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Medicinal Plants Used for Treatment of Gastrointestinal Infections in Tharaka-Nithi County

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Original Research Article

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ABSTRACT

Health care is a basic need to humans which can only be achieved with medicines with high efficacy against disease causing pathogens. Globally, gastrointestinal infections are major health concern particularly to travelers since over 60% visiting tropical and subtropical regions develop diarrhea. Herbal plants have been used for decades to treat gastrointestinal infections globally including Tharaka-Nithi County in Kenya. However, there is little information on the demography of herbalist and the plants used in treatment of gastrointestinal infections such as typhoid, cholera and shigellosis. A cross sectional survey was carried out involving thirty herbalists to assess their demographic data and to establish herbs commonly used to treat typhoid, cholera and shigellosis in Tharaka-Nithi County. Data collected was subjected to Chi square test of association and descriptive statistics and presented in percentages. There were more male herbalists (65.52%) in the study than female herbalist (34.48%). Most of the herbalist (65.52%) were aged above 70 years. There was a significant ($p < 0.05$) association between herbalists' level of education and age (X^2 (6, N = 30) = 17.349, p = 0.008). Most herbalists were found to have below primary education level 58.62%. *Aloe vera*, *Aspilia pluriseta*, *Ficus sycomorus* and *Physalis peruviana* were identified as commonly used plants for treatment of cholera with *Aspilia pluriseta* being most preferred (27%) by herbalist above the age of 70 years. *Vangueria infausta*, *Eucalyptus globulus*,

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Carissa edulis and *Erythrina abysinnica* were commonly used for treatment of shigellosis with *Eucalyptus globulus* being most preferred (58.6%) by herbalist above the age of 70 years. *Erythrina abysinnica*, *Carissa edulis*, *Vangueria infausta* and *Eucalyptus globulus* were commonly used for treatment of typhoid while 50.0% of herbalist above the age of 70 preferred *Erythrina abysinnica*. Most of the herbalists had below primary education level. In conclusion, herbal medicine is mostly dispensed by older people in Tharaka-Nithi County in Kenya. Different herbal plants are used in the treatment of cholera, shigellosis and typhoid.

Keywords: herbalist_ Demography; herbal; cholera; shigellosis; typhoid; Tharaka-Nithi County.

1. INTRODUCTION

Bacterial gastroenteritis remains a major cause of morbidity and mortality in developing countries [1]. Increased cases of cholera caused by *Vibrio cholerae*, shigellosis caused by *Shigella* species and typhoid caused by *Salmonella typhi* have been reported in Tharaka Nithi County [2-6]. Acute diarrhea and vomiting remain the leading cause of death of children below the age of 5 years in Tharaka-Nithi County [7]. Symptoms of the infections include inflammation of the digestive tract, severe vomiting and diarrhea [1]. The mode of transmission of gastroenteritis is faecal–oral route, either through direct person-to-person contact or through contaminated food or water [8-10]. Symptoms of cholera include large amounts of watery diarrhea that lasts a few days, vomiting and muscle cramps [11,12]. The diarrhea can be so severe that it causes dehydration and electrolyte imbalance which can result in decreased skin elasticity, wrinkling of the hands and feet as well as sunken eyes [13]. Treatment of cholera involves oral rehydration therapy or use of antibiotics such as doxycycline and erythromycin [14].

Typhoid is caused by *Salmonella typhi* and transmitted by fecal -oral route mainly through contaminated food and water [15]. The symptoms include vomiting, fever, diarrhea and abdominal cramps 12 to 72 hours after infection [16]. In some cases, the infection may last seven days after which most people recover and in some instances, the diarrhea may be so severe leading to dehydration of the patient requiring hospitalization. Treatment involves use of cephalosporins and quinolones classes of drugs. Shigellosis is caused by a group of bacteria called shigella and is transmitted by fecal oral route and mostly through food, water or by person to person spread [17]. The bacteria release Shiga toxins that irritate the intestines [18]. Shigellosis is a disease of the resource poor, crowded communities having no adequate sanitation or safe water and where disease rates are high [19]. Treatment is mainly by combating dehydration and taking plenty of fluids more so electrolyte solutions. Drugs include lactams, macrolides and quinolones classes of drugs [20,21].

Preferences for herbal medicine as alternative conventional medicine to illnesses globally is on the rise [22]. Thus, investigations of ethno botanical products has gained relevance to assess their suitability and effectiveness. Indeed, about 80% of world populations relies on herbal medicine for disease management [23,24]. Acceptability of herbal medicine among the population is attributed to cultural acceptance, accessibility and cost effectiveness [22]. The demographic characteristics of herbalists is documented in different studies [25-28]. In most of the studies, dispensing of herbal medicine has been reported to be a male dominated profession [29-32]. For instance, in Bahrain, Alalwan et al. [29] reported that out of 41 of the herbalist interviewed in a study, majority (95.1%), were male. Few studies have reported higher number of female herbalists [33].

Lower number of female herbalists may be attributed to myriad of factors such as their busy activities and workload at home unlike male who are free to move to the forests thus interacting with nature more while looking after animals, timber among other things [34-36]. Further, low number of females may be attributed to the fact that most traditional knowledge in most communities is passed to first born sons from male parent [37,38]. Education status of herbalists have been reported by Alalwan et al. [29] ranging from those who have not gone to school (17.1 %) to those who have completed secondary school education (51.2%).

Though herbal dispensing has been done by people across different age groups, studies have reported dominance of age groups between 35 – 60 years a fact that has been attributed to the faster learning potential among young generation

[29]. Studies involving survey of herbalist practitioners have reported a low number of sample size [39,29,40]. For instance, Alalwan et al. [29] reported sample size of 41 respondents. Low number of herbalist practitioners could be attributed to the method of knowledge acquisition. According to Adekannbi et al. [41], Alalwan et al. [29] and Bent [42] most herbalists gain knowledge by vertical transmission from parents and grandparents. However, transmission and exchange of herbal knowledge is low among practitioners which may explain the low number of available herbalists [43].

Kenya has a wide range of flora with over 7,000 plant species [44] and up to 70% of the rural populace use home remedies from plant parts as the first source of medicine to treat infections [45,46,44]. Sources of home remedies identified by Gakuya et al. [47] include flowers, leaves and fruits of *Cascabela thevetia*, flowers of *Oncoba routledgei* and leaves of *Ocimum suave*. However, there is little demographic information about the dispensers of these herbal medicines and the efficacy of plant parts prescribed for the infections. For instance, in Tharaka-Nithi County there exist knowledge gap on the herbalists demographic and plants used for the treatment of gastrointestinal infections such as typhoid, cholera and shigellosis. Thus, this study was carried out to provide herbalists' demographic and also to create awareness on the herbal plants used to manage gastrointestinal infections.

2. MATERIALS AND METHODS

2.1 Study Area

The study was carried out in Tharaka north within Tharaka-Nithi County in Kenya. The County borders Embu, Isiolo, Kitui and Meru counties. It is located at a latitude coordinate of 0º9´25.03´´S and longitude coordinates of 37º58´41.48´´E, and is divided into four sub counties; Maara, Tharaka North, Tharaka South and Meru South, covering a total area of 2,662.1 km^2 (Fig. 1). The human population is estimated at 365,330 [48].

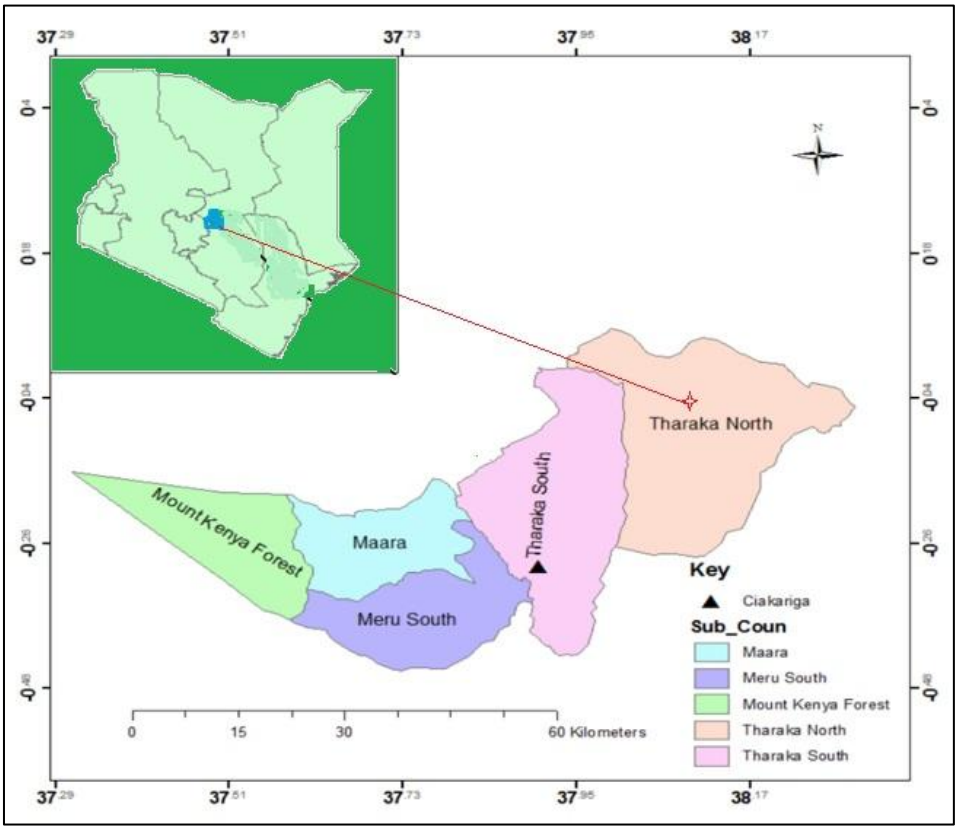

Fig. 1. Map of Tharaka-Nithi County

2.2 Survey Design and Tool

A cross-sectional study design was used to gather information on the herbal use in the treatment of cholera, typhoid and shigellosis diseases in Tharaka-Nithi County in Kenya using structured questionnaire. Only adults both male and female aged 18 years and above who are herbalists were voluntarily recruited in the study. Herbal practitioners were purposively sampled from Tharaka North Sub-County based on existence of herbalists in the area. Snowballing sampling technique was used to get the desired sample size since there were no existing documented evidence on the number of herbalist. Prior to the study, research permit was acquired from the National Commission of Science, Technology and Innovation as required for anyone carrying out research in Kenya. The study was conducted between September to December 2020.

The herbalists were visited at their homes by the researcher and were interrogated to confirm if they actually dispense herbal medicines before participating in the interview. The questionnaire was administered by the researcher who read the question and interrogated the herbalists to gather information on herbal plants used by the practitioners in the treatment of human health conditions that included cholera, typhoid and shigellosis. The questionnaire had two sections i.e., section A collecting data on the herbalists' demographics i.e., age, gender, education level, religion and number of years of dispensing herbal medicine. Section B of the questionnaire gathered herbal plants used in treating cholera, typhoid and shigellosis, part of the plant used, preparation, dose used, perceived effectiveness and healing duration. Based on the pilot study, a Cronbach's α coefficient value of 0.778 was obtained from 14 trial questionnaires confirming the reliability and internal consistency of the questionnaire used in the study [49]. Pilot study was conducted in the neighboring county (Meru County) and its data not cooperated in the analysis of data gathered in the actual study.

Data on the categorical variables were presented as percentage (%) and the Pearson Chi-square (χ^2) test used in the analysis at alpha = 0.05 in Scientific Analysis system version 9.4 where p value < 0.05 indicated significance results.

3. RESULTS

3.1 Age and Gender of Herbalists

There was no significant ($p > 0.05$) association between age and gender of herbalists in Tharaka-Nithi County ($X2$ (3, N = 30) = 3.529, p = 0.317). The female herbalists ranged from 0 % at age 51-60 to 24.14% for female aged 70 years and above while male herbalists ranged from 0% for age 41-50 to 41.38% for male aged 70 years. Generally, there were more male herbalist (65.52%) in the study as compared to female herbalist [34.48% (Fig. 2)].

3.2 Level of Education and Age of Herbalists

There was a significant ($p < 0.05$) association between herbalists' level of education and age (X^2 (6, N = 30) = 17.349, p = 0.008). Herbalist with below primary education level ranged from

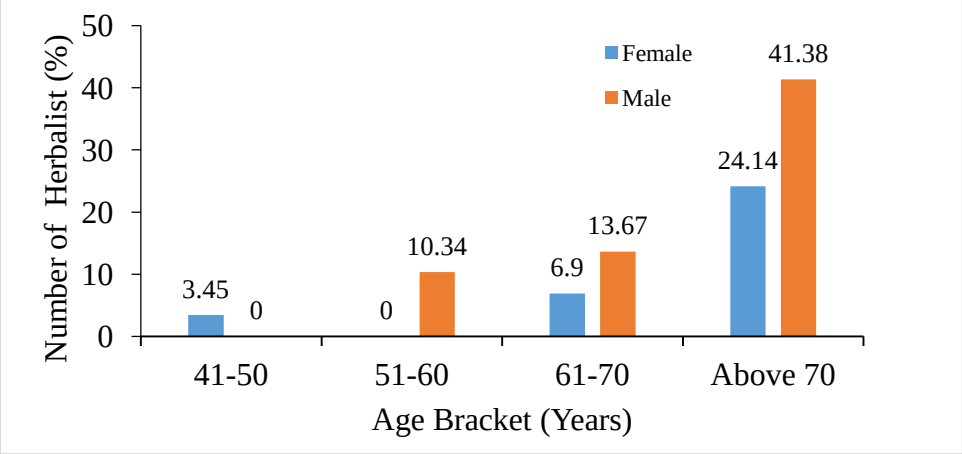

Fig. 2. Age and gender of herbalists who participated in the study

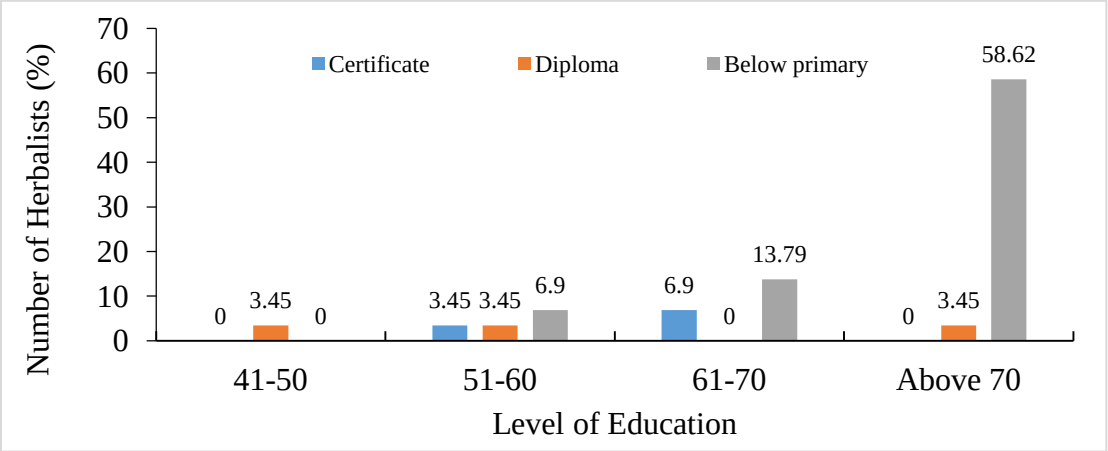

Fig. 3. Education level and age of herbalist participants in Tharaka Nithi County

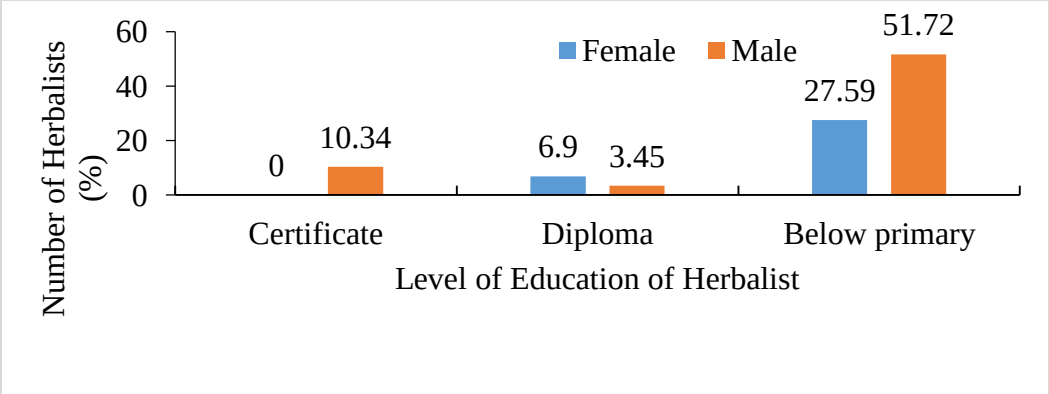

Fig. 4. Education level and age of herbalist participants in Tharaka Nithi County

0% for those aged 41-50 and 58.62% for those aged above 70 years. Herbalist with certificate education ranged from 0% for those aged 41-50 years to 6.90% for those aged over 70 years. Herbalists who were diploma holders were 3.45% for age bracket of 41-50 years, 51-60 and those aged over 70 years with 0% for aged between 61-70 years (Fig. 3).

3.3 Level of Education and Gender of Herbalists

There was significant ($p < 0.05$) association between gender and education level of the herbalist (X^2 (2, N = 30) = 2.955, p = 0.228). Education status for female herbalists ranged from 0% for those with certificate to 27.58% for those with below primary education status. Education status for male herbalists ranged from 3.45% for those who holds diploma to 51.72% for those with below primary status (Fig. 4).

3.4 Identities of Herbal Plants and the Parts used in Treatment of Gastrointestinal Infections

Aloe vera, *Aspilia pluriseta*, *Ficus sycomorus* and *Physalis peruviana* were the plants identified as commonly used for treatment of cholera in the study area (Table 1). The most commonly used plant for cholera treatment was *Aspilia pluriseta* (27%) by herbalist above the age of 70 years, while *Physalis peruviana* and *Aloe vera* were the least used herbs (0.00%) by 51-60 and 41-50 age brackets respectively. More herbalists (23.90%) of above 70 years preferred to use stems and leaves of the herbs for cholera treatment, while none (0.0%) of the herbalists of 41-50 years used roots. *Vangueria infausta*, *Eucalyptus globulus*, *Carissa edulis* and *Erythrina abysinnica* were the plants identified as commonly used for treatment of shigellosis in the study area (Table 1). The most commonly used plant for shigellosis treatment was *Eucalyptus globulus* (58.6%) by herbalist above the age of

70 years, while *Eucalyptus globulus, Erythrina abysinnica* and *Carissa edulis* were the least used herbs (0.00%) by 41-50 age brackets. More herbalists (62.1%) of above 70 years preferred to use leaves of the herbs for shigellosis treatment, while none (0.0%) of the herbalists of 41-50 and above 70 years used bark and roots respectively.

Erythrina abysinnica, *Carissa edulis*, *Vangueria infausta* and *Eucalyptus globulus* were the plants identified as commonly used for treatment of typhoid in the study area (Table 1). The most commonly used plant for typhoid treatment was *Erythrina abysinnica* (50%) by herbalist above the age of 70 years, while *Vangueria infausta* and *Eucalyptus globulus* were the least used herbs (0%) by 41-50 age bracket. *Vangueria infausta* was also least used by herbalists in age 51-60 years. More herbalists (56.7%) of above 70 years preferred to use stems and leaves of the plants for typhoid treatment. None (0%) of the herbalist in 41-50 years of age used stems. Similarly, none of the herbalist 51-60 and over 70 years used bark of *Vangueria infausta*.

Table 1. Plants used in Tharaka-Nithi by herbalist in the treatment of gastrointestinal infections

Factor	Age of herbalist	Herbalist response (%)				
		AV	***FS***	***AP***	***PP***	**% respondents**
Which plant do you use to treat cholera?	41-50	1.5%	1.5%	1.5%	0.0%	4.5%
	51-60	0.0%	6.1%	6.1%	1.5%	13.6%
	61-70	4.5%	9.1%	9.1%	1.5%	24.2%
	Over 70	1.5%	24.2%	22.7%	9.1%	57.6%
Total						100.0%
		Stem	**Root**	**Back**	**Leaf**	**% respondents**
Which plant part do you use to treat cholera?	41-50	1.5%	0.0%	1.5%	1.5%	4.5%
	51-60	6.0%	1.5%	3.0%	6.0%	16.4%
	61-70	9.0%	1.5%	7.5%	10.4%	28.4%
	Over 70	23.9%	0.0%	3.0%	23.9%	50.7%
Total						100.0%
		VI	***EG***	***CE***	***EA***	**% respondents**
Which plant do you use to treat shigellosis?	41-50	3.4%	0.0%	0.0%	0.0%	3.4%
	51-60	0.0%	13.8%	13.8%	13.8%	13.8%
	61-70	6.9%	10.3%	20.7%	13.8%	20.7%
	Over 70	0.0%	58.6%	34.5%	44.8%	62.1%
	Total					100.0%
		Stem	**Root**	**Back**	**Leaf**	**% respondents**
Which plant part do you use to treat shigellosis?	41-50	3.4%	3.4%	0.0%	3.4%	3.4%
	51-60	13.8%	0.0%	3.4%	13.8%	13.8%
	61-70	17.2%	6.9%	10.3%	20.7%	20.7%
	Over 70	55.2%	0.0%	20.7%	62.1%	62.1%
Total						100.0%
		EA	***CE***	***VI***	***EG***	**% respondents**
Which plant do you use to treat typhoid?	41-50	3.3%	3.3%	0.0%	0.0%	3.3%
	51-60	10.0%	3.3%	0.0%	6.7%	10.0%
	61-70	16.7%	20.0%	13.3%	3.3%	23.3%
	Over 70	50.0%	20.0%	46.7%	43.3%	63.3%
	Total					100.0%
		Stem	**Root**	**Back**	**Leaf**	**Total**
Which plant part do you use to treat typhoid?	41-50	0.0%	3.3%	3.3%	3.3%	3.3%
	51-60	10.0%	3.3%	0.0%	10.0%	10.0%
	61-70	16.7%	16.7%	13.3%	13.3%	23.3%
	Over 70	56.7%	16.7%	0.0%	56.7%	63.3%
	Total					100.0%

where EA= Erythrina abysinnica, CE= Carissa edulis, VI= Vangueria infausta, EG= Eucalyptus globulus, AV= Aloe vera, FS= Ficus sycomorus, AP= Aspilia pluriseta, PP= Physalis peruviana

4. DISCUSSION

4.1 Herbalist Gender, Age, Education Level and Use of Herbal Medicine in Treatment of Typhoid, Shigellosis and Cholera in Tharaka-Nithi County

Association between gender and age has been reported in many studies which involve medicinal plant knowledge [50,51]. In Brazil for instance, older people are reported to have more know how in medicinal plants than younger people [50,51] which is consistence with other reports [52]. In our study, though there was no significant difference in gender of herbalists participating, based on *chi* square goodness of fit, percentage of male was higher than female herbalist. This finding agrees with the report of Aiah et al. [39] which indicated that more male herbalist (64%) of over 40 years than females (36%) participated in his study. Ibrahim et al. [53] reported that in Narasawa State of Nigeria, male herbalists were more knowledgeable on medicinal plants than female herbalists though while in a separate study in Niger, men and women were reported to have equal knowledge on medicinal plants [54]. In some communities of Atlantic rainforest in Brazil, men had more knowledge on medicinal plants as compared to women indicating that men in these communities have a closer relationship with the forest [55]. The results of our study agree with those of Mokgobi [56] in which preparation of herbal remedies was found to be the responsibility of men in 76 (29%) implying that there were more male herbalists than female. Dominance of male herbalist may be attributed to the fact that majority of women work in male dominated society. According to Camou-Guerrero et al. [57] and Reyes-García et al. [58], men are traditionally tasked by maintenance of the economy of their household and provision of resources, thus are better placed to know much of natural resources as compared to women.

Majority of the herbalist who participated in this study were aged 70 years and above. Educational level of the majority of the herbalist were below primary education meaning the elderly have more knowledge on medicinal plants as compared to the younger generations. Many studies have found the same tendency in their research on medicinal plant knowledge in different parts of the world [59,60,61,62]. Reason for this could be that with increase in age, people have more time to accumulate knowledge hence show greater medicinal knowledge than the younger people [50]. The association between age and knowledge does not mean an increase in ethnobotanical know how overtime. Reason for low knowledge among the younger people has been linked to the ongoing socio-economic and cultural changes [40]. For instance, Figueireido et al. [63] indicates that younger people in Atlantic rainforest community in Brazil are not interested in homemade medicine but are more keen to modern medicine. A study by Matavele and Habib [62] shows that in the rural communities of Cabo, Delgado and Mozambique, this knowledge tends to be lost between generations because the younger people are more receptive to modern health centers than to the medicinal knowledge of their elders.

In our study, there was a significant association between herbalists' level of education and age, where majority were below primary education and of 70 years and above. This could be associated with the fewer number of schools in Kenya in the 1940 (s) and 1950s which were located very far and also scarce financial support.

The *Aspilia pluriseta*, *Physalis peruviana*, Aloe vera and *Ficus sycomorus* were identified by herbal practitioners as the plants used in the treatment of Cholera. For the treatment of typhoid, *Erythrina abysinnica*, *Physalis peruviana* and *Carissa edulis* were identified by herbalists. Different parts of the plants that include leaves, roots and stem bark are useful in treatment of various illness. Use of leaves, stem and roots in herbal medicine is well documented. Maroyi [64] reported that in Zimbabwe and South Africa plant parts used for treatment of stomach disorder were roots (47.4%), bark (26.3%), leaves (21.1%) and rhizomes (5.3%).

5. CONCLUSION

In the County, more herbalists are found in Tharaka North sub-county due to the existence of medicinal plants in the North. Most of these herbalists are of 70 years and above and most have below primary education level. *Aloe vera, Aspilia pluriseta* and *Ficus sycomorus* are the medicinal plants used for treatment of cholera where the stems and leaves of these plants are used. *Vangueria infausta*, *Eucalyptus globulus*, *Carissa edulis* and *Erythrina abysinnica* are the plants used for treatment of shigellosis. Leaves of these plants are used. *Erythrina abysinnica,*

Carissa edulis, *Vangueria infausta* and *Eucalyptus globulus* are the plants used in typhoid treatment where stems and leaves are the parts used.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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