

Uses of Beehive Products by the Baoule Population, Central Côte d'Ivoire

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Abstract: *Honey production is a significant potential source of food and financial income for the rural population. In order to contribute to the development of the beekeeping sector, it is necessary to produce scientific data on beekeeping in Côte d'Ivoire, which is still insufficient. Among the baoulé of the Central Côte d'Ivoire, a survey was conducted among 156 honey producers. The objective of the study is to list the uses as well as to provide information on the marketing of honey in the baoulé society. Honey is used in the treatment of 28 diseases and symptoms. In total, 57.29% of the honey produced by the rural population is reserved for family consumption and 42.71% for marketing. The selling price of honey is between 1500 and 2125 F CFA per liter. The annual income per traditional or modern beekeeper varies from 375 to 685312.5 F CFA.*

Keywords: Côte d'Ivoire, apitherapy, honey, price, disease

1. Introduction

Beekeeping, a secular activity in West Africa, is the set of techniques for the breeding of honey bees with a view to the rational exploitation of the products of the hive: honey, pollen, wax, propolis and royal jelly [1]. Beekeeping constitutes a positive externality for the environment and biodiversity [2]. Similarly, honey, the flagship product of the hive, has very important nutritional and therapeutic properties [3]. Indeed, composed of simple sugars, it is easily assimilated by the organism. It becomes a natural palliative to refined sugars. In addition, there is a certain revival of interest for beekeeping which appears as one of the interesting alternatives for poverty reduction [4].

The observation of bees in their environment (flowers and hives), made our ancestors understand that these insects take care of themselves, perpetuate their species with as only means, the products of the hive: honey, propolis, venom, royal jelly, pollen and nectar. Despite their smallness, bees know how to take care of themselves. The products made by bees have virtues and provide benefits to the population. Thus, from the therapeutic use of the products of the hive for the well-being and beauty of humans was born "apitherapy". The products of the hive are noble and rich in active ingredients and recognised for their mystical power. Among the baoulé, the presence of honey in a house repels evil spirits and negative waves. Moreover, these small animals intervene in biodiversity by polluting flowers, increasing harvests and enriching ecosystems.

In spite of all its virtues, very few studies have been carried out on the different forms of use of honey in Ivory Coast. Indeed, the already existing works have been

oriented towards the honey flora in the Dimbokro department [5] and in the agroforestry zone of the Yamoussoukro Higher School of Agronomy [6]. It is therefore necessary to deepen knowledge on the different forms of use of hive products in order to promote their productivity in Côte d'Ivoire. In central Côte d'Ivoire, in addition to the open forest and savannah vegetation, the large plantations of cocoa trees, cafiars, rubber trees and papaya trees constitute enormous potential for honey production. This makes this area favourable for honey production. The objective of this study is to list the different forms of use of honey and to provide information on its marketing in Baoulé society.

2. Material and Methods

2.1. Presentation of the study environment

The study site is made up of the rural areas of the District of Yamoussoukro (06° 7' and 07° 8' North latitude and between 04° 6' and 05° 6' West longitude) in which there is a population practising traditional or modern beekeeping (figure 1). The relief of the District of Yamoussoukro is generally made up of plains and plateaus. Its soil rests on vast granite massifs, metamorphic and schistous rocks [7]. The District of Yamoussoukro belongs to the mesophilic sector of the Guinean domain [8]. It is subject to a sub-equatorial climate, also known as the Baulean climate. It is marked by a very variable spatio-temporal distribution of rainfall, with an alternation of two seasons of unequal importance; a rainy season from March to November and a dry season the rest of the year. The vegetation is characterised by a mosaic of Guinean savannahs and dense humid semi-deciduous forests [9].

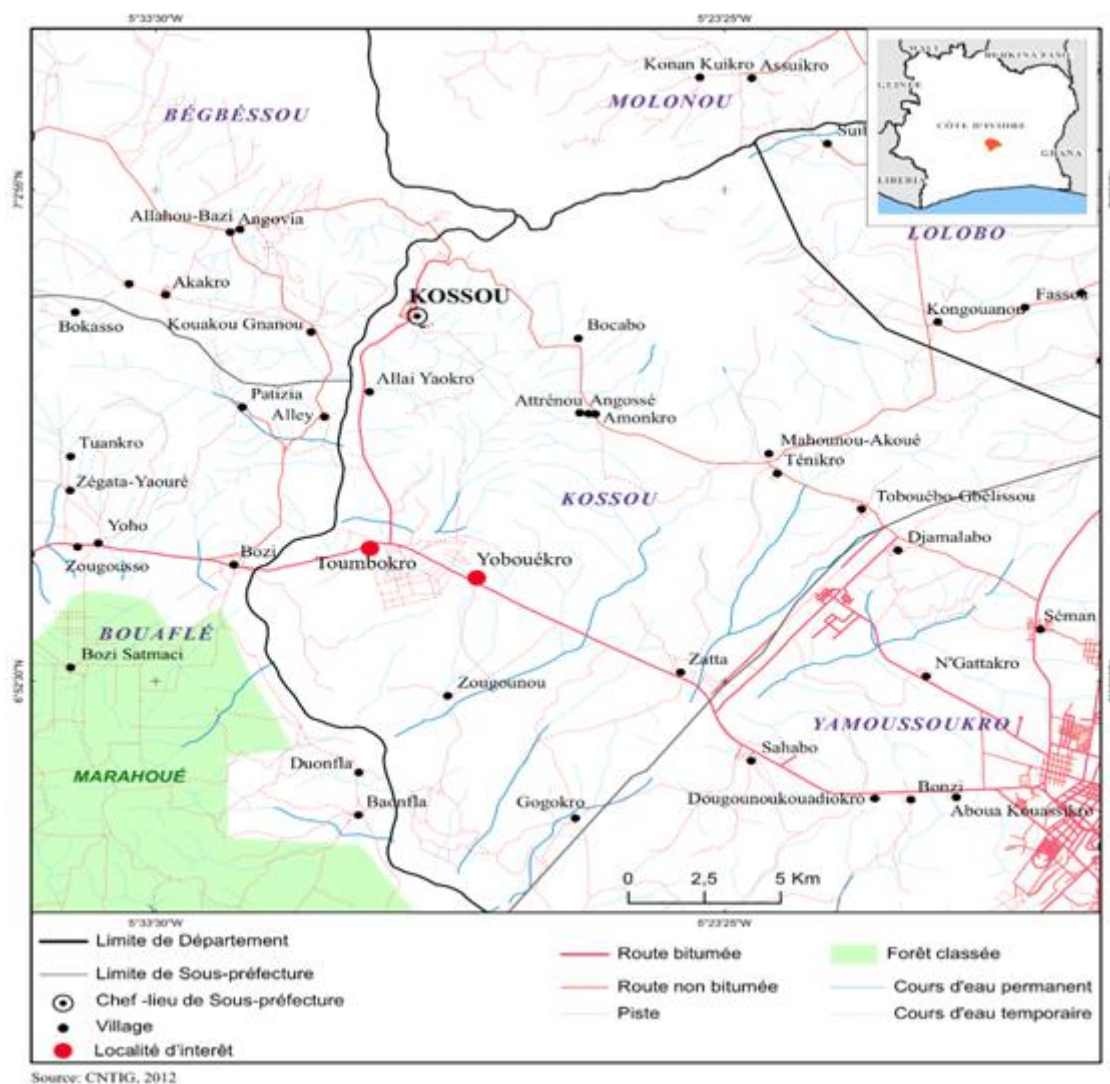


Figure 1: Carte de la localisation de la zone d'étude en Côte d'Ivoire

2.2 Technical equipment

2.2.1. Data collection

Data collection was carried out among honey producers in the rural areas around Yamoussoukro. It consisted of interviews with producers with a questionnaire on apitherapy; the quantity of honey reserved for consumption and that intended for marketing; the unit price of honey and the financial income of farmers.

The people surveyed are producers who have harvested honey at least once during the 2016-2018 period and who have marketed part of their production. The survey was conducted randomly. The approach used was semi-structured interviewing [10].

2.2.2. Data analysis

The survey data were entered into Microsoft office Excel 2007 software in order to be able to group the number of participants by category. With regard to apitherapy, the diseases, symptoms treated by honey as well as its effect on the organism according to the developmental stages of

humans were first counted. Then the methods of use, preparation and route of administration were described.

The quantity of honey reserved for consumption and that intended for marketing were determined by summing the respective quantities given by all producers.

The annual income (**ra**) is calculated by multiplying the quantity of honey produced during the year (**qa**) by the average unit price (**pu**).

The total income (**Rt**) is obtained by adding the incomes of all beekeepers (**rp**).

The quantity of honey consumed per person (**Q**) in 2018 is obtained by dividing the quantity produced in 2018 (**qt**) by the population (**pp**) of the areas crossed.

3. Results

3.1. Apitherapy

Honey is used in the treatment of common illnesses and symptoms in the study area, in simple use in its pure state or in combination with other remedies, in external or

internal application. It also has positive effects on the organism according to the stages of human development. The treatment is suitable for children, young people and adults alike. The villagers use honey as a memory aid as well as for the treatment of coughs, burns, headaches, fever in children, earaches, colds, stomach aches, painful

periods, prostatitis, snake bites, constipation, liver aches, aging, heart problems, high blood pressure, abdominal pain after childbirth, mental fatigue, fractured limbs, malaria, lung infections, purulent wounds, menopause, weight loss, asthma, ulcers, skin diseases and dentition in children (Table 1).

Table 1: Apitherapy according to the Baoulé people

Diseases and symptoms treated	The nature of the honey used	Method of preparation	Route of Administration	Treatment
Cough	raw	Mix honey and lemon juice in lukewarm water or take honey without additive.	Oral	Take 1 to 2 spoonfuls of the mixture or honey, morning and evening until healed.
Burn	raw	Brush the burnt area with honey.	External	Brush at least 3 times a day for 3 days in a row
Headaches	raw	Dilute the honey in water or take it without additives.	Oral	Regularly wash 1 to 2 spoonfuls of the mixture or honey each morning
Fever in children	raw	Brush the body with honey	External	Every night until body temperature becomes normal..
Earache	raw	Soak a piece of clean cloth or cotton in honey.	Auditory	Put the honey-soaked cloth or cotton in the ear in the morning and at dusk for 1 to 2 weeks.
Fact sheet	raw	Mix the honey and the crushed unripe papaya (<i>Carica papaya</i>) seeds.	Oral	Usually wash 1 teaspoonful on an empty stomach in the morning.
Cold	raw	Form a mixture of equal amounts of honey and lemon juice (<i>Citrus limon</i>)	Oral	Drink the juice obtained morning and evening for 3 days.
Stomach aches	raw	Boil some water, let it cool down, put it in a glass and add honey.	Oral	Drink the solution morning, noon and evening for 2 days.
Dentition in children	raw	Badigeonner les gencives avec du miel	Oral	Brush the gums with honey morning, noon and evening for 10 days.
Painful menstruation	raw	Honey without additives	Oral	Take two spoonfuls of honey twice a day and four days before menstruation
Prostatitis	raw	Honey without additives	Oral	Usually lap honey
Snake bite	raw	Transform the propolis into a ball by kneading.	Oral	Apply the ball of propolis obtained against the bite point.
Constipation	raw	Form a solution by mixing liquid honey and dried green papaya.	Oral	Drink the solution obtained, morning, noon and evening, during the discomfort, for 2 days.
Liver ailments	raw	Wash the honey at least ½ hour before the meal.	Oral	Take 1 spoonful regularly, morning, noon and evening.
Decline in Ageing	raw	Honey without additives	Oral	Lather the honey often
Heartache / Palpitation	raw	Honey without additives	Oral	Consume 1 teaspoonful of honey regularly, morning and evening.
Hypertension	raw	Leave a sugar cube in honey for one day.	Oral	Put the sugar cube in your mouth and breathe
Stomach aches after childbirth	raw	Form a solution from a mixture of honey cake, millet flour (<i>Pennisetum glaucum</i>) and water.	Oral	Drink enough of the solution obtained, morning, noon and evening, for 3 days for a baby boy and 4 days for a baby girl.
Intellectual fatigue	raw	Form a solution from a mixture of honey, lemon juice (<i>Citrus limon</i>) and water.	Oral	Drink the resulting solution morning and evening for one to two weeks.
Limb fracture	raw	Form a solution by mixing 2 beehive products (pollen and liquid honey) and African peach root powder (<i>Naucleria latifolia</i>), "monkey orange" (<i>Strychnos innocua</i>), small chilli pepper (<i>Hynocardia acidia</i>) and water.	Oral	Regularly massage the immobilised limbs (healed after a fracture) with the solution obtained.
Malaria	raw	Add 3 spoonfuls of honey to the herbal decoctions.	Oral	Drink 2 glasses morning and evening for 3 days
Pulmonary infection	raw	Form a solution with propolis, alcohol and honey.	Oral	Take 2 to 3 drops, morning and evening for 3 weeks.
Purulent wounds	raw	Form a propolis powder and mix it with honey.	External	Clean the wound and spread the mixture of propolis powder and honey

				over it.
Retreat of the Menopause	raw	Honey without additives	Oral	Regularly wash 2 spoonfuls each morning
Slimming	raw	Boil some water and let it cool down, then add 3 spoonfuls of honey.	Oral	Drink the solution constantly on an empty stomach in the morning and at dusk.
Asthma	raw	Mix half a spoonful of onion macerate (<i>Allium cepa</i>), 1 spoonful of lemon juice (<i>Citrus limon</i>) and 1 spoonful of honey.	Oral	Consume the mixture on an empty stomach in the morning every day for 2 weeks.
Ulcer	raw	Mix the honey with the white baobab fruit powder. (<i>Adansonia digitata</i>)	Oral	Take on an empty stomach in the morning, 3 spoonfuls every 2 days, until healed.
Dermatoses in children	Cooked	Honeycomb leather	External	Wash baby with the decoction morning and evening for 3 months.

3.2. Quantity of honey used in consumption and marketing

A large part of the honey produced (1293.5 liters or 57.29%) is destined for consumption. This production is either donated or used for self-consumption (Table 2). On the other hand, 964.5 liters of honey or 42.71% of the total harvest is marketed. A significant quantity is sold on

village markets (Table 2). Only modern beekeepers sell their honey in pharmacies and in the town markets.

The use of honey continues to grow over time: from 619 liters in 2016, it rose to 670 liters in 2017, an increase of 8.24%, then to 960 liters in 2018, an increase of 43.28% (Table 2). Out of a population estimated at 10.519 inhabitants, consumption will rise to 960 liters in 2018, i.e. 0.091 liters per person.

Table 2: Annual distribution of harvested honey

Years	Distribution of harvested honey (liters)				Total	Increase
	Consumer		Marketing			
	Self-consumption	Donation	Local market	Pharmacies and city markets		
2016	327.8	81.95	168.375	40.875	619	
2017	317.8	79.45	140.875	140.875	679	8.25%
2018	389.2	97.3	236.75	236.75	960	43.28%
Total	1293.5		964.5			
Percent	57.29%		42.71%			

3.3 Marketing

3.3.1. Unit price of honey from 2016 to 2018

The price of a liter of honey has varied from 1500 FCA to 2125 CFA among modern beekeepers depending on the year. These modern beekeepers are grouped into Moderns

1 and 2 according to the prices charged (Table 3). From 2016 to 2017, honey is sold either at 1500 F CFA or 2000 F CFA. In 2018, the price fluctuated between 1750 CFA and 2125 CFA. For products from the traditional harvest, the price remained constant at 1500 F CFA over the period 2016-2018 (Table 3).

Table 3: Distribution of the unit price according to the years and the type of beekeeping

Years	Type of producers	Price per unit	Percentage of producers
2016	Modern 1	1500	83.33%
	Modern 2	2000	16.67%
	Traditional	1500	100%
2017	Modern 1	1500	83.33%
	Modern 2	2000	16.67%
	Traditional	1500	100%
2018	Modern 1	1750	83.33%
	Modern 2	2125	16.67%
	Traditional	1500	100%

3.3.2. Evaluation of turnover

The financial income of the two types of beekeeping in Yamoussoukro is 1761750 CFA for the three years under consideration. The income of traditional operators varies from 184875 CFA (in 2018) to 191250 CFA (in 2016).

Indeed, production in 2018 saw a slight increase of 8.35% compared to that of 2017 (170625 CFA) and a slight decrease of 3.33% compared to that of 2016. The average annual income per traditional producer varies from 587.4 CFA to 966.36 CFA depending on the year.

With regard to modern beekeeping, monetary income increases over time. It was 163500 CFA in 2016. This figure is more than double in 2017 (317625 CFA) and that of 2018 (733875 CFA) is four times the amount in 2016. The average annual income per modern beekeeper varies

from 37916.88 CFA to 78480 CFA depending on the year (Table 4). In 2018, the annual income per traditional producer fluctuated from 375 to 6000 F CFA and from 2625 to 685312.5 F CFA per modern beekeeper.

Table 4: Financial income by year and type of beekeepers

Years	Type of beekeepers	Money income (CFA)	Yield/year/apiculturist (CFA)	Total/year (CFA)
2016	Modern	163500	78480	354750
	Traditionnal	191250	966.36	
2017	Modern	317625	16675.31	488250
	Traditionnal	170625	587.4	
2018	Modern	733875	37916.88	918750
	Traditionnal	184875	629.79	
Total for 3 years (CFA)		1761750		1761750

4. Discussion

4.1. Apitherapy

In the study area, honey is used in the treatment of some common diseases and symptoms. It has effects on the organism according to the stages of human development. Menopause, weight loss, asthma, ulcers, dermatoses and dentition in children, ageing, stomach aches after childbirth, identified during the survey as problems that can be treated with honey, are also encountered in Benin by [11]. Nevertheless, many authors testify to the therapeutic effects of honey. According to [12, 13, 14, 15, 16], honey is antibacterial because of its high sugar content and the presence of inhibins and antimicrobials because of its enormous sugar concentration and its high osmotic pressure. In honey we distinguish 2 groups of inhibins [17, 14]: the peroxidised inhibin, consisting of hydrogen peroxide and the non-peroxidised inhibins consisting of acids, bases and neutral and volatile substances such as flavonoids. These inhibins come mainly from plants and are powerful bacteriostats [1]. This justifies the effectiveness of honey-based treatment against these ailments such as stomach aches, liver aches, heart aches, intellectual fatigue, lung infections and hypertension. Its anti-inflammatory properties [1], help fight purulent wounds. Honey also has antitussive, expectorant and soothing effects that help to fight against respiratory ailments [15]; hence the use of honey against coughs. In addition, the plants visited by bees contain essential oils that are well known for their antiseptic effects [18]. Therefore, honey can fight against blight [19]. The flavonoids contained in drugs give them various therapeutic properties [20], hence the virtues of honey.

4.2. Quantity of honey marketed and that reserved for consumption by producers

A large part of the honey is intended for self-consumption. This could be explained by the fact that honey has long been produced for family consumption [21]. The most common place where honey is sold is the local market [1]. Indeed, it abounds with many customers who are not very demanding in terms of honey quality. On the other hand, honey sold at the pharmacy must be subject to quality

controls; thus, only modern beekeepers can have access to this channel.

The average quantity of honey (0.91 liter) consumed per inhabitant in the study area is comparable to that of metropolitan France (0.9 liter/inhabitant), according to [22].

4.3 Marketing

The price per liter of honey is derisory for honey hunters. This is due to the fact that these hunters invest less in beekeeping [23, 4]. Indeed, these farmers devote less time to beekeeping because it constitutes an accessory activity for them [24, 25, 26]. In addition, the equipment used for harvesting is not expensive [25, 27] and not adapted either. This low investment would also justify the low income of honey hunters. Moreover, the price depends on the quality of the honey produced [23]. Traditionally produced honey is not always of good quality because of the presence of plant debris (ashes) and animal debris (dead bees and broods) [25, 28, 29, 30].

The high price of honey produced by the modern method is linked to its quality [31], the large investment in time and material [11] and the experience acquired by the actors over the years. The direct consequence of this fact is the better income of modern beekeepers compared to honey hunters.

5. Conclusion

The overall objective of the survey on the uses of the products of the hive in the region of central Côte d'Ivoire was to evaluate the uses as well as the marketing of the honey coming from the rural areas of the district of Yamoussoukro. The observations made with the producers, showed that the main objective of beekeeping remains the marketing, feeding and use of honey in traditional medicine. At the end of this study, it appears that 42.71% of the total production of honey is sold at a derisory and constant price by honey hunters and at low prices by modern beekeepers. even if they are higher than those of the former.

Beekeeping is of increasing interest to rural populations. They are eager to improve it, but the lack of financing and the absence of an official marketing circuit constitute a hindrance to the development of the beekeeping sector. We suggest to the decision makers to direct the development actions of rural areas firstly towards the training of young people in beekeeping, then their installation by helping them financially and finally, to plan a strategy of follow-up of these young beekeepers.

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