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Original Article

Profiling Village Chickens Predators, Parasites and Medicinal Plants Used to Control the Parasites

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ABSTRACT

Rural communities rely heavily on chickens to meet their socio-economic needs. However, predators, diseases, and parasites deprive them of nutrients required for sustained growth and development. A cross-sectional survey and key informant interviews were conducted in selected villages of Limpopo Province, South Africa to find out the parasites and predators prevalent in indigenous chickens. Medicinal plants commonly used to control parasites as well as the household heads' views on the preservation of indigenous chickens for sustained rural food security were investigated. Qualitative data gathered through interviews was analysed thematically using Atlas Ti version 8.1.4 while the IBM Statistical Package for the Social Sciences version 25.0 was used to compute descriptive statistics and carry out cross-tabulations of quantitative data. Approximately, 72 % of the respondents reported that predation affected chicks with hens at (67 %) and cocks (63 %) following in that respective order. Snakes such as the king cobra (*phakhu phakhu*), birds such as the martial eagle (*Goni*), and wild animals, especially the genet cat (*tsimba*) were the predominant predators. Among the commonest parasites, fleas [*Dermanyssus gallinae* (*thatha*)] and mites [*Siphonaptera* (*magomani*)] were predominant. Sorghum (*Sorghum bicolour*) and aloe (*Aloe vera*) were the most common medicinal plants that were used to control the parasites. It is, therefore, recommended that farmers and extension officers alike, consider the profile of major predators, parasites, medical plants, and preservation of indigenous knowledge for the sustainability of indigenous chickens and enhanced rural food security.

INTRODUCTION

Indigenous chickens play key roles in rural economies and ways of life of people in both developing and underdeveloped countries (Padhi, 2016). They are sources of food for survival and nutrients required for growth and development (Tarig *et al.*, 2014; Poliakov & Olcott, 2016). The importance of chickens as sources of high-quality animal protein and income is more evident among residents of marginalised communities (Ayieko *et al.*, 2015; Bekele *et al.*, 2016). The preceding evidence highlights the significance of Indigenous chickens in ensuring that food nutrition and security are not compromised, thus contributing to improved livelihoods.

The importance of Indigenous chickens should also be viewed from the perspectives of health benefits and the tastiness of their meat and eggs. In general, most consumers regard the eggs and meat of Indigenous chickens as tastier and preferable compared to that of commercial layer and broiler breeds (CTA, 2007). Throughout the world, medical bills are escalating. This is mainly attributed to consuming genetically modified foods, including chicken produce.

Thus, it is important to promote the production of Indigenous chickens to present healthier alternatives to the food on the market. Also, it is critical to do this particularly in the face of the increasing advocacy for organic agriculture and/or green economy.

As is the case with other animals, Indigenous chickens are subjected to predators, diseases, and parasites attack (Flanders & Gillespie, 2015). They represent a major challenge to rearing Indigenous chickens, mainly through significantly reducing the capacity of farmers to make a meaningful contribution to increase production and economic benefits. Parasites deprive Indigenous chickens of nutrients and intake in sufficient quantities required for sustained growth (Mandal, 2015). Apart from the preceding challenges, parasites cause bleeding, diseases, and ultimately, the death of affected and infected birds.

Predation is another challenge in indigenous chicken rearing. Reptiles, cats, and birds are some of the predators that prey on the carcasses of indigenous chickens for food and survival. Famers often worry and find it difficult to protect their chickens from both predators and parasites. It is quite common for predators to attack birds at night, which necessitates the establishment of safety and security systems that contain loss due to predation. For this to be effective, it is important to identify the range of predators first.

For several centuries, before modern civilization, grassroots communities across the world have been using what is now called "traditional systems" to treat and control parasites and predators that often attack cattle, pigs, small ruminants such as goats and sheep, and Indigenous chickens (Mathius-Mundy & McCorkle, 1989; Reyes-García *et al.*, 2013). Medicinal plant-based treatment and control methods are the most commonly used to contain parasites and predators. As Douglas & Alie (2014) reveal, the medicinal plants are fed to animals or put in the water that the animals drink to control both the parasites and diseases. Some plants that are used to repel predators from where the chickens are kept (Karim *et al.*, 2013). For example, the plant in question can be grown around the chicken house or crushed, and juices of particular plant parts smeared onto the chicken housing to repel predators getting near where the chickens are kept. Since the discovery of the medicinal plants and predator repellents, this knowledge has been passed on from one generation to another (Amirmohammadi *et al.*, 2014). However, in the contemporary world, there is the increased use of conventional methods and marginalisation of environmentally friendly and affordable indigenous practices.

Rural communities still rely on the traditional and indigenous methods to treat and control parasites in Indigenous chickens (Amirmohammadi *et al.*, 2014). The use of medicinal plants is preferred over conventional methods mainly due to the high costs associated with modern veterinary practices. Also, most rural households are resource-limited, and modern veterinary medicines are not friendly to use (Mwale *et al.,* 2009; Kumarasingha *et al.*, 2014). Recent studies have also established that conventional methods are harmful to the environment and have many side effects concerning the growth and development of chickens (Yadav *et al.*, 2016). Yadav *et al.* (2016) reveal that some side effects of conventional methods can be detrimental to consumers. For instance, they may cause cancer or food poisoning if their dosages are not properly administered.

Currently, there are increased calls for absorbing and protecting indigenous knowledge systems (IKS) because they present unprecedented benefits to both the growth of Indigenous chickens and consumers (Sharma & Kaushik, 2015). According to Moreki *et al.* (2016), modernisation of rural areas and the accompanying increase in the use of conventional methods pushes the beneficial and less harmful traditional medicinal plants towards extinction. Thus, the use of ethnoveterinary medicine (EVM) such as indigenous medicinal plants in particular and its embedded knowledge is disappearing. The advent of modern technology and limited knowledge transmission from one generation to the next is often cited as the major cause of this worsening problem (Khan *et al.,* 2015). Thus, preservation and profiling of indigenous knowledge are crucial. It is not surprising that there are increasing calls to profile the medicinal plants used to treat, and control parasites and diseases that afflict Indigenous chickens.

Some studies have been conducted in the past aiming to profile medicinal plants used to treat, and control parasites and diseases in Indigenous chickens (Gabanakgosi *et al.*, 2012; Moreki, 2013; Nghonjuyi *et al.*, 2015). However, in the Vhembe District of Limpopo Province, in particular, there is inadequate documented evidence about predators and medicinal plants to control parasites in Indigenous chickens. Therefore, the objective of the current study was to identify and profile the predators and, internal and external parasites that hindered the survival and productivity of Indigenous chickens. Moreover, medicinal plants used to control and treat Indigenous chicken internal and external parasites were also profiled.

METHODOLOGY

Study Area

This study was conducted in Tshamutshedzi, Tshidzini, Tshikambe, and Thivhilwi villages of Thulamela Local Municipality. Thulamela Local Municipality is in the Vhembe District of Limpopo Province of South Africa. The province is in the northern part of South Africa, sharing borders with Botswana, Mozambique and Zimbabwe. Approximately, 79 % of the population in Limpopo Province lives below the national poverty line (StatsSA, 2015). It is estimated that in 2011, 74 % of the population resided in rural areas under traditional leadership, compared to a national average of 27 % (StatsSA, 2015).

Most people residing in rural areas depend on traditional or indigenous knowledge systems to treat and control Indigenous chicken parasites, diseases, and predators. This is why the study area was chosen. Rural dwellers who rear Indigenous chickens have considerable knowledge of EVM acquired over centuries and passed from one generation to the other. Apart from this consideration, agricultural extension personnel recommended that the study be conducted in the villages listed above, arguing that they were home to dense populations of Indigenous chickens that were raised traditionally.

Study Design

A mixed qualitative and quantitative approach was adopted in the current study. Key informant interviews and a cross-sectional survey were conducted. This was done to identify the parasites and predators prevalent in chickens reared in the selected villages. Also, the plants commonly used to control the parasites and predators were identified. The study was descriptive and explorative, mainly profiling the predators, parasites, and plants used to treat and control Indigenous chickens. Following a survey, the approach made it possible to engage indigenous knowledge holders and Indigenous chicken farmers in the course of exploratory studies that sought to build an understanding of the issues highlighted above as the study focus.

Sample size valuation and selection

Households rearing indigenous chickens were selected purposively. Only indigenous chicken farmers who were willing to participate were included in the cross-sectional survey. One hundred households participated in the study. An equal number (25) of households was selected randomly from each one of the four villages (n =100). Apart from this, 30 key informants were selected for qualitative research. Possession of indigenous knowledge and indigenous chicken productivity was used to identify the key informants. Extension officers and community leaders were instrumental in this exercise.

Data collection methods, tools, and techniques

A semi-structured interview guide was used to collect data from key informants. Quantitative data were collected from the Indigenous chicken farmers using a questionnaire. Before data collection, postgraduate students pursuing various degree programmes at the University of Venda were recruited to serve as research assistants. They were oriented on the focus of the study and associated objectives before they received training on how to administer data collection tools. The research assistants pilot tested the candidate tools before the actual collection of data to check the usability and applicability of the data collection tools. This was done to enhance the validity and reliability of the tools for gathering authentic data. Taking into consideration the errors noted during the pilot testing and general experiences, the tools were revised. Face-to-face interviews were then conducted with key informants who included two extension personnel, one traditional leader, one community leader, and twenty-six indigenous knowledge holders. Questionnaires were administered face to face to all the 100 selected households. The questionnaires were administered to rural households via reading the questions, recording answers, and explaining to the respondents in the local language, viz. Tshivenda.

Demographic data, prevalent external parasites, and predators of Indigenous chickens as well as methods used to treat and control chicken parasites and predators were gathered. Moreover, data on techniques of preparing medicinal plants before the use in the control of parasites and predators were collected. Indigenous medicinal plants were ranked based on the frequency or number of times the household mentioned each one of them. Data collected through the interviews were triangulated with what was obtained during key informant interviews. This helped to enhance the trustworthiness and reliability of the findings of the study. Further, the triangulation of the results was realised through presenting the findings in a conference comprising Limpopo Province Department of Agriculture Executive Managers, extension officers, and advisors.

During interviewing, data on common Indigenous chicken parasites were deduced based on the clinical signs that the respondents presented. Data on medicinal plants were collected by asking the respondents to provide the names of the plants commonly used in managing Indigenous chicken parasites, concoction, quantities used, and methods of administration. Thus, the names of the plants were translated from Tshivenda to English. Local and scientific nomenclature was used thereafter.

Data analysis

Quantitative data describing common breeds; threat and predators as well as internal and external parasites infesting indigenous chickens were collected and analysed descriptively. Further to that, methods and medicinal plants used to treat and control internal and external parasites in indigenous chickens were descriptively analysed. IBM-Statistical Package for the Social Sciences (SPSS) version 26.0 was utilised for the analysis and used to compute descriptive statistics and cross-tabulations. On the other hand, explorative data on the preservation and sustainability of indigenous chickens was thematically analysed with the aid of Atlas. Ti version 8.1.4 software.

RESULTS AND DISCUSSION

Breeds of local Indigenous chickens

Villagers kept a broad range of breeds of chickens, which were identified using local and English names (Table 1). The breeds were named considering their behaviour, plumage, or appearance. For instance, *Ntswu* is translated as black and the breed that the villagers identified as *Ntswu* was also black. Thus, it was named after its colour. To identify the English common names for the identified breeds, agricultural extension officers were consulted (Table 1). Among the breeds, the White Plymouth Rock [*Venda*] was the most common with 141 chickens of this type and 90% of households kept this breed. Breeds such as Necked neck [*Dengula*; Asil [*Lutiri*]; Araucan Chicken [*Tshiphunya*] and Potchefstroom koekoe [*Khanga*] were kept by at least three-fifths (62%) of the households. Potchefstroom koekoe [*Khanga*] breed was least (117) represented in the four villages and among the participating households.

Although there was no proven or scientific classification of these breeds, the local communities identified and categorized Indigenous chickens according to their behaviour and plumage. This is a common indigenous knowledge-based practice among rural dwellers across South Africa and the continent at large (Dorji *et al.*, 2011). A study conducted in Botswana also revealed that the indigenous farmers gave the name of the breeds in the villages taking into account plumage and appearance (Moreki *et al.*, 2016). The naming of the village or traditional chickens based on their appearance is also common beyond Africa. For example, in Bangladesh, the English name given to the chicken without feathers on the neck was "Necked neck" (Hossain *et al.*, 2012). Thus, it can be concluded that it is common to name Indigenous chicken breeds using their appearance and sometimes, plumage as a basis.

Table 1 – Common breeds in selected villages of Thulamela Local Municipality in South Africa

Local name	English name	Total Number of Chickens	Number of Mentions per Household (N =100)
Dengula	Necked neck	121	62
Lutiri	Asil breed	122	62
Dzhapani	Frizzle	121	64
Venda	White Plymouth Rock	141	90
Tshiphunya	Araucan Chicken breed	124	62
Tswuku	Hemisphere breed	123	64
Tshena	Leghorn	119	63
Ntswu	Australap breed	120	63
Khanga	Potchefstroom koekoe	117	62

Threats to Indigenous chickens in rural villages

Internal and external parasites, predators, and theft were the most common challenges that affected indigenous chicken rearing to varying extents (Table 2). Respondents were asked to state based on their lived experiences, to indicate if chicken rearing was affected by predators, internal and external parasites or theft. About 3 % of the households complained of theft of their chicks compared to equal proportions (6 %) for hens and cocks. Almost 72 % of the households cited predators as a major concern concerning chicks as opposed to 67 % and 63 % for hens and cocks, respectively. Furthermore, parasites were regarded as another source of the greatest distress to the rearing of indigenous chickens. Results further indicate that although chicks (62%), and hen (62%) were perceived to be the most affected, cocks (60%) were also marginal and similarly haunted by the same parasites. Theft of the chickens seldom occurred with a chick being the less likely to be stolen. Hens and cocks had a higher and equal chance to be subjected to theft. This might indicate that the stealing of chicken is more

inclined to theft for consumption or resale as opposed to rearing.

These results fall in line with patterns observed throughout the world where parasites and predators are reported to be the major threat to raising chickens in rural areas. Desta and Wakeyo (2013) studied Indigenous chicken management practices in the Wolaita zone in Ethiopia and observed that predation was one of the major challenges to chicken rearing. A study conducted in the Eastern Cape Province of South Africa revealed that parasites and predators threatened the production of Indigenous chickens (Nyoni & Masika, 2012). In the latter study, parasites and predators were also said to negatively affect the hatching of eggs of Indigenous chickens. Therefore, the results of the current study confirm that this is a common challenge to Indigenous chicken farming, particularly in Africa.

Table 2 – Proportions (%) of Indigenous chicken categories affected by internal and external parasites, predators, and theft.

Class of chickens	Proportion (%) infested by parasites		Proportion (%) affected by Predators		Proportion (%) Stolen	
	Yes	No	Yes	No	Yes	No
Chicks	62	38	72	28	3	97
Hens	62	38	67	33	6	94
Cocks	60	40	63	37	6	94

Predators of Indigenous chickens

As shown in Table 3, the commonest predators were the martial eagle [(*Lophaetus pomarina* (*Goni*)], Ruddy mongoose [*Herpestes smithii (Lukhohe*)], African rock python [*Python sebae* (*Tharu*)], King cobra [*Ophiophagus hannah* (*Phakhu phaku*)], Genet Cat [*Genetta tigrina* (*tsimba)*], White-tailed Mongoose *[Ichneumia albicauda (Mutsherere*)] and Bush Baby *Otolemur crassicaudatus (Dzelehane)*]. Furthermore, these predators were common and widely spread among the 72% of the households that complained of predation to their chickens. Similarly, Zewdu *et al.* (2013) state that predation is a major problem facing the rearing of Indigenous chickens in the Metekel zone of Northwest Ethiopia. Desta and Wakeyo (2013)'s results concur with the observations made in the current study in which a range of snakes was found to be posing a threat to chickens in the villages.

Table 3 – Common predators of Indigenous chickens in some villages of Thulamela Local Municipality.

Local name:	Common name	Scientific name
Goni	Martial Eagle	*Lophaetus pomarina*
Lurwanzhivha	Martial Eagle	*Polemaetus bellicosus*
Lukhohe	Ruddy mongoose	*Herpestes smithii*
Tharu	African rock python	*Python sebae*
Phakhu phaku	King cobra	*Ophiophagus Hannah*
Tsimba	Genet Cat	*Genetta tigrine*
Mutsherere	White-tailed Mongoose	*Ichneumia albicauda*
Dzelehane	Bush Baby	*Otolemur crassicaudatus*

Parasites infesting Indigenous chickens

Internal and external parasites were identified. Specifically, Tapeworm [*Choanotaenia infundibulum/ Raillietina cesticillus*] (Manowana), Fleas [*Dermanyssus gallinae* (thatha)], and mites [*Siphonaptera/ Echidnophaga gallinacea* (magomani)] were the parasites commonly found among the indigenous chickens in the area (Table 4). The majority (62%) of the households reported these parasites as a major threat to chicken rearing and surprisingly, it occurred at random at any season. Similar results were made in a study conducted in the North-East District of Botswana (Moreki *et al.*, 2016). A study that Malatji *et al.* (2016) carried out in Limpopo and Kwazulu-Natal Provinces confirmed the assertion that tapeworms or *manowani* (local name) threatened the wellbeing of Indigenous chickens. Farmers in Kenya also revealed that parasites constrained Indigenous chicken production (Ogada *et al.,* 2016). The areas where the parasites were cited as a challenge have almost similar agro-ecological conditions and thus are likely to support their growth. It is worth highlighting that Indigenous chickens are prone to both internal and external parasites attacks, presumably due to their scavenging feeding behaviour. Indigenous chicken farmers rarely feed their birds, which forces the birds to scavenge for food (Dube *et al.*, 2010; Malatji *et al.*, 2016).

Methods used to treat and control parasites

Indigenous chicken farmers conceded that they used indigenous methods to treat and control both internal and external parasites. Even though this was the case, most farmers used conventional methods (28 %) and medicinal plants (25 %) (Figure 1). About 16 % of the households used other indigenous methods, while 23 % said they used a cocktail of methods. A small proportion of households (7 %) did not apply anti-helminthic treatment to their Indigenous chickens. Most studies conducted in rural communities

Table 4 – Parasites commonly found in Indigenous chickens in Thulamela Local Municipality.

Local Name	Common Name	Type of Parasites	Scientific Name
Thatha	Flea	External	*Siphonaptera/ Echidnophaga gallinacea*
Vhulivhe	Louse	External	*Phthiraptera/Lipeurus caponis*
Vhulivhe	Mite	External	*Dermanyssus gallinae/Knemidocoptes mutants*
Manowana	Tapeworm	Internal	*Choanotaenia infundibulum/Raillietina cesticillus*

in sub-Saharan Africa reveal similarities in the usage of indigenous methods and medicinal plants to treat and control parasites in Indigenous chickens (Mathius-Mundy & McCorkle, 1989; Gabanakgosi *et al.,* 2012; Moreki 2013; Zewdu *et al.,* 2013).

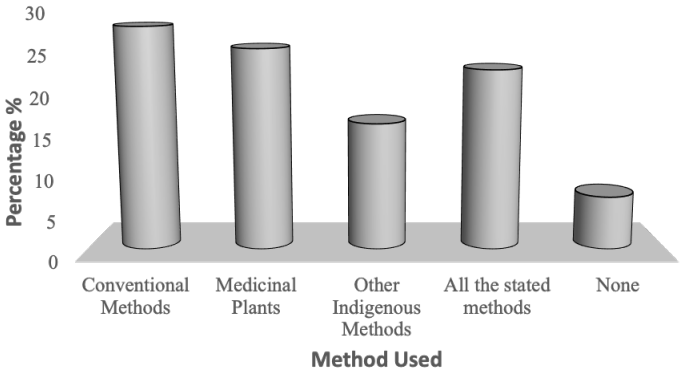

Figure 1 – Treatment and control methods used by Indigenous chicken farmers in Thulamela Local Municipality.

Indigenous medicinal plants used to treat and control internal and external parasites

The Indigenous chicken farmers used indigenous methods, mainly plants, to control internal and external parasites. Sorghum (*Sorghum bicolour*), ashes, and the common aloe (*Aloe vera*) were commonly used to control external parasites *Thatha* or Flea (*Siphonaptera spp)* and *Magomani* or Mite *(Dermanyssus gallinae*). Sorghum leaves were crushed and fed to chickens directly. Concerning the aloe, the juice extracted from the leaf was mixed with water and given to the chickens to drink. The ash obtained after burning stems, leaves, and bark of *Miora aaxale* was applied directly to the affected area of the chicken.

The findings reported above confirm those of Moreki *et al.* (2010) observed during a study of rural dwellers in 10 districts of Botswana. In that study, firewood ash was applied to control parasites, specifically mites (*Dermanyssus gallinae)*. The firewood ash used in the study was obtained from the households' fireplaces in homes. Household ash normally comes from the burning of tree barks, stems, and occasionally, leaves and twigs. Local indigenous trees and other plants are often used. Ash usage for the treatment of both internal and external parasites and diseases is a common practice in rural areas in many parts of the world (Kumar *et al.*, 2013).

Sorghum (*Sorghum bicolour*) and Aloe (*Aloe vera*) were used to control both internal and external parasites in Indigenous chickens within the four villages where the study was carried out. Moreki *et al.* (2010) also reported the use of the Aloe to control internal parasites in Indigenous chickens reared in Tswana speaking communities of rural districts of Botswana. When chickens started to exhibit signs and symptoms of sickness, which the community suspected was due to internal parasites [*Manowana* Tapeworm (*Choanotaenia infundibulum/Raillietina cesticillus*)] sorghum and Aloe were administered to the whole flock aiming to counter the spread of infection. The same practice was observed in the current study. Key informants interviewed in the study highlighted the need to document this information to enhance its sustainability and application in the promotion of improved productivity of Indigenous chickens (Figure 2). By so doing and the fact that it is safe, affordable, and environmentally friendly, the indigenous knowledge would be preserved for future generations (Dove, 2006; Mapira & Mazambara, 2013).

Preservation of Indigenous Knowledge Systems

Key informants were asked to express their views on the preservation of IKS in their villages. Two major themes emerged from the key informant's interviews and these are sustainability and sharing of IKS (Figure 2). Ensuring the transfer of information on the treatment of Indigenous chickens was viewed as key to the sustainability of IKS.

Mentoring, documentation, continuous use, community information-sharing platforms, and the growing of these medicinal plants were suggested as important for knowledge preservation. Indicating the current status quo in the villages, some participants were quoted below,

"We ask others to observe as we prepare … my children are the ones who do it while I give instructions"

"We teach them (children), but we need to document this knowledge in books, libraries and upload this information online"

"I am not doing anything to spread this information"

The currently limited information sharing is a threat to indigenous sustainability (Figure 2). Some participants indicated that there are no information-sharing platforms and nothing is being done to improve this situation. Although information sharing is done at a family level, not all chicken farmers share the information with their family members. Farmers also stated that sharing this information with youth and children is viable as the traditional way of passing knowledge from one generation to the next. On how this information could be preserved, one participant alluded it could be done through, "*sharing information with the young one for next-generation*". Sylvia, Mehta, and Maretzki (2014) affirmed the participants' views that online information sharing through social media is important for disseminating and preservation of indigenous knowledge. In a similar view, Shinwari (2011) and Owusu-Ansah (2013) agreed with the views of the community on the documentation and establishment of information sharing platforms to ensure sustainability of IKS.

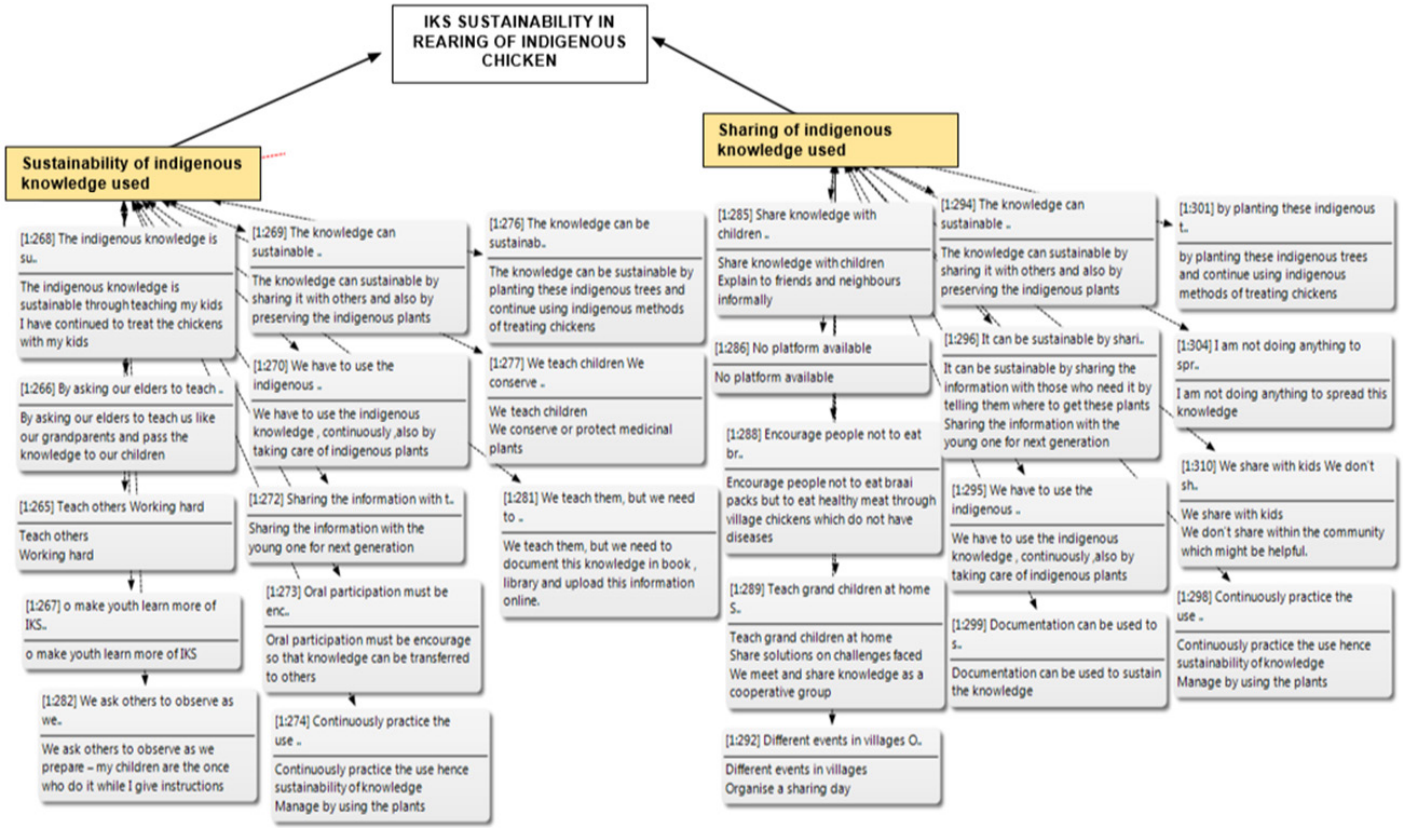

Figure 2 – Importance and ways of influencing the sustainability of indigenous knowledge systems for improved Indigenous chicken productivity.

CONCLUSION

The current study aimed to profile the predators and parasites commonly found afflicting Indigenous chickens. Medicinal plants used to control the parasites were also profiled. Three major predators and two most important parasites found in Indigenous chickens were identified. Similar findings have been reported in other parts of the world with almost the same agro-ecological conditions. Both traditional and conventional methods were used to control the parasites. The common aloe and ash drawn from the traditional fire were most commonly used. Understanding the types of predators, parasites, and medicinal plants used to control parasites is central to informed decision making when developing long-lasting interventions. Furthermore, documenting the indigenous practices helps preserve and store the information to pass it on better to future generations.

RECOMMENDATIONS

Appreciable knowledge of the indigenous practices of treating and controlling parasites in indigenous chickens was generated. There is a need to track changes in parasite loads and changes in productivity indices of the indigenous chickens. Furthermore, scientific testing of the mechanism of action of the

active ingredients in the aloe and ash, including dosages required for effective treatment is recommended. Also, future studies should consider recording the frequency of mention per household for each parasite and predator to provide a clearer picture of the amount, their trend and distribution in the study area.

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