



Ethnomedicinal uses of stingless bee honey among native communities of Baringo County, Kenya

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ABSTRACT

Stingless bees live in tropical and subtropical areas around the world, however, stingless bee honey and other products have traditionally been used in the tropical and sub-tropical parts of the world to treat various diseases since ancient times. Little has been done to document these traditional medicinal uses, particularly in Africa. Therefore, an ethnomedicinal survey was conducted in Baringo County, Kenya to document knowledge on medicinal uses of stingless bee honey. The study was a cross-sectional survey in which semi-structured questionnaires were used to collect data from randomly selected 327 residents in five sub-counties of Baringo County. Of these, 139 (42.5%) were men and 188 (57.5%) were women, with a mean age of 36.7 (range 18–94). Majority of the participants (29.8%) had primary education, 29.2% had attained secondary education and only 9.2% had no formal education. The results indicated that over 90% of the community members are not only aware of stingless bee honey, but also its medicinal uses. Treatment of respiratory disorders, infections, gastrointestinal disorders, sore throat and wounds are top most medicinal uses of stingless bee honey by the community. Importantly, the medicinal use of stingless bee honey was perceived to be associated only with mild side effects including nausea, throat irritation and loss of appetite, which are mainly due to intake of excessive amounts. Majority of participants 170 (52.8%) indicated that stingless bee honey was not readily available despite the existing huge demand.

In conclusion, stingless bee honey is a popular therapeutic remedy for various health conditions among the native communities in Baringo County. Future pharmacological studies are needed to evaluate and validate the reported traditional therapeutic uses of stingless bee honey and its unique therapeutic properties. In addition, the potential of farming the local stingless bee species should be explored to meet demand and prevent overexploitation of the wild occurring stingless bee colonies.

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Introduction

Stingless bee honey (SBH) is a sour and flowery liquid produced by various species of stingless bees (Apidae, Meliponini), that are found mainly in the tropics and sub-tropical regions of the world [9,12,20]. Since the ancient times, stingless bee honey has been of great nutritional, cultural and medicinal significance among various indigenous communities around the tropical and subtropical regions. Among the ancient Mayans for example honey “kab” from stingless bee *Melipona beecheii*, “xunan kab” was extensively used to cure “cold” and “hot” diseases, respiratory, digestive, and sensory maladies, syndromes of cultural filiations, and a group of ailments known as fevers, wounds, burns, and poisonous stings or bites (Genoveva 2013) [26].

Among the original people of northern Australia, SBH is a valued source of nutrients and play an important role in social traditions, traditional medicine and rituals [1]. In Brazil, stingless bee honey is used in traditional medicine to treat diabetes, bronchitis, mycosis, throat aches, and sexual impotence, as well as an antidote against snakebites or rabid dog bites [11]. In Ecuador, the Achuar populations use the stingless bee honey mainly for nutritional purposes and as a remedy against colds and throat inflammation [15]. In Malaysia, honey produced by stingless bee (*Trigona spp.*), commonly known as ‘Kelulut’ is used as a remedy for many diseases and as an anti-aging agent [2,27].

Although entomological studies have documented the presences of various stingless bee species in Africa [5,20–22], few studies have been done to document traditional medicinal uses of stingless bee honey and other stingless bee products among indigenous African communities. Connal and Peter (2013), observed that stingless bee honey is well appreciated and widely used by traditional healers in Eastern Africa, but detailed medicinal uses are undocumented as it remains trade secrets in the society. One study in Uganda reported that Batwa pygmies, Abayanda, Bakiga and Bafumbira people use the honey of *Meliponula ferruginea* and other stingless bees honey for medicinal purposes including alleviation of constipation [5].

Generally, knowledge on traditional medicine among the African people is passed orally from generation to generation and in most cases remains community medicinal secrets. However, with the rapid lifestyle changes, a shift to conventional medicine and lack of interest on traditional medicine knowledge and practice among the younger generation, the ethnomedical knowledge that has transcended generations is likely to be permanently lost if undocumented. The knowledge loss may further be accelerated by the rapid loss of many aged traditional healers [8], especially now with the current COVID 19 pandemic, which majorly affect the old. Ethno-medical surveys are therefore urgently needed to document authentic ethnomedical information among the African societies. To this end we conducted a community-based survey to document the ethnomedicinal uses of stingless bee honey among the native inhabitants of Baringo County. We report that there is an extensive knowledge of stingless bee honey, its use in the treatment of various ailments and side effects.

Material and methods

Study site and population

This study was conducted in Baringo County, which is located in Midwestern Kenya (0°40'0" N and 36°0'0" E) and covering an area of 11,015 km². The county consists of six sub counties/districts namely; Koibatek, Marigat, Mogotio, Baringo Central, Baringo East 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. According to the 2019 census, Baringo County has a total population of 666,763 persons residing in 142,518 households [19]. All the residents of Baringo County in the study area, aged above 18 years and who were willing to consent were eligible to be included in the study. People who were below 18 years and/or non-residents of Baringo County at the time of the study were not included in the study.

Study design and sampling

The study was a community-based descriptive cross-sectional study. Cluster sampling was used to obtain a representative sample of 327 respondents from five administrative sub-Counties namely; Koibatek, Marigat, Mogotio, Baringo Central and Baringo North. Each of the five sub-Counties was allocated a sample in proportion to their total population. Three administrative divisions per sub-county were then randomly selected from which household members were randomly selected until the sample allocated to each sub-County was attained.

Data collection

Data was collected by trained enumerators through administration of a semi-structured questionnaire with both open and closed ended questions. Prior to data collection, a pilot survey in selected areas, which was not included in the main study was conducted to pre-test and refine the questionnaire. The socio-demographic data collected included age, gender, marital status and level of education. The knowledge, a data collected included common medicinal uses of stingless bee honey, known side effects and availability of the stingless bee honey.

Table 1
Socio-demographic characteristics.

Characteristic	
Age (Mean±SD)	36.7 ± 12.4
Gender:	
Male	139 (42.5%)
Female	188 (57.5%)
Education Level:	
Primary	97 (29.8%)
Secondary	95 (29.2%)
Tertiary	67 (20.6%)
University	36 (11.1%)
No formal education	30 (9.2%)
No response	(0.6%)

Data analysis

Collected data was checked for completeness and consistency, coded and then entered into statistical package for social sciences (SPSS, version 25). In total 327 returned questionnaires was included in analysis. Descriptive analysis was performed to generate proportions. The diseases and other medicinal uses of stingless bee honey cited by the informants were categorized into specific disease groups.

Ethical considerations

Ethical review was sought from Masinde Muliro University of Science and Technology institutional review committee (MMU/COR:403,009 (Vol 1)). Clearance was also obtained from national council of science and Technology (NA-COSTI/P/19/2147). Informed consent was sought from participants before data collection. To ensure participant confidentiality no identifier information was collected or reported throughout the entire study.

Results

Socio-demographic characteristics of participants

Of the 327 participants included in the analysis, 139 (42.5%) were men and 188 (57.5%) were women. The mean age of the study participants was 36.7 (range 18–94). Majority of the participants (29.8%) had primary education, 29.2% had attained secondary education, 20.6% had tertiary education, those with University education were 11.1% and only 9.2% had no formal education (Table 1).

Participant's knowledge on medicinal uses of stingless bee honey

Of the 327 study participants, 325 (99.4%) knew of stingless bee honey, which is known in the local dialects as 'kosomion' or 'kosomiantet'. In addition, a majority, 322 (98.5%) respondents thought or agreed that stingless bee honey is of medicinal value with 319 (97%) of them being knowledgeable of its various therapeutic uses. When asked to list the therapeutic uses of stingless bee honey in their community, the respondents listed a wide array of 52 therapeutic uses. These therapeutic uses were subsequently categorised into 18 specific groups and their frequencies tabulated (Table 2).

Disorders treated with stingless bee honey by community members

Having established that virtually all the respondents knew about stingless honey and its therapeutic uses, the researchers wanted to know whether they had used it to treat specific disorders in last one year prior to the study. Out of 323 participants that responded 262 (81%), reported to have personally used stingless bee honey to treat a sickness. When asked whether any other member of their household had also used stingless bee honey to treat a disorders, 264 (81.7%) responded yes, indicating its popularity as local household medicinal remedy for common health disorders. Table 3 lists the conditions for which the respondents or their household members had reportedly treated with stingless bee honey. Notably also, majority 97.8% of the respondents was likely to recommend other people to use stingless be honey as a treatment/remedy for illness.

Side effects associated with medicinal use of stingless bee honey

The researchers wanted to know from the community members whether using SBH for medicinal purpose was associated with any undesired side effects. Out of the 309 respondents, majority 284 (92%) reported that medicinal use of stingless

Table 2
Knowledge on therapeutic use of stingless bee honey.

Known therapeutic uses	Frequency (%)
Respiratory disorders	229 (24.4)
Stomach disorders	218 (23.2)
Infections	148 (15.8)
Throat ailments	76 (8.1)
Allergic reactions	67 (7.1)
Wounds	38 (4.0)
Poisoning	32 (3.4)
Teeth problems	24 (2.6)
Skin disorders	23 (2.5)
Reproductive health disorders	20 (2.1)
Musculoskeletal disorders	16 (1.7)
Burns	14 (1.5)
Loss of appetite	13 (1.4)
Immune booster	7 (0.7)
Prophylaxis/protection against diseases	6 (0.6)
Promotion of child growth	4 (0.4)
Fever	3 (0.3)
Cancer	(0.1)

Table 3
Disorders treated with stingless bee by participants and their families.

Treated disorders	Frequency (%)
Respiratory disorders	135 (30.7)
Stomach disorders	90 (20.5)
Infections	74 (16.8)
Throat ailments	44 (10.0)
Allergic reactions	36 (8.2)
Wounds	12 (2.7)
Poisoning	12 (2.7)
Teeth problems	6 (1.4)
Prophylaxis/protection against diseases	6 (1.4)
Skin disorders	5 (1.1)
Burns	4 (0.9)
Loss of appetite	3 (0.7)
Immune booster	3 (0.7)
Reproductive health disorders	2 (0.5)
Musculoskeletal disorders	2 (0.5)
Bone fractures	2 (0.5)
Promotion of child growth	2 (0.5)
Fever	1 (0.2)
Cancer	(0.2)

bee honey was not associated with any side effects. Among the side effects reported by the few 25 (8%) of the participants included stomachache, loss of appetite, skin rashes, throat irritation, nausea, heart burn and abdominal pain (Fig. 1). Notably, these side effects particularly, stomachache and loss of appetite was reported to occur upon excessive intake of stingless bee honey.

Availability of medicinal stingless bee honey

Unlike the common bee, which is widely farmed in Baringo County, stingless bees are yet to be domesticated and the wild colonies produce little honey. Therefore, the study participants were asked whether stingless bee honey was readily available for use as a medicinal product in their locality. Out of the 322 who responded, majority 170 (52.8%) said it was not readily available (Fig. 2), despite the existing huge demand.

Discussion

Stingless bee honey is widely used for medicinal purposes (Rosales 2013). In the present study, we investigated the knowledge on medicinal use of community members concerning the stingless bee honey in Baringo County, Kenya. In the local dialects of Baringo County communities, stingless bee honey is popularly known as '*Kosomion*' or '*Kosomiandet*'. Generally most of the people were knowledgeable regarding the various medicinal uses of stingless bee honey which was consistent with findings of a study in central Ghana and Northwest Ethiopia where the local people showed great wealth of knowledge about the medicinal uses of stingless bee honey (Afia and Kwapong 2007; [16,18]). The results showed that a

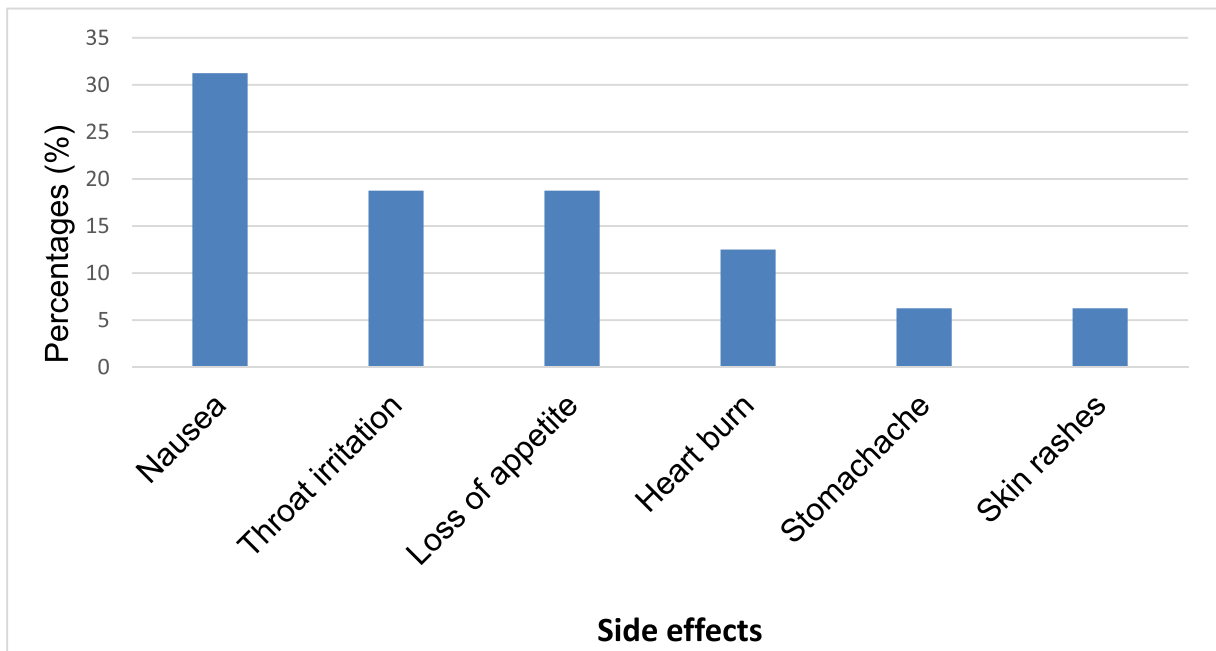


Fig. 1. Side effects associated with medicinal use of stingless bee honey.

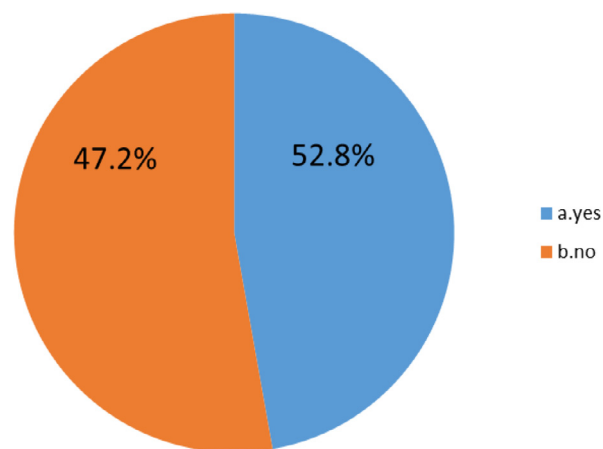


Fig. 2. Availability of stingless bee honey for medicinal uses.

high proportion (over 90%) of the general community members not only knows about stingless bee honey, but are also aware of its medicinal uses, (Table 2) regardless of age, education level or gender (Table 1). The findings also demonstrated that most of the respondents or their household members had taken stingless bee honey as a remedy against common disorders within the last one year prior to this study. This was surprising because although the practice of traditional medicine is common in Kenya, it is not fully accepted, particularly by the well-educated and is still subject to stigmatization [14]. Unlike other traditional medicines such as herbal-based products, whose contents, sources and preparation remains a trade secret of the traditional healers [14], stingless bee honey is produced by local stingless bees that are well known to the general public and is used in its natural form. Stingless bee honey is also considered as natural food. Moreover, Baringo County comprises mainly of arid and semi-arid rural settings, often with inadequate availability or poor accessibility of conventional health care. Altogether, these might explain the high popularity, knowledge, and widespread use of stingless bee honey as a medicinal remedy in the study area.

Respiratory disorders including asthma, bronchitis and coughing were the topmost disorder treated with stingless bee honey by the native communities of Baringo County (Table 3). This is consistent with the findings of other previous ethnomedical survey of indigenous communities living in tropical and subtropical areas. Among the Maya people, for example, respiratory diseases was among the most common disorders that were treated with the honey “kab” of the native stingless

bee *Melipona beecheii* (Rosales 2013). Among the natives of Nocupétaro, Michoacan, Mexico, stingless bee honey together with different ingredients (lemon juice, agave mescal, ethanol) is mainly used to treat cold, cough, bronchitis and other respiratory illnesses [25]. Among the native Achuar population of Ecuador stingless be honey is similarly used mainly as a remedy against respiratory disorders including colds and throat inflammation [15]. In Ghana also, asthma has been reported as among the various ailments commonly treated by local communities with stingless bee honey (Eardley and Kwapong 2013; [17]). In the Sheka region of Ethiopia, stingless bee honey is used to treat tuberculosis, coughing, tonsillitis and asthma [18]. It is well known that infections (both bacterial and viral), oxidative stress and inflammation are key factors in the etiology and pathogenesis of most respiratory disorders. On the other hand stingless bee honey is known to have broad spectrum antimicrobial effects [4,13,27,28] as well as potent antioxidant and anti-inflammatory properties [6,10,23]. A study conducted in Ghana showed that stingless bee honey produced by *Meliponula bocandei* was very effective against *Pseudomonas aeruginosa* [7]. This might account for the consistent and wide spread use of stingless bee honey against respiratory disorders.

Studies among the Batwa pygmies, Abayanda, Bakiga and Bafumbira people of Uganda *Meliponula ferruginea* and other stingless bees honey was used for medicinal purposes chief among them being alleviation of constipation [5]. Stingless bee honey is also used to treat constipation in Ethiopia [18]. This is consistent with our study finding that up to 20% of our respondents had used stingless bee honey to treat stomach disorders including stomachache and constipation (Table 3).

In the present study, treatment of infections was the third most common use of stingless bee honey in the study area (Table 3). Importantly, several previous studies have demonstrated high antimicrobial potency of stingless bee honey from different parts of the world, including Kenya [4,13,27,28]. This antimicrobial activity has been linked to various chemical compounds in stingless bee honey including flavonoids. Therefore, it would be interesting in future to characterize the antimicrobial properties of stingless bee honey and other related products including the propolis from Baringo County.

Owing to its antioxidants and antimicrobial properties, stingless bee honey is effective in wound healing [29]. In a study done in North-West Ethiopia, respondents mentioned 15 medical conditions, for which the honey is used and notably 11 out of 15 ranking was given to wound-healing properties of honey. This was consistent with our finding showing that a number of native people of Baringo use stingless bee honey to treat wounds and burns (Table 2 and 3). Use of stingless bee honey for allergic reactions, as an immune booster and for prophylaxis against diseases was also reported in our study. This might have a basis in the fact that stingless bee honey has potent anti-inflammatory and immunomodulatory effects [3,24].

As expected most of the respondents indicated that stingless bee honey was not associated with serious adverse effects. However, it was apparent from the respondents that in excessive amount, stingless bee honey can lead to unwanted effects including nausea, throat irritation and loss of appetite. Surprisingly also stomachache was mentioned as one of the side effects by up to 5% (Fig. 1) of the respondents, yet it was also used by many respondents to treat stomachache disorders (Table 3).

The reported inadequate availability of stingless bee honey highlights a potential opportunity for development of conventional stingless bee farming (meliponiculture) in the study area. Already, meliponiculture have been successful introduced and practiced in other parts of Africa including western Kenya and Ghana [20,22].

CRedit authorship contribution statement

Sabella J. Kiprono: Methodology, Investigation, Validation, Writing - Review & Editing, Visualization. **Gladys Mengich:** Methodology, Supervision, Validation. **Charles Mutai:** Methodology, Supervision, Project administration. **Jackline Kosgei:** Methodology, Resources, Validation. **Sammy Kimoloi:** Methodology, Validation, Conceptualization, Software, Formal analysis, Data Curation, Writing - Original Draft, Visualization.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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