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THE UTILIZATION OF MEDICINAL PLANTS BY THE MASAAI COMMUNITY IN ARID LANDS OF KAJIADO COUNTY, KENYA

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ABSTRACT: Arid and semiarid lands (ASALs) in Kenya endowed with many valuable plants used in primary healthcare in the treatment of human diseases. Medicinal plants used by local communities of ASALs in Kenya have not been well documented, despite their widespread use. The threat of complete disappearance of the knowledge on herbal medicine from factors such as deforestation, lack of proper regulation, overexploitation, land use tenure and socio-cultural issues warrants an urgent need to document the information. The purpose of the study was to document information on medicinal plants used by local Masaai community of Kajiado County in Southern Province of Kenya towards the utilization of indigenous ethnobotanical knowledge for the advancement of biomedical research and development. The aim of the study was to identify plants used as a medicine locally, document the generational traditional knowledge in using of treatment of various health problems, calculating the medicinal value (MV) and use value (UV) of the plant species by the local Masaai community and looking at the trend of these medicinal plants in the area. Structured questionnaires were prepared and administered to respondents in households located in different villages at the three study sites. A total of 96 key informants were interviewed randomly of whom 30, 34 and 32 were from Kenya Marble Quarry (KMQ), Mile 46 and Oltepesi respectively. Field experiment was also carried out through set up of a quadrat measuring 10 ×10 m within a distance of 100 m between plots in the transect erected at each sites. A total of 21 plots were set up at Mile 46 and 20 plots at each site of Kenya Marble Quarry and Oltepesi to examine the trend of the medicinal plants in the field condition. Both quantitative and qualitative statistical analysis was performed. A total of 40 useful plant species are used by the local community for medicinal purpose. The results showed that in Kenya Marble Quarry (KMQ), *Acacia tortilis, A. mellifera, Balanites aegyptiaca* and *Commiphora africana* had the highest total use value, whereas in Mile 46 site, *A. tortilis, A. mellifera, Balanites aegyptiaca, A. nubica* and *Commiphora schimperi* and in Oltepesi site, A. tortilis, A. mellifera, Salvadora persica and Balanites aegyptiaca had the highest total use value. In regard to medicinal value of the surveyed species, *A. mellifera, A. tortilis, Commiphora africana* and *Commiphora schimperi* were the top most species used by the local people for medicinal purpose in KMQ site while *A. tortilis, A. nubica, Commiphora schimperi, A. mellifera* and *Balanites aegyptiaca* were used by the community in Mile 46 for the treatment of different diseases. *A. mellifera, A. tortilis* and *Salvadora persica* were highly used as medicine for the treatment in Oltepesi site. It is concluded that Masaai community in central Kajiado heavily relies on medicinal plants for primary health care and these plants are also used for other different purposes. The research sites were dominated by few medicinal plant species which would imply overutilization of the other species.

Key words: Ethnobotany; Medicinal plants; Medicinal Value (MV); Use Value (UV)

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INTRODUCTION

Throughout history, plants have been the most important source of medicines for human health. The use of plants and plant derivatives for preventing and treating human diseases and afflictions is as old as civilization [1]. History shows that every culture on Earth has benefited from the medicinal virtue of plants. Indeed, plants are still the backbone of most medicinal and health care systems in place around the world. Medicinal plants play an important role in the daily lives, and the cultural heritage of many East African local communities [2]. The use of plants in the treatment of various diseases, as a specific antidote against magic, and for religious ceremonies, has been an integral element of African society for centuries [2]. This traditional medical system is characterized by variation in socio-cultural background, ecological diversity of the country as well as ethnic group and this knowledge of traditional medicine is usually passed from generation to generation through word of mouth [3]. As much as 95% of African drug needs comes from medicinal plants, and as many as 5,000 "high valued" medicinal plant species in Africa are used medicinally [1,4] across the African continent. Medicinal plants are reservoir of curative elements used by a large population of African local communities in the cure and treatment of various diseases such as malaria, diabetes, respiratory infections, skin diseases, diarrhea, hypertension and mental disorders and many others [5].

In Kenya, traditional medicine from medicinal plants still continued to play a major role in primary health care of many local communities. More than 70% of the Kenyan population relies on traditional medicine as its primary source of health care, while more than 90% use medicinal plants at one time or another [6]. For many local communities in Kenya, traditional medicine is less expensive, locally available, and culturally accepted than modern conventional medicine [1]. More than 1200 plants are described as medicinal plants from a flora of approximately 10,000 members in East Africa [7]. The wide spread use and acceptability of the traditional medicinal value of plants in both urban and rural society in Kenya could be attributed to culture, efficacy against some diseases, accessibility and affordability as compared to modern medicine [1]. Pastoralist Masaai people live in Kenyan Arid and Semiarid lands (ASALs) of Southern Province. In Kenya ASALs account for 88% of the land's surface area and home to over 10 million people from different ethnic groups [8].

Maasai being Pastoralist and living in the harsh climatic conditions, they rely on plants for the treatment of both human and livestock diseases, harvested from the wild. As elsewhere in East Africa, indigenous Masaai in Kenya, by large employed plant based traditional medicine to get cured from diseases arising from worms, fungi, bacteria, viruses and protozoa [1] also reported by [9] for Ethiopia. Medicinal plants of ASALs areas facing intense degradation due to pressure arising from overharvesting from the wild to utilize as primary healthcare and to generate income. Already, the disappearance and depletion of medicinal plants from the wild ASALs lands and from the forests in Kenya is impacting severely on the livelihoods of traditional healers and herbalists, curtailing their ability, not only to administer to the health needs of their own local communities including Masaai people, but also to trade among themselves, as has long been their custom [2,10].

The medicinal plants used by several local communities for generations, have not been well documented, despite their widespread use. The threat of complete disappearance of the knowledge on herbal medicine from factors such as deforestation, lack of proper regulation, overexploitation and sociocultural issues warrants an urgent need to document the information [1]. The purpose of the study was to document information on medicinal plants used by Masaai community in Kajiado County of Southern Province of Kenya towards the utilization of indigenous ethnobotanical knowledge for the advancement of biomedical research and development. This study tried to investigate the knowledge of ethno-medicine, calculating the medicinal value (MV) and use value (UV) of the plant species in the local community and looking at the trend of these medicinal plants in the area.

MATERIALS AND METHODS

Study area

The study was carried out at Kajiado district at three sites (Oltepesi, Elangata-Wuas (Mile 46) and Kenya Marble Quarry (KMQ)), located at the southern end of the Rift Valley Province (Figure 1). Kajiado county is bordered by the Republic of Tanzania to the southwest; and is situated between longitudes 36°5' and 37°55' East and latitudes 1°10' and 3°10' South. The district lies in the rain shadow of Mount Kilimanjaro and has semi-arid climate. Annual rainfall has a bimodal distribution pattern with precipitation usually occurring during the period between November and January (short rains) and March to May (long rains). The mean annual rainfall is low (350 mm) and daily temperature ranges from 35 °C in February and March to 12 °C in July [11].

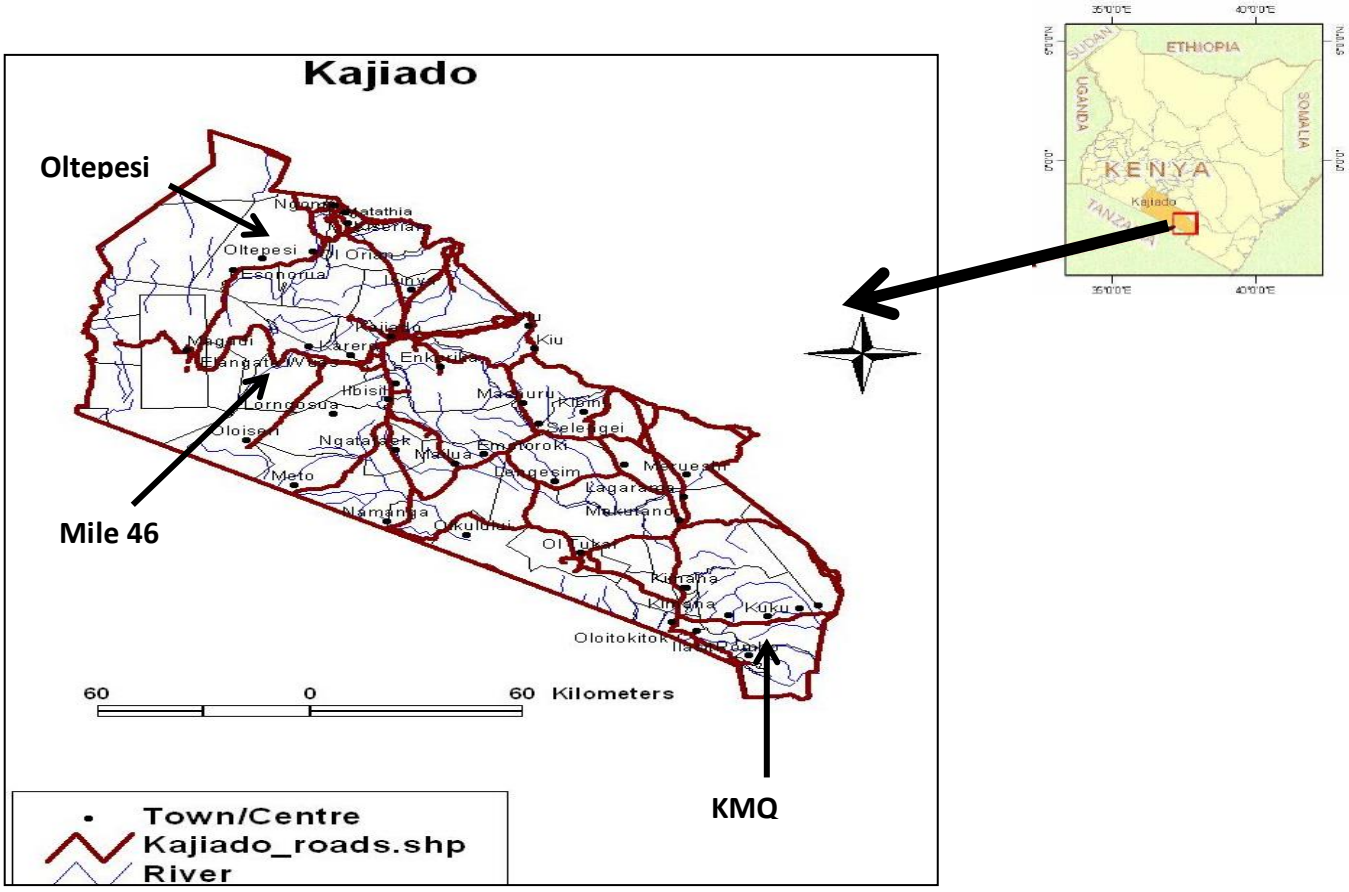

Figure 1: The study area showing the three sampling sites.
(Source: Department of Geography and Environmental Studies, University of Nairobi)

The key characteristics of the three sites selected for this study are summarized in Table 1. The average land elevation lies below 1600 m and it is characterized by shallow soils and ground vegetation cover ranging from zero to 85%. The natural vegetation occurred in the form bushed grassland, bush land and open woodland, especially in the seasonal river valleys.

Table 1: Geographical location of the study sites in Central Kajiado County, Kenya.

Site name	GPS Location	Site elevation (m)	Habitat
Kenya Marble Quarry	S 01^o 55.241`, E 036$^o$ 38.176`	1534 - 1598	Open woodland
Mile 46	S 01^o 53.547`, E 036$^o$ 35.217`	1410 - 1424	Open woodland
Oltepesi	S 01^o 58.626`, E 036^o 36. 873	1409 - 1410	Open grassland & woodland

Data Collection

Ground reconnaissance was conducted by walking across the area, on motorable tracks and on foot through tracks. A GPS was used to locate the research sites and sampling transects and plots were set up across the available vegetation types in the Kenya marble, Mile 46 and at Oltepesi. Sampling plots measuring 10 × 10 m were established along each 100 m transect erected at each of the study sites. A total of 21 plots were set up at the main study site at mile 46 and a total of 20 plots Kenya Marble Quarry and Oltepesi.

A semi-structured questionnaire was prepared to collect information and data from the three research sites and a total of 96 key informants were interviewed randomly of whom 30, 34 and 32 were from Kenya Marble Quarry (KMQ), Mile 46 and Oltepesi respectively at Kajiado County in Kenya. Qualitative and quantitative statistical analyses were done using SPSS 20 and R software. Semi structured interviews were used to get ethnobotanical data as it is described by Ref. [12]. The plants specimens were identified with experienced field guide and using the text book Illustrated guide for Medicinal plants in Ease Africa [1,2,13] at each sites.

The use value (UV) was calculated to demonstrate the relative importance of the species known locally according to [12,14] as follows:

$$UV = \sum U/n$$

Where ΣU is the number of citations per species and n is the number of informants.

The use value and medicinal value of the plants were calculated using this formula. Field experiment was also carried out in each research sites by setting up sampling transects and plots across the vegetation types using random sampling method. A quadrat measuring 10 × 10 m were established within a distance of 100 m between plots in transect erected at each study sites. A total of 21 plots were produced at mile 46 in 2.1 km distance and a total of 20 plots at Kenya Marble Quarry and Oltepesi in 2 km distance. The data collected from these quadrats helped to understand the trend of the medicinal plants in the sites.

Field observation

This activity had been undertaking in each research sites in the whole period of the data collection. This was supported by taking field notes, counts and measurement of the relevant parameters and crosschecking different information obtained from the informal discussion with the society and field guide. In the three research sites, respondents and herbalists were interviewed. There are few numbers of herbalists in the sites and most were males which show that it is the males who involve in activities of medicinal plants.

RESULTS AND DISCUSSIONS

In the study sites, 83.9% of the respondents were male and 16.1% were female. Both sexes have the indigenous knowledge of treating different diseases traditionally even though most were males in the area. The possible explanation for this might be in the Maasai culture females are more engaged in the house activities as compared to men and men are more involved in traditional medicinal plant practices. But, in the informal communication, it was said that women are highly curious in traditional medicines of childbirth, pediatrics and abortifacient herbs. The information provided by male and female did not reveal significant differences (df =1, F=0.597, P= 0.442 and $\alpha = 0.05$) statistically between the study sites based on gender type. The finding of this research is contrary to that of [15] in Tanzania who reported that all traditional medicinal practitioners were females but it is in line with the finding of [16] in Ethiopia who reported that men are usually involved in medicinal plant utilization in treating health abnormality traditionally.

A total of around 40 useful plant species were identified through semi-structured questionnaires delivered to the local community in the three research sites. In Kenya Marble Quarry (KMQ), *Acacia tortilis*, *Acacia mellifera*, *Balanites aegyptiaca* and *Commiphora africana* had the highest total use value to the local community (Table 2). In Mile 46 sites, *Acacia tortilis, Acacia mellifera, Balanites aegyptiaca, Acacia nubica* and *Commiphora schimperi*; in Oltepesi, *Acacia tortilis, Acacia mellifera, Salvadora persica* and *Balanites aegyptiaca* had the highest total use value to the local community.

In regard to medicinal value of the surveyed species, *Acacia mellifera*, *Acacia tortilis*, *Commiphora africana* and *Commiphora schimperi* (Table 2) were the top most species used by the local people for medicinal purpose in KMQ site, while *Acacia tortilis*, *Acacia nubica*, *Commiphora schimperi*, *Acacia mellifera* and *Balanites aegyptiaca* were frequently used by the locals in Mile 46 for the treatment of different diseases. Acacia mellifera, *Acacia tortilis* and *Salvadora persica* were used as medicine for the treatment in Oltepesi site.

But, the total use value of the species did not reveal significant differences statistically between the research sites (df=2, F=1.456, P=0.238 and α=0.05). This implies that the species have various uses to the society and knowing and undertaking such kind of study helps to identify some useful plant species that should be considered as priorities for management and conservation, as suggested by Ref. [17]. Moreover, one plant species has more than one use as [18] who found that some of the plant species used for herbal medicines had other uses such as firewood, animal fodder and in traditional cultural rites.

Low use value scores of plant species could be associated in part with their scarcity. As pointed out by Ref. [19], the use of a plant resource is a function of its abundance, with more abundant species being more extensively used. In other words, the low use value of some plant species could be related to their scarcity or the decrease of their populations.

Table 2: Medicinal plants used by local Masaai people in KMQ, Mile 46 and Oltepesi sites and their Use Value (UV) and Medicinal Value.

Maasai Name	Botanical name	Family	Treatment	Plant part	KMQ		Mile 46		Oltepesi	
					MV	UV	MV	UV	MV	UV
Oluai	*Acacia drepanolobium*	*Fabaceae*	Appetite, stomachache, increase blood content, increase general health	Bark	0.37	2.68	0.38	2.48	0.22	1.51
Osiyiamalili	*Acacia etbiaca*	*Fabaceae*	Diarrhea, stomachache, appetite	Bark	0.6	3.78	0.21	1.32	0.52	3.46
Oiti	*Acacia mellifera*	*Fabaceae*	Stomachache, encourage health, typhoid, reduce vomiting	Bark	0.9	6.38	0.68	4.89	0.93	5.87
Olkiloriti	*Acacia nilotica*	*Fabaceae*	Wounds, Gonorrhea, appetizer	Bark, root, pods	0.47	3.38	0.59	3.55	0.41	2.5
Oldepe	*Acacia nubica*	*Fabaceae*	Gonorrhea, diarrhea, malaria, cough	Bark, root	0.37	2.54	0.76	4.53	0.93	5.09
Oltepesi	*Acacia tortilis*	*Fabaceae*	Typhoid, womb cleaning, stomachache, reduce vomiting	Bark (inner part), pods	0.83	6.69	0.82	4.96	0.93	5.98
Olerai	*Acacia xanthophloea*	*Fabaceae*	Diarrhea	Bark	0.2	1.09	0.12	0.69	0.07	0.49
Olperr-elongo	*Albizia amara*	*Mimosaceae*	Encourage health, headache	Branch, bark	0.1	0.66	0.06	0.39	0.07	0.31
Olmukutan	*Albizia anthelmintica*	*Fabaceae*	Deworming	Bark	0.27	1.25	0.18	0.18	0.3	1.62
Osukuroi	*Aloe secundiflora*	*Aloaceae*	Malaria, headache, diarrhea, eye-infection	Leaves, latex	0.5	1.23	0.5	1.74	0.44	1.00
Olong'osua	*Balanites aegyptiaca*	*Balanitaceae*	Vomiting, common-flu, tonsil, cough, typhoid, chest pain	Resin (gum), bark	0.7	5.31	0.68	4.89	0.67	5.67
Osaragi	*Balanites glabra*	*Balanitaceae*	Edible fruit	fruits	0.00	0.00	0.06	0.42	0.00	0.00
Oloireroi	*Boscia angustifolia*	*Capparidaceae*	Induce vomiting	Bark	0.1	0.63	0.15	1.05	0.00	0.00
Enchani-pus	*Cadaba farinosa*	*Capparidaceae*	Swollen part of the body	Leaves	0.13	0.67	0.18	1.2	0.26	1.26
Olamuriaki	*Carissa sipinarum*	*Apocynaceae*	Diarrhea, Gonorrhea, sexual transmit disease infection	Root, fruits	0.1	0.8	0.12	0.12	0.00	0.00
Olmakutukut	*Clerodendrum myricoides*	*Verbenaceae*	Gonorrhea	roots	0.03	0.09	0.00	0.00	0.00	0.00
Osilalei	*Commiphora africana*	*Burseraceae*	Diarrhea, food, stomachache	Bark	0.83	5.08	0.06	0.06	0.44	2.66
Olailupai	*Commiphora schimperi*	*Burseraceae*	Diarrhea, stomachache	Roots, bark	0.8	4.79	0.74	4.27	0.74	5.49
Oseki	*Cordia monoica*	*Boraginaceae*	Eye-infection	Leaf	0.63	4.41	0.26	1.87	0.48	4.15
Oldorko	*Cordia sinensis*	*Boraginaceae*	Edible fruit	Fruits	0.23	1.84	0.03	0.18	0.22	1.55
Enkitarru	*Croton macrostachyus*	*Euphorbiaceae*	Common cold, headache, malaria	Roots, bark	0.2	0.75	0.12	0.42	0.07	0.39
Oloibor-benek	*Croton megalocarpus*	*Euphorbiaceae*	Common cold	roots	0.00	0.00	0.00	0.00	0.04	0.2
Olenarran	*Euclea racemosa*	*Ebenaceae*	Increase blood in the body	Bark, branch	0.17	0.65	0.06	0.06	0.04	0.04
Oloilei	*Euphorbia tirucalli*	*Euphorbiaceae*	Allergy, toothache	New emergi-ing shoots, branch	0.13	0.48	0.00	0.00	0.00	0.00

Maasai Name	Botanical name	Family	Treatment	Plant part	KMQ		Mile 46		Oltepesi	
					MV	UV	MV	UV	MV	UV
Ositeti	*Grewia bicolor*	*Tiliaceae*	Stomach pain in women during delivering, treating miscarriage woman	Bark, root	0.73	4.34	0.41	2.46	0.56	3.98
Oirri	*Grewia tembensis*	*Malvaceae*	Edible fruit	fruits	0.2	0.8	0.35	1.45	0.37	2.09
Olmankulai	*Grewia villosa*	*Malvaceae*	Edible fruit	fruits	0.2	1.22	0.41	1.65	0.04	0.28
Emimm	*Indigofera erector*		Stomachache, headache	Root	0.17	0.37	0.21	0.75	0.11	0.25
Esonkoyo	*Justicia odora*	*Acanthaceae*	Flavoring of food, perfume	Bark, roots	0.07	0.21	0.09	0.21	0.00	0.00
Oloirien	*Olea africana*	*Oleaceae*	Stomachache	Stem, leaves	0.07	0.38	0.09	0.57	0.04	0.04
Oltimigomi	*Pappea capensis*	*Sapindaceae*	Encourage health in adults, malaria	Bark	0.17	1.11	0.09	0.57	0.04	0.04
Olorrondoi	*Quercus rotundifolia*	*Fagaceae*	Eye-infection	leaves	0.03	0.09	0.12	0.18	0.11	0.23
Olkokola	*Rhamnus staddo*	*Rhamnaceae*	Malaria, headache, joint, make the body health	Bark, branch stem	0.17	0.88	0.00	0.00	0.04	0.08
Olmisigiyioi	*Rhus natalensis*	*Anacardiaceae*	Chest pain, edible fruits, food	Bark/fruits	0.1	1.17	0.00	0.00	0.00	0.00
Olmunkushi	*Rhus vulgaris*	*Anacardiaceae*	None, encourage health	Fruits	0.23	1.43	0.00	0.00	0.00	0.00
Oremit	*Salvadora persica*	*Salvadoraceae*	Malaria, Gonorrhea, common cold, swollen part	Root, fruit	0.63	3.68	0.56	3.25	0.81	5.8
Entulelei	*Solanum incanum*	*Solanaceae*	Headache, stomachache, malaria	Root	0.13	0.29	0.12	0.3	0.11	0.26
Enchanienkashe	*Turrea abyssinica*		Backache, Gonorrhea	Stem, roots	0.07	0.42	0.12	0.84	0.00	0.00
Olgumi	*Vangueria madagascariensis*	*Rubiaceae*	Edible fruits, reduce back pain	Fruits	0.03	0.18	0.00	0.00	0.00	0.00
Olamai	*Ximenia americana*	*Olacaceae*	Encourage health, edible fruit	Bark, fruit	0.17	0.69	0.09	0.27	0.00	0.00

The medicinal use value of the species with their presence in each research sites was taken to avoid multi-collinearity effect which was brought in as a result of different use of the plant species. The consequence of multi-collinearity in general increased standard error of estimates of the β`s (decreases reliability) and often confusing and gives misleading results.

Below figures 2, 3 and 4 showed the medicinal use value of the plant species across the plot in the research sites.

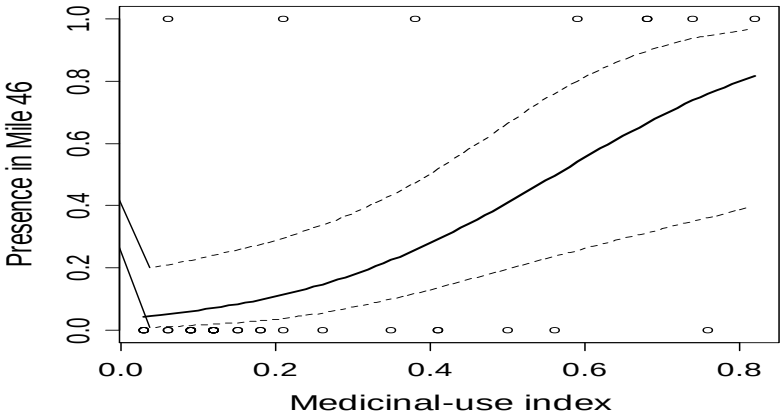

Figure 2: The medicinal use value of plant species across the plots in Mile 46.

The broken line in the figure represented the confidence interval and the solid line in the middle relates the medicinal-use index across the plots in Mile 46. The medicinal use value of plant species in Mile 46 in the field across the plot increased significantly and revealed significant difference statistically (One sample t-test: t = 5.049, df= 40, P=0.00)

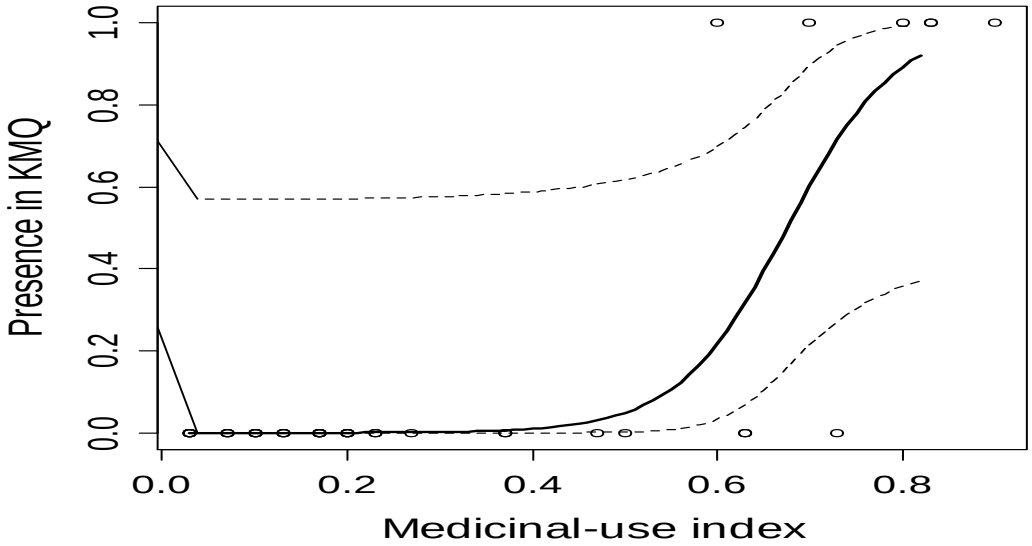

Figure 3: The medicinal use value of plant species across the plots in KMQ.

The medicinal plant species in the field across the plot increases significantly (One sample t-test: t=5.713, df= 39, P=0.00) in KMQ and the confidence interval (the broken line) was wider as compared to the other two sites. This was partly because medicinal plant species weren't many in this site as compared to the other two sites.

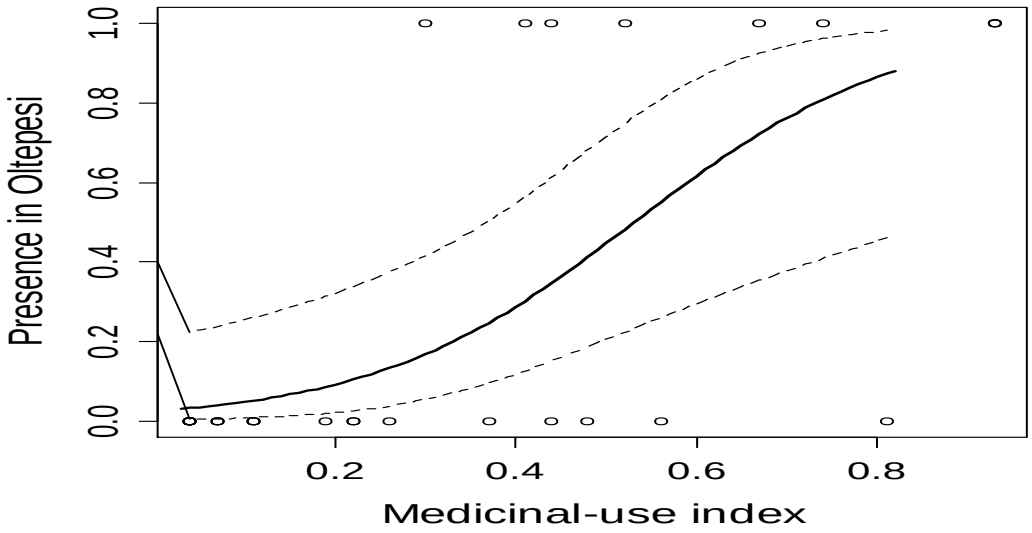

Figure 4: The medicinal use value of plant species across the plots in Oltepesi.

The medicinal plant species in the field across the plot increases significantly (One sample t-test: t=5.055, df= 30, P=0.00) in Oltepesi. Figures 1, 2 and 3 revealed that medicinal plant species increase across the plots and found more on Mile 46 and Oltepesi than KMQ as the confidence interval was wider in the KMQ due to less number of medicinal plants in the area.

CONCLUSION

Herbal practice is still common in the central Kajiado, Kajiado County in Kenya. The study provides comprehensive ethnobotanical information about herbal medicine and healing methods among the Masaai community of the study area. The research sites were dominated by few medicinal plant species which would imply overutilization of the other species. The rural community heavily relied on medicinal plants for primary health care and these plants were also used for different purposes like firewood, grazing, charcoal, fencing, construction etc, and this showed that the plants were under pressure due to overall increasing demand on plant resources for various uses by the local Masaai community. The major threats in the area were deforestation, drought, lack of awareness, land use tenure, urbanization, ignorance and human settlement to the area. The identification of the active ingredients of the plants used by the herbalists may provide some useful leads for the development of new drugs.

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