURAL EXTENSION

JUNE, 2023.

CERTIFICATION

This is to certify that this work, entitled "Use of indigenous Medicinal Plants by small holder Ruminant Farmers in Imo state Nigeria" was carried out by ONUOHA EUGENIA NNEKA, Reg. No: **(20154997968)** in the Department of Agricultural Extension, Federal University of Technology, Owerri, Imo state.

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DEDICATION

This work is dedicated to God Almighty for His immense love, strength and wisdom to complete the study. I also dedicate this work to my family, especially my husband and kids for their support and patience throughout the period of the study.

ACKNOWLEDGEMENTS

I am particularly grateful to Prof. A.O. Ani, my major supervisor for his immense contributions and guidance throughout the period of the study to enhance the quality of the work. I commend Prof. F.C. Anaeto the Co-Supervisor and Dr. J.U. Chikaire for their assistance in the selection of the topic and design of the study. They also assisted immensely in data analysis and interpretation.

I also acknowledge Profs. F.N. Nnadi, M.T. Ukpongson and Edna Matthews-Njoku for finding time to review and make technical corrections in the work. They also taught me some courses especially research methods that helped me in the course of the study. I sincerely appreciate all the lecturers in the Department of Agricultural Extension, FUTO for reviewing my work. Specially recognized are Mr F.O. Ugwoke and P.C. Umunakwe who checked my work for editorial issues. Appreciated also is the effort of all the non-academic staff in the department, who have in one way or the other assisted me in the course of my study especially in the creation of an enabling environment throughout the times I presented my work. At this point I sincerely appreciate the efforts of the Departmental Postgraduate Coordinator, Dr.

J.O. Ajaero. I very much appreciate Prof. O.C. Korie, for his encouragement and guidance through my study. Mr. E.I. Nnorom, for his contributions to the research (Both from the Department of Agricultural Economics, FUTO. May God bless and give us the very best always, Amen.

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ABSTRACT

The study analyzed the use of indigenous medicinal plants for healthcare by small ruminant farmers in Imo State, Nigeria. The specific objectives were to describe the socio-economic characteristics of the small ruminant farmers, identify the indigenous medicinal plant species available to them, identify small ruminant ailments prevalent in the study area, ascertain methods of preparation of the medicinal plants used, determine the situations or conditions for use of the medicinal plants in small ruminants' healthcare by male and female farmers, ascertain the perceived reasons for use of indigenous medicinal plants in small ruminants' healthcare, and identify the constraints to the use of indigenous medicinal plants in small ruminants' healthcare in the study area. The hypotheses tested were; there was no significant relationship between the socioeconomic characteristics of the farmers and their perceived reasons for use of indigenous medicinal plants for small ruminant healthcare, there was no significant difference in the perceived reasons for use of indigenous medicinal plants for small ruminant healthcare between the male and female farmers and there were no significant differences in the perceived reasons for use of indigenous medicinal plants among farmers for small ruminant healthcare in the three agricultural zones of Imo State. Multi-stage sampling procedure was used to select the sample for the study. A total of 240 small ruminant farmers were selected for the study. Data were obtained from primary sources and were analysed using mean score, standard deviation and percentage. The hypotheses were tested using ordinary least square multiple regression model, Z- test and ANOVA. The result of the study showed that the farmers had an average age of about 51 years, the majority (52.9%) of the farmers were male while 47.1% were female and majority (86.3%) were married. The mean household size was eight persons and the mean years of farming experience of the respondents was 15.7 years. The majority (57.5%) of the respondents took farming as their major occupation. The mean herd size owned by the farmers was 18 animals and the majority (68.0%) of the respondents belonged to church organizations while 57.5% were ADP contact farmers. A greater proportion (42.9%) of the respondents got credit from friends and relatives while the mean annual income of the farmers was ₦87, 325. Furthermore, the study identified 20 indigenous plant species utilized in small ruminant animal healthcare. Seventeen ailments were identified. The result also revealed that many methods were used to prepare and administer the indigenous plant species to the animals, with squeezing, boiling and crushing being the most preferred. The most frequent situation to administer medicinal plants was each time a disease condition is observed ($\bar{}$ = 2.5) and the most perceived reason for the use of indigenous medicinal plant was readily available and cheap (X= 3.1). It was also found that problem of dosage of the medicine (85.8%) was the major constraint to the use of medicinal plants in the study area. The multiple regression analysis run to predict the influence of socioeconomic characteristics on farmers' perceived reasons for use of indigenous medicinal plants for small ruminant healthcare showed that R^2 = 39.6 and Fvalue = 9.8, sex ($t = 3.2$), age (t = 3.3), marital status ($t = -2.1$), educational level ($t = 3.6$), herd size ($t = 3.9$), membership of social organizations ($t = 4.7$), sources of information ($t = -2.8$), annual income $t = -1.92$, frequency of extension contact ($t = 1.8$) and major occupation ($t = 1.8$) were statistically significant at 1%, 5% and 10% significant levels. The z-test analysis showed that the male and female farmers did not differ in their perceived reasons for use of indigenous medicinal plants. Furthermore, the ANOVA result revealed a statistically significant difference (F(2,237) = 7.109, p = 0.001 in the perceived reasons for use of medicinal plants for small ruminant healthcare among the farmers in the three agricultural zones. It was recommended that government and other relevant stakeholders should promote the use of medicinal plants in livestock management. There should also be a synergy between farmers, researchers and extension personnel in the identification and use of medicinal plants in small ruminant healthcare.

Keywords: *Indigenous, Medicinal Plants, Healthcare, Small Ruminant Farmers*

CHAPTER ONE

INTRODUCTION

1.1 Background to the study

Ruminants form a significant proportion of livestock production and possess obvious advantage over other livestock such as playing significant roles in the lives of rural households (Aruwayo *et al*., 2015). Small ruminants (sheep and goat) are cloven-footed animals which belong to the genus, Ovis and Capra respectively. They were domesticated over 800 years ago in Africa (along River Nile), Asia (along Tigris and Euphrates rivers) and India (Indus). The breeds of sheep and goats in Nigeria are believed to have originated from western Asia, passing through the Middle East to North Africa and eventually Nigeria. They are ruminants that chew the cud or regurgitate and ruminate and have four stomachs (Otaru & Iyola-Tunji, 2015).

Small ruminant agriculture plays a crucial role in social and economic development, especially for developing countries. They contribute to the management and development of landscapes, ecosystem maintenance, biodiversity conservation and provision of job opportunities from products (meat, skin and milk) and by-products in the market (Marino *et al*., 2016). The sector is so important that 56% of the world ruminant domestic populations (3.872 billion herds) are sheep (1.178 billion) and goats (1 billion) and they are distributed all over different types of ecology (FAO, 2018). Over 56% of the world's small ruminants are located in water-limiting and dry zones in developing countries whereas temperate and humid account for 27% and 21% respectively (FAO, 2018; Marino *et al*., 2016). While less than sheep and cattle, the goat population of the world has constantly increased since the 60s especially in countries of low income or less favoured regions of the world (Skapetas & Bampidis, 2016) and a 60% increase in global sheep number is expected by 2050

(Mazinani, 2020). Sheep and goat are clustered in 1000 and 300 breeds respectively and are distributed across various geographical and agro-ecological zones around the world (Vila et al., 2021; HappyChicken, 2020).

Market demand and a shift to more profitable agricultural ventures seem to be the main determinants for changes in the small ruminant population (Acibuca & Budak, 2021). The small ruminant sector contributes about 25.6 million tons of milk and 1.5 million tons of milk annually (Wodajo et al., 2020). The socioeconomic importance of small ruminants (especially sheep and goat) both to smallholder and commercial farmers in the entire world cannot be overemphasized. This is because the demand for their product and by-product keeps increasing with the rise in population (Akinmoladun *et al.,* 2019).

Certain characteristics make it easier to keep small ruminants over large animals. They are easier to handle, do not require so much capital and space to start, have reduced feed intake and high adaptability (Monteiro et al., 2016). Tropical Africa has about 22% and 40% of the total world sheep and goat population of 1,028 million and 765 million respectively (Utaaker et al., 2021). Nigeria is home to about 22.1 million sheep and about 70% of the small ruminants are found in the semi-arid zones of Nigeria and these belong to the agro-pastoral farmers utilizing extensive and semi-intensive management systems (Ogbaje et al., 2018). Whereas the majority of sheep population in the country are owned by smallholder rural livestock farmers, a few are still in the urban areas (Ogbaje et al., 2018). In rural communities in southeastern Nigeria, sheep and West African Dwarf (WAD) goat production fulfils important economic and social functions. In this part of the world, about 80% of rural families keep sheep and goats primarily as an investment and source of manure, for meat at home or during festivals (Okoli *et al.*, 2003). Traditionally, these animals are allowed free grazing or are tethered and fed plant leaves and kitchen wastes brought to them by the owner. Plants utilized for feeding goats constitute an

abundant biomass in farm lands, bush fallows and forests in the state and are commonly utilized in the wild by the rural farmers (Obua, 2013).

The common breeds of sheep in Nigeria include the large, long-legged, long tailed breed (*Balami* and *Uda*), the medium size breed (*Yankassa*), the small shortlegged, short-tailed breeds (West African dwarf) whereas in goats they include the large breeds of the north (e.g. the Sahel goats), small breeds of the south (West African dwarf goats), the medium sized breeds of the sudan and Guinea Savanna zones (Red Sokoto goats) (Otaru & Iyiola-Tunji, 2015).

In Nigeria, management of small ruminants is largely in traditional hands (Ahmed & Egwu, 2014). Diseases are very important to farmers and affect the production of small ruminants in several ways. It increases cost of production, lowers production level, reduces the quality and quantity of animal products and generally causes great loss to the farmer (Unigwe et al., 2016). Though, proven scientific methods of preventing and managing animal diseases in form of veterinary service abound, this may not always be readily available to rural farmers who are poor and less educated. Rural farmers are not well educated on the modern veterinary practices and drugs; and veterinary services are unavailable or unaffordable to them. However, the rural farmers have their own local methods of preventing and managing animal diseases. Such knowledge and practices are not well documented but are passed down orally from generation to generation (Rabiu *et al.,* 2013).

However, the rural small ruminant farmers have developed indigenous methods or technologies for coping with the constraints. Among the various indigenous methods is the use of herbs to manage animal diseases. The knowledge base of these herbs differs not only from region to region but also within communities.

In Nigeria, medicinal plants constitute one of the cheapest and available sources of medication for livestock, especially ruminants in the tropics (Ogbuewu *et al.*, 2015). Small ruminant farmers can cope with a reasonable spectrum of common disease conditions such as diarrhea, wounds, colds, worms, and reproductive disorders etc. (Matekaire & Bwakura, 2004). Small ruminant owners have an excellent knowledge of ethnobotany, which has formed the basis for screening plant materials as potential sources of medicinal drugs (Spore, 1992).

Southeastern Nigeria is home to sixty percent of the rainforest resources and biological diversity of the country (Okoli *et al.*, 2002). These biological resources including medicinal plants have overtime supported sedentary small scale livestock and arable rural farmers, who depend on the diverse forest resources for livelihood (Sori *et al.*, 2004; Tadeg *et al.*, 2005). Some studies have reported the increasing destruction of the forest resources of southeastern Nigeria by natural and entrenched human activities (Njoku, 2006; Njoku, 2009). Being a fragile ecosystem, the rainforest in southeastern Nigeria readily degrade under persistent human pressure as the dependent populations continue to meet their livelihood needs. Added to this, are the recent reports on the activities of migrant pastoralists in the region, which result in soil compaction, deforestation of remaining fragile vegetative cover thereby complicating the perilous forest ecosystem and depletion of the region (Okoli *et al.*, 2012). These problems no doubt may affect the availability and use of indigenous medicinal plants and ultimately small ruminant production.

1.2 Statement of the problem

Herbal medicine is the oldest and still the most widely used system of medicine in the world today. It is used in all societies and common to all cultures (Ezekwesili & Okaka, 2019). Conventional veterinary services in spite of its crucial roles, have

limited coverage in developing countries (Sathiyaraj *et al.,* 2010) and as a result, livestock keepers especially in rural areas seek solution from traditional healers for the health of their sick animals. Traditional medicine complement modern medicine by providing a socially acceptable remedy or alternative from inexpensive resources. Several studies carried out in Africa, Asia, Europe, Latin America and North America showed that plants are routinely used as remedy for animal diseases (Passalacqua, *et al*., 2006; Lans, *et al*.,2007). FAO reported that about 80% of the people in developing countries rely largely on indigenous practices for the control and treatment of various diseases affecting both humans and animals (Uwagie-Ero *et al*., 2017). Different traditional healing practices worldwide are designed for either therapeutic or prophylactic use in human or animal diseases.). The traditional system of medicine, especially the herbal medicine, in Nigeria is directly linked to its rich floral diversity. The southeastern Nigeria is one such high bio-cultural diversity region, which is one of the global biodiversity hot-spots (Okoli *et al.*, 2002; Okoli *et al.*, 2003; Obua, 2013).

Among the benefits of traditional medicine is that the resources are freely available or at a cost in proportion to the value of the animal that is beneficial. It is easily administered, usually orally or topically; it has a little or no resistance effect compared to modern veterinary practices and it can be practiced almost by everyone as no western knowledge is required (Uwagie-Ero *et al.,* 2017). However, traditional knowledge on ethnoveterinary practices by local healers who are knowledgeable and experienced in traditional systems of treatment is important but their knowledge is not adequately documented and is fast disappearing as a result of the increasing demand for herbs (Chukwuma et al., 2015). The situation is worsened by the rapid socioeconomic, agricultural expansion, urbanization technological and environmental changes (Sarasan *et al*., 2011). According to (Cetinkaya *et al*., 2009) documenting, promoting and conserving the ethnoveterinary medicinal plant lore in

Nigeria has become very pertinent. It will also serve as a key towards the establishment of people-centred natural resources management systems (Lynam *et al*., 2007), a potential for scientific discovery of new compounds that could be used in development of modern drugs (Cos *et al*.,
2006) and a way of preserving people's cultural identity (Cetinkaya *et al.,* 2009). Research has shown that our native plant species are rich in phytochemical compounds such as tannins, alkaloids, steroids, flavonoids and saponins on analysis (Echo *et al.*, 2012; Akpanyung *et al.*, 2013) and being evergreen plants, they could form an all year round medicinal resource (Oji & Isilebo, 2000).

Several attempts have been made to document the vast ethnoveterinary information from the region in the form of general documentation (Okoli *et al.*, 2002; Okoli *et al.*, 2003; Obua, 2013). Despite the involvement of many farmers in Imo State in small ruminant production, literature is scanty in empirical studies on the use of medicinal plants for the treatment of diseases of these class of animals. The study is therefore an effort to close this knowledge gap. The following research questions were asked:

1. What are the socioeconomic characteristics of the small ruminant farmers?
2. What indigenous medicinal plant species are available to the small ruminant farmers?
3. What common livestock ailments are prevalent in the study area?
4. What indigenous medicinal plants are used for the treatment of small ruminant diseases?
5. What are the methods used in the preparation and administration of the medicinal plants in small ruminant healthcare?
6. What are the situations or conditions for use of indigenous medicinal plants in small ruminants' healthcare?

7. What are the perceived reasons for use of indigenous medicinal plants in small ruminants' healthcare?
8. What are the constraints to the use of indigenous medicinal plants in small ruminants' healthcare?

1.4 Objectives of the study

The broad objective of the study was to analyze the use of indigenous medicinal plants by small holder ruminant farmers in livestock healthcare in Imo State, Nigeria.

The specific objectives were to:

i. describe the socio-economic characteristics of the small ruminant farmers;
ii. identify indigenous medicinal plant species available to the small ruminant farmers;
iii. determine the prevalence of small ruminant diseases;
iv. ascertain the indigenous medicinal plants used for the treatment of small ruminant diseases;
v. ascertain methods of preparation/administration of the indigenous medicinal plants used in small ruminants' healthcare in the study area;
vi. describe the situations or conditions for use of indigenous medicinal plants;
vii. identify reasons for the use of medicinal plants as perceived by the farmers; and
viii. ascertain the constraints to the use of indigenous medicinal plants in small ruminants' healthcare in the study area.

1.5 Hypotheses of the Study

The following null hypotheses were tested:

1. There is no significant relationship between the socioeconomic characteristics of the farmers and their perceived reasons for use of indigenous medicinal plants for small ruminant healthcare.
2. There is no significant difference in perceived reasons for use of indigenous medicinal plants between the male and female farmers for small ruminant healthcare.
3. There is no significant differences in the perceived reason for use of indigenous medicinal plants among farmers for small ruminant healthcare in the three agricultural zones of Imo State.

1.6 Justification of the study

This study was designed to assess the use of indigenous medicinal plants for treating small ruminant diseases. It will therefore, serve as a source of useful information for extension administration in the state, in planning and providing solution to the problems that impede famers use of indigenous medicinal plants. The findings of the study will be beneficial to the crop, livestock, agro-forestry sectors, policy makers, extensionists, researchers and the farmers as well.

The ultimate aim was to provide bench mark data to aid decision-making by development planners in Nigeria such that the benefits of so liberal agrarian policies will be reaped by all. The paucity of empirical evidences, the factors that determine the availability and use, documentation of indigenous medicinal plants in the treatment of small ruminant diseases generally and specially in Imo State necessitated the investigations in this study.

It was also expected that the study will be useful to donor agencies as it will assist them in decision making on funding of developmental projects in areas of agriculture and health. It will also assist the extension service delivery systems to re-adjust their techniques and modify their teaching methods so as to be more effective and efficient to their clientele. The study will also help to document baseline data for future pharmacological and phytochemical studies.

1.7 Scope of the study

The study was designed to cover Imo state. It focused on the use of indigenous medicinal plants as it concerns small ruminant farmers in the three Agricultural zones of the state. The study therefore was only concerned with use of indigenous selected medicinal plants by small ruminant farmers in Imo state.

CHAPTER TWO
LITERATURE REVIEW

Understanding and knowing the farmer within his social environment as well as how he lives and interact with his livestock in healthcare management remain essential prerequisite to analyzing the use of medicinal plants in health care management of small ruminant animals. This review will focus on studies conducted within and outside Nigeria that would be relevant to the present study. The presentation will be done under the following sub headings;

- ✞ Overview of the livestock industry in Nigeria
- ✞ Ruminant production in the world
- ✞ Ruminant production in Nigeria
- ✞ Management practices of ruminant production in Nigeria
- ✞ Economic importance of ruminant production in Nigeria
- ✞ Small ruminant production in Nigeria
- ✞ Concept of indigenous knowledge
- ✞ Importance of indigenous knowledge
- ✞ Limitations of indigenous knowledge
- ✞ The loss of indigenous knowledge

- ✞ Indigenous medicinal plants
- ✞ Benefits of use of medicinal plants
- ✞ Medicinal plants and conservation
- ✞ Ethnomedicine and traditional medicine
- ✞ Concept of indigenous medicine and ethno-veterinary medicine
- ✞ Ethno-veterinary health management practices
- ✞ Ethno-veterinary health management practices in ruminant animals
- ✞ Ethno-veterinary health management practices in other livestock animals
- ✞ Theoretical and conceptual framework
- ✞ Theoretical framework
- ✞ Empirical framework
- ✞ Conceptual framework

2.1 Overview of the livestock industry in Nigeria

The livestock sub-sector is an important and integral component of Nigeria's agriculture and is a major source of household wealth and food security. Cattle are the single most important livestock species in terms of output and capital value. While sheep, goats and poultry are raised throughout the country, cattle are largely concentrated in the dry savanwnah parts of the country including areas that are not considered free of tsetse fly (World Bank, 2017). The livestock sub-sector contributed about 1.7 %to the national GDP and 9.0% to the agricultural value added

2019 (Federal Ministry of Agriculture and Rural Development (FAO, 2019). Nigeria is one of the four leading livestock producers in sub-Sahara Africa. In 2019, Nigeria's national livestock population was estimated to consist of 18.4 million cattle, 76 million goats, 43.4 million sheep, 6.6 million pigs, 19,000 camels and 166 million chickens. Total production of milk, meat and eggs amounts to 0.5 billion litres, 1.4 and o.6 million tonnes per year respectively (FAO, 2019).

The low national herd growth rate is supplemented by the import of live cattle from the neighbouring countries through transhumance and trade. There has been an increasing demand for beef and milk, the main sources of domestic animal protein in Nigeria. This has resulted in a domestic supply gap due to the challenges of low livestock productivity of the indigenous production systems. The current economic situation in Nigeria indicates that domestic supply of animal protein is growing at 1.8% per annum while the overall demand is estimated to be rising at 5.1% annually. In spite of its importance and the existence of an unsatisfied internal demand for livestock products, the livestock sub sector has suffered from inadequate investment by both the public and the private sectors. Although there is limited formal importation of beef into Nigeria, the national supply gap is mainly filled in by the live animals coming in from the neighbouring countries (FMARD, 2011).

The main goal of livestock transformation agenda is however to provide adequate supply of quality meat in the domestic market and develop the potential towards export. Also the objectives of the transformation agenda include:

a. Increase the amount of beef into the national meat market by 650,000 metric tons annually by 2015.
b. Raise the national average slaughter weight of cattle from 250kg to 350kg
c. Increase the national herd growth rate from 1.4 to 3.3%
d. Provide commercially viable partnership between livestock producers and markets along the value chain.

e. Improve the production system along commercial and business operations
f. Establish a national livestock breeding policy that promotes technology adoption for faster growth of the industry.
g. Establish a National Meat Development and Marketing Corporation for the longterm sustenance and growth of the industry.

2.2 Ruminant production

2.2.1 Ruminant production in the world

When looking for solutions that increase ruminant production or productivity in the world, it is necessary to differentiate between emerging markets and poor countries. Emerging countries such as China, India, Brazil, Mexico, Russia, Indonesia and Turkey, and many other countries located in Europe (from the former Soviet Union), Africa (e.g. Egypt, Morocco, Nigeria, Kenya and South Africa), and America (e.g. Argentina), have embarked on the process of development. For most of these countries, the primary sector itself (crops and livestock) is still 'emergent', thus requiring the time needed for a full development, as it happened in the already developed countries.

Worldwide, farms smaller than 2 ha account for 84%of the total number of farms (570 million) but only12% of the Earth's land surface used for agricultural purposes (FAO, 2014). Particularly, small-scale farms likely account for only 25– 30% of the cultivated surface. Prairies, grasslands and other uncultivable areas (approximately 3 billion ha) are of interest for animal systems only when large areas are available. Small-scale family farms, where subsistence farming is often practiced, devote most of their activities and arable land to produce human food. However, it must be underlined that these small-scale farms supply a low amount of food worldwide, and may hardly meet the requirements of the farming family.

In small-scale family farms, the presence of livestock is scarce and the expertise and knowledge of animal husbandry is very limited and linked to traditions with little, if any, scientific basis. In these farms, livestock (mainly chickens and laying hens, waterfowls, sheep and goats, and, if not forbidden by religious norms, pigs) are normally reared around the huts and kept in shelters only for the night (Costa *et al*., 2013). In some areas of Asia and Africa, labour animals are also reared, mainly for field labour and transport (e.g. water buffaloes, cattle, horses and donkeys), but with limited possibilities to yield meat and milk.

Extensive or semi-extensive livestock farming systems do exist and are mainly focused on sheep and goats in Asia, cattle in Africa and camelids in South America. These farming systems are practiced by populations that traditionally are pastoralists, with the main goal of supplying food (meat and milk) and textile fibres, but also for other reasons, such as social role, 'currency', and religious value and significance. This is why increasing the number of animals is often preferred to having a high production per animal, thus frequently causing overgrazing, with consequent soil degradation and desertification, favoured by the common property of land and little interest in preserving that land over time. Paradoxically, the improved hygienic-sanitary tools available today, which are able to reduce animal mortality, have worsened this situation.

Satisfying the need to integrate foods of plant origin with foods of animal origin in a balanced human diet can be difficult in small-scale family farms which cultivate crops, mainly cereals and tubers, rich in starch, but poor in protein, lipids and micro-nutrients. In these subsistence farming systems, where the level of production seldom exceeds family requirements, the following is observed: (a) small surpluses, which are mostly temporary, are immediately sold to get cash; (b) there is no actual way or awareness to trans-form such surpluses into animal products; and (c)there is a lack of awareness that staple foods (e.g. rice, maize, cassava, and potatoes) could

be integrated with other foods that the farmer could produce at limited amounts, such as peanuts, legumes and vegetables in general, and also chicken and goats. As a consequence, the population groups at higher risk of malnutrition, particularly children, are those living in rural areas. In fact, people with other working activities and, therefore, cash can buy almost any food and acquire complementary foods, which are sold by farmers to make some money.

In small-scale farming systems, animal production accounts for only 10–13% of the income (Food and Agricultural organization (FAO), 2009).This is mainly attributable to the following: (a) health problems (i.e. infectious and parasitic diseases) able to decrease the already low animal production and population; (b) the low genetic merit of the animals; (c) the insufficient availability of feeds, particularly during drought and cold periods, partially due to a lack of knowledge of techniques for drying forages; (d) lack of structures such as shelters and stalls, hatcheries, animal feed producers and slaughterhouses; and (e) anal most complete lack of expertise and knowledge of animal management, because local people are traditionally hunters, gatherers, fishermen or crop farmers and not animal farmers.

Animal farming has many goals, but the most important is to supply food in order to combat malnutrition. Over the last 20–30 years, meat, eggs and, recently, milk have been consumed in greater amounts in the (FAO, 2009). This holds true only for some countries among those considered still developing, particularly China and Brazil, which together account for almost 2 billion people. The low consumption of food of animal origin is typical of the countries still affected by high levels of malnutrition, such as India, Kenya, Democratic Republic of Congo, Ghana and Nigeria and in general, the low and the lower-middle income countries (FAO, 2009), accounting for about half of the population of the planet, where 30% of the children suffer from malnutrition (Crovetto, 2015).

According to FAO (2009), livestock production follows economic development. Therefore, lack of development is correlated with few animals being farmed and this contributes to widespread malnutrition, especially among children. In fact, the nutritional status of children from 3 to 10 years old registered in economic-ally poor countries reveals a serious situation, with a percentage of underweight children which reaches 60%and 42% in the Congo Democratic

Republic and the tribal area of Northeastern India, respectively (Bertoni *et al*., 2015). Unfortunately, after being breastfed, poor-country children consume the same food as adults, and their diet is almost free of animal products (except for some fish, mainly in India). Therefore, in addition to food availability, a specific nutritional education is required to improve this situation.

Besides contributing to child mortality (Crovetto, 2015), the fact that malnutrition due to a lack of food of animal origin in the di*et al*so causes serious damage to cognitive development (Black *et al*., 2013) is a major obstacle for economic development and this, in turn, is correlated with a low level of animal production. Hence, a new vicious circle having the animals at the centre occurs. Animal production is considered an ideal complement to agricultural production, increasing the human working capacity and integrating the nutritional properties of crops, which are mostly rich in carbohydrates.

Considering the very high number of people living in malnutrition conditions, it is frustrating to realize that this situation cannot be solved without economic development and in turn livestock production (again a vicious circle). As a matter of fact, FAO (2014) considers that the development of small-scale family farms requires the dissemination of innovation which, in turn, implies research, experimentation, technical assistance, roads, markets, schools, hospitals and so on. Unfortunately, the governments and local authorities of these countries are by no means able to com-ply with this request, simply because they are not able to start development. Moreover, even if it were possible to start development, the so-called

‘last mile problem’, i.e. the transfer of technologies to local populations, would remain. As the old proverb says: ‘Give a man a fish, and you feed him for a day. Teach a man to fish, and you feed him for a lifetime’.

We are therefore convinced that the vicious cycles cited above must be broken, in order to overcome or alleviate the problems discussed here. This must happen, above all in the developing countries, starting from the small-scale farms and promoting an increase in animal husbandry activities and knowledge.

Sheep and goats are very common among small-holder farmers in developing countries. Normally they are raised in small numbers and are free to range and graze nearby the huts of the village, sometimes tethered to a pole or a tree. This situation is common in the rural areas of Africa and in India, particularly during the season of rice cultivation.

For cattle there is a great difference between the pastoralist and the agricultural areas. In pastoralist farming systems, cattle are raised mainly in the savannah, far from the tilled fields and, therefore, with low risk of causing damage and having quarrels. In this case, some improvements have been obtained through the control and reduction of external para-sites, but a much better management should be applied in order to reduce the number of animals while improving animal performance (by means of genetics, health care, and feeding). In this way, livestock production could be maintained and over-grazing would be reduced. In agricultural areas where crop production prevails, different situations occur in terms of livestock farming, varying from a total lack of know-ledge (as in the Democratic Republic of Congo) to good knowledge but with a lack of improved and efficient techniques (as in many areas of India).

Several improvement efforts have been made in developing countries, but the results are not always positive and it is evident that introducing advanced technologies to be just copied and applied often results in failure. Our proposal is totally different

and based on the involvement of local people, who must engage directly, despite having some external technical and financial support.

2.2.2 Small ruminant production in Nigeria

Livestock production is an important tool in the economy of developing countries. Goats particularly play an important role in the livelihood of small scale farmers as a major component of livestock mixed farming systems, which produce meat, milk, skin, fiber, and manure to large number of low income earners (Acharya *et al*., 2011).

The complex factor that affects livestock production is nutrition, as feed resources are limited in quantity and quality. The systems of goat production in Nigeria are usually characterized by limitations posed by non-availability of yearround feed resources due to prolonged dry season of northern Nigeria (Aina *et al*., 2002). In Nigeria goats are raised extensively on natural grasses and crop residues. Studies have shown that grasses alone cannot provide adequate nutrients for optimum production of goats (McDonald, 1995). Crop residues are the most abundant and readily available feed resources for livestock production (Belete, 2006; Ajeigbe *et al*., 2011).

Sheep and goats are widely distributed in Nigeria in rural, urban and periurban areas representing about 63.7% of total grazing domestic animals in Nigeria (Gefu, 2002). Small ruminants remain popular among the rural populace and resource-poor people. Their importance is primarily associated with their small size, which is significant for the advantage of mankind as it favours low investments, small risk of loss and preference over large ruminants for food and reproductive efficiency and economic use of available land (Omoike *et al*., 2006). Boyejo and Adedoyin (1994) also reported that sheep, goats rearing are a common feature in most rural households in Nigeria and are important items in religion festivals in Western Nigeria. Hooft *et al* (2008) and Rege (1997) fully documented the contributions of

livestock to include economic, food security, family income, risk mitigation and social roles. Generally, sheep and goat production tend to be extensive. According to Obinne *et al*. (2006), small ruminants are kept using a number of different production systems including subsistence in which the animals are tethered; extensive in which they are allowed to roam and tend for themselves and intensive in which they are kept in total confinement.

2.2.3 Management practices by small ruminant farmers

Sheep (*Ovis aries*) and goats (*Capra hircus*) were perhaps the first ruminants domesticated by man (Ndofor *et al*., 2012). Domestic sheep originated from wild sheep which included the Mouflon (Europe and Asia), the Urial (Asia), the Argali (Asia) and the Bighorn (Asia and North America) while goat originated from the wild goat bezoar. Sheep and goat share many characteristics in common and play important role in the socio-economic life of the people of Nigeria. They play a significant role in the food chain and overall livelihoods of rural households, where they are largely the property of women and their children (Lebbie, 2004).

In the humid zone of Nigeria, small ruminants fit into the smallholder production system, as they require low initial capital investment and low operational cost (Pollot and Wilson, 2009 in Njofor Eze Chima and Okaridje Bowell, 2016). Diseases and inadequate nutrition (in terms of quality or quantity) constitute serious constraints to small ruminant production in Africa (Tadesse, 2012 in Njofor Eze Chima and Okaridje Bowell, 2016). Good management practices in terms of adequate nutrition, disease prevention and control and breeding are essential for improved small ruminant production.

Traditional livestock production in Nigeria is varied and complex. Livestock production is an instrument for socioeconomic change to improve income and quality of life of farmers who are the primary drivers of the present government

transformation agenda. Livestock especially ruminants are the most efficient users of uncultivated land and can contribute substantially to crop production (Nuru, 2001). Integration of sheep with crop agriculture usually occurs under subsistence conditions on small-scale farmers. They form an integral part of the system, providing milk, meat, manure and cash to the farm family during the time of need. Sheep and goats are efficiently reared on marginal lands and are good users of crop residues (Fakoya, 2002; Sanni *et al*., 2004). As such, they provide the only practical means of using vast areas of natural grasslands in regions, where crop production is almost impracticable (Ngatazie, 1989; Rege 2001). Small ruminants have been reported to be prolific (Otchere, 1986) and need only short gestation periods to increase flock size. This therefore makes traditional small ruminant production system a low input but high output enterprise with predictable profitability and economic returns (Nwafor, 2004).

Records show that sheep and goats are among the domesticated small ruminants in terms of total numbers and production of food and fibre products (Varella, 2020). This attribute may partly be due to their lower feed requirements compared to cattle, because of their body size (Okunlola *et al*., 2010). This, however, allows for easy integration of small ruminants into different farming systems (Hirpa & Abebe, 2008). According to Ochepo and Momoh (2010), subsistence animal agriculture (livestock) is the main contributor to the meat industry in Nigeria. This consists of small herds and flock in the rural, urban and peri-urban areas in Nigeria. Their small size and early maturity give them several distinct economic advantages in smallholder situations (Chukwuka *et al*., 2010)

Sheep and goat seem to stand out among every other livestock including cattle. The common breed of sheep and goat in eastern part of Nigeria (Imo State) is the West African Dwarf sheep and goat. They enjoy a wider distribution and greater flock dynamism than other livestock species within Africa (Chah *et al*., 2009). Sheep and

goat breeds in Nigeria are meat producers that have adapted to the various ecozones in which they are found (Ozung *et al*., 2011). The West African sheep and goats are highly adaptable to a broad range of environment. They are thought to be tolerant to trypanosomiasis and other diseases, allowing them to graze on land not available to other domestic livestock (Okoli *et al*., 2006).

In spite of the numerous economic and sociocultural advantages of keeping sheep and goats, the production of these small ruminant animals (sheep and goats) is still at the subsistence level via the local extensive/ free range system in Imo State. Their management is still largely in traditional hands. Ozung *et al*. (2011) even reported that the potentials of these animals have not been fully explored by livestock farmers and Government livestock establishments. Sheep and goats keepers have limited access to improved species and such cannot experiment with available new breeds. More so, there seems to be basically few or no standard, adequately constructed, modern sheep and goat farms in most places where sheep and goats are reared. These animals are housed in dilapidated locally constructed houses where they are vulnerable to diseases, pests and predators.

2.2.4 Economic importance of ruminant production

Sheep and goats play a significant role in the food chain and overall livelihoods of rural households, where they are largely the property of women and their children (Lebbie, 2004). These animals can be reared for various reasons such as income generation, religious purpose, household consumption and hobby and as security against crop failure. According to Adu *et al*. (1996) small ruminants in Southern Nigeria are integral component of the household, where they contribute to the cultural, food and socioeconomic life of the people. Potential returns from sheep and goat keeping under the traditional management system are high. In South West Nigeria, goats are used for customary rites in addition to meat production and

religious purpose (Odeyinka and Ajayi, 2004). It has been documented that sheep and goats are the principal domesticated small ruminants in terms of total numbers and production of food and fibre products. This attribute may partly be due to their lower feed requirements compared to cattle, because of their body size (Okunlola, *et al*, 2010). This, however, allows for easy integration of small ruminants into different farming systems (Hirpa & Abebe, 2008).

Traditionally, sheep and goats have served as means of ready cash and a reserve against economic and agricultural production hardship (Hamito, 2008). In temperate zones, goats are kept often as supplementary animals by small holders, while commercially cows or buffaloes are kept for milk, cheese and meat; and sheep for wool and meat production (National Diary Database (NDD), 2004). Okunlola *et al*. (2010) reported a similar trend in Tropical Africa where a majority of small ruminants is owned by individuals or families in rural areas and the number per group is small. Small ruminant animals contribute significantly to the economy of third world countries, for example, about 50% of the sheep and over 80% of the goats of the world are found in the third world countries. The world population of sheep and goats has been estimated as 1,130.8 million and 468.8 million respectively.

2.3 **Small ruminant production in Nigeria**

Nigeria has the largest small ruminant herd in Africa followed by Sudan, Ethiopia and Kenya. There are 73.8 million goats and 42.1 million sheep which are mainly indigenous breeds. Small ruminants in Nigeria are largely kept by pastoralists and agro-pastoralists in the central and northern part of the country. The small ruminants are kept by the farmers for meat, hides, wool and to a lesser extent milk (National Bureau of Statistics, 2011). In 2016, the gross production value of small ruminant

animals in Nigeria was estimated at US$372.1 and US$73.4 million for goats and sheep respectively (CSIRO, 2017). The animals graze predominantly on communal natural pastures and crop residues. A small number of these farmers practice semi-intensive and intensive systems. Also, small ruminant meat and milk value chains are poorly developed in Nigeria. Some issues affecting small ruminant production in Nigeria include seasonal feed shortages, limited access to veterinary services, genetically potential of small ruminant breeds currently used, suboptimal farm management and diseases that cause mortality or affect reproduction (www.fao.org/faostat.com).

2.4 Concept of indigenous knowledge

Indigenous knowledge (IK) is, broadly speaking, the knowledge used by local people to make a living in a particular environment (Warren, 1991). Terms used in the field of sustainable development to designate this concept include indigenous technical knowledge, traditional environmental knowledge, rural knowledge, local knowledge and farmer's or pastoralist's knowledge. Indigenous knowledge can be defined as "A body of knowledge built up by a group of people through generations of living in close contact with nature" (Johnson, 1992). Generally speaking, such knowledge evolves in the local environment, so that it is specifically adapted to the requirements of local people and conditions. It is also creative and experimental, constantly incorporating outside influences and inside innovations to meet new conditions. It is usually a mistake to think of indigenous knowledge as 'oldfashioned,' 'backwards,' 'static' or 'unchanging.

While IK research originally emphasized indigenous technical knowledge of the environment, it is now accepted that the concept of IK goes beyond this narrow interpretation. IK is now considered to be cultura*l* knowledge in its broadest sense, including all of the social, political, economic and spiritual aspects of a local way of

life. Sustainable development researchers, however, have found the following categories of IK to be of particular interest: resource management knowledge and the tools, techniques, practices and rules related to pastoralism, agriculture, agroforestry, water management and the gathering of wild food; classification systems for plants, animals, soils, water and weather; empirical knowledge about flora, fauna and inanimate resources and their practical uses; and the *worldview* or way the local group perceives its relationship to the natural world (Emery, 1996).

Ngulube, Dube and Mhlongo (2015) defined indigenous knowledge as multifaceted, dynamic, and eclectic know-how that is spiritually, culturally, economically, socially and politically embedded in a unique local geographical context. It is the body of knowledge held by people who are not regarded as developed as far as modern science and civilization is concerned (Mposhi, Manuyeruke & Hamauswa, 2013). World Health Organization (2002) define IK as health practices, approaches, knowledge and beliefs incorporating plant, animal and mineral based medicines, spiritual therapies, manual techniques and exercises, applied singly or in combination to treat, diagnose and prevent illnesses or maintain well-being. Indigenous knowledge can be expressed in the form of stories, songs, folklore, proverbs, dances, myths, cultural values, beliefs, rituals, community laws, local language and taxonomy, agricultural practices, equipment, materials, plant species and animal breeds (Ondari-Okemwa, 2014).

While research may focus on a particular category or type of IK, any IK under investigation must be viewed in terms of the overall cultural context. IK is embedded in a dynamic system in which spirituality, kinship, local politics and other factors are tied together and influence one another. Researchers should be prepared to examine any other aspects of a culture that may play an important role in shaping the IK in question. For example, religion is an integral part of IK and cannot necessarily be separated from technical forms of knowledge. Spiritual beliefs about

nature may influence how resources are managed and how willing people are to adopt new resource management strategies (International Institute for Rural Reconstruction (IIRR), 1996).

2.3.1 Importance of indigenous knowledge

Indigenous knowledge (IK) of the traditional health practitioners has been playing significant roles in the primary health care in Nigeria. According to Ebijuwa (2015), several studies have affirmed that up to 80% of the world's population depends on traditional medicine for their primary health needs. IK is the mainstay of primary healthcare for the majority of those in the rural areas in Africa (Omo, 2008; Sackey, 2008; Odukoya, 2012). Anyaoku, *et al.* (2015) observed that there is a general agreement on the gradual extinction of Indigenous Knowledge Systems (IKS) in African communities including traditional medical knowledge, which they attributed partly to colonization that was not positively disposed to anything African and the colonization of the minds of Africans who were made to perceive everything about them as inferior including their knowledge. IKS has been so important for the survival of the people before western civilization; it has been widely applied in the areas of health, agriculture, ecosystem, environmental management and entertainment.

There are two basic reasons why it is important for researchers to consider IK when carrying out research projects. First and foremost, incorporating IK into research projects can contribute to local empowerment and development, increasing self-sufficiency and strengthening self-determination (Thrupp, 1989). Utilizing IK in research projects and management plans gives it legitimacy and credibility in the eyes of both local people and outside scientists, increasing cultural pride and thus motivation to solve local problems with local ingenuity and resource. Local capacity-building is a crucial aspect of sustainable development, and researchers and

development specialists should design approaches which support and strengthen appropriate indigenous knowledge and institutions.

Secondly, indigenous people can provide valuable input about the local environment and how to effectively manage its natural resources. Outside interest in indigenous knowledge systems have been fueled by the recent worldwide ecological crisis and the realization that the causes lie partly in the overexploitation of natural resources based on inappropriate attitudes and technologies. Scientists now recognize that indigenous people have managed the environments in which they have lived for generations, often without significantly damaging local ecologies (Emery, 1996). Many feel that indigenous knowledge can thus provide a powerful basis from which alternative ways of managing resources can be developed. IK technologies and know-how have an advantage over introduced forms in that they rely on locally available skills and materials and are thus often more cost-effective than introducing exotic technologies from outside sources (IIRR, 1996). As well, local people are familiar with them and so do not need any specialized training.

The following are some of the features of IK which have relevance to conservation and sustainable development:

a. locally appropriate: IK represents a way of life that has evolved with the local environment, so it is specifically adapted to the requirements of local conditions.

b. restraint in resource exploitation: production is for subsistence needs only; only what is needed for immediate survival is taken from the environment.

c. diversified production systems: there is no overexploitation of a single resource; risk is often spread out by utilizing a number of subsistence strategies.

d. respect for nature: a ‘conservation ethic’ often exists. The land is considered sacred, humans are dependent on nature for survival, all species are interconnected.

e. flexible: IK is able to adapt to new conditions and incorporate outside knowledge.

f. social responsibility: there are strong family and community ties, and with them feelings of obligation and responsibility to preserve the land for future generations (Dewalt, 1994)

2.3.2 Limitations of indigenous knowledge

As with scientific knowledge, however, IK has its limitations, and these must be recognized. IK is sometimes accepted uncritically because of naive notions that whatever indigenous people do is naturally in harmony with the environment. There is historical and contemporary evidence that indigenous peoples have also committed environmental 'sins' through over-grazing, over-hunting, or overcultivation of the land. It is misleading to think of IK as always being 'good,' 'right' or 'sustainable. For example, a critical assumption of indigenous knowledge approaches is that local people have a good understanding of the natural resource base because they have lived in the same, or similar, environment for many generations, and have accumulated and passed on knowledge of the natural conditions, soils, vegetation, food and medicinal plants etc. However, under conditions where the local people are in fact recent migrants from a different ecological zone, they may not have much experience yet with their new environment. In these circumstances, some indigenous knowledge of the people may be helpful, or it may cause problems (e.g., use of agricultural systems adapted to other ecological zones).

Therefore, it is important, especially when dealing with recent migrants, to evaluate the relevance of different kinds of indigenous knowledge to local conditions. Indigenous knowledge can also be eroded by wider economic and social forces. Pressure on indigenous peoples to integrate with larger societies are often great, and as they become more integrated, the social structures which generate indigenous knowledge and practices can break down. The growth of national and international

markets, the imposition of educational and religious systems and the impact of various development processes are leading more and more to the

'homogenization' of the world`s cultures (Grenier, 1998). Consequently, indigenous beliefs, values, customs, know-how and practices may be altered and the resulting knowledge base incomplete.

Sometimes IK that was once well-adapted and effective for securing a livelihood in a particular environment becomes inappropriate under conditions of environmental degradation (Thrupp, 1989). Although IK systems have a certain amount of flexibility in adapting to ecological change, when change is particularly rapid or drastic, the knowledge associated with them may be rendered unsuitable and possibly damaging in the altered conditions (Grenier, 1998). Finally, an often overlooked feature of IK which needs to be taken into account is that, like scientific knowledge, sometimes the knowledge which local people rely on is wrong or even harmful (Thrupp, 1989). Practices based on, for example, mistaken beliefs, faulty experimentation, or inaccurate information can be dangerous and may even be a barrier to improving the well-being of indigenous people. However, researchers need to be careful when making such judgments.

2.3.3 The loss of indigenous knowledge

With the rapid environmental, social, economic and political changes occurring in many areas inhabited by indigenous people comes the danger that the IK they possess will be overwhelmed and lost forever. Younger generations are acquiring different values and lifestyles as a result of exposure to global and national influences, and traditional communication networks are breaking down, meaning that Elders are dying without passing their knowledge on to children. In some cases, the actual existence of indigenous people themselves is threatened. Researchers can assist in preserving IK through the following:

a. the community from which it originates (IIRR, 1996).
b. *record and use IK*: document IK so that both the scientific and local community have access to it and can utilize it in the formulation of sustainable development plans.
c. *raise awareness in the community about the value of IK*: record and share IK success stories in songs, plays, story-telling, videos and other traditional or modern means of communication. Encourage people to take pride in their knowledge.
d. *help communities record and document their local practices*: Get local people involved in recording their IK by training them as researchers and providing means of documentation. (computers, video equipment, etc.)
e. *make IK available*: disseminate IK back to the community through newsletters, videos, books and other media.

observe intellectual property rights: have agreements so that IK is not misused and benefits return to

2.4 Indigenous medicinal plants (concept of indigenous medicinal plants)

Man's life and survival would be impossible without 'symbiosis' with, and extensive use of plants and plant products. Traditional plant uses can be inventoried for present day use, adaptation, or for future survival. As defined by the World Health Organisation (1997), a medicinal plant is any plant which in one or more of its organs contains substances that can be used for the therapeutic purposes or which are precursors for the synthesis of useful drugs. Schmelzer & Gurib-Fakin (2008) pointed out that they contribute significantly to rural livelihoods of the people and social equilibrium in Africa. Overtime, these important flora species have been collected from the wild and used for their medicinal activity in local traditional medicine, but little is known about their conservation status.

Plants are living things that are seen growing on the surface of the earth and usually have root, stem, leaves and produce fruits and seeds. Their importance as well as

roles in nature cannot be over emphasized. Most plants are edible and contain different amount of vitamins, protein or carbohydrates etc, these helps the body to replace worn out cells or tissues, digest food and combat ailments among other health related problems. Since the dawn of history, man has been faced with the challenges of eliminating ailments completely, which inheritance has not been met, therefore different ages have been adopting different measures to help combat ailments but from creation to date, plants have always been among the most effective primary measures for this check (Proter, 1997). Plants have an inert ability to combat ailment and maintain one's state of good health, since it provides the body with vital nutrients. Plants have been proved scientifically to have the ability to cure ailments by providing some necessary nutrients which may be lacking in the body or by attacking the causative organisms themselves. On the other hand, different plant species perform varied roles (ecological niche) which has been harnessed by the ancient and correspondingly used to combat human pathology. Mbagwu (2009) stated that man has used plants from the earliest times to cure disease and relieve physical suffering. He maintained that the medicinal value of drug plant is due to the presence of some chemical substances (active ingredients) that produce a definite physiological action in the human body. Cowley (2002) reported that the most important drug obtained from tropical plants is quinine and is used as a cure for malaria. It is obtained from the back of several species of the Genus *Cincona.*

Nwachukwu *et al* (2010) maintained that the role of food crop in human nutrition is based on the primary products of photosynthesis, the carbohydrates, protein and triglycerides (fats and oil). In the case of most drugs, herbs produce essential oils and cosmetics are derived from the secondary products of plant metabolism such as alkaloids, terpenoids and flavenoids. It is therefore worthy of note that ethnomedicine is not the modern conventional way of checking ailments but it exists

alongside with the orthodox or conventional form of medicine and complements it is an alternative form.

The use of medicinal plants for the treatment of disease and infections is as old as mankind. Therefore, many indigenous plants are used in Traditional medicine to cure diseases, heal injuries and infections (Okwu and Josiah, 2006).These ancient and indigenous medicinal practices were discovered but then could not be proven by scientific theories, but the results have been beneficial and efficient to the people. A large majority of these plants are herbaceous, while some are trees, weeds and shrubs. These indigenous plants are found in the wild, semi wild and in cultivated habitat. Many of these indigenous medicinal plants are consumed as foods (Faleye & Ogundaini, 2012; Edoga, *et al*., 2005).

The use of plant extracts or chemicals derived from plants have become the base for the development of a medicine- a natural blue print for the development of new drugs (Khan *et al.,* 2011). The medicinal values of these plants lie in their phytochemical constituents, which produce definite and diverse physiological and pharmacological response in the human body. (Ekanem & Udo, 2009; Edoga, *et al.,* 2005).

Nigeria is rich in biodiversity. The country is endowed with a variety of plant and animal species. There are about 7, 895 plant species identified in 338 families and 2, 215 genera. There are 22,000 vertebrates and invertebrates species. These species include about 20,000 insects, about 1,000 birds, about 1, 000 fishes, 247 mammals and 123 reptiles. Of these animals, about 0.14% is threatened, while 0.22% is endangered. About 1,489 species of microorganisms have also been identified. All of these animal and plant species occur in different numbers within the country's vegetation that range from the mangrove along the coast in the south to the Sahel in the north. Most of the biodiversity sustain the rural economy (Federal Republic of Nigeria, Fourth National Biodiversity Report, 2010).

In Nigeria, vast arrays of plant are traditionally used for the treatment of various ailments and diseases. These plants, mostly employed in a synergistic combination, have shown to be as effective, and are often preferred to the commercially available drugs by a larger portion of the society (Ajose, 2007). The vast chemical diversity of plants in bio-diverse regions such as Nigeria is a promising source of novel lead compounds that are still relatively unexplored. Thus the indigenous knowledge of traditional medicinal plants is a valuable tool for targeting potentially active species from the wealth of medicinal plants in these regions, which may be of great importance as new medicines. Over the years the importance of these traditional medicine has been established. Nigerian researchers have spent much effort on the systematic identification, scientific evaluation and validation of Nigeria's medicinal aromatic plants, healing arts and systems. Some notable medicinal plants in tropical rainforest of Nigeria include African nutmeg (*Monodora myristica*), guinea pepper (*Xylopiaeathiopicum*), lemon grass (*Cymbopogon citrallus*), sweet basil (*Cocimum gratisimum*), garlic (*Allum sativa*), ginger (*Zingiber officinale*), bitter leaf (*Vernonia amygdaline*), black pepper (*Gongronema latifolum*). Nigeria: First Biodiversity Report, 2001).

Major steps have also been taken by the Nigerian government to boost research into traditional medicine in an effort to preserve the country's indigenous medical knowledge. However, this increasing trend in the use of medicinal plants amongst both urban and rural dwellers has grave consequences on the survival of some plant species. This is because of the unsustainable manner in which many species are harvested. Furthermore, the downturn in the economy and inflationary trend has led to the excessive harvesting of non-timber forest products for various uses (Federal Republic of Nigeria, Fourth National Biodiversity Report, 2010). Some of these species are now threatened Examples are H*ymenocardia acida, Kigelia africana, and Cassianigricans.*

2.4.1 Indigenous medicinal plants

The United Nations Biodiversity Treaty of 22nd May, 1992 in Rio de Janeiro sought to encourage conservation of indigenous natural resources. Implicit in the Biodiversity treaty is the realization of the need to protect such natural resources from becoming endangered (Nwankwo, 2011). WHO defined Traditional Medicine as the sum total of all knowledge and practical application, whether explicable or not, used in diagnosis, prevention and elimination of physical, mental or social imbalance, and relying exclusively on practice, experience and observations handed down from generation to generation, whether verbally or in writing. The United Nations through WHO programmes sought to promote and develop traditional medicine in Health care systems, to integrate traditional medicine and modern/orthodox medicine and to promote manpower development and research in traditional Medicine.

Plants constitute a major economic resource of most countries. They have taxonomic classes which enable their classifications with respect to their role in economic development. In Nigeria and in Eastern Nigeria in particular, the medicinal plants are considered by several researchers to form an important component of the natural wealth of the country (Ekanem and Udo, 2009; Egharevba and Ikhetua, 2008).

The use of medicinal plants for the treatment of disease and infections is as old as mankind. Therefore, many indigenous plants are used in Traditional medicine to cure diseases, heal injuries and infections (Okwu and Josiah, 2006). These ancient and indigenous medicinal practices were discovered but then could not be proven by scientific theories, but the results have been beneficial and efficient to the people. A large majority of these plants are herbaceous, while some are trees, weeds and shrubs. These indigenous plants are found in the wild, semi wild and in cultivated habitat. Many of these indigenous medicinal plants are consumed as foods (Faleye and Ogundaini, 2012; Edoga, *et al*., 2005).

The use of plant extracts or chemicals derived from plants have become the base for the development medicine- a natural blue print for the development of new drugs (Khan *et al*., 2011). The medicinal values of these plants lie in their phytochemical constituents, which produce definite and diverse physiological and pharmacological response in the human body. (Ekanem and Udo, 2011; Edoga, *et al*., 2005). Across the continent, many medicinal plants have gone into extinction before documentation. There is rapid depletion of these natural plant resources due to over exploitation, large scale deforestation, unsustainable arable land use, urbanization, industrialization and lack of conservation programmes. Also, due to fear of lack of patronage and to mystify their trade, the traditional medicine practitioners hide the identity of medicinal plants and discourage its cultivation, leading to a huge loss in the knowledge of these plants (Obute, 2005).

2.4.2 Benefits of use of medicinal plants

Medicinal plants are inexhaustible primary bio-resource of drugs for traditional systems of medicine, modern medicines, pharmaceuticals, forklore medicines and chemical entities (Ncube *et al*. 2008). In the past few decades, medicinal plants have been used as sources of medicine in virtually all cultures. The use of herbal remedies has expanded globally and is gaining popularity because it has continued to be used not only for primary health care of the poor in developing countries but also in countries where conventional medicine is predominant in the national health care system.

In the world today, up to 80% of the population uses herbal medicine for primary health care and the global market for herbal medicines currently stand at over US $ 60 billion annually and is growing steadily (Tilburt and Kaptchuk, 2008). In Nigeria today, therapy with medicinal plants is of great importance in conjunction with western medicine in the health care system. The practice of traditional medicine

using medicinal plants is as old as the origin of mankind. This type of health care is described as Herbalism. The growing sophistication in the lifestyle among world populations makes it imperative to refer to herbal practice as alternative or complimentary medicine to appeal to a cross section of people irrespective of their cultural affiliation. An herbalist is one who studies, collects, sells or administers plants and/or plant products for healing purposes (Morah, 2007). The name herbalist has been most loosely and erroneously used in Nigeria, especially in the media, to be synonymous with medicine man, witch doctor and sorcerer.

The bioactive ingredients that have the therapeutic activity in plants used in herbal practice are mostly unidentified and herbalists believe in the holistic nature of their treatment. Although an herbalist is free to practice any of these arts, it is wrong to take them to be synonymous with herbal healing.

Substances found in medicinal plants, containing the healing property is known as phytochemicals. Phytochemicals are naturally occurring, non-nutritive biologically active chemical compounds in plants which act as a natural defence system for host plants and provide colour, aroma and flavour (Ugbogu *et al*., 2013; Liu, 2003). Basically phytochemicals are broadly classified into two main categories, namely, primary constituents and secondary metabolites. Primary constituents includes proteins, amino acids, common sugars and chlorophyll, whereas, secondary constituents include glycosides, alkaloids, phenolic compounds, flavonoids, saponins, essential oils, tannins and terpenoids. Majority of phytochemicals contain important therapeutic activities and the plants thus find their medicinal importance due to presence of the respective phytochemical constituents (Zeb *et al*. 2014). For instance, saponins have the ability to treat different disease conditions and serve as antimicrobial, antidiabetic, cytotoxic, antitumor, antioxidant, antiplasmodiasis and as antihelminthic. Plants also contain other compounds such as morphine, atropine, codeine, steroids, lactones and volatile oils, which possess medical values for the

treatment of different diseases. In recent years, these active principles have been extracted and used in different forms such as infusions, syrups, concoctions, decoctions, infused oils, essential oils, ointments and creams.

The clinical success of quinine and quinidine isolated from the Cinchona tree bark and recently artemisinin from Artemisia annuain used in the treatment of malaria, which have rekindled interest in medicinal plants as potential sources of novel drugs (Igoli *et al*., 2005). Today artemisinin based combination therapy is recognized as drug of choice for treatment of malaria (WHO, 2006). Also, the numerous advantages of herbal medicine such as low-cost, affordability, ready availability, accessibility, acceptability and low toxicity are ready sources of medical power. However, the various disadvantages of the practices which include; lack of adequate scientific proof, imprecise diagnosis and dosage, unstandardized medicines and occultic practices can also be resolved.

Medicinal plants play vital roles in disease prevention and their promotion and use fit into all existing prevention strategies. However, conscious efforts need to be made to properly identify, recognize and position medicinal plants in the design and implementation of these strategies. This present review therefore shows the already identified and well documented Nigerian medicinal plants, the benefits and limitations associated with their usage as they portend great promise for the treatment of several diseases.

Medicinal plants are known to contain substances which could be used for treatment purposes or used to produce drugs (Sofowara, 1999). Many of such plants are known to be used primitively to alleviate symptoms. The medicinal value of some plants lie in some chemical substances that produce definite physiological actions in the human body. Examples of these most important medicinal plants are discussed below.

***Garcina kola* (Henkel)**

It is commonly called bitter kola and in Igbo language as 'akilu'. This is a popular agricultural produce available in large quantities in Western Africa. It is found grown in the rain forests and served in almost all Nigerian homes as adjunct or supplement to the true kolanuts in ceremonies, occasions and complimentary visits. Bitter kola is used in the treatment of cough, diarrhoea, tuberculosis and other bacterial infections as it has very potent antibiotic features (Obute, 2005). It helps to detoxify the system and can be chewed immediately after eating any suspected bacteria contaminated food.

Bitter kola has an anti-poison property. The plant has a hypoglycaemic effect as it reduces plasma glucose level by aiding the beta cells of Islet of the Langerhans of the pancreas perform its hypoglycaemic function. Garcina kola contains some bioactive compounds like terpenes and saponins which have also been noted to be effective in the treatment of inflamed or ulcerated tissues.

***Gongronema latifolium* (Utazi)**

Gongronema latifolium is a climbing shrub with a broad, heart-shaped leaf and its leaves are bitter in taste. It is commonly called 'Utazi' and 'arokeke' in South Eastern and South Western parts of Nigeria respectively. It is a tropical rainforest plant primarily used as a spice and vegetable in traditional folklore medicine. It has been used traditionally in South Eastern part of Nigeria for the management of diseases such as diabetes and high blood pressure.

Phytochemical analysis of the leaf extract of the plants shows the presence of essential oil, saponins, and alkaloids, while the minerals estimation reveals calcium, phosphorous, magnesium, copper and potassium. *Gongronema latifolium* exhibits the following herbal actions:- Analgesic, anti-tumour, broad spectrum antimicrobial (antibacterial, antifungal, antiparasitic and antiviral), antipyretic, antioxidant,

antiinflammatory, antiulcer, anti-sickling, anti-asthmatic, mild expectorant, hypoglycaemic , hypolipidemic, hepatoprotective, digestive tonic and laxative properties. It stimulates the flow of bile and appetite for food and enhances the activities of the pancreas, regulates plasma glucose and promotes the detoxification actions of the liver (Alagwu *et al*., 2014).

In Southern part of Nigeria, especially among the people of Southeast and south-south, the leaves of these herbs are used commonly for nutritional purposes, including spice and vegetable to garnish some special local delicacies, such as 'Isiewu', 'Nkwobi', 'Abacha/ugba' (African Salad), 'Ofe Nsala' (White Soup), unripe plantain porridge etc, because of its sharp-bitter and sweet taste. In many local 'joints', where people enjoy Isiewu, Nkwobi and African Salad with palm wine or beer, the leaves are usually added to these delicacies to help prevent drunkenness or hangover.

The leaves are believed to neutralize the intoxicating properties of alcohol and its harmful effects on the liver. Medicinally, its leaves and stems infusion or decoction is used in the home treatment of digestive problems, such as loss of appetite, dyspepsia, colic and stomach ache, constipation, dysentery and intestinal worms. It lowers plasma glucose level and high blood pressure in diabetic and hypertensive patients respectively. It can also be employed in the cleansing of the womb and treating of abdominal pain after child birth. It prevents liver damage associated with alcoholism and viral hepatitis. It is also helpful in treating malaria, releases cough, wheezing and asthmatic attacks.

***Vernonia amygdalina* (Bitter leaf)**

The leaves of Vernonia amygdalina are green with a characteristic odour and bitter taste. Vernonia amygdalina is a valuable medicinal plant that is widespread in West Africa. It is known as bitter leaf due to its characteristic bitter taste and flavour and can be used as an active anti-cancer, anti-bacterial, anti-malarial and antiparasitic

agent. This plant contains complex active components that are pharmacologically useful in a living system. In ethnomedicine, the roots and leaves are used to treat fever, hiccups, kidney problems and stomach discomfort. Many West African countries like Cameroon, Ghana and Nigeria use the stem and root as chewing sticks (Burkill, 1985). It is also documented that V. amygdalina has been traditionally used in blood clotting and has elicited a substantial reduction in the level of glucose in the blood at post- prandial time examination. Fasola *et al*. (2011) reported that V. amygdalina has hypoglycaemic activity. They observed a close dependent reduction in fasting blood sugar level in alloxan-induced diabetic rats after treatment with different concentrations of the aqueous leaf extracts. Yedjou *et al*. (2008) also demonstrated that V. amygdalina leaf extracts as a DNA-damaging of cancer agent in the management of breast cancer.

Carica papaya **(paw-paw)**

Papaya, botanical name Carica papaya, is a lozenge tropical fruit often seen in orange-red, yellow-green and yellow-orange hues, with a rich orange pulp. The fruit is not only delicious and healthy, but whole plant parts, fruits, roots, bark, peel, seeds and pulp are also known to have medicinal properties.

Papaya is a power house of nutrients and is available throughout the year. It is a rich source of three powerful non enzymic antioxidants;-, Vitamin C, Vitamin A and Vitamin E; the Minerals include: Magnesium and Potassium; the B vitamin include, Pantothenic acid and folate, and fibre. In addition, it contains a digestive enzyme papain, aids in remedying causes of trauma, allergies and sport injuries. All the nutrients of papaya as a whole improve Cardiovascular- system i.e. protects against heart diseases, heart attacks, strokes and prevent Colon Cancer. The fruit is an excellent source of beta Carotene that prevents damage caused by free radicals that may cause some forms of cancer by its trigger of the oncogenes. It is reported that it

helps in the prevention of diabetic-heart disease. Papaya lowers high cholesterol levels as it is a good source of dietary fibre (Yogiraj *et al*., 2014).

Papaya effectively treats and improves all types of digestive and abdominal disorders. It is a medicine for dyspepsia, hyperacidity, dysentery and constipation. It helps in the digestion of proteins as it is a rich source of proteolytic enzymes. Papain found in papaya acts as a meat tenderizer. This papain (digestive enzyme) is extracted, dried as powder and used as an aid in digestion. It is reported that papaya prevents premature aging. This may be attributed to poor digestion which impairs nutrients from being distributed evenly in our body. The fruit is regarded as a remedy for abdominal disorders. The skin of papaya works as a best medicine for wounds (Yogiraj *et al*., 2014).

The nutritional values of papaya help to prevent the oxidation of cholesterol. Papaya is rich in iron and calcium; a good source of Vitamin C (ascorbic acid). The extract of unripe *Carica papaya* contains terpenoids, alkaloids, flavonoids, carbohydrates, glycosides, saponins and steroids. Pharmacological activities include

- Dengue fever: Papaya leaf juice helps to increase the number of white blood cells, and platelets which normalizes clotting and repairs the liver.
- Cancer cell growth inhibition: Recent research on papaya leaf tea extract has demonstrated cancer cell growth inhibition. It appears to boost the production of key signaling molecules called T helper 1-type Cytokines, which helps in regulating the immune system.
- Antimalarial and antiplasmodal activity: Papaya leaves are made into tea as a treatment for malaria. Antimalarial and antiplasmodal activity have been noted in some preparations of the plant as they reduce the number of Schizonts, gametocytes and trophozoites produced by the plasmodium.

- Facilitate digestion: The leaves of the papaya contain chemical compounds like papain, a substance which kills microorganisms that often interfere with digestive function (Yogiraj *et al*., 2014).

Ocimum gratissimum **(Scent leaf)**

Scent leaf is a perennial plant which is widely distributed in the tropics of Africa and Asia. It belongs to the family Labiatae and it is the most abundant of the genus Ocimum. In the Southern part of Nigeria, it is called 'Efirin nla'by the Yoruba speaking tribe. 'Nchanwu' in Igbo land, while in the Northern part of Nigeria; it is called 'Daidoga' (Effraim *et al*. 2003).

The phytochemical evaluation of *Ocimum gratissimu*m shows that it is rich in alkaloid, tannins, phytates, flavonoids and oligosaccharides (Ijeh *et al*., 2004). In the coastal area of Nigeria, the plant Ocimum gratissimum is used in the treatment of epilepsy, high fever and diarrhoea (Sofowara, 1993). This is a home grown shrub used mainly as spices for cooking delicacies due to its unique aromatic tastes.

Ocimum gratissimum plants are of high importance to the health of individuals and the society at large. This plant has huge medicinal values that depend on certain active chemical substances which have physiological impact on the human body. Extensive research has shown that the nchanwu extract exhibit antifungal activities. Scent leaf can be used in the treatment of cough and catarrh when inhaled. It can be infused and used as a remedy for stomach disorder such as gastroenteritis. Ocimum gratissimum leaf can be used to treat stomach pain, diarrhoea, cholera, chronic dysentery and emesis, especially, if blended. It can also act as a repellent to mosquitoes and other insects. The essential oil of scent leaf contains eugenol, which has antibacterial properties.

***Azardirachta indica* (Neem/Dogoyaro)**

For thousands of years, the beneficial properties of Neem (Azardirachta indica) have been recognized in the Indian tradition. Each part of the neem tree has some medicinal property.

More than 135 compounds have been isolated from different parts of neem and several reviews have also been published on the chemistry and structural diversity of these compounds. The compounds include; Isoprenoids (like diterpenoids and triterpenoids containing protomeliacins, limonoids, azadirone and its derivatives, vilasinin type of compounds and (Secomeliacins such as nimbin, salanin and azadirachtin) and non-isoprenoids, which are proteins (amino acids) and carbohydrates, sulphurous compounds, polyphenolics such as flavonoids and their glycosides, dihydrochalcone, coumarin, tannins, and aliphatic compounds etc.

Various parts of the Neem tree have been therapeutically used as folk medicine to control leprosy, intestinal helminthiasis, respiratory disorders, and constipation. Its use for the treatment of rheumatism, chronic syphilitic sores and indolent ulcer has also been evident.

Biological activity of neem compounds includes

- Immunostimulant activity: The aqueous leaf extract of Neem bark and leaf also possesses anti-compliment and immunostimulant activity. Neem oil has been shown to possess activity by selectively activating the cell mediated mechanisms to elicit an enhanced response to subsequent mitogenic or antigenic challenge.
- Hypoglycaemic activity: Aqueous extract of Neem leaves significantly decreases plasma glucose level and prevents adrenaline as well as glucose induced hyperglycaemia. Recently, hypoglycaemic effect was observed with leaf extract and in seed oil, in normal as well as alloxan-induced diabetic wistar rats.
- Antiulcer effect: Neem leaf and bark aqueous extracts produce highly potent antacid secretion and antiulcer activity.

- Antifertility: Intra-vaginal application of Neem oil, prior to coitus, can prevent pregnancy. It could be a novel method of contraception.
- Antimalarial activity: Neem seed and leaf extracts are effective against both chloroquine resistant and sensitive strain malarial parasites.
- Antifungal activity: Extracts of Neem leaf, neem oil seed kernels are effective against certain fungi including Trichophyton, Epidermophyton, Microspor, Trichosporon, Geotricum and Candida spp.
- Antibacterial activity: Oil from the leaves, seed and bark possesses a wide spectrum of antibacterial actions against Gram-negative and Gram-positive microorganisms including Mycobacterium tuberculosis and Streptomycin resistant strains. In vitro studies have shown that- it inhibits Vibrio cholera, Klebsiella pneumonia, Mycobacterium tuberculosis and M. pyogenes. Antimicrobial effects of Neem extract have been demonstrated against Streptococcus mutans and Streptococcus faecalis.
- Antiviral activity: Aqueous leaf extract offers antiviral activity as seen in Vaccinia virus, Chikungunya and measles virus.
- Anticancer activity: Neem leaf aqueous extract effectively suppresses oral squamous cell carcinoma induced by 7, 12-dimethylbenzanthracene (DMBA), as revealed by induced incidence of neoplasm. Neem may exert its chemo preventive effect in the oral mucosa by the modulation of glutathione and its metabolizing enzymes.
- Antioxidant activity: Antioxidants are molecules that inhibit the oxidation of other molecule. Oxidation is a chemical reaction involving the loss of electrons or an increase in oxidation state. Oxidation reactions can produce free radicals. In turn, these radicals can start chain reactions. When the chain reaction occurs in a cell, it can cause damage or death to the cell. Antioxidants terminate these chain reactions

by removing free radical intermediates and inhibit other oxidation reactions. They do these, by being oxidized themselves, so antioxidants are often reducing agents.

Xanthoxylum macrophylla

Xanthoxylum macrophylla (formerly Fagara xanthoxyloides) is a tree found in Africa, with its fruits used to produce a peculiar spice. The tree is popularly known in the West as the Yoruba chewing stick. In Yoruba, it is called Oriata, or Ata-Igbo, and in Igbo as Ukor. This plant is used as a vermifuge and for the relief of toothache. Traditional healers throughout Nigeria have used species of the Xanthoxylum for the treatment of a wide range of disorders, including toothache, urinary and veneral diseases, rheumatism and lumbago. Metabolites isolated from Xanthoxylum include; alkaloids, aliphatic and aromatic amides, sterols, carbohydrate residues etc. Some of the metabolites have shown cytotoxic, molluscidal, anticonvulsant, antisickling, anaesthetic, antibacterial, antihypertensive and anti-inflammatory properties (Adesina, 2005).

Moringa oleifera

Moringa oleifera is a nutritional plant used as a constituent in food preparation owing to its active ingredients like essential amino acids, carotenoids found in its leaves and nutraceutical properties. Some nutritional assessment has been carried out in leaves and stems. An important factor that accounts for the medicinal uses of *Moringa oleifera* is the wide range of vital antioxidants, antibiotics and nutrients including vitamins and minerals. Almost all parts of this plant can be used as source for nutrition with other useful values (Leone *et al*. 2015).

In traditional medicine, these leaves are used to treat several ailments including malaria, typhoid fever, parasitic diseases, arthritis, swellings, cuts, diseases of the

skin, genito-urinary ailments, hypertension and diabetes. They are also used to elicit lactation and boost the immune system (to treat HIV/AIDS related symptoms) as well as cardiac stimulants and contraceptive remedy (Leone *et al*., 2015).

Barks are boiled in water and soaked in alcohol to obtain drinks and infusions that can be used to treat stomach ailments (ease stomach pain, ulcer and aiding digestion), poor vision, joint pain, diabetes, anemia and hypertension (Popoola and Obembe, 2013; Abe and Ohtani, 2013), toothache, haemorrhoids, uterine disorder.

Roots are soaked in water or alcohol and boiled with other herbs to obtain drinks and infusions as remedies for toothache, as antihelminthic and antiparalytic (Popoola and Obembe, 2013), drugs and as sex enhancers.

Finally, flowers are used to produce aphrodisiac substances and to treat inflammations, muscle diseases, hysteria, tumours and enlargement of the spleen (Yabesh *et al*., 2014).

Psidium guajava

The important constituents of guava are vitamins, tannins, phenolic compounds, flavonoids, essential oils, sesquiterpene, alcohols and triterpenoid acids (Barbalho *et al*. 2012). Leaves of this plant contain phenolic compounds, isoflavonoids, gallic acid, catechin, epicatechin, rutin, naringenin, kaempferol having hepatoprotective, antioxidant, anti-inflammatory, antispasmodic, anticancer, antimicrobial, anti-hyperglycemic, analgesic actions (Barbalho *et al*., 2012). The leaf contains two important flavonoids; quercetin which is known for its spasmolytic, antioxidant, antimicrobial, anti-inflammatory actions and guajaverin, known for its antibacterial action. Its pulp contains ascorbic acid, carotenoids (lycopenes, β-carotene) possessing antioxidant, antihyperglycaemic, antineoplastic (Barbalho *et al*. 2012). The seed contains glycosides, carotenoids, phenolic compounds having antimicrobial actions (Ravi and Divyashree, 2014).

General uses

Guava is proven for its antidiarrheal, antimicrobial, antiparasitic, antitussive, hepatoprotective, antioxidant, antigenotoxic, antimutagenic, antiallergic, anticancer and anti-hyperglycaemic effects (Gupta *et al*., 2011). It has been used in the treatment of diarrhoea, dysentery, menstrual disorders, vertigo, anorexia, digestive problems, gastric insufficiency, inflamed mucous membrane, laryngitis, skin problems, ulcers, vaginal discharge, cold, cough, cerebral ailments, nephritis, jaundice, diabetes, malaria and rheumatism to mention a few (Kumar *et al*., 2012)

2.4.3 Medicinal plants and conservation

Medicinal plants are valuable species; they provide income and healthcare to thousands of people around the world. Greater numbers of people rely on traditional medicine, mostly based on herbs, for their primary healthcare than 'conventional' or western medicine.

Medicinal flora has been the focus of much ethnobotanical research and also bioprospecting over the years. This current and potential value of medicinal plants as traditional remedies and possible commercial pharmaceuticals is widely acknowledged through the large gamut of research centred on phytomedicine.

Across the continent, many medicinal plants have gone into extinction before documentation. There is rapid depletion of these natural plant resources due to over exploitation, large scale deforestation, unsustainable arable land use, urbanization, industrialization and lack of conservation programmes. Also, due to fear of lack of patronage and to mystify their trade, the traditional medicine practitioners hide the identity of medicinal plants and discourage its cultivation, leading to a huge loss in the knowledge of these plants (Obute, 2005).

However, efforts to understand the conservation needs of even the most important species of medicinal plants in these regions have received relatively little attention

and support. Surveys indicate that 80% of the continent's population relies on plant and animal based medicine to meet its health care requirements. For the most part the plants used in traditional medicine are collected from the wild, and in many cases, the demand exceeds the supply. Yet, plant conservation has long been overshadowed by conservation efforts directed towards animals, and has also been much divided among efforts focused on different production sectors that rely on plant resources – forestry, agriculture, non-wood forest products – and efforts targeting different types of ecosystems. Direct and coherent efforts to conserve plant species have received relatively little policy attention and research support (Leaman, 2004). Relatively few medicinal and aromatic plants species are cultivated. The great majority is still provided by collection from the wild (Lange and Schippmann, 1997, Srivastava *et al*., 1996).

This practice is likely to continue over the long term due to numerous factors; most medicinal plants are traded locally and regionally rather than internationally, the costs of domestication and cultivation are high, and land for cultivation of nonfood crops is limited. Moreover, cultivation is not necessarily the most beneficial production system. Wild collection practices secure valuable income for many rural households, especially in developing countries like Africa (Schippmann *et al.,* 2002).

However, over-harvesting of medicinal and aromatic plants, land conversion, and habitat loss increasingly threaten a considerable portion of the world's medicinal and aromatic plants species and populations. For these reasons, approaches to wild medicinal and aromatic plants collection that balance the needs of local, regional, and international markets with the need for conservation and sustainable use are urgently needed. Nigeria has also set up such centres, for example the Centre for Indigenous Knowledge in Farm and Infrastructure Management, Centre for Food and Agricultural Strategy, Centre for Indigenous Knowledge on Population

Resource and Environmental Management, Yoruba Resource Centre for Indigenous Knowledge and Centre for Urban and Regional Planning.

In order to encourage the conservation of the medicinal plants there is a need for the collaboration and establishment of more national and local bodies dedicated to this conservation drive, to ensure the sustainability of these valuable plants.

2.5 Ethnomedicine / traditional medicine

The utilization of plants and plan derived products as well as other complementary and alternative therapies in the alleviation of diseases make up a reservoir of indigenous knowledge generally referred to as ethno-medicine (Ogunkunle and Ashiru, 2011). Long time ago, in traditional societies, herbalism was a way of life rather than a trade as it later turned out to be. If a person fell sick, the other person who knew just what to use went to the nearby bush and brought back herbs that gave relief to the sick (Ogunkunle and Ashiru, 2011). Kafaru (1994), cited in Ogunkunle and Ashiru (2011), stated that in Europe, Asia and the America, herbal medicine was practiced as a magical or religious healing art under separate systems, and by 1850s, Chinese immigrants had added their own herbal tradition to the European and Native American herbalism to produce a mix.

Globally, people developed unique indigenous healing traditions adapted and defined by their culture, beliefs and environment, which satisfied the health needs of their communities over centuries (Oreagba and Oshikoya, 2011). Previous studies of herbal medicine use in Nigeria were focused on adults with various forms of chronic illnesses (Danesi and Adetunji, 1994; Amira and Okubadejo, 2007; Ogbera *et al*., 2010), pregnant women (Fakeye *et al*., 2009) and children with chronic illnesses (Oshikoya *et al*., 2008) and among a general population without chronic health conditions.

Historically, it is documented that humans utilize the same herbal preparations that they use to treat their sick animals (Yinegar, *et al.,* 2007). In Nigeria, farmers are known to treat animal diseases with herbs and other traditional medical practices before the advent of orthodox medicine. Traditional medicinal and veterinary practices remain relevant and vital in many areas in Nigeria due to absence or inadequate provision of modern medical services particularly in rural areas (Alves, *et al.,* 2010). Ethno veterinary medical practice is widespread among herdsmen and native livestock producers in Nigeria, especially in northern Nigeria. Traditional remedies in this area include plant extracts from different plant parts (Alawa, *et al.,* 2002). Herdsmen in non-industrialized nations of the world still use medicinal plants for the treatment of livestock diseases including: diarrhoea, either due to lack of access to trained veterinarians and high cost of orthodox medicines, or the held belief that herbal remedies are more efficacious (Rashid, *et al.,* 2010).

The World Health Organization (1991) redefined traditional medicine (TM) as comprising therapeutic practices that have been in existence, often for medicine and are still in use today. These practices vary widely in relation to the social and cultural heritage of different countries. According to Sofowora (1993) the practitioners of traditional medicine could serve as additional sources of health manpower in developing countries such as Nigeria. This is especially so where a developing country is trying to achieve total health coverage for its people. Sofowora (1993) also noted that traditional medicine enjoys a wider acceptability among the people of developing countries partly due to the inaccessibility of orthodox medicine, but the major contributing factor is the fact that it blends readily into the socio-cultural life of the people in whose culture it is deeply rooted. In fact, it is reported that 60-85% of the population in every country of the developing world has to rely on traditional or indigenous forms of medicine. For example, Green and Makhubu

(1983) noted clearly that 85 % of Swazis use traditional medicine while Erinosho and Ayonrinde (1985) observed the same situation for Nigerians.

There are instances today in Ogun, Osun, Ekiti, Edo, Delta, Imo, Enugu, Niger and Zamfara states to mention but a few places in Nigeria, where even the urban dwellers still consult traditional healers as a first choice. Such is also the case in Kenya, Guatemala, Ethiopia and Ghana respectively (Erinosho and Ayonrinde 1985; Maclean 1971; Oyebola 1989) However, several African countries including Nigeria have relied upon spiritual and practical skills of the traditional medical practitioners such as herbalists, herb sellers, traditional birth attendants, bone setters, faith healers and traditional surgeons, whose botanical knowledge of plant species, their ecology and scarcity are invaluable as opined by Cunningham (1993)

Traditional medical knowledge may be passed on orally from generation to generation, in some cases with families specializing in specific treatments, or it may be taught in officially recognized universities WHO (2001); such as University of Ibadan (Ibadan, Oyo state), Obafemi Awolowo University (Ile-Ife, Osun State), University of Lagos (Lagos State), University of Nigeria (Nsukka, Enugu State) to mention a few of these in Nigeria.

Herbal medicines have been recognized by the WHO as the most popular form of traditional medicine, and thus, highly lucrative in the international medicine market. Annual revenues in Western Europe were estimated at US$ 5 billion in 2003-2004, in China the revenue was estimated at US$ 14 billion in 2005, and in Brazil it was US$ 160 million in 2007 (Oreagba and Oshikoya, 2011). The increasing widespread use of Traditional medicine has prompted the WHO to promote its integration into the national health care systems of some countries and to encourage the development of national policy and regulations as essential indicators of the level of integration of such medicine into a national health care system (Oreagba and Oshikoya, 2011).

Also in Nigeria, approximately 205 medicinal plant species are prevalent in nature (FEPA, 1992).

Traditional medicine in Nigeria is as old as the people and it is growing in importance and this has made the Federal Government of Nigeria to formulate a traditional medicine policy and to establish a Traditional Medicine Council to regulate practice and encourage research in five core areas (herbal medicine, bone setting, mental health, traditional birth attendance and sale of traditional medicine ingredients. It is however in the past two decades that the traditional medicine was given formal recognition and attention. Virtually all local communities have huge collections of plants and animals for healing different kinds of diseases and performing other health related services such as antenatal care, childbirth, antiinfection treatments and sexual drive improvements. Ethno-botanical studies have revealed the importance of hundreds of different kinds of herbs used for curing different kinds of diseases in different parts of Nigeria. Accordingly, trade in medicinal plants and animal parts have grown and now form a major category of merchandise in village markets in rural and peri-urban settlements. The number of people who rely on herbs, wildlife parts and other agricultural and wild resources is increasing. Consequently, maintaining health standards for millions of Nigerians depends on the protection and sustainable management of biodiversity.

Research findings and field reports indicate that a lot of time, energy and resources are required to harvest the much needed herbs and other plant and animal materials needed for traditional medicine. Efforts are now being made in different parts of the country to domesticate some of these medicinal plants. Accordingly, one of the mandates of the National Agency for Genetic Resources and Biotechnology (NAGRAB) is to document and keep essential genetic biodiversity resources. The National Institute for Pharmaceutical Research and Development (NIPRD) also has

reliable data on the medicinal and patent value of plant resources in Nigeria (Federal Republic of Nigeria, Firth National Biodiversity Report, 2015).

Currently, dispensing herbs/active ingredients is on the increase as herbal medicine is becoming more popular (Ekor, 2013). The WHO estimate of population that has used some form of alternative or complementary medicine including Ayurvedic, homeopathic, naturopathic, traditional oriental and Native American Indian medicine in developing countries is between 70 and 80 % (Oreagba and Oshikoya, 2011). According to Ayiteh-Smith cited in Okoli, Aigbe, Ohaju-Obodo, and Mensah (2007), herbal medicines evolved from environmental resources, which the people of a community adopted in desperation for survival from diseases and to improve livelihood generally; it was a part of the medical system for health care before the advent of orthodox or modern medicine. Herbal medicines in spite of its popularity have been challenged on many grounds; one of such is that its popularity is based on anecdotal experiences of patients (Erinosho, 2006). Osborne (2007) notes that the practitioners inflate the claims attached to advertisement and its products, as well as not having scientific data about its effectiveness, thus making it difficult to ascertain legitimate and effective therapy and therapists. Furthermore, most of the claims of the herbal practitioners are said to be unsubstantiated and their post market monitoring has been difficult. Akinleye (2008) corroborated this when he identified some of the drawbacks of herbal medicine as: incorrect diagnosis, imprecise dosage, low hygiene standards, the secrecy of some healing methods and the absence of written records about the patients. Tyler (1999 cited in Ekeanyanwu, 2011) opined that the prejudice of current practicing health care professionals who did not learn about phytomedicines during their academic programs and consequently, believe all of them to be ineffective, forms a barrier to the advancement of herbal medicines in Nigeria. Herbal medicine practice in Nigeria, however, faces greater challenges in the hands of government officials who look at it with disdain and disrespect

(Adefolaju, 2011). This is manifested in the Nigeria government's reluctance to accord herbal medicine its primate position in the health care delivery system as it is the case with China and India (Adefolaju, 2011).

2.5.1 Concept of indigenous medicine and ethno-veterinary medicine Ethno-veterinary medicine (EVM) is a scientific term for knowledge, skills, methods, practices, and beliefs about animal health care found among community members (McCorke, 1986). According to Misra and Kumar (2004), EVM is the community-based local or indigenous knowledge and methods of caring for, healing and managing livestock. This also includes social practices and the ways in which livestock are incorporated into farming systems. The EVM knowledge has been developed through trial and error and deliberate experimentation.

Africa is a rich source of medicinal plants; the best known species is *Phytolacca dodecandra* (Hoareau and Da Silva, 1999). In South Africa, a large proportion of the population relies on traditional remedies to treat themselves and their animals for common diseases (McGraw and Eloff, 2008). Roberts (1971) argued that EVM provides valuable alternatives to and complements western-style veterinary medicine. Ethno-veterinary medicine can play a significant role in grassroots development, which seeks to empower people by enhancing the use of their own knowledge and resources. The EVM is of specific value in developing countries where allopathic veterinary medicines are often not accessible to livestock producers.

Hoareau and DaSilva (1999) noted that medicinal plants have for several centuries been widely used as a primary source of prevention and control to livestock diseases and parasites. Ethno-veterinary medicine is sustainable and ecologically sound because plant products with recognized medicinal properties are far more accessible to the villagers than Western medicine (Guéye, 1999). Similarly, McGraw and Eloff

(2008) observed that EVM may be a cheaper and more easily accessible alternative to expensive pharmaceuticals. Most of the developing countries including Nigeria rely wholly or partly on traditional herbal medicine for treatment and control of animal and human diseases (Sofowora, 1993; Kudi and Myint, 1999).

2.5.2 Ethno-veterinary health management practices

In Nigeria, Chah and Igbokwe (2011) reported that farmers use traditional remedies because they are more readily available and are cheaper. Additionally, EVM is partly effective and practicable (Kaikabo *et al.*, 2004). Guéye (1999) noted that all the ethno-veterinary knowledge (EVK) is in the custody of older people, both men and women, who transmit it to younger generations by word of mouth, which is still the common means of communication in Africa. In Zimbabwe, Matekaire and Bwakura (2004) noted that EVK base differs from region to region and also among and within communities. Ethno-veterinary knowledge focusing on ethno-veterinary animal healthcare has existed alongside human evolutionary history, taking different forms (Wanzala *et al.,* 2005). SriBalaji and Vikrama (2010) pointed out that ethnoveterinary practices concern to livestock is as old as the domestication of various livestock species. According to Wanzala *et al.,* (2005), EVK comprises all ethno practices, approaches and traditional knowledge applied by humans with a view to alleviating health constraints that affect livestock and hence, improve their production performance. Many indigenous veterinary beliefs and practices persist in a wide majority of livestock raisers, particularly in the developing countries (Roberts, 1971).

As in other developing countries, livestock health management in Botswana is a combination of EVM and use of modern medicine with EVM usage predominating in small holder livestock production. Ethno-veterinary information is facing

extinction because of the current rapid changes in communities across the world (SriBalaji and Vikrama, 2010).

2.5.3 Ethno-veterinary health management practices in ruminant animals In the rural areas where modern medicine is in accessible to farmers, ethnoveterinary medicine (EVM) is often used to expel retained placenta in livestock.

According to a study carried out by Moreki *et al.,* (2012), the most common traditional remedies used for retained placenta in cattle are salty water (19.05%), soap detergent solution (19.05%), *Terminalia serecea* roots (14.29%), Spirostachys *africanum* bark (9.52%) and *Burkea africanum* bark (9.52%). The herbal plants included *Ziziphus mucronata, Peltophorum africanum, Elephantorrhiza elephantina, Pouzolzia mixta, Dicerocaryum eriocarpum, Asparagaus spp., Hermania guerkeana, Ozoro apaniculosa, Scacdoxus* spp. and *Boscia albitrunca*. Verma and Singh (2009) reported that medicinal herbs as potential sources of therapeutics aids have attained a significant role in health system all over the world for both humans and animals not only in the diseased condition but also as potential material for maintaining proper health. Moreki*et al.,* (2012) stated that the predominant tree species appeared to be *T. serecea*, *S. africanum, P. africanum* and *Z. mucronata* and that *S. africanum* was facing extinction, indicating that conservation may be inevitable. The remedies were given either solely or as mixtures and administered either as a decoction or infusion. Moreki*et al.,* (2012) reported that the common plant parts used for treatment of retained placenta were barks (57.14%), roots (40.48%) and bulbs (11.90%). Finch *et al.,* (2003) reported that the parts of plants used for medicinal purposes by livestock producers were roots (59%), leaves (26%) and whole plant (13%). Furthermore, SriBalaji and Vikrama (2010) stated that parts and products of animals such as skins and hides, bones, milk, butter and even urine and dung are ingredients of EVM. Salty water, as reported by Swaleh

(1999); Koloka and Moreki (2011), in Kenya apart from being used as a tanning agent, is also used for medicinal purposes in both livestock and humans. *E. elephantine (mositsane*) is also used for medicinal purposes in both livestock and humans whereas the roots are used for high blood pressure (Mathias-Mundy and McCorkle, 1989). Similarly, Maphosa *et al.,* (2009) mentioned that *E. elephantine* is a traditional remedy for a wide range of ailments both in humans and livestock. In goats, it is used by farmers in the Eastern Cape Province (South Africa) to control helminthes (Okoli *et al.,* 2010). Roodt (1998) reported that a decoction of *T. serecea* roots is administered orally to a cow suffering from a retained placenta and or internal parasites. In humans, a hot infusion of the root and bark treats pneumonia (Roodt, 1998), whereas eye wash is made by soaking the roots in coldwater (Roodt, 1998; Drummond and Moll, 2002). Drummond and Moll (2002) mentioned that a hot infusion of the roots' outer layers is used to make a fomentation for treating pneumonia, while a decoction of the roots is used to cure diarrhoea and relief colic. The roots of *P. mixta* are used for retained placenta while Maphosa *et al.,* (2010) reported that the leaves of *P. mixta* are used instead. These authors noted that *P. mixta* leaves are crushed to produce a slippery paste that is inserted in to the animal's vagina in order to stimulate the expulsion of the retained placenta. Roodt (1998) stated that *P. africanum* is widely used medically as the bark and roots contain tannins. In addition, powdered debarked roots are used as local application for wounds, diarrhea and dysentery. In humans, Maphosa *et al.,* (2010) stated that the bark from *P. africanum* is chewed to relief colic; an infusion is taken orally to relief stomach disorders while the steam from a hot decoction is applied to sore eyes. The root of *P. africanum* is used to promote the fertility of cattle (Drummond and Moll, 2002), while ash is applied to domestic birds infested with mites and lice (Moreki, 1997). It is suggested that the plants with multipurpose uses may contain more than one type of physiologically active ingredients (Chah and Igbokwe, 2011).

According to Moreki *et al.,* (2012), *B. albitrunca* was identified as one of the plants used for the treatment of retained placenta in cattle. *B. albitrunca* leaves are used in folk medicine for the treatment of inflamed and infected umbilical cords in Nigeria. Additionally, cold infusion of *B albitrunca* leaves is applied as a lotion to the inflamed eyes of cattle while a decoction of the roots provides a treatment for haemorrhoids (Drummond and Moll, 2002). In humans, roots are edible and used as substitute for coffee or chicory (Drummond and Moll, 2002). In Uganda, a concoction of the shoot of *Sida cuneifolia* and the roots of *Acacia sieberiana* roots are used for retained placenta (Drummond and Moll, 2002). In the global perspectives, the various EVM materials used to expel retained placenta in cattle include the bark of *Vitex doniana*, fruit of *Hibiscus esculentus* and the leaves of *Carica papaya*, *Hedera helix* L., *Debra glabra, Dobera loranthifolia*, *Aloe tenuior*, *Glyphaea Brevis* and *Spondia mombin* are used respectively (Swaleh, 1999; Dold and Cocks, 2001; Lans *et al*., 2007; Chah and Igbokwe, 2009). While the root of *Salvadora persica* (Toyang *et al.,* 2007) and whole plant of *Tribulus terrestris* L. (Thomas *et al.,* 2011) are used. Furthermore, Lans *et al.,* (2006) reported that *Curcumalonga* rhizome is used for retained placenta in horses.

According to Drummond and Moll (2002), *Z. mucronata* is considered immune to lightning in Botswana, so any person that shelters under it is thought to be safe. In addition, *Z. mucronata* leaf paste can be used to treat boils and other skin infections in both humans and livestock. Drummond and Moll (2002) stated that inhuman the powdered leaf and bark has been used to relief chest pains, while an infusion of the bark alone is used to cure coughs. According to Mathias-Mundy and McCorkle (1989), roots of *Z. mucronata* are used for general pain relief and menstrual pain in women.

2.5.4 Ethno-veterinary health management practices in other livestock

Rural poultry farmers are aware of the need to keep birds in good health and when they are sick to seek for prescription and procure medicine for treating rural poultry diseases and parasites. A study by Mapiye and Sibanda (2005) has shown that large number of farmers gives traditional medicine to chickens indicating that traditional medicines in some instances have potential to improve the health status of rural household flocks. The major plant used by the rural chicken farmers for the treatment of rural chickens against Newcastle Disease (ND) are mahogany (*Khaya senegalensis*) bark/roots (25.1%), wild garden egg (*Solanum nodiflorum*) (20.3%), bitter leaf (*Vernonia amygdalina*) (7.8%) and pepper (*Capsicum frutescens*), as the main sources of remedies (Musa *et al.,* 2008). The root of *P. africanum* is used to promote the fertility of cattle (Musa *et al.,* 2008) while ash is applied to domestic birds infested with mites and lice (Moreki, 1997). It was also observed that 2% of the farmers employed the use of white maggi (Monosodium glutamate), which they usually soak in water and administer to chickens orally for the treatment of ND. Their findings also revealed that about 50.16% of the farmers obtained prescription and medicine for the treatment of ND in chicken from ethno-veterinary sources, 29.40% from modern veterinary services, 9.74% from pharmaceutical shops and 10.71% from open shops/markets.

In Nigeria, studies have shown that ND is endemic in both rural and commercial poultry with epidemic outbreaks being recorded in highly susceptible flocks (Sa'idu *et al.,* 2006). Traditional remedies are reported to be much more easily and readily obtained and affordable (Abdu *et al.,* 2000). Some plants influence the immune system or are effective against internal and external parasites (Abdu and Faya, 2000). Antihelminthic and antiprotozoan properties of *Khaya senegalensis*, *Vernonia amygdalina* and *Solanum nodiflorum* have been reported by Abdu and Faya (2000), Nwude and Ibrahim (1980) and Atawodi *et al.,* (2000).

The practice of sourcing for medicine through the traditional method is mostly and popularly adopted by rural farmers for treatment of birds. It may not be perfect enough to ensure good health due to poor knowledge and understanding of the etiology and pathology of poultry disease by the farmers. Hence, they may succeed in treating the observable symptoms of the disease without dealing with the actual cause. Dosages are imprecise as most of the remedies are soaked in water without regard to quantity of the remedy or volume of water used. This may expose the birds to dangers of over or under dosing and may lead to kidney or liver damage. These remedies used by rural farmers in the study may or may not have direct effect on ND virus, but could affect protozoan and helminth parasites of rural poultry by reducing the parasites burden, and boosting the immunity of the birds against infection. As a result, extension services are required in educating rural farmers in matters relating to the use of appropriate medicaments and adopting new technologies for improving rural household chicken production and disease control. Alders and Spradbrow (2001) have recommended extension services and community participation for the successful adoption of the oral feed vaccine for the control of Newcastle Disease (ND) in rural areas.

The importance of medicinal plants in the development, growth and survival of a country like Nigeria cannot be over emphasized. Medical plants are plants that have medicinal properties for treating and preventing specific ailments and diseases. Almost all our present medicine emanates from medicinal plants. Medicinal plants have always been considered a healthy source of life for all people and therapeutic properties of medicinal plants are very useful in healing various diseases and the advantage of these medicinal plants is being 100 percent natural (Nwandu, 2010). Medicinal plants are mostly found in wild but can also be domesticated by gathering them from the wild and cultivating them in the farmers' fields (Nwandu, 2010). According to Osuagwu and Okereke (2014), medicinal plants domestication has

played a key role in the public health of the people of Nigeria including Imo State. Okigbo and Mmeka (2006), argued that about 80 percent of the inhabitants of Imo State depend on medicinal Plants which have shown a wide range of uses in the treatment of diseases of human and animals especially those of the tropics including malaria diabetes, Arthritis, measles, ulcer, headache, piles, catarrh, obesity (overweight), chest pain, insomnia (sleeplessness), Typhoid fever, cough, hypertension, rheumatism and many more livestock diseases.

There are thousands of species of medicinal plants in the wild and domesticated. Some of them include, *Azadirachita indica* which is also known as Neem (*Dogoyaro*), drinking or bathing with the leaf decoction or infusion is a remedy for chicken pox and small pox while boiling leaves with lemon grass treats malaria and also used as remedy for ulcer and wounds. *Ageratum conyzoides* which is also known as goat weed/*ulanjula* is used as a purgative. Sap squeezed from the leaves is used to treat wounds and eye problem. *Cymbopogon citratus al*so used as an astringent, diuretic and antiseptic and also used to treat typhoid fever. *Garcinia kola* also known as bitter cola/*Akuilu* is chewed to treat bronchitis and throat infections. An infusion of the root with a little salt is a remedy for asthma – *Ocimum gratissimum* which has a common name as scent leaf is a remedy for constipation as well as for worms and can also be used to treat diabetes mellitus. *Gangronema latifolium* also known as *utazi* is used for cleaning the womb after child birth and for treating running stomach. *Piper nigrum* which is also known as *Uziza* is also used to stabilize the womb, in women after child birth. *Veronia amygdalina* which is popularly known as bitter leave is used to cure measles, small pox and chicken pox. It is also used to cure pile and treat diarrhea. Other medicinal plants abound in nature such as *Anarcadium occidental* (Cashew), *Chromolaena odorata* (scan weed, Awolowo weed), *citrus aurantifolia* (lime), *corchorus olertonus* (vegetable jute) *Zingiber officinale* (Ginger), *Allium cepa* (Onion, *Solanium lycopersium* (Tomato),

citrus Limon (lemon), *Persea americana* (Avocado), *Borassica oleracea* (cabbage), *Vitis vinifera* (Grape), *Daucus carota* (Carrot) *Cucumis salivas* (Cucumber), *Glycine maxmerr* (Soybean) etc are used for treating different ailments. Federal Republic of Nigeria, Fourth National Biodiversity Report (2010).

2.6 Theoretical and conceptual framework

2.6.1 Theoretical Framework

The present study framework will be premised on the theoretical perspective of the Ethno Medical Model, which is a sociological approach to the study of health and health care. The study on the use of indigenous knowledge for primary health care embraces two important aspects of a health care system; i.e. indigenous conceptualization of diseases (traditional beliefs about the nature and cause of disease) and the health care delivery (prevention, protection and cure). The framework related to this type of study is called the ethno-medical or often also called the Socio-cultural approach. The ethno-medical approach studies medical problems as socio-cultural phenomena. Health care and disease are seen as culturally definable. For anthropologists who regard a culture as a symbolic system, the people's view of health and illness is part of that system. It was stated that:

"Any disease is in part a cultural construct. Disease derives much of its form, the way it is expressed, the value it is given, the meaning it possesses and the therapy appropriate to it in large measures from the system of symbolic meaning" (Sargent and Johnson, 1996).

Adoption of the ethno medical approach in a study; is to investigate how a particular group of people perceives and deals with health and disease. This approach embraces

the study of health beliefs, healing techniques and medical practitioners as phenomena related to the culture and society in which they are found.

An ethno medical approach illuminates how a society's culture creates specific problem solving mechanisms involving health, illness and medical practice. Literature on ethnomedicine, amplifies the importance of understanding the various paradigms of disease and health care which are bound to culture, social construction and at least in part, to their worldview (Emeagwali, 2003).

Usefulness of the model to the research

The usefulness of the ethno-medical approach refers to its practicality in the present study. The ethno-medical model provided a framework on which to explore the use of indigenous knowledge for primary health care. The model provided a framework upon which to develop the research methods such as study design, sample, data collection and analysis methods that will be helpful in the collection of data about the indigenous health care practices and medical ethno-botanical knowledge of animals/livestock.

2.6.2 Theory of information flow

Information flow (information theory) in an information theoretical context is the transfer of information from a variable to a variable in a given process.

Information has a central role in our modern way of living and agriculture is no exception: to be successful in farming requires gaining, processing, using and evaluating a huge amount of information. Information flow with regards to the use of indigenous medicinal plants by livestock farmers in Imo state can best be explained by information theory by Rogers;

Rogers (1995) emphasizes that the exchange of information (communication) and its diffusion take place within a social system. Actors such as individuals, informal

groups, organizations and subsystems are the members of the system and the structure of the social system and their actors or members' roles affect the diffusion process.

Farmers are working in an information-intensive environment and numerous studies have showed that information and communication technologies (ICT) can play a vital role in realizing benefits with more effective information management at the farm level. The supply chain in agriculture not only means the flow of products and income but also that of information (Niderhauser *et al.*, 2008). The toolkit of the information society, information communication technologies (ICT) offers new opportunities for efficient operation, decision-making and adaptation to the environment (Herdon, 2009).

Rural Africa has experienced a particularly high uptake of information and communication technology (ICT) in the last 3 to 4 years (Jere and Erastus 2015), which is changing the way farmers communicate and the way they access and exchange information, especially among younger generations (Odiaka 2015). This fast penetration of ICT thus brings new opportunities for African farmers to improve their knowledge and livelihoods (Asongu 2015; Aker and Mbiti 2010; Demombynes and Thegeya 2012).

2.7 Empirical Framework

2.7.1 Socioeconomic characteristics

Many socioeconomic factors appear vitally important in small ruminant production in literature, empirical studies and personal observations. Inomi *et al*. (2006) posited that annual income, household size and gender of household head are statistically significant determinants of the value of flock in smallholder production. Gender

inequality in livestock ownership has traditionally been measured in terms of gaps in men's and women's opportunities and outcomes.

Ownership and control over assets such as land provide benefits to farmers as collateral for credit that can be used for investment or consumption. According to Doss, *et al*. (2008), quoting Banerjee and Duflo (2003); Barrett and Carter (2005); Carter and Zimmerman (2000) asset inequality, combined with market failures, lead to differential productivity between the asset poor and asset rich. These create poverty and inequality traps.

In terms of gender and asset ownership, women may not receive the benefits of assets held by men, even when they live in the same household (Deere and Doss, 2006). It has also been reported by Agarwal (2001) that personal endowments (such as educational levels, property status) of women and social infrastructure determine their participation in decision making. Studies by Agarwal (2002) and Allendorf (2007) found that women who owned land had greater say in household decision making than women without land. Grown *et al*., 2005 reported that the UN Millennium Project Task Force on Gender Equality and Women's Empowerment recommends that countries and agencies use a measure of the gender asset gap, such as the incidence of asset ownership by men and women, as an indicator of progress toward Millennium Development Goals 3. Education is not only related to the ability to obtain and process information, but is often conducive to implementing knowledge intensive conservation and sustainable agricultural technologies.

The ability of agro-ecosystem to withstand stress and shock, determines the persistence or durability of an agro-ecosystem's productivity under known or possible conditions. Sustainability is defined as the ability of an agroecosystem to maintain productivity when subjected to stress or shock. Stress is a frequent (sometimes continuous) relatively small and predictable disturbing force that has a

large cumulative effect. Examples of stress in small ruminant production are lack of capital and concentrate/fodder. Alternatively, the disturbance can be caused by a shock, which is defined as an infrequent, relatively large and unpredictable force that has an immediate effect. Examples of shock in this case are pests and diseases; livestock however could provide safety net when crops failed (Dolberg, 2001).

In small ruminant production, grazing and water are common property resources meant for common use of the villagers without individual ownership rights. Consequently, public or common pasture ownership has thus been singled out as a threat to proper range management. Livestock production also provides a constant flow of income and reduces the vulnerability of livelihoods (Birthal and Rao, 2002). Small ruminant's production being less capital-intensive is an important option for small ruminant farmers because of its low land requirement, low initial investment and low operational costs (Birthal and Ali, 2005).

2.8 **Conceptual Framework**

The conceptual framework explains schematically, the relationship between the variables (dependent and independent) in the study (Use of indigenous medicinal plants by small holder Ruminant healthcare in Imo state, Nigeria).

The independent variables (A) consist of the socio-economic characteristics of the farmers; Sex, Age, Level of education, farm size, Farming experience, Annual income, Membership of organization etc. The Dependent variables (B) comprise of the use of indigenous medicinal plants / plants types; *Garcina kola, Gongronem latifolium, Vernonia amygdalina etc.*

Block C outlines the various ailments being treated by the Medicinal plants.

Block D shows the benefits and effects of using the indigenous medicinal Plants, E & F show the intervening variables, while G shows the constraints to the use of Indigenous medicinal Plants.

The constraints however, can be ameliorated by adequate documentation of information on the various indigenous medicinal plants, their uses and benefits, the ailments that can be handled with the various plants, adequate and accurate dissemination of information to farmers, their disposition towards new knowledge, acceptance and practice of the new discoveries. These and many more will help to enhance the productivity of small holder Ruminant Farmers in Imo State, Nigeria

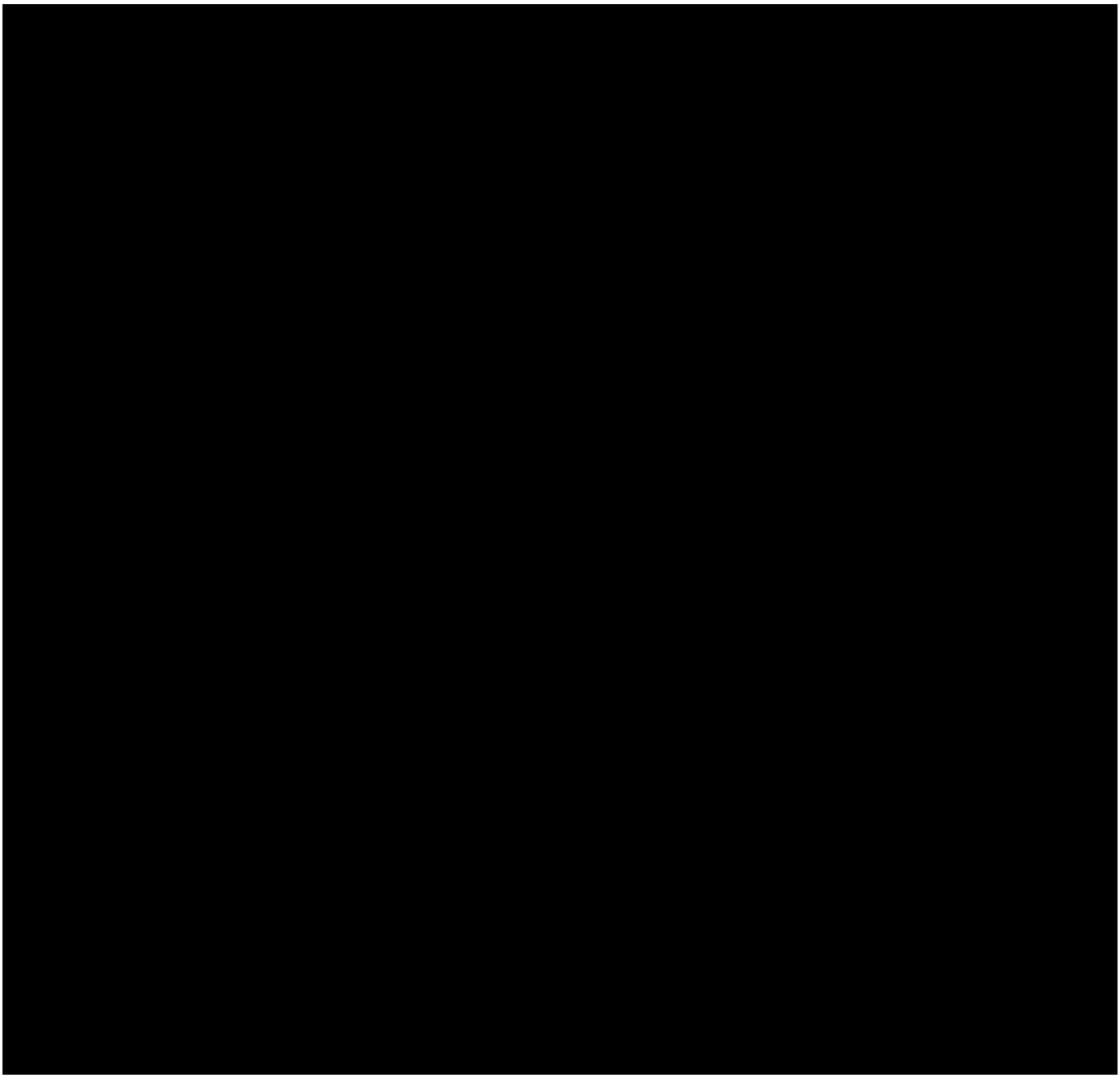

Figure 1: A schema showing the use of indigenous medicinal plants by smallholder ruminant farmers in livestock healthcare in Imo State, Nigeria
CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Study area

The study was carried out in Imo State. Imo State is one of the thirty-six states of Nigeria, and one of the states in the South eastern part of the country. Imo state comprises 27 local government areas and is made-up of three agricultural zones; Owerri, Orlu and Okigwe. Imo State lies within latitudes 4°45'N and 7°15'N, and longitude 6°50'E and 7°25'E with an area of 5,100 sq km (Nwajiuba, 2002). It is bordered by Abia State on the East, by the River Niger and Delta State on the west, by Anambra State to the north and Rivers State to the south. The state is rich in natural resources including crude oil, natural gas. Economically exploitable flora like the iroko, mahogany, obeche, bamboo, rubber tree and oil palm predominate (Information Management System Group (IMSG), 2001).

However, with a high population density and over cropping, the soil has been degraded and much of the native vegetation has disappeared. This deforestation has triggered soil erosion which is compounded by heavy seasonal rainfall that has led to the destruction of houses and roads. The rainy season begins in April and lasts until October with annual rainfall varying from 1,500mm to 2,200mm (60 to 80 inches). An average annual temperature above 20 °C (68.0 °F) creates an annual relative humidity of 75%, with humidity reaching 90% in the rainy season. The dry season experiences two months of Harmattan from late December to late February. The hottest months are between January and March. The estimated population is 4.8 million and the population density varies from 230-1,400 people per square kilometer (Nwajiuba, 2002). The people of Imo State are mainly farmers that deal on both plant and animal production. A good number of them are civil servants. The common breeds of livestock they keep are poultry, pig, goat and sheep.

3.2 Sample and sampling techniques

Imo State has three agricultural zones namely Owerri, Orlu and Okigwe. Owerri agricultural zone has 12 extension blocks, Orlu agricultural zone has 18 and Okigwe zone has 10 thereby making a total of 40 extension blocks. Multi-stage sampling procedure was used to select the sample for the study. The first stage was the proportionate sampling of the extension blocks from the three zones. This gave 6 extension blocks for Owerri, 9 for Orlu and 5 for Okigwe zone. The second stage involved the random selection of 3 circles from each block which gave 27 for Orlu and 18 circles for Owerri and 15 for Okigwe zone. In the third stage, with the ADP listing of households, there was random selection of 4 farmers (who were into ruminant production) each from the circles. This gave sample size of 108 farmers for Orlu, 72 farmers for Owerri and 60 farmers for Okigwe, totaling 240 farmers for the study.

The state ADP, through its extension agents, block supervisors, zonal extension officers and key informants provided the sampling frame and helped to identify the ruminant farmers in the study area.

3.3 Data collection

Two main data sources were used for the study, primary and secondary data. Structured questionnaire was administered to the 240 farmers. The questionnaire contained the farmers' socio-economic background, types of ruminants being kept, system of production and management practices. Information on medicinal plants and other traditional methods used for animal healthcare were sought from the farmers. Secondary data were obtained from relevant literature, past research reports, Ministry of Agriculture, library, bulletins, journals, etc.

3.4. Standardization of research instrument

In order to minimize errors, the research instrument was pretested in order to standardize it. This is necessary to avoid bias findings. The following procedures were adopted to determine validity and reliability of the test items in the data gathering instrument to ensure a standardized measuring scale.

3.4.1 Estimation of validity

Validity relates to ability of the instrument to measure the variables it was designed to measure. In this study, the rational judgement procedure was used to determine how the data collection instrument measured what it was intended to measure. To achieve this, a sample of the questions was given to the supervisors and other experts in the field of Agricultural Extension of the Department of Agricultural Extension, Federal University of Technology, Owerri to review independently. Questions which were agreed upon unanimously to be relevant made up the questionnaire for the study.

3.4.4 **Estimation of reliability**

This is the ability of a measurement scale to consistently produce same result when applied to the same population over time. The test-retest method was used to determine the ability of the research instrument to yield consistent results. The instrument was administered twice to a group of respondents possessing similar characteristics but not part of the study to be sampled within a considerable time interval. Their first and second responses thereafter were correlated using Pearson Product Moment Correlation to determine the coefficient of correlation between the two responses. A positive correlation coefficient of 78% was obtained, which indicated that the instrument was reliable.

3.4.5 **Measurement of variables**

Objective one: To determine the socio-economic characteristics of the respondents. The variables measured under this objective included: age, sex, marital status, educational level, household size, farming experience, farm size, membership of social organization, annual income, financial sources, major occupation and extension contact.

i. Age: the respondents were asked to indicate their actual ages in years.

ii. Sex: the respondents were asked to indicate whether they were male or female and their response was recorded as male = 1, female = 0.

iii. Marital Status: this was measured as Single = 1, Married = 2, widowed = 3, divorced = 4 and separated = 5.

iv. Educational level: the respondents were asked to indicate their highest level of educational attainment and responses taken as No formal education = 1, primary education = 2, secondary education = 3, tertiary education = 4, others= 5.

v. Household size: the respondents were asked to indicate the number of dependants (people living with them under one roof and feeding from the same pot).

vi. Farming experience: the respondents were asked to state the number of years they spent in farming.

vii. Herd size: the respondents were asked to state the number of small ruminants they had in their farm.

viii. Membership of social organization: the respondents were asked to indicate their membership of social organization using dummy scale of yes or no. ix. Sources of Information: the respondents were asked to indicate their sources of information which was recorded as individual contact, group contact, mass contact, newspapers, television/radio, fellow farmers, cooperative societies, extension services.

x. Annual income: the respondents were asked to state their annual income in naira.

xi. Sources of credit: the respondents were asked to state their source(s) of credit which was recorded as friends/relatives, age grades/ social clubs, religious organizations, farmer's cooperatives, local government and Banks etc.

xii. Extension contact: the respondents were asked if they had contact with extension and this was measured as yes or no. xiii. Major occupation: Farmers were asked to state if farming is their major occupation or any other form of occupation.

Objective two: identify indigenous medicinal plant species available to the small ruminant farmers; Farmers were asked to indicate the indigenous plant species available to them from a list that was provided.

Objective three: ascertain the indigenous medicinal plants used for the treatment of small ruminant diseases. Farmers were asked to indicate the indigenous medicinal plants in use by them for the treatment of small ruminant diseases.

Objective four: To determine small ruminant ailments prevalent in the study area. The common ailments of livestock in the area were itemized and the respondents responded by indicating the ones that applied to them.

Objective five: To investigate methods of preparation/administration of the medicinal plants in treating small ruminant diseases. The various methods used in preparing and administering the medicinal plants in treating animal diseases were itemized and the respondents indicated the ones they used.

Objective six: To ascertain the different situations or conditions to use the medicinal plants for treatment of the small ruminant ailments. The situations measured

included ‘when there is need for prevention’, ‘as part of feeding regime’, ‘each time a disease condition is observed’, ‘as immunization against occurrence’ and ‘as alternative to boost modern medication’. They were itemized and the respondents indicated the ones applicable to them on a 3-point Likert type scale of Very often = 3, often = 2, rarely = 1. A discriminating index of 2.0 was obtained and any item with $\bar{X} \geq 2.0$ was used “often” while any $\bar{X} < 2.0$ implied used “rarely”.

Objective seven: Identify reasons for the use of medicinal plants as perceived by the farmers. The farmers were asked to indicate the different perceived reasons for use of the medicinal plants such as heaper to administer, quicker treatment of ailment, no side effects, faster rate of recovery, animals take it easily etc and these were measured on a 4-point Likert-type scale of strongly agree = 4, agree = 3, disagree = 2 and strongly disagree =1. A discriminating index of 2.50 was obtained and any item with $\bar{X} \geq 2.50$ was taken as “agreed” and a reason for the use of medicinal plants. Any $\bar{X} < 2.50$ was regarded as “disagreed”.

Objective eight: to identify constraints to the use of indigenous medicinal plants. The possible constraints to the use of indigenous medicinal plants in treating small ruminant diseases were listed out and the farmers were made to tick as many as applied to them in multiple response form and the percentages were computed.

3.5 Methods of data analysis

Descriptive statistics such as mean and percentage were used to analyse data for objectives 1, 2, 3, 4, 5 and 8. Data for objectives 6 and 7 were analysed using mean score and standard deviation.

Hypothesis 1 was tested using ordinary least squares multiple regression techniques implicitly specified as follows;

$Y = f(X_1,X_2,X_3,X_4,X_5,X_6,X_7,X_8,X_9,X_{10},X_{11},X_{12},X_{13+}e)$ ---------- (1) Where

Y= level of use of indigenous medicinal plants (No of indigenous plants used) x_1 = Sex of the farmer (Dummy: Male =1, Female= 0) x_2 = Age (Years) x_3 = Marital status (Dummy: Married = 1 otherwise = 0) x_4 = Educational Attainment (Dummy: educated = 1 otherwise = 0) x_5 = Household size (No. of persons) x_6 = Herd size (No. of animals) x_7 = Farming experience (Years) x_8 =Membership of social organization (dummy: Yes = 1 otherwise = 0) x_9 = Sources of information (Dummy: Extension agents = 1 otherwise = 0) $x_{10=}$ Annual income (Naira)

x_{11} = Sources of credit (dummy: formal sources =1 otherwise = 0) x_{12}= Frequency of Extension contact (Number of Visits) x_{13}= Major occupation (dummy: Farming=1 otherwise = 0) e = error term

Hypothesis **2** which stated that there is no significant difference in the use of indigenous medicine plants by both male and female farmers for treating livestock diseases will be shown using Z-test. The Z-test is represented by the formula.

$$Z = \frac{\bar{x}1 - \bar{x}2}{\blacksquare}$$

Where z = the value by which the statistical significance of the mean difference is to be judged.

$\bar{x}_1$ = mean level of use of indigenous medicinal plants by male ruminant farmers

$\bar{x}_2$ = mean level of use of indigenous medicinal plants by female ruminant farmers

s_{12} = the variance of use of indigenous medicinal plants by male ruminant farmers

s_{22} = the variance of use of indigenous medicinal plants by female ruminant farmers

n_1 = the number of male ruminant farmers (GroupI)

n_2 = the number of female farmers (GroupII)

Hypothesis III which stated that there was no significant difference in the perceived reasons for use of indigenous medicinal plants among farmers for treating livestock diseases in the three agricultural zones of the state was tested using analysis of variance (ANOVA) model expressed as follows.

$$F = \frac{\frac{MSSB}{SSB(n-k)}}{\frac{MSSW}{(k-1)}} = \text{---------- (2)}$$

$$SSB = \sum_{j=1}^{K} ((\bar{\bar{x}} - \bar{\bar{x}}))^2 \text{ ---------- (3)}$$

$$SSW = \sum_{i=1}^{K} \sum_{j=1}^{k} (xij - \bar{x}j)^2 \text{ ---------- (4)}$$

Where F = value by which the statistical significance of the mean differences would be judged.

SSB = sum of Squared deviations between the use of indigenous medicinal plants among ruminant farmers in the 3 agricultural zones of the state.

SSW = Sum of Squared deviations within the mean use of indigenous medicinal plants among ruminant farmers in the 3 agricultural zones.

$\bar{x}j$ = mean frequency of use of indigenous medicinal plants among ruminant farmers from agricultural zone j

$\bar{\bar{x}}$ = grand mean frequency of use of indigenous medicinal plants among ruminant farmers Xij = i^{th} level of perceived reasons of use of indigenous medicinal plant by farmers from agricultural zone j.

nj = Sample size of farmers from agricultural zone j n = number of observations in

the 3 agricultural zones.

K = number of agricultural zones in the state.

CHAPTER FOUR

RESULTS AND DISCUSSION

This chapter deals with the presentation and discussion of findings of the study. It is presented under the following sub-headings:

- Socio-economic characteristics of the small ruminant farmers
- Indigenous medicinal plant species available to the small ruminant farmers,
- Indigenous medicinal plant species in use by the small ruminant farmers,
- Small ruminant ailments prevalent in the study area,
- Methods of preparation of the medicinal plants used in the treatment of the small ruminant ailments
- Perceived situations/conditions of use of the medicinal plants in treating small ruminant diseases
- Perceived reasons for use of indigenous medicinal plants in treating small ruminant diseases
- Constraints to the use of indigenous medicinal plants in treating small ruminant disease

4.1 Socioeconomic characteristics of ruminant farmers

4.1.1 Age

Table 4.1 Distribution of ruminant farmers according to age

Age (Years)	Frequency	Percentage	
< 18	2	0.8	
18-35	28	11.7	
36-53	102	42.5	$\bar{X} = 50.9$
54-71	93	38.8	
≥72	15	6.3	

Source: Field Survey, 2019

Table 4.1 shows that a greater proportion (42.5%) of the farmers were within the age bracket of 36 - 53 years. The mean age was 50.9 years. It could be inferred that middle-aged farmers dominated small ruminant production in the study area. According to Togola *et al*. (2005), people between 40 years and above are the custodians of information and knowledge about indigenous medicinal plants. Older people are risk-aversive and would prefer to continue with the local medicine they are used to. Also, the relative ease in preparing and administering medicinal plants would it more preferred by older farmers.

4.1.2 Sex

Table 4.2 Sex of the ruminant farmers

Sex	Frequency n = 240	Percentage
Female	113	47.1
Male	127	52.9

Source: Field Survey, 2019

Table 4.2 shows that majority (52.9%) of the farmers were male while 47.1% were female. This implies that more men are engaged small ruminant production in the study area. This is in line with the findings of Teklehaymanot *et al*. (2007) and Muthee *et al*. (2011) who reported male dominance in traditional medicine in Ethiopia and Kenya respectively. Domestic responsibilities might hamper the involvement of females unlike the males since the practice requires movement away from home in search of the plants used for treatment. Also, the lack of resources by female farmers might reduce their involvement in small ruminant production compared to their male counterparts. For example, access to credit is generally lower among female farmers and this could limit their herd size. It could also reduce their ability to afford other resources that might be needed in the management of animals.

4.1.3 Marital status

Table 4.3 Marital status of the ruminant farmers

Marital Status	Frequency n = 240	Percentage
Single	18	7.5
Married	207	86.3
Widowed	11	4.6
Divorced	3	1.3
Separated	1	0.4

Source: Field Survey, 2019

The distribution of small ruminant farmers according to marital status as shown in Table 4.3 indicates that majority (86.3%) of the farmers were married, 7.5% were single, 4.6% were widowed, 1.2% were divorced and 0.4% were separated. Since most of the respondents were married, this implies that there will be more hands and labour available for small ruminant production as this will result to increased income and in turn increased use of medicinal plant for small ruminant animal healthcare. Since the local preparation of herbal formulations undergo several stages, complementing household efforts would promote the practice and save the money that would have been spent on hiring labour from outside. This finding reinforce suggestions by Nkonki-Mandleni et al. (2018) on the labour benefits for livestock farming from family members. Similarly, Taruvinga et al. (2022) posited that married farmers are more likely to keep small ruminants for food provision and sale of surplus to generate income for the household.

4.1.4 Educational level

Table 4.4 Educational attainment of the ruminant farmers

Educational Level	Frequency n =240	Percentage
No formal education	5	2.1
FSLC	59	24.6
WASCE	55	22.9
NCE/ OND	32	13.3
HND	25	10.4
BSc	57	23.8
MSc	3	1.3
Ph.D	4	1.7

Source: Field Survey, 2019

Table 4.4 shows that majority (97.8%) of the farmers acquired one form of formal education or the other while 2.1% had no formal education. Acquisition of formal education can enhance decision making among farmers. In general, the result implies that the small ruminant farmers have basic education needed for better and faster understanding of the use of medicinal plant in small ruminant animal healthcare and other agricultural innovations. Acquisition of education also enhances decision-making abilities of the farmers. Asiabaka (2002) noted that the resultant effect of lack of education is resistance to change especially in the spread of information on agricultural innovation that are meant to change the lives of farmers positively.

4.1.5 Household size

Table 4.5 Household size of the ruminant farmers Household Size

Household size	F	%	
< 5	54	22.5	
5 – 10	165	68.8	
– 16	15	6.3	$\bar{X} = 8$
– 22	4	1.7	
> 22	2	0.8	

Source: Field Survey, 2019

Table 4.5 shows that the majority (68.8%) of the farmers had 5 - 10 persons in their household. The mean household size was 8 persons. It could be inferred that the farmers have a large household size which could be a source of cheaper labour and relevant information. The higher the family size, the more the availability of potential labour (Okolo, 2007). Besides, the money that would have been spent on hiring labour from outside would be used on other needs thus improving the standard of living of the household members. Increasing household size implies high labour availability for livestock production. According to Nkonki-Mandleni et al. (2018) household size is deemed a key variable in family labour available in smallholder farming activities to carry out farming practices and ensure completion of tasks timeously. Majkodunmi (2011) management of large herds successful for the maximum benefits of the household requires family labour from both genders.

4.1.6 Farming experience

Table 4.6 Distribution of ruminant farmers according to farming experience

Farming experience (Years)	Frequency n = 240	Percentage
< 5	15	6.3
5 – 10	54	22.5
– 16	59	24.6 $\bar{X} = 15.7$
– 22	46	19.2
> 23	66	27.5

Source: Field Survey, 2019

Table 4.6 shows that greater proportion (27.5%) of the farmers had farmed for more than 23 years and above. The mean farming experience was about 16 years. This implies that the farmers may have gained reasonable experience in the use of medicinal plants for small ruminant animal healthcare and might give useful information about their use and effectiveness. According to Anning and Dickson (2017) long history of traditional medicine use allows users to ascertain the safety or otherwise of the formulations.

4.1.7 Major occupation

Table 4.7 Distribution of small ruminant farmers according to major occupation

Farming as Major Occupation	Frequency	Percentage
Yes	138	57.5
Total	240	100

Source: Field Survey, 2019

Table 4.7 shows that majority (57.5%) of the respondents took farming as their major occupation. However, the other 42.5% have trading and other business activities as their major occupation, while still engaging in small ruminant production and other farming activities. The farmers might have diversified their economic activities as a way of boosting income generation and avoiding possible risks.

4.1.8 Herd Size

Table 4.8 Distribution of small ruminant farmers according to herd size

Herd Size	Frequency	Percentage	n = 240
< 10	132	55.0	
10 – 20	61	25.4	
– 40	19	7.9	$\bar{X} = 18$
– 60	14	5.8	
≥60	14	5.8	

Source: Field Survey, 2019

Table 4.8 shows that majority (55%) of the small ruminant animal farmers owned less than 10 animals, 25.4% owned 10-20 animals, 7.9% owned 21-40 animals while

5.8% owned 41-60 and 61 and above respectively. The mean herd size was 18 animals. This implies that the farmers are small-scale livestock farmers. Their small scale of operation can be linked to some factors like limited access to credit. The size of their farm may have favoured their use of indigenous medicine which is administered manually. Also, small-scale farmers often lack the capacity to afford improved and modern technologies because of cost implications. This might have contributed to their reliance on traditional remedies for their livestock.

4.1.9 Social organization membership

Table 4.9 Distribution of small ruminant farmers according to social organization membership

Social organization membership	Frequency*	Percentage
Religious-based organizations	165	68.0
Age grades	99	41.3
Farmers' forum	58	24.2
Farmer council	19	7.9
ADP contact farmers	138	57.5
Social club	54	22.5
Market association	49	20.4
Cooperative societies	79	32.9
Association of ruminant farmers	79	32.9

*Multiple responses

Source: Field Survey, 2019

Table 4.9 shows that majority (68.0%) of the small ruminant farmers belonged to religious-based organizations, 57.5% were ADP contact farmers, 41.3% belonged to

age grades, 32.9% cooperative societies and associations of ruminant farmers, 24.2% to farmers' fora, 22.5% to social clubs, 20.4% to market associations while 7.9% belonged to farmers' councils. Social organizations have proven to be crucial avenue for sharing/dissemination of agricultural information. They also promote interactions among farmers and offer the extension agency an opportunity to get their information across at a cheaper cost. Farmers who belong to social organizations are mostly likely to share information concerning their experiences and wealth of knowledge. This would allow members to know what works and what does not work.

4.1.10 Sources of credit

Table 4.10 Distribution of small ruminant farmers according to sources of credit

Source of credit	Frequency* n = 240	Percentage
Friends/relatives	206	85.83
Age grade/social clubs	62	25.83
Religious organizations	78	32.50
Farmers' cooperatives	38	15.83
Self-financing	58	24.20
Banks	12	5.0

***Multiple responses**
Source: Field Survey, 2019

Table 4.10 shows that the majority (85.8%) of the farmers got credit from friends and relatives, 32.5% from religious organizations, 25.8% from age grades and social clubs. Other sources of credit included 24.2% from self-financing, 15.8% from farmers' cooperatives and 5.0% from banks. This result implies that the farmers got credit mainly from informal sources. The result also revealed the almost insignificant role commercial banks play in the provision of credit to farmers in the area. Osabohien *et al*. (2020) noted that access to credit promotes agricultural production and lack of it may hinder the uptake of appropriate technologies.

4.1.11 Annual Income

Table 4.11Distribution of small ruminant farmers according to annual income

Annual Income (₦)	Frequency	Percentage	
30,000 – 130,000	105	43.8	$\bar{X} = ₦87,325$
131,000 – 230,999	33	13.8	
> 230,999	17	7.1	
< 30,000	85	35.4	

Source: Field survey, 2019

Table 4.11 shows that greater proportion (43.8%) of the farmers earned ₦40,000 ₦130,000 yearly, while just 7.1% earned more than ₦230,000 as annual income from small ruminant production. The mean annual income of the farmers was ₦87,325. This implies that the farmers earn above the minimum wage (N30,000) in Nigeria. However, comparing it with the mean household size of the farmers shows that each household member earns about N10,000 monthly which is largely below the minimum wage per capita. This can hardly be adequate for good living considering the economic condition of the country.

4.2 Indigenous medicinal plant species available to the small ruminant farmers

Table 4.12 Distribution of small ruminant farmers according to availability of indigenous medicinal plant species

Plant species	F	%
Scent leaf (*Ocimum gratissimum)*	144	60.0
Pawpaw (*Carica papaya*)	126	52.5
Bitter leaf (*Vernonia amygdalina)*	143	59.6
Bitter kola (*Garcina kola)*	93	38.8
Neem (Dogonyaro) (*Azadirachtaindica)*	123	51.3
Moringa (*Moringa oleifera)*	83	34.6
Utazi (*Gangronema latifolium*)	123	51.3
Guava (*Pisidium guajava*)	110	45.8
Mango (*Maginifera indica*)	100	41.7
Lemon grass (*Cymbopogon citrates*)	90	37.5
Camwood/Abosi (*Baphia nitida*)	77	32.1
Indigo tree/uri (*Indigofera tinctoria*)	59	24.6
Alligator pepper (*Afromomum meiegueta*)	90	37.5
African spinach (*Amaranthus Hybridus*)	68	28.3
Lime (*Citrus aurantifolis*)	112	46.7
Black pepper (*Piper nigrium*)	49	20.4
Goatweed/Ulanjula (*Agerantum conyzoides*)	139	57.9
Siamweed, awolowo weed/obiarakara	148	61.7
Opete (*Costus afer*)	29	12.1
Alfafa (*Medicago sativa*)	13	5.4

Source: Field Survey Data, 2019

Table 4.12, identified 20 indigenous plant species available for small ruminant animal healthcare in Imo State, Nigeria. However, the most available plant species included Siam weed (61.7%), scent leaf (60.0%), bitter leaf (59.6%), goat weed (57.9%) and neem (51.3%). The finding suggests the availability of indigenous plant species for livestock diseases management in the study area. This could suggest that

the farmers. Jima and Mergesa (2018) identified 70 plant species used in the treatment of livestock diseases in Ethiopia. Similarly, Luseba and Tshisikhawe (2013) identified about 49 plant species used in the management of livestock health in Limpopo Province, South Africa. If this decline is left unchecked, sometime in the future, there may be a complete loss of these plant species and this will have an adverse effect on small ruminant production in animal. The loss can be attributed to such factors as pollution, invasion by alien species, overexploitation and climate change. Thomas *et al*. (2004) argued that between 15 and 37% of all species could be threatened with extinction as a result of climate change. Invasive species can alter biodiversity and ecosystem functioning (Vila *et al*., 2011). Also land-use change impacts seriously on biodiversity (Sala *et al*., 2000).

4.3 The indigenous medicinal plants used for the treatment of small ruminant diseases in the study area.

Table 4.13: Distribution of small Ruminant farmers according to indigenous medicinal plant species used for the treatment of diseases

Plant species used	F	%
Scent leaf (*Ocimum gratissimum)*		15.8
38		
Pawpaw (*Carica papaya*)	79	32.9
Bitter leaf (*Vernonia amygdalina)*	67	27.9
Bitter kola (*Garcina kola)*	83	34.6
Neem (Dogonyaro) (*Azadirachtaindica)*	65	27.1
Moringa (*Moringa oleifera)*	92	38.3
Utazi (*Gangronema latifolium*)	90	37.5
Guava (*Pisidium guajava*)	108	45.0
Mango (*Maginifera indica*)	105	43.8
Lemon grass (*Cymbopogon citrates*)	94	39.2
Camwood/Abosi (*Baphia nitida*)	74	30.8
Indigo tree/uri (*Indigofera tinctoria*)	58	24.2
Alligator pepper (*Afromomum meiegueta*)	98	40.8
African spinach (*Amaranthus Hybridus*)	95	39.6
Lime (*Citrus aurantifolis*)	82	34.2
Black pepper (*Piper nigrium*)	80	33.3
Goatweed/Ulanjula (*Agerantum conyzoides*)	42	17.5
Siam weed, awolowo weed/obiarakara	55	22.9
Opete (*Costus afer*)		
Alfafa (*Medicago sativa*)		

Table 4.13 shows that all the identified plant species had medicinal values and were found usable by the farmers. However, the most important plant species were guava (45.0%), mango (43.3%) and alligator pepper (40.8%). It could be inferred from the result that the farmers used a plethora of plant species for the treatment of their animal diseases in spite of their declining availability.

However, the result indicated that some of plant species that were highly available in Table 4.12 had low usage by the respondents in Table 4.13. This could be explained by the fact that those plant species have lower efficacy for the treatment of livestock diseases. Several studies have reported the use of plants in the treatment of livestock diseases in Africa (Chitura *et al*., 2018; Azziz *et al*., 2018). Luseba and Tshisikhawe (2013) and Chinsembu *et al*. (2014) found that some people still hold a valuable knowledge on food and medicinal plants and that some of these plants can act as crucial factors in livelihood strategies of indigenous communities. The relative advantage offered by these plant resources such as their relative cheapness, efficacy, ease of administration and proximity to the farmers may have encouraged their use by the farmers. According to Dilshad *et al*. (2010) the utilization of traditional remedies poses a cheaper, easier and sustainable alternative to synthetic drugs and pharmaceuticals. Richert *et al*. (2013) contended that the lack of knowledge or prior experience to alternative medicine can influence farmers' use of medicinal plants.

4.4 Prevalence of small ruminant ailments in the area

Table 4.14 Distribution of farmers according to prevalence of small ruminant ailments

Diseases/Ailments	Frequency*	Percentage
Helminthosis	134	55.8
Contagious ecthyma	93	38.8
Pneumonia	141	58.8
Anthrax	72	30.0
Blackquarter	38	15.8
Foot rot	114	47.5
Diarrhoea	157	65.4
Retained placenta	165	68.8
Rashes	175	72.9
Cough	166	69.2
Ringworm	150	62.5
Wounds	158	65.8
Goat/sheep pox	107	44.6
Conjuctivities	98	40.8

*** Multiple Response Source: Field survey 2019**

Table 4.14 shows that seventeen (17) ailments were identified by the small ruminant farmers. The most prevalent were rashes (72.9%), cough (69.2%), retained placenta (68.8%), wounds (65.8%), diarrhoea (65.4%), pneumonia (58.8%) and helminthosis (55.8%). This finding shows that many diseases affected small ruminants in the study area. Bukar (2012) reported that pox, pneumonia, contagious ecthyma and internal and external parasitism were the common livestock diseases in Nigeria. The ability of the farmers to identify the diseases of their livestock indicates a good

understanding of diseases affecting their livestock will help in the selection of the right plant specie for the treatment . The depth of knowledge of livestock diseases implies the dependence of that society on livestock farming (Bolajoko *et al*., 2011). Thus, any challenge to that enterprise would adversely affectthe means of livelihood of the people. Diseases are known to reduce the productivity of livestock thus reducing the benefits accruable from them. Perry and Grace (2009) noted that diseases add to the production cost. Also they reduce the market value of livestock products thus exposing farmers to poverty (World Bank, 2005).

4.5 Methods of preparation/administration of medicinal plants used in treatment of small ruminant ailments

Table 4.15 Distribution of the farmers according to methods of preparation of medicinal plants used in treatment of small ruminant ailments

Diseases/Ailments	Plant Used	Plant Part Used	Method of Preparation/administration	Frequency	Percentage
Helminthosis	Alfafa	Leaf	Squeezing	2	0.8
	Siam weed	Leaf	Curing	3	1.3
	Scent leaf	Leaf	Curing	20	8.3
	Pawpaw	Leaf	Drying	71	29.6
	Bitter leaf	Leaf	Drying	14	5.8
	Utazi	Leaf	Chewing	5	2.1
	Lime	Seed	Squeezing	4	1.7
	Oil Palm	Oil Sludge	Mixing with ash	15	6.3
	Ijikara	Leaf	Chewing	2	0.8
	Goat weed	Leaf	Curing	7	2.9
Contagious ecthyma	Pawpaw	Leaf	Squeezing	2	0.8
	Lemon Grass	Leaf	Boiling	3	1.3
	Siam weed	Leaf	Curing for 24 hours	3	1.3
	Tomato leaf	Leaf	Squeezing	1	0.4

	Scent leaf		Drying	9	3.8
	Goat weed	Leaf	Curing	2	0.8
	Oil Palm	Oil Sludge	Mixing with ash	18	7.5
	Uri	Leaf/seed	Pounding/squeezing	2	0.8
	Lime	Fruit	Extraction of Juice	16	6.7
	Lemon grass	Leaf	Chewing	1	0.4
	Neem	Leaf	Squeezing	1	0.4
	Abosi	Leaf	Pounding	1	0.4
	Black pepper	Seed	Grinding	1	0.4
	Moringa	Leaf	Boiling	1	0.4
Anthrax	Goat weed	Whole plant	Curing for 24hrs	1	0.4
	Scent leaf	Leaf	Squeeze/Drying	1	0.4
	Bitter leaf	Leaf	Chewing	1	0.4
	Moringa	Leaf	Chewing	6	2.5
	Pawpaw	Leaf	Drying	3	1.3
	Guava	Leaf	Curing and chewing	4	1.7
	Lemon grass	Leaf	Chewing	2	0.8
	Neem	Leaf	Squeezing	2	0.8
	Alfar-far	Whole plant	Squeezing	1	0.4
	Utazi	Whole plant	Boiling	1	0.4
	Awolowo	Leaf	Squeezing	1	0.4
Pneumonia	Moringa	Leaf	Curing &chewing	13	5.4
	Pawpaw	Leaf	Curing and feeding	1	0.4
	Utazi	Whole plant	Boiling with water	25	10.4

	Scent leaf	Leaf	Squeezing	73	30.4
	Bitter leaf	Leaf	Chewing	1	0.4
	Ogurishi	Leaf	Squeezing	18	7.5
	Goat weed	Whole plant	Curing	4	1.7
	Alligator pepper	Leave/seed	Chewing/grinding	5	2.1
	Guava		Chewing	4	1.7
	Lime	Fruit	Extraction of juice	2	0.83
	Bitter kola	Seed	Grinding	2	0.8
	Black pepper	Seed	Grinding	1	0.4
	Abosi	Leaf	Squeezing	1	0.4
Blackquarter	Opete	Whole plant	Chopping into bits	1	0.4
	Moringa	Leaf &seed	Curing/grinding	6	2.5
	Alfar-far	Leaf	Squeezing	1	0.4
	Neem	Leaf	Squeezing	1	0.4
	Utazi	Whole plant	Squeezing	2	0.8
	Mango	Leaf	Curing & chewing	1	0.4
	Alvian spinach	Leaf	Chewing	1	0.4
	lemon grass	Leaf	Chewing	3	1.3
	Lime		Squeezing	3	1.3
	Guava	Fruit Leaf	Chewing	3	1.3
	Alligator pepper	Leave	Placing on the ground	1	0.4
	Scent leaf	Leaf	Squeezing	1	0.4
	Goat and Siam weed	Leaf	Curing	1	0.4
Foot rot	Opete	Whole plant	Cutting into pieces	2	0.8

	Lemon grass	Leaf	Solution	49	20.4
	Scent leaf	Leaf	Squeezing	5	2.1
	Neem	Leaf	Squeezing	3	1.3
	Siam weed	Leaf	Squeezing	3	1.3
	Bitter kola	Leaf	Spreading on the ground	2	0.8
	Goat weed	Leaf	Squeezing	2	0.8
	Camwood	Leaf	Spreading on the ground	1	0.42
	Pawpaw	Leaf	Spreading on the ground	2	0.8
	Abosi	Leaf	Squeezing	1	0.4
	Lime	Fruit	Grinding	37	15.4
	Bitter leaf		Squeezing	6	2.5
	Alligator pepper	Seed	Crushing	1	0.42
	Moringa	Leaf	Spreading on the floor	1	0.4
Flies	Neem	Leaf	Squeezing	75	31.3
	Lime	Fruit/Leaf	Squeezing out liquid	6	2.5
	Lemon grass	Leaf	Boiling/cutting	14	5.8
	Bitter leave	Leaf	Boiling/cutting	1	0.4
	Black pepper	Leaf/seed	Spreading on the ground	22	9.2
	Scent leaf	Leaf	Placing on the ground	1	0.4
	Moringa	Seed/leaf	Grinding/squeezing	1	0.4
	Guava	Leaf	Chewing	1	0.4
Ticks	Neem	Leaf	Squeezing	40	16.7
	Lemon grass	Leaf	Squeezing	4	1.7
	Scent leave	Leaf	Squeezing	4	1.7

	Alligator pepper	Seed/leaf	Mixing with palm oil	36	15.0
	Bitter Kola	Seed	Grinding	1	0.4
	Lime	Fruit/seed	Squeezing	14	5.8
	Utazi	Leaf	Chewing/boiling	2	0.8
	Bitter leaf	Leaf	Squeezing	9	3.8
	Black pepper	Leaf/seed	Curing	3	1.5
	Goat weed	Leaf	Boiling	1	0.4
Diarrhoea	Bitter kola	Seed	Grinding	9	3.5
	Goat weed	Whole plant	Curing for 24hrs	1	0.4
	Alfar-far	Leaf	Squeezing	3	1.3
	Scent leaf	Leaf	Squeezing	39	16.3
	Guava	Leaf	Squeeze	22	9.17
	Alligator pepper	Leaf	Chewing	4	1.67
	Utazi	Leaf	Chewing	24	10.0
	Bitter leaf	Leaf	Curing	4	1.7
	Moringa		Boiling	2	0.8
	Oil Palm	Leaf	Chewing	19	7.9
	Oke Uda	Leaf	Chewing	15	6.3
	Neem	Leaf	Pounding and squeezing	9	3.8
	Black Pepper	Leaf/seed	Chewing	2	0.8
	Aboshi	Leaf	Extraction	1	0.4
	Ijikara	Leaf	Chewing	2	0.8
	Lime	Fruit	Juice extraction	1	0.4
	Camwood	Leaf	Chewing	1	0.4

Retained placenta	Alfalfa	Leaf	Squeezing	5	2.1
	Moringa leaf	Leaf	Squeezing	7	2.9
	Paw-paw	Leaf	Squeezing	2	0.8
	Scent leaf	Leaf	Squeezing	13	5.4
	Neem	Leaf	Squeezing	1	0.4
	Abosi	Leaf	Chewing	44	18.3
	Ijikara	Leaf	Chewing	47	19.6
	Cam weed	Leaf	Chewing	3	1.3
	Black pepper	Seed	Grinding to powder	6	2.5
	Opete	Leaf	Curing	2	0.8
	Goat weed	Leaf	Boiling	11	4.6
	Guava	Leaf	Boiling	2	0.8
	Ege	Leaf	Extraction	4	1.7
	Lemon grass	Leaf	Grind and mix with red oil	2	0.8
	Bitter leaf	Leaf	Curing	1	0.4
Rashes	Uri	Fruit/Leaf	Squeezing	13	5.4
	Scent Leaf	Fruit/Leaf	Squeezing	20	8.3
	Abosi	Fruit/Leaf	Squeezing	3	1.3
	Lime	Fruit/Leaf	Squeezing	59	24.6
	Siam weed	Fruit/Leaf	Squeezing	2	0.8

	Black pepper	Fruit/Leaf	Squeezing	3	1.3
	Lemon grass	Leaf	Chewing	1	0.4
	Indigo tree	Seed/leaf	Grinding	2	0.83
	Neem	Leaf	Curing	10	4.2
	Guava	Leaf	Curing	1	0.41
	Goat weed	Leaf	Squeezing	1	0.4
	Bitter leaf	Leaf	Squeezing	5	2.1
	Mgbo Agu	Leaf	Squeezing	19	7.9
	Awolowo	Leaf	Squeezing	5	2.1
Cough	Moringa	Leaf/Seed	Squeezing &Grinding	2	0.8
	Lemon grass	Leaf	Chewing	41	17.1
	Alfalfa	Leaf	Chewing	1	0.42
	Lime	Leaf	Chewing	7	2.92
	Cam weed	Leaf	Chewing	6	2.5
	Abosi	Leaf	Chewing	8	3.3
	Bitter kola	Seed	Grinding	36	15.0
	Black pepper	Seed	Grinding	3	1.2
	Alligator pepper	Seed	Grinding	1	0.4
	Guava	Leaf	Curing	7	2.9
	Agbo	Leaf	Squeezing	20	8.3
	Bitter leaf	Leaf	Boling	1	0.42
	Scent leaf	Leaf	Squeezing	26	10.8
	Siam weed	Leaf	Squeezing	1	0.4
	Cam weed	Leaf	Chewing	2	0.8
	Ijikara	Leaf	Chewing	7	2.9
	Awolowo	Leaf	Squeezing	1	0.4
	Utazi	Leaf	Squeezing	3	1.3
Ringworm	Scent leaf	Leave	Squeezing and rubbing	18	7.5
	Siam weed	Leaf	Squeezing and rubbing	5	2.1

	Paw-paw		Squeezing and rubbing	54	22.5
	Goat weed	Leaf	Squeezing and rubbing	6	2.5
	Abosi	Leaf	Squeezing and rubbing	2	0.8
	Awolowo	Leaf	Squeezing and rubbing	10	4.2
	Cam weed	Leaf	Squeezing and rubbing	1	0.4
	Lime	Leaf	Squeezing & rubbing	1	0.4
	Lemon grass	Leaf	Chewing	7	2.9
	Neem	Leaf	Chewing	3	1.3
	Bitter leaf	Leaf	Chewing	2	0.8
	Uziza	Leaf/Seed		2	0.8
Wounds	Awolowo	Leaf	Crushing, mixing with palm oil Squeezing	55	22.9
	Bitter leaf	Leaf	Squeezing	33	13.8
	Siam weed	Leaf	Squeezing	21	8.8
	Goat weed	Leaf	Squeezing	24	10.0
	Scent leaf	Leaf	Squeezing	2	0.8
	Ulanjula	Leaf	Squeezing	5	2.1
	Neem	Leaf	Squeezing	1	0.4
	Paw-paw	Sap	Extraction of juice	6	2.5
	Guava	Leaf	Boiling	4	1.7
	Moringa	Root	Crushing	4	1.67
	Black Pepper	Leaf/seed	Grinding	1	0.4
	Utazi	Leaf	Squeezing	1	0.4
Mites	Neem	Leaf	Squeezing	56	23.3
	Siam weed	Leaf	Squeezing	1	0.4
	Moringa	Leaf	Squeezing	2	0.8
	Scent leaf	Leaf	Squeezing	3	1.3
	Goat weed	Leaf	Squeezing	1	0.4
	Utazi	Leaf	Squeezing	1	0.4

	Alligator pepper	Seed	Grinding	2	0.8
	Black pepper	Seed	Grinding	8	3.33
	Bitter kola	Seed	Grinding	1	0.4
	Bitter leaf	Seed	Grinding	13	5.4
	Awolowo	Leaf	Chewing	8	3.3
	Lemon grass	Leaf	Grinding and mixing with red oil	2	0.8
	Lime	Fruits	Use juice and apply	2	0.8
Goat/sheep pox	Uri	Fruit/Leaf	Squeezing	3	1.3
	Moringa	Leaf/Seed	Squeezing/grinding	9	3.8
	Neem	Leaf/Seed	Squeezing/grinding	9	3.8
	Scent leaf	Leaf	Squeezing	39	16.3
	Lime	Leaf	Squeezing	51	21.3
	Indigo tree	Leaf	Squeezing	3	1.3
	Lemon Leaf	Juice	Squeezing	4	1.7
	Alligator pepper	Seed	Grinding and rubbing	1	0.42
	Black pepper	Seed	Grinding and rubbing	1	0.4
	Goat weed	Leaf	Curing and feeding	1	0.4
	Bitter leaf	Leaf	Squeezing	5	2.1
	Bitter kola	Seed	Grinding	2	0.8
Conjunctivitis	Uri	Fruit/Leaf	Squeezing	3	1.3
	Sugar Cane	Leaf	Squeezing	33	13.8
	Goat weed	Leaf	Squeezing	6	2.5
	Siam weed	Leaf	Squeezing	1	0.4
	Moringa	Leaf	Squeezing	20	8.3
	Indigo tree	Leaf	Squeezing	2	0.8
	Lime	Leaf	Squeezing	5	2.1
	Scent leaf	Leaf	Squeezing	6	2.5
	Pawpaw	Leaf	Squeezing	6	2.5

Guava	Leaf	Squeezing	1	0.4
Ulanjila	Leaf	Squeezing	3	1.3
Utazi		Chewing	1	0.4
Lemon grass	Leaf	Chewing	1	0.4

Source: Field Survey, 2019

Result in Table 4.15 revealed that the farmers used an array of methods for preparing and administering the medicinal plants on the livestock. However, dominant ones were squeezing, drying, boiling and curing. The preference for these methods could be that they enhance the extraction of the active substances from plants thus promoting their efficacy. Eshetu *et al*. (2015) reported that squeezing, chewing and crushing were the major methods used in the preparation of medicinal plants in Southern Ethiopia. Squeezing enhances administration through nose, eyes or mouth. Luseba *et al*. (2011) demonstrated that dried medicinal plants harvested from the wild had better antibacterial activities than fresh and grown plant materials. The dominance of preparation of medicinal plants through squeezing could be explained by the fact that farmers mostly have recourse for traditional remedies during emergency, implying that the plants are collected fresh and thus do not see the need for storage. Chitura *et al*. (2018) argued that the method of preparation of medicinal plants depends on the active ingredient to be extracted and the mode of administration.

Furthermore, the result revealed that different plant parts were used for medicinal plant preparation and leaves were predominant. This could imply that the leaves have higher concentration of active ingredients and higher pharmaceutical value than other plant parts in the area. Also, other parts will require mixing with substances like water to extract the active ingredients which might reduce the potency. Eshetu *et al*. (2015) found that farmers in Ethiopia used leaves of medicinal plants mainly for remedying the diseases of their livestock. Luseba and Tshisikhawe (2013) contend that there is the

tendency that water-based medicinal plant preparation might not be effective *in vivo* due to lack of biological activities of these preparations in the laboratory. Gomez-Baggethum *et al*. (2012) confirmed that the transmission of this biocultural heritage is at the base of human adaptive strategies and can play a critical role in minimizing the disturbances on livelihood of local communities especially those living in highly unpredictable systems.

The study further revealed that some plant parts were combined with substances such as palm oil or with other plant parts before they could be used. Giday *et al*. (2010) reported the efficacy of combinations of medicinal plant parts with other substances. Also the result revealed that the diseases treated with the highest number of plant species were diarrhea (17), retained placenta (15), cough (14) and rashes (14). This implies a high demand for those plant species.

4.6 Situations or conditions when indigenous medicinal plants were used

Table 4.16 Distribution of ruminant farmers according to situations or conditions medicinal plants were used

Situations to Administer	Very Often	Often	Rarely	Mean $\bar{X}$	Remark
When there is need for prevention	56(23.3%)	119(49.6%)	65(27.1%)	1.96	Rarely
As part of feeding regime	105(43.7%)	95(39.5%)	40(16.7%)	2.27	Often
Each time a disease condition is observed	137(57.1%)	74(30.8%)	29(12.1%)	2.45	Often
As immunization against occurrence	49(20.4%)	114(47.5%)	77(32.1%)	1.88	Rarely
As an alternative to boost modern medication	68(25.0%)	96(40.0%)	76(35.0%)	1.97	Rarely
As complete alternative to modern medication	76(31.7%)	57(23.8%)	107(44.5%)	1.87	Rarely

$\bar{X} \geq 2.0$ imply "used often"

$\bar{X} \leq 2.0$ imply "used rarely"

Source: Field Survey, 2019

Table 4.16 shows that most farmers administered medicinal plants often (49.6%) when there was need for prevention; very often (43.7%) as part of feeding regime; very often (57.1%) each time a disease condition is observed, often (47.5%) as immunization against occurrence, often (40.0%) as an alternative to boost modern medication and rarely (44.5%) as a complete alternative to modern medication. It could be deduced from the result that the farmers used the medicinal plants under different conditions implying that they serve different purposes. However, the farmers used the medicinal plants often each time a disease condition is observed. Also, this finding implies high

demand for the plant species used for these purposes. Maroyi (2012) reported a high demand for plant species used very often in the treatment of livestock diseases.

4.7 Reasons for the use of medicinal plant species as perceived by the farmers

Table 4.17 Distribution of ruminant farmers according to perceived reasons for use of the medicinal plants

Perceived reasons	$\bar{X}$	Standard Deviation	Remark
Cheaper to administer	3.1*	0.9	Agree
Quicker treatment of ailment	2.8*	0.8	Agree
Has no side effect	2.8*	0.9	Agree
Earlier sign of recovery	3.1*	0.7	Agree
Animals take it easily	3.0*	0.8	Agree
Used to heal several health conditions	3.0*	0.7	Agree
More readily available and cheaper to procure	3.9*	0.7	Agree

$\bar{X} \geq 2.50$ imply "agree" $\bar{X}<2.50$ imply "disagree"
Source: Field Survey, 2019

Table 4.17 shows that the farmers used medicinal plants for several reasons. All the reasons itemized were agreed to by all of them. However, the major ones included that they are readily available and cheapness ($\bar{X}$ = 3.9, S.D = 0.7), cheaper to administer ($\bar{X}$ = 3.1, S.D = 0.9) and show earlier signs of recovery ($\bar{X}$ = 3.1, S.D = 0.7). The availability and relative cheapness of traditional medicine may encourage its use among small ruminant farmers. Similarly, the ease of administration could as well enhance their use. Many of the traditional remedies do not require specialized knowledge or skills for their preparation and administration and thus can be prepared and administered easily by farmers. Similarly, the cost of modern veterinary medicine may discourage small ruminant farmers from using them and consequently resort to traditional medicine. Most of the plant species are found growing in the wild or cultivated by the farmers near their environment and can easily be used by farmers due to the preponderance of

knowledge on their use. Besides, the increasing decline in the practice of modern veterinary medicine and their near absence in rural areas could encourage the use of traditional medicine. Ohemu *et al*. (2017) reported that many farmers prefer traditional medicine because they are cheaper, readily available and easier to administer. According to Chitura *et al*. (2018) farmers resort to indigenous medicinal practices because they have little or no access to modern veterinary medicine. Yuan *et al*. (2016) stated that traditional medicines are acceptable, convenient and accessible and these have made them very popular.

4.8 Constraints to the use of medicinal Plants

Table 4.18 Distribution of small ruminant farmers according to constraints to the use of indigenous medicinal plants

Constraints to use of medicinal plants	Frequency*	Percentage
Availability of the particular medicinal plant	144	60.0
Lack of information on the particular medicinal plant of interest	127	52.9
Lack of knowledge on how to prepare the medicinal plant	118	49.2
Lack of knowledge on how to administer the prepared medicine	103	42.9
Dosage of the medicine to administer	206	85.8
The frequency of use of the medicine	131	54.6
Extinction of the medicinal plant	143	59.6
Lack of adequate knowledge on the medicinal plant	145	60.4
Lack of extension contact with extension agents	84	35.0

* Multiple Response
Source: Field Survey, 2019

Table 4.18 shows that the majority (85.8%) of the farmers identified dosage of the medicine as the constraint to the use of medicinal plants. Others were lack of adequate knowledge about medicinal plants (60.4%), limited availability of the plant species (60.0%), extinction (59.6%) and lack of information on the medicinal plants (52.9%). The identification of extinction as among the challenges to utilization of indigenous medicinal plants by farmers confirms the declining diversity of medicinal plants in the study area. Issues surrounding dosage have remained a serious challenge to the use of herbal remedies in both humans and animals. Merlin *et al.* (2017) noted that dosage and storage have remained serious challenges to the development of traditional medicine.

4.9 Relationship between socioeconomic characteristics of small ruminant farmers and their perceived reasons for using medicinal plants for the treatment of small ruminant diseases

4.9.1 Multiple regression analysis on the significant relationship between the socio-economic characteristics of the farmers and their perceived reasons for the use of indigenous medicinal plants for small ruminant healthcare

Table 4.19 Multiple regression analysis result

VARIABLE	LINEAR	EXPONENTIAL	SEMI-LOG	COB-DOUGLAS
Constant	4.710 (3.283)*	1.796 (15.093)*	-5.553 (-1.719)***	0.854 (3.195)*
Sex(X_1)	-0.026 (-0.005)	0.001 (0.046)	-0.074 (-0.263)	-0.003 (-0.122)
Age(X_2)	0.665 (3.209)*	0.064 (3.698)*	1.829 (2.860)*	0.176 (3.322)*
Marital Status(X_3)	-1.162 (-2.0)**	-0.107 (-2.227)**	-1.078 (-1.821)**	-0.102 (-2.087)**
Education Level (X_4)	0.309 (2.577)*	0.028 (2.797)*	1.462 (3.346)*	0.128 (3.553)*
Household Size(X_5)	-0.052 (-1.024)	-0.004 (-0.856)	-0.626 (-1.271)	-0.046 (-1.121)
Herd Size(X_6)	0.026 (2.293)**	0.002 (2.132)**	1.040 (3.847)*	0.087 (3.878)*
Farm Experience (X_7)	-0.003 (-0.128)	-0.001 (-0.291)	0.077 (0.236)	0.003 (0.123)
Memb. Of Soc. Org(X_8)	0.241 (3.011)*	0.023 (3.479)*	0.943 (4.077)*	0.090 (4.684)*
Source of Info(X_9)	-0.374 (-2.826)*	-0.038 (-3.444)	-0.651 (-2.229)**	-0.068 (-2.822)*
Annual Income(X_{10})	-0.267 (-1.297)	-0.023 (-1.352)	-0.671 (-1.723)***	-0.062 (-1.915)***
Source of Fin. Aid(X_{11})	0.133 (1.897)***	0.013 (2.243)**	0.180 (0.896)	0.022 (1.329)
Freq of Ext. Cont(X_{12})	0.203 (1.486)	0.017 (1.465)	0.632 (1.901)***	0.052 (1.887)***
Major Occupation(X_{13})	0.530	0.043	0.531	0.043

	(1.804)***	(1.776)***	(1.827)***	(1.780)***
	(1.654)***	(1.723)***	(0.062)	(0.026)
R^2	33.7	37.9	35.1	39.6
F-Statistics	7.6	9.128	8.089	9.791
Standard Error	2.08258	0.17275	2.96038	0.17041
n	240	240	240	240

* significant at 1%, ** significant at 5% and *** significant at 10%

Source: field survey 2019

The result shows that the Cob-Douglas (Double Log) functional form was chosen as the lead equation because it had the highest F-value, highest number of significant variables and the highest R^2 value. The result revealed age (t = 3.20, $p_{\text{-value}} = 0.002$), marital status (t = - 2.09, $_{\text{p-value}} = 0.02$), educational level (t = 3.553, $p_{\text{-value}} = 0.04$), herd size (t = 3.9, $p_{\text{-value}} = 0.003$), source of information (t = -2.23, $p_{\text{-value}} = 0.05$), annual income (t = - 2.88, $p_{\text{-value}} = 0.05$), source of credit (t = -1.92, p-value = 0.02) and major occupation (t = 1.881, $p_{\text{-value}} = 0.04$). The positive relationship between age(X_2) and frequency of use of indigenous medicinal plant can be explained from the perspective of older farmers being custodians of knowledge on the method of preparation and application of medicinal plants (Mafimisebi and Oguntade, 2011). Also, the longer years of acquaintance with indigenous medicinal plants will enable older farmers to be sure of the effectiveness or otherwise of some of the indigenous medicinal plants and the conditions to be fulfilled in their preparation to enhance effectiveness. Education broadens one's intellectual and information horizons through extended contact with outside knowledge and information sources (Islam and Kashem, 1999). Educated farmers can make intelligent decisions. Farmers are therefore able to compare and select a combination of indigenous medicinal plants and modern veterinary practices that is more cost-effective. Herd size(X_6) increases brought about an increased utilization of indigenous medicinal plants probably because the higher the herd size, the higher the

expenditure on modern veterinary services and as rational beings the farmers resort to traditional medicine.

Variables that showed significant negative or inverse relationships with the reasons for use of indigenous medicinal plants were marital status, annual income(X_{10}) and source of information(X_9). For these variables, the higher their values, the lower the perceived reasons for use of indigenous medicinal plants. The negative relationship between farmer's annual income and perceived reasons for use of indigenous medicinal plants is explainable from the view point that a farmer's economic position will influence his access to modern veterinary services in rearing and managing livestock health. The higher the income, the higher is the access to veterinary drugs. Higher economic status may therefore reduce farmer's use of indigenous medicinal plants (Mafimisebi and Oguntade, 2010; 2011). Furthermore, increase in the source of information resulted in reduced use of indigenous medicinal plants probably because many sources of information led to increased expenditure which in turn reduced the use of indigenous medicinal plants.

Conclusively, the hypothesis which state that "there is no significant relationship between the socio-economic characteristics of the farmers and their perceived reasons for use of indigenous medicinal plants for small ruminant healthcare" is therefore rejected since age(X_2), educational level(X_4), herd size(X_6), membership of social organization(X_8), effectiveness of use of medicinal plant(X_{14}), frequency of extension contact(X_{12}), major occupation(X_{13}), marital status(X_3), annual income(X_{10}) and source of information(X_9) were significant.

4.9.2 Difference between male and female farmers' perceived reasons for use of indigenous medicinal plants

Table 4.20 Z-test on the significance difference between male and female farmers' reasons for use of indigenous medicinal plants

Male	*Female*	
Mean	12.4488189	12.36283186
Known Variance	5.646	6.733
Observations	127	113
Hypothesized Mean	0	
Z	0.26658225	
P(Z<=z) one-tail	0.394895412	
z Critical one-tail	1.644853627	
P(Z<=z) two-tail	0.789790823	
z Critical two-tail	1.959963985	

Source: Field Survey, 2019* Significant at 5% level

The result thus shows that there is no significant difference in their reasons for use of indigenous medicinal plants for small ruminant animal diseases between male and female farmers in Imo State, Nigeria. Therefore, the hypothesis which state that "there is no significant difference in the use of indigenous medicinal plants between the male and female farmers for treating small ruminant diseases" is here by accepted since there is no significant difference between male and female farmers' reasons for use of indigenous medicinal plants for small ruminant animal diseases in Imo State, Nigeria.

Reasons for the use of traditional medicine varies across farmers. It could be as a result of its relative ease of use. It could also be due to the relatively cheaper cost. Most of the plants can be found close to the farmers' surroundings and can thus be easily obtained when needed especially during emergency.

4.9.3 Analysis of variance in the perceived effectiveness of use of indigenous medicinal plants among farmers in the three agricultural zones of Imo State

Table 4.21 Analysis of variance in the perceived reasons for use of indigenous medicinal plants among farmers in the three agricultural zones

Groups	*Count*	*Sum*	*Average*	*Variance*
Owerri zone	90	1981	22.01111111	10.37066167
Orlu zone	91	1879	20.64835165	6.297191697
Okigwe zone	59	1210	20.50847458	7.012857978

ANOVA

Source of Variation	*SS*	*Df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	113.7680957	2	56.88404783	7.108699168	0.001004	3.03392
Within Groups	1896.481904	237	8.002033352			
Total	2010.25	239				

SUMMARY

Source: Field Survey 2019 * Significant at 5% level

The result of ANOVA on the significant difference in the perceived reasons for use of indigenous medicinal plants among farmers for treating small ruminant diseases in the three agricultural zones of Imo State, Nigeria in Table 4.21, shows a significant mean difference (**f**=7.109, **p**=0.001). This implies that the small ruminant farmers in the different agricultural zones of the state differed in their reasons for use of indigenous medicinal plants for small ruminant healthcare.

CHAPTER FIVE

SUMMARY, CONCLUSION, RECOMMENDATION AND CONTRIBUTIONS TO KNOWLEDGE

5.1 Summary

The study was carried out to analyze the use of indigenous medicinal plants by small holder ruminant farmers in livestock healthcare in Imo State, Nigeria. The specific objectives were to; describe the socio-economic characteristics of the small ruminant farmers; identify indigenous medicinal plant species available to the small ruminant farmers; ascertain the indigenous medicinal plants used for the treatment of small ruminant diseases; determine the prevalence of small ruminant diseases; ascertain methods of preparation/administration of the indigenous medicinal plants used in small ruminants' healthcare in the study area; determine the situations/conditions for use of the indigenous medicinal plants; identify reasons for the use of medicinal plants as perceived by the farmers and identify the constraints to the use of indigenous medicinal plants in small ruminants' healthcare in the study area.

The hypothesis tested were; there is no significant relationship between the socioeconomic characteristics of the farmers and their perceived reasons for use of indigenous medicinal plants for small ruminant healthcare, there is no significant difference between the male and female farmers in their perceived reasons for the use of indigenous medicinal plants for small ruminant healthcare and there are no significant differences in the perceived reasons for use of indigenous medicinal plants among farmers for small ruminant healthcare in the three Agricultural zones of Imo State.Multi-stage sampling technique was used to select the sample for the study. A total of 240 respondents were selected for the study. Two main data sources were used for the study, primary and secondary data. Structured questionnaire was administered to the 240 farmers. Data were analysed using mean score, standard deviation and

percentage. The hypotheses were tested using ordinary least square multiple regression model, Z- test and ANOVA.

The result of the study shows that mean age was 50.9 years and 52.9% of the respondents were males while 47.1% were females. Majority (86.3%) of the respondents were married. The mean household size was 8 persons. The mean years of the farming experience of the respondents was 15.7 years. Majority (57.5%) of the respondents took farming as their major occupation. The mean herd size owned by the farmers was 18 animals. Majority (68%) of the respondents belongs to church organizations, while 57.5% belong to ADP Contact Farmers. The result also showed that 42.9% of the respondents source credit from friends and relatives, 16.3%, from religious organizations, 12.9% from age grade and social clubs, 7.9% from farmer's cooperative, and 0.3%, from Banks while 24.2% of the respondents relied on self-financing. The mean annual income of the farmers was ₦87,325.

The study identified 20 indigenous plant species utilized in small ruminant animal healthcare in Imo State, Nigeria. Seventeen (17) ailments were identified by the small ruminant farmers in the study area. Out of the 17, the top eight (8) were rashes (72.9%), cough (69.2%), retained placenta (68.8%), wounds (65.8%), diarrhoea (65.4%), flies and pneumonia (58.8%), helminthosis (55.8%) and Mites (55.4%). It was also found that of all the methods of preparation of the various medicinal plants for treating each of the ailments, squeezing method was the most prevalent method adopted in the study area. Also, "each time a disease condition is observed"

(with mean of 2.45 and standard deviation of 0.70) was the most frequent situation or condition to administer medicinal plant. This was followed by "as part of feeding regime". Also, "readily available and cheap" with a mean of 3.28 and standard deviation of 0.74 was the most perceived reason for the use of indigenous medicinal plant. This

was followed by “cheap to administer”, “early sign of recovery”, “Animals take it easily”, “used to heal several health conditions” and least by “quick treatment of ailment” and “Has no side effect”.

The majority (85.8%) of the respondents identified problem of dosage of the medicine as their greatest constraints to the use of medicinal plants in the study area. This was followed by lack of adequate knowledge on the medicinal plant, availability of the particular medicinal plant, extinction of the medicinal plant, the frequency of use of the medicine, lack of information on the particular medicinal plant of interest, lack of knowledge on how to prepare the medicinal plant, lack of knowledge on how to administer the prepared medicine and least by lack of extension contact with extension agents.

The result of the hypothesis which state that “there is no significant relationship between the socio-economic characteristics of the farmers and their perceived reasons for use of indigenous medicinal plants for small ruminant healthcare” is therefore rejected since age(X_2), educational level(X_4), herd size(X_6), membership of social organization (X_8), effectiveness of use of medicinal plant(X_{14}), frequency of extension contact (X_{12}), major occupation(X_{13}), marital status(X_3), annual income(X_{10}) and source of information(X_9) were significant.

The hypothesis which state that “there is no significant difference in perceived reasons for the use of indigenous medicinal plants between the male and female farmers for treating small ruminant diseases” was accepted since there is no significant difference between male and female in their perceptions of indigenous medicinal plants for small ruminant animal diseases in Imo State, Nigeria.

The result of ANOVA on the significant difference in the perceived effectiveness of use of indigenous medicinal plants among farmers for treating small ruminant diseases in the three agricultural zones of Imo State shows a significant mean difference (**f**=7.109, **p**=0.001). This implies that the small ruminant farmers in the different agricultural zones of the state differed in their reasons for use of indigenous medicinal plants for small ruminant healthcare.

5.2 Conclusion

The study revealed an existence of vast knowledge and wide use of indigenous medicinal plants in the treatment of livestock diseases in the study area. Several plant species were used and different methods were used in their preparation and administration. It was also found that most plant species were used in the treatment of more than one disease. The major issue of dosage and lack of adequate knowledge of the medicinal plant must be further researched in order to optimize the use of indigenous medicinal plant.

However, for the full realization of the potentials of the use of indigenous plant species in the treatment of animal diseases, the constraints to their use must be addressed.

5.3 Recommendations

The following recommendations are made from the findings of the study:

- The use of indigenous medicinal plants should be scaled-up by extension organizations by organizing routine capacity building programmes by extension agents. This will enhance extension agents' capability to disseminate information related to the use of indigenous medicinal plants.

- ✞ Indigenous veterinary medicine should be integrated with orthodox veterinary medicine by researchers as a way of promoting synergy between indigenous and western knowledge.
- ✞ Efforts should be made to promote the conservation of identified medicinal plant species by researchers. This can be achieved through the establishment of botanical gardens. Laws protecting forests and other areas these resources can be found should be made.
- ✞ Ethnoveterinary research institutes should be established by the government and other relevant agencies to advance research and development of indigenous medicinal plant species.
- ✞ Indigenous medicinal plant species found effective in some areas can be introduced in other areas by extension organizations as a way of scaling up their use.

5.4 Contributions to knowledge

- ✞ 20 medicinal plants were identified to be available and in use by small holder ruminant farmers in the study area.
- ✞ 17 ailments were found to be prevalent in the area that were tackled with the medicinal plants.
- ✞ Squeezing of leaves was the most reoccurring method of preparing the medicinal plants.
- ✞ The work is calling to mind the apparent usefulness of medicinal plants which is gradually going extinct.
- ✞ There is the need to sustain our indigenous knowledge system
- ✞ The findings of the study will open an opportunity for synergy between orthodox and traditional veterinary medicine.

- Livestock contributing to the economy of the country and hence, the need for further research

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