

Full Length Research Paper

Therapeutic uses of stingless bee honey by traditional medicine practitioners in Baringo County, Kenya

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African traditional medicine knowledge, skills and practices have often been passed verbally from the older generation to the younger generation. However, the current traditional medicine practitioners (TMPs) are rapidly aging, while the younger generation is not taking up the practice. Therefore, this study aimed at documenting the therapeutic uses of stingless bee honey among TMPs in Baringo County. Briefly, 91 TMPs were conveniently sampled and interviewed using an interviewer-administered questionnaire specifically designed to capture source of traditional medicine knowledge and skills, traditional therapeutic uses of stingless bee honey, duration of therapy and associated side effects. All the 91 TMPs knew about stingless bee honey and used it as a traditional medicinal product to treat various health-related disorders. Respiratory disorders, stomach disorders, oral thrush, wounds, measles and poisoning, were the five top-most common disorders that were commonly treated using stingless bee honey by the TMPs. The honey is also used to treat cancer, allergies and pain. The majority of the TMPs (72.34%) reported that the honey was not associated with side effects and all of them said that it was a highly effective form of traditional therapy. Duration of therapy ranged from 1-5 days (39.77%), 6-10 days (11.36%), 11-15 days (9.09%), >15 days (3.41%) until when the health condition improved. In conclusion, stingless bee honey is widely used as a traditional medicine to treat various disorders by TMPs in Baringo county. There is need for future detailed pharmacological studies on the stingless bee honey from the study area.

Key words: stingless bee honey, therapeutic uses, therapy duration, respiratory disorders, gastrointestinal disorders

INTRODUCTION

Traditional medicine has been defined as the sum of the knowledge, skill, and practices based on the theories, beliefs, and experiences indigenous to different cultures,

whether explicable or not, used in the maintenance of health as well as in the prevention, diagnosis, improvement or treatment of physical and mental illness

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(WHO, 2007, 2013). In many countries, traditional medicine is currently either the mainstay of health care delivery or serves as a complement and its demands are on the rise worldwide (WHO, 2007, 2013, 2018). In Africa, the knowledge, skills, and practices of traditional medicine are held by traditional healers, and often passed down the generations orally (WHO, 2007, 2013; Kigen et al., 2013). However, these experienced traditional healers are rapidly aging and their inevitable loss coupled with rapid lifestyle changes and lack of interest among the younger generation may lead to permanent loss of valuable traditional medicine knowledge and skills (Cox and Balick, 1994). To mitigate such losses, there have been concerted and systematic efforts to study and document herbal plants and herbal products used in traditional medicine by various ethnic groups in Kenya (Jeruto et al., 2007, 2008; Nanyingi et al., 2008; Okello et al., 2009; Muthee et al., 2011; Nagata et al., 2011; Kisangau et al., 2017; Wanjohi et al., 2020) as well as several other parts of the world (Tariq et al., 2015; Abidullah et al., 2021; Birjees et al., 2022; Chaachouay et al., 2022; Maqsood et al., 2022; Wali et al., 2022). However, there is limited documentation of non-herbal medicinal products, which are also widely used as traditional medicines by native ethnic groups. One such medicinal product is stingless bee honey (SBH), which is produced by various species of the Meliponini and Trigonini tribes (Crane, 1990). In contrast to *Apis mellifera* honey, the stingless bee honey taste sour, has higher water content, higher acidity (low pH), lower sugar content, lower enzyme activity and is richer in trehalulose (Nordin et al., 2018; Fletcher et al., 2020).

Evidence from different parts of the world indicates that stingless bee honey has long been widely used as a traditional remedy to treat various ailments from time immemorial. Among the ancient Mayans, for example, stingless bee honey locally known as “kab” was extensively used to cure “cold” and “hot” diseases, respiratory, digestive, sensory maladies, syndromes of cultural filiations, and a group of ailments known as fevers, wounds, burns, and poisonous stings or bites (Rosales, 2013). Stingless bee honey is also a valued source of nutrients and plays an important role in social traditions, traditional medicine and rituals among the indigenous Aboriginal people in northern Australia (Akerman, 1979; Isaacs, 2000). In Brazil, stingless bee honey is used to treat diabetes, bronchitis, mycosis, throat aches, and sexual impotence, as well as an antidote against snakebites or rabid dog bites (dos Santos and Antonini, 2008). In Ecuador, the Achuar people are known to use stingless bee honey mainly for nutritional purposes and as a remedy against colds and throat inflammation (Guerrini et al., 2009). In Malaysia, honey produced by a stingless bee (*Trigona* species), commonly known as ‘Kelulut’ is used as a remedy for many diseases and as an anti-ageing product (Barakbah, 2007; Shahjahan et al., 2007).

In the Eastern African region, Eardley and Kwapong

(2013), observed that stingless bee honey is well appreciated and widely used by traditional healers. However, detailed ethnomedicinal uses remain largely undocumented. One study in Uganda reported that Batwa pygmies, Abayanda, Bakiga and Bafumbira people use the honey of *Meliponula ferruginea* and other stingless bees for medicinal purposes including treatment of constipation (Byarugaba, 2004). In Kenya, there has been very limited systematic documentation of the medicinal uses of stingless bee honey, particularly among traditional medicine practitioners. Therefore, the purpose of this study was to document the therapeutic uses of stingless bee honey by traditional medicine practitioners in Baringo County, Kenya. This study reported that stingless bee honey is a common medicinal remedy that is used to treat a wide array of health-related ailments, majorly respiratory and gastrointestinal disorders by traditional practitioners. The high demand for stingless bee honey against a low supply mainly from wild nesting bees, which necessitates the development of meliponiculture in the study area was also highlighted.

MATERIALS AND METHODS

Study site and population

The study was conducted in Baringo County (0°40'0" N and 36°0'0" E), which covers a total land area of 10,976.4 km². The county comprises seven sub-counties: Koibatek, Marigat, Mogotio, Baringo Central, Tiaty east, East Pokot and Baringo North. Koibatek is composed of four administrative divisions. Marigat district is composed of three administrative divisions, while Mogotio, Baringo Central, Baringo East and Baringo North are composed of five, four, five and four administrative divisions, respectively. Baringo County has a total population of 662,760 persons residing in 142,518 households (KNBS, 2019). The county is dominated by the Tugens consisting of Lembus, Arror, Ndoorois and Samor people as well as the Njemps and Pokot communities, who mainly inhabit Tiaty and East Pokot (KNBS, 2019). The county is largely rural with few medium-sized townships. The main economic activities include mixed farming Koibatek, Baringo Central and Baringo North as well as pastoralism and bee farming in Marigat, Mogotio, Baringo East and Tiaty sub-counties.

Study design, study population and sampling

The study was a community-based descriptive cross-sectional study of traditional medicine practitioners. Convenient non-random sampling was used to obtain a total sample of 91 traditional medicine practitioners from five sub-counties (Koibatek, Marigat, Mogotio, Baringo Central, and Baringo North) of Baringo County. Potential traditional practitioners were identified in local open-air markets as well as through village elders and local community leaders.

Data collection

Data was collected by trained enumerators using a pre-piloted semi-structured questionnaire with both open and closed-ended questions. The socio-demographic data collected included age, gender and marital status. The key data collected included the

source of knowledge and skills about traditional medicine practice, duration of practice, knowledge and use of stingless bee honey as a therapeutic product, disorders that are treated with stingless bee honey, potential side effects, duration of therapy, demand, availability and sources of the medicinal stingless bee honey. This study also sought to document how the traditional practitioners packaged and stored the medicinal honey.

Ethical approach and consent to participate

This research was questionnaire-based field study with no human or animal experiments or collection of human samples. Ethical review was sought from Masinde Muliro University of Science and Technology institutional review committee. Clearance was also obtained from National Council of Science and Technology (NACOSTI/P/19/2147). The study purpose and aims were presented to research participants and written prior informed consent were sought before collecting data. No identifier information was collected to guarantee confidentiality.

Data analysis

Collected data was coded and then entered into a statistical package for social sciences (SPSS, version 25). Descriptive analysis was performed to generate proportions. Since some of the 91 participants did not answer all the questions and due to the small sample size, analysis was done based on the total number of respondents answering a particular question. Since multiple therapeutic uses were cited by each respondent, the proportions of disorders reportedly treated using stingless bee honey were calculated based on the total count (288) and not the number of respondents. Health conditions that were reportedly treated with stingless bee honey and which belong to a specific anatomic body system, for example, respiratory or gastrointestinal systems were further grouped and their proportions summed up (Chebii et al., 2020).

RESULTS

Socio-demographic characteristics and duration of practice

Of the 91 traditional medicine practitioners included in the analysis, 16 (17.6%) were men and 75 (82.4%) were women. The mean age of the traditional medicine practitioners was 56.9 ±10.5 years (Mean±SD, N=89), with a majority (64 (64.1%)) being in the 51-70 years age group. Most of the participants 69 (78.4%) were married. The average duration of traditional medicine practice was 18.5±9 years (Mean±SD, Table 1).

Sources of knowledge and skills of traditional medicine

When asked about how they their knowledge and skills of traditional medicine practice, 84 (93.3%; N=90) of the respondent reported that they had acquired through an apprenticeship with experienced traditional practitioners, while 3 (3.3%) were self-taught and 1 (1.1%) obtained their knowledge and skills from elders (Table 2).

Therapeutic uses of stingless bee honey by traditional medical practitioners

All the 91 traditional medical practitioners that were interviewed not only knew about stingless bee honey, but also used it in the treatment of various health-related conditions. As shown in Figure 1, respiratory disorders (coughs, tonsillitis, pneumonia, whooping cough, asthma, chest problems), were mentioned as the most common disorders (34.4%) treated with stingless bee honey by the traditional practitioners, this was followed by stomach disorders (diarrhoea, stomach ulcers, and indigestion) at 20.5%, then oral thrush (16%), wounds (5.2%), measles (4.5%), poisoning (4.2%), cold allergies (2.8%), skin rashes (1.7%), pregnancy-related abdominal pain (1.7%), dental problems (1.4%), itching (1.4%), mouth problems (1%), burns (0.7%), mumps (0.7%) and cancer (0.7%). Other human disorders (frequency ≤ 0.5%) that were reportedly treated using stingless bee honey by the respondents included joint problems, fever, abdominal edema, headache, and loss of appetite and muscle pain. Moreover, the respondents also mentioned that stingless bee honey was locally used in the treatment of animal diseases including foot and mouth disease, eye diseases in cows and indigestion.

Duration, effectiveness and side effects of stingless bee honey therapy

To further understand stingless bee honey traditional therapy, the traditional practitioners were asked about the duration for which their patients are advised to take the honey as a treatment for their ailments. As shown in Figure 2A, the majority of the respondents 35 (39.77%) advised their clients to take the stingless bee honey for a period of 1-5 days, 10 (11.36%) gave for a duration of 6-10 days, 8 (9.1%) advised patients to take it until the condition improves, while 6 (6.82%) and 3 (3.41%) mentioned a treatment duration of 11-15 days and >15 days, respectively. Importantly, 25 (28.4%) of the respondents were not willing to give information on the optimal duration of stingless bee therapy.

When asked about the effectiveness of stingless bee honey as medicinal product, all the respondents (N=90) said the patients got well after taking stingless bee honey. Having established that all the traditional medicine practitioners use stingless bee honey in the treatment of various disorders, we asked whether the honey caused any undesired side effect. Of the 89 participants who responded, 68 (72.34%) reported that therapeutic use of stingless bee honey is not associated with any side effects. Only 9 (10%) of the respondents mentioned nausea as a common side effect. Other side effects that were reported by the respondents included choking, diarrhea, hypersomnia, heartburn, ulcers and vomiting (Figure 2B). Notably, one respondent mentioned that stingless bee honey was not suitable for diabetics and

Table 1. Socio-demographic characteristics and duration of practice.

Characteristic	Value
Age (years)	
Mean±SD	56.9 ±10.5
Range	32-81
Age groups (years)	
30-40	6 (6.7)
41-50	19 (21.3)
51-60	32 (36.0)
61-70	25 (28.1)
71-80	5 (5.6)
81-90	2 (2.2)
Gender	
Male	16 (17.6)
Female	75 (82.4)
Marital status	
Single	7 (8)
Married	69 (78.4)
Widowed	9 (10.2)
Divorced/seperated	3 (2.5)
Duration of practice	
Mean (years±SD)	18.5±9
Range (years)	2-45

Source: researcher's original data

Table 2. Source of knowledge and skills of tradition medicine practice.

Source of knowledge or skills	N (%)
Apprenticeship	84 (93.3)
Self-taught	3 (3.3)
Elders	1 (1.1)
Other sources	2 (2.2)

Source: researcher's original data

another respondent mentioned that it could worsen malaria.

Source of knowledge on therapeutic uses of stingless bee honey

When asked about how they learned about traditional medicine, 57 (65.5%, N=87) mentioned that they acquired their knowledge about therapeutic uses of stingless bee honey through an apprenticeship with experienced traditional practitioners, while 19 (21.8%) self-taught and 5 (5.7%) learned about therapeutic uses

of the stingless bee honey from community elders (Table 3).

Monthly demand, availability and sources of stingless bee honey

To estimate the demand for stingless bee honey for medicinal uses, the participants were asked to give their estimated monthly demands in liters. As shown in Figure 3A, majority 54 (60%) said they needed 1-5 L for treating their clients, 31 (34.4%) needed 5-10 L, 3 (5.6%) needed 10-15 L and 2 (2.2%). The traditional practitioners were

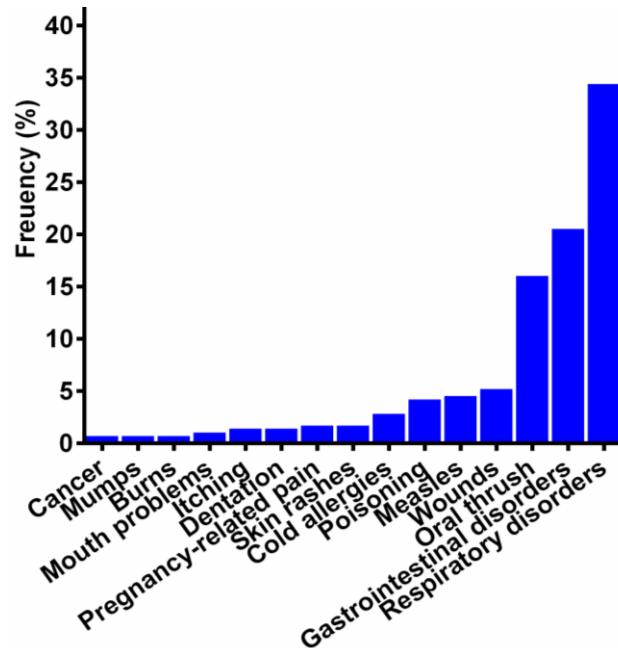


Figure 1. Disorders that are treated using stingless bee honey among traditional practitioners in Baringo County. Others in the figure include (joint problems, fever, abdominal edema, headache, loss of appetite and muscle pain in humans as well as foot and mouth disease, eye diseases and indigestion in animals). Source: researcher's original data

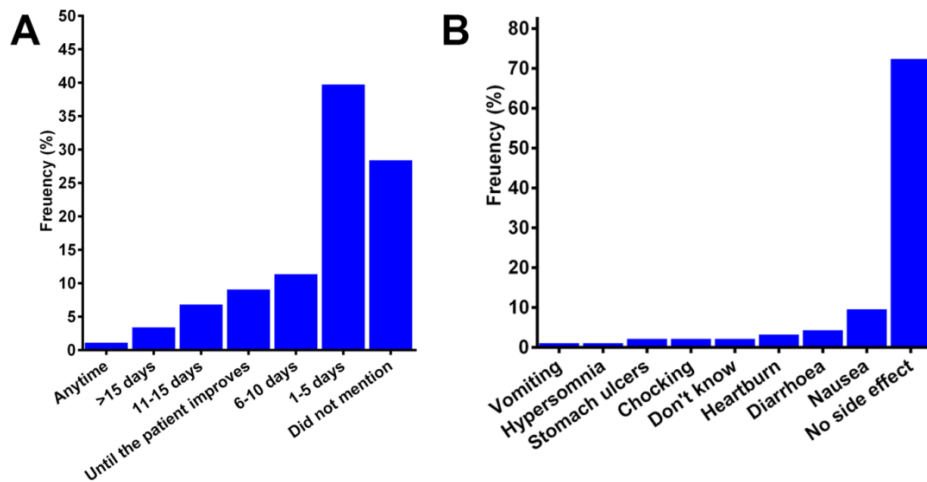


Figure 2. Duration of stingless bee honey therapy varies and the honey is considered safe with minimal side effects by traditional practitioners: (A) Duration and (B) side effects of stingless bee honey therapy. Source: researcher's original data

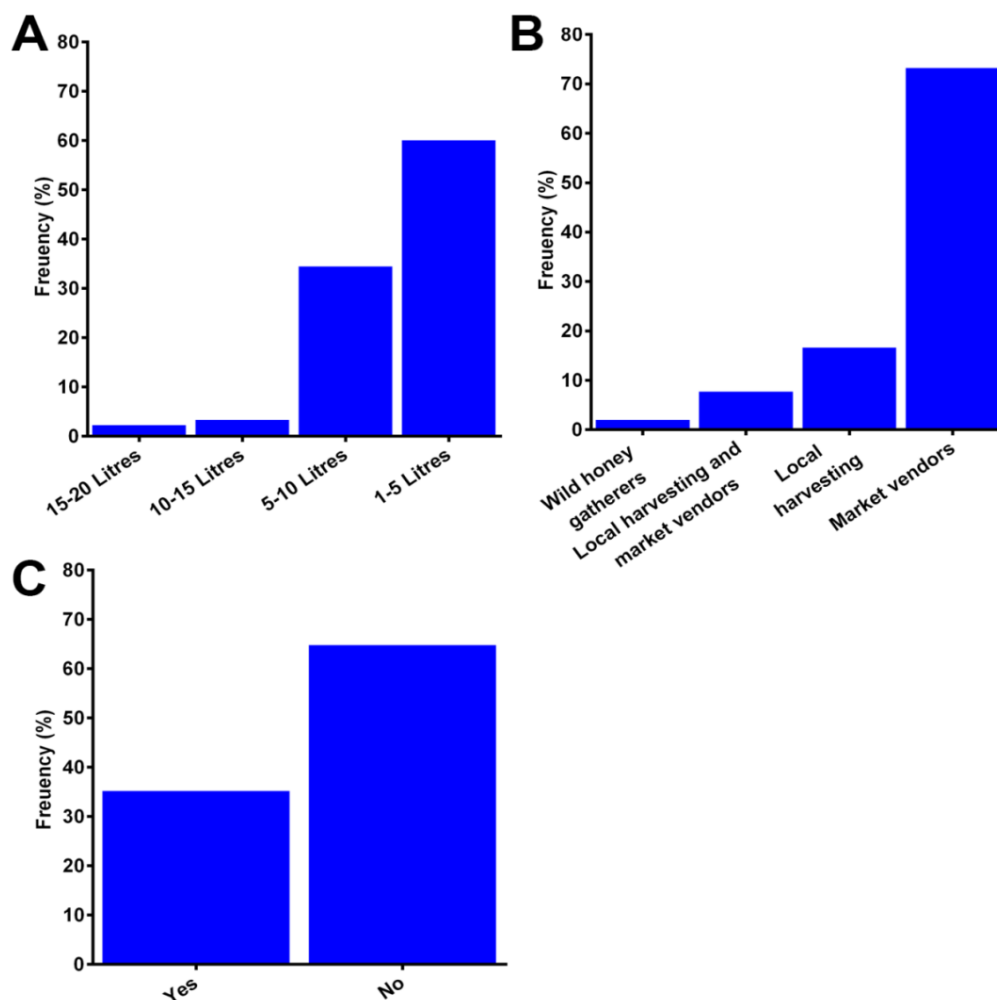
then asked where they sourced stingless bee honey. The majority of them 66 (73.2%) bought the stingless bee honey from local market vendors, who in turn obtained the honey from wild nesting stingless bee honey

gatherers. 15 (16.6%) by harvesting the honey from wild nesting stingless bee in their locality, 7 (7.7%) sourced their medicinal honey from both local vendors and harvesting from the wild, while 2 (2%) bought it directly

Table 3. Sources of knowledge about therapeutic uses of stingless bee honey.

Source	N (%)
Apprenticeship	57 (65.5)
Self-taught	19 (21.8)
Elders	5 (5.7)
Other sources	6 (6.9)

Source: researcher's original data

**Figure 3.** Traditional medical practitioners obtain stingless bee honey from different sources, which do not meet their demands A) monthly demand of stingless bee honey, B) main sources of stingless bee honey and C) sufficiency of stingless bee honey supply.

Source: researcher's original data

from wild nesting stingless bee honey gatherers (Figure 3B). When asked whether the supply from these sources was sufficient enough for their medicinal purposes, the majority 57 (64.8%) mentioned that it was not sufficient to meet their monthly demands (Figure 3C).

Packaging and storage of stingless bee honey by traditional medicine practitioners

Stingless bee honey has been shown to contain several bioactive chemical constituents including flavonoids and

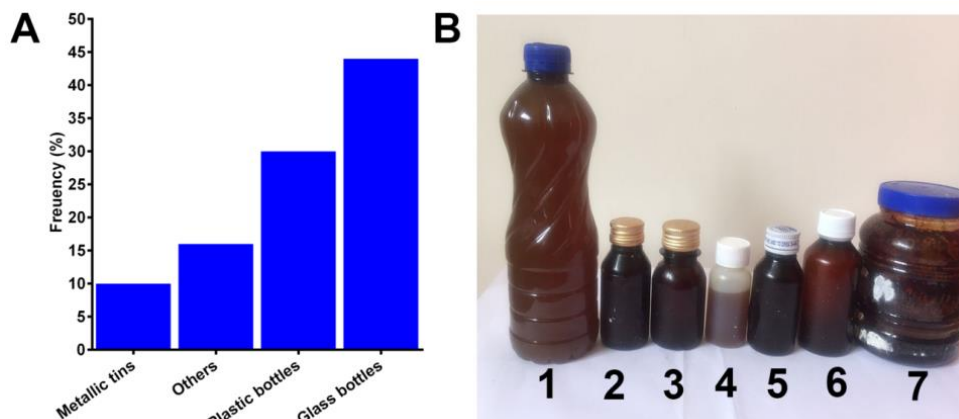


Figure 4. Traditional medical practitioners use various containers for packaging and dispensing of stingless bee honey: (A) percentages of respondents using different container for storage and dispensing of stingless bee honey; (B) photograph of selected packaging/dispensing containers. (1) recycled plastic water bottle, (2,3, 5,6) recycled drug bottles, (4) clear plastic bottle and (7) recycled detergent plastic container.

Source: researcher's original data

polyphenols (Pimentel et al., 2013; Zulhairi Amin et al., 2018). The stability and bioactivity of these chemicals can be affected by the packaging and storage conditions. Inappropriate and inconsistent packaging and storage might also affect the safety of stingless bee honey among consumers. Therefore, we investigated the packaging and storage of stingless bee honey practices among traditional medicine practitioners. Of the 91 respondents included in the analysis, 30% packaged and dispensed the medicinal honey in plastic bottles, 44% used glass bottles, 10% used metallic tins, while 16% used other assorted containers including Jerri cans, and aluminium containers and recycled conventional medicine bottles (Figure 4A and B).

DISCUSSION

In Africa, the ratio of traditional medicine practitioners to the population is 1:500, whereas that of conventional medical doctors to the population is 1:40000 (Abdullahi, 2011). This highlights the important role of traditional medicine practitioners in the delivery of primary health care to the African populations, particularly in rural areas, where access to conventional health care is still limited (WHO, 2007, 2013, 2018). The experienced African traditional practitioners often pass their indigenous knowledge, skills and practices of traditional medicine to the next generation orally, without any form of documentation (Abdullahi, 2011; WHO, 2013). However, the traditional medicine practitioners are rapidly aging and being lost due to old age and the current Corona virus pandemic. The current younger generations are also not very keen to embrace traditional medicine

knowledge and practice. As such, the risk of permanent loss of valuable indigenous ethnomedical knowledge and skills is greater than ever before in Africa. While a number of ethnomedical studies have attempted to document herbal medicine used by various Kenyan ethnic groups (Jeruto et al., 2007, 2008; Nanyingi et al., 2008; Okello et al., 2009; Muthee et al., 2011; Kisangau et al., 2017), non-herbal medicinal products have been largely overlooked. Herein, we have documented the therapeutic uses of stingless bee honey among traditional medicine practitioners in the rural County of Baringo, Kenya.

This study showed that majority of the traditional health practitioners are within the age range of 51-70 years, with a mean age of 56.9 ± 10.5 and an average practice duration of 18.5 years (Table 1). These findings are in agreement with a recent study, which reported a mean age of 64 years and an average practice duration of 24 years among traditional healers in the larger western Kenya region (Chebii et al., 2020). Together, these findings confirm that indeed, the traditional practitioners, who are the custodian of indigenous medical knowledge in Kenya, are aging while the younger people are not joining the profession. This could be due to several factors, including the embracement of conventional medicine, rural-urban migration among the youth, better economic terms for the younger people and stigmatization of traditional medicine (Gakuya et al., 2020). Alternatively, old and experienced traditional practitioners in the study area are willing to pass the knowledge and practice of traditional medicine only to their next of kin at mid-adulthood age. This could explain the fact that traditional medicine practitioners in our study had practiced only for mean duration of 18.5 years despite a

majority of them being in the 51-70 years age range.

The present findings reveal that stingless bee honey is a popular medicinal remedy among the ethnic people of Baringo County as demonstrated by the finding that all the traditional practitioners interviewed were not only aware of it, but also used it to treat several disorders. This is in agreement with earlier studies conducted among the natives of Nocupétaro, Michoacan, Mexico (Reyes-Gonzalez et al., 2014), central Ghana (Kwapong et al., 2010), native Achuar population of Ecuador (Guerrini et al., 2009), Sheka community in southwestern Ethiopia (Kidane et al., 2021) as well as among the Batwa pygmies, Abayanda, Bakiga and Bafumbira people of Uganda (Byarugaba, 2004).

Consistent with other studies (Guerrini et al., 2009), it was found that stingless bee honey is majorly used traditionally for the treatment of respiratory disorders including coughs, tonsillitis, chest problems, asthma, pneumonia and whooping cough (Figure 1). This might be related to the well-known, antioxidant, anti-inflammatory and anti-microbial activities of stingless bee honey (Shahjahan et al., 2007; Pimentel et al., 2013; Zulkhairi Amin et al., 2018). Besides respiratory disorders, gastrointestinal tract disorders were also mentioned among the top-most disorders that are treated with stingless bee honey. Notably, the Batwa pygmies, Abayanda, Bakiga and Bafumbira people of Uganda, have also been reported to use honey of *M. ferruginea* and other stingless bees honey in the treatment of constipation (Byarugaba, 2004). Moreover, stingless bee honey was also recently reported as a common remedy for treating constipation among the Sheka community in South-Western Ethiopia (Kidane et al., 2021). Notably, the *A. mellifera* honey has also been used in various traditional medicine systems to manage stomach diseases (Eteraf-Oskouei and Najafi, 2013), indicating some close similarities with the stingless bee honey.

Oral thrush was the third topmost use of stingless bee honey in the study area (Figure 1). Oral thrush is a fungal infection caused by *Candida albicans* overgrowth, particularly in people with compromised immunity (Hedderwick and Kauffman, 1997; Lu, 2021). Importantly, stingless bee honey has already been shown in laboratory studies to have potent antifungal activity, particularly against *C. albicans* (Hau-Yama et al., 2020). Therefore, it is likely that the local stingless bee honey used by traditional medicine practitioners might have antifungal activity, but this needs to be confirmed in future laboratory studies. In addition, the present study revealed the use of stingless bee honey to treat poisoning cases, which has rarely been reported.

Treatment duration is a key factor in the effectiveness and safety of any form of therapy. Here, we show that stingless bee honey therapy duration varies from as short as 1-5 days to indefinite, with a majority of the traditional practitioners (>40%) prescribing it for 1-5 days (Figure 2A). Although we did not analyze whether the variation

was disease-specific or not, this finding highlights that there might be a lack of standardized duration of stingless bee honey therapy among traditional practitioners in the study area. Of note also, is that 28.4% of the respondents were not willing to mention the duration of stingless bee honey treatment (Figure 2A). This indicates that a substantial number of traditional medicine practitioners in the study area consider some specific information about stingless bee honey therapy as secrets that cannot be shared. A similar pattern of partial secrecy was reported among traditional medicine practitioners in western Kenya (Chebii et al., 2020). If unmitigated such secrecy might lead to a permanent loss of pertinent indigenous therapeutic knowledge.

Among the side effects that were associated with the therapeutic use of stingless bee honey included nausea, choking, diarrhea, excess sleep, heartburn, ulcers and vomiting. However, the majority of the traditional practitioners claimed that they were not aware of any side effects associated with the therapeutic use of stingless bee honey (Figure 2B), pointing to its perceived good safety profile. This is not surprising, since stingless bee honey is a natural product that has been consumed by humans for many years for food nutritional and medicinal purposes. Nevertheless, controlled confirmatory studies would still be needed to ascertain the perceived lack of side effects. The response by some respondents that stingless bee honey is not suitable for diabetics and that it could worsen malaria, for example, points to the possibility of disease-specific side effects.

The present findings indicate that majority of the participants obtained or learned about therapeutic uses of stingless bee honey through an apprenticeship with an experienced traditional practitioner (Table 3). This is in line with the African practice of passing traditional medical knowledge orally from generation to generation (Abdullahi, 2011). This might also explain the finding that the majority of traditional practitioners were old, as young people might not be patient or enthusiastic to spent time learning about traditional medicine from old practitioners who lives mainly in rural places. Therefore, the documentation of traditional therapeutic uses in this work would provide a reference and additional source of knowledge for other practitioners who are not aware of the uses as well as for future generations.

On average, stingless bees produce 2-12 L of honey, per colony annually. The present data shows that the majority of the traditional practitioners in Baringo County requires between 1 and 5 L of honey per month. Since melipolinoculture is not yet developed in the area, this requires harvesting of 1-5 wild nesting colonies per traditional medicine practitioner, per month. This explains the finding that up to 64.8% of the respondents could not get sufficient supplies of medicinal stingless bee honey. Considering that harvesting of wild stingless bee honey in most parts of Africa is often destructive to the bee colonies (Macharia et al., 2007), such a high demand for

stingless bee honey by traditional medical practitioners not only puts a lot of pressure on the wild nesting stingless bee colonies, but might also threaten the long term survival of native species. Therefore, there is a need to develop meliponiculture and training of traditional practitioners to produce their own medicinal honey for the treatment of their clients. Such an initiative will not only aid in meeting honey demand, but will also contribute to biodiversity conservation. Indeed, stingless bee farming has been piloted in western Kenya as an economic activity and incentive to conserve biodiversity, with substantial success (Macharia et al., 2007a, b).

The study shows that traditional practitioners in Baringo package and dispense stingless bee honey in assorted containers including glass bottles, plastic bottles, and tins (Figure 4). This indicates a lack of standardized and hygienic packaging practices, which might in turn lead to contamination of the honey and deterioration of its therapeutic effectiveness. Therefore, there is a general need to train traditional medical practitioners in Baringo County on hygienic packaging, and dispensing practices.

Conclusion

Stingless bee honey is a popular traditional medicine, that is used by traditional practitioners in Baringo County to treat various disorders, particularly respiratory and gastrointestinal disorders. The high demand for stingless bee honey in Baringo County for traditional medicinal uses offers a potential opportunity for the development of modern meliponiculture.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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