Full Length Research Article

Postharvest Handling Practices and Marketing of Honey at Arba Minch Zuria District of Gamo Zone, Southern Ethiopia

Alemayehu Anza[1,2*], Nebiyu Yemane[2], Amssalu Bezabeh[3]

[1] *Worabe Agricultural Research Center, Southern Agricultural Research Institute, Ethiopia*
[2]*Department of Animal Science, Arba Minch University, Arba Minch, Ethiopia*
[3]*Holeta Bee Research Center, Holeta, Oromia, Ethiopia*
**Corresponding author: alemayehunz@gmail.com*

ABSTRACT

This study was conducted at Arba Minch Zuria District of Gamo Zone, Southern Ethiopia to assess postharvest handling practices and marketing systems of honey. The district was selected purposively based on its beekeeping potential and stratified into three agro-ecological zones. Seven representative Kebeles from the District were selected proportional to their agro-ecological variations. A total of 156 beekeepers was selected using systematic random sampling technique. A cross-sectional study was conducted to generate data via an official survey. The data was analyzed using SPSS version 24 software. The result revealed that most (96.8%) of the beekeepers practiced traditional beekeeping system. Only 29.7% of the bee keepers strained their honey using sieve (68.4%), hand (21.1%) and a piece of cloth (10.5%). Plastic buckets (64.7%), tin and gallon (32.7%) and plastic sack (2.6%) were major honey handling materials. Most (90.4%) of the bee keeperssell honey to generate income and only 9.6% used honey for both sale and home consumption. Producers, consumers, retailers, tej houses and collectors were main actors involved in the honey value chain. Agro-ecology significantly influenced the market price of both crude and strained honey. The price of crude and strained honey in lowland location was significantly ($P < 0.001$) higher than highland and midland locations.

Keywords: Agro-ecology**,** Arba Minch, beekeeper, honey, price

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1. INTRODUCTION

Ethiopia is one of the countries in the African continent that has the largest honey bee population and owns a big honey production potential in its varied ecological and climatic zones (Takele, 2014). The honey and beeswax annual production potential is estimated at 500,000 and 50,000 tons, respectively. Currently, the country produces only 64,000 tons of honey and 6,000 tons of beeswax that account for more than 25% of production in Africa, making it one of the top ten honey and five beeswax producers in the globe (Apimondia, 2018).

Honey, the major product of honeybees, directly and indirectly contributes to the income of households and the economy of the nation (Martin et al., 2012). It is of good quality as long as it is in the hive, but faulty handling from the time of its harvest until it reaches to market is responsible for its inferior quality (Crane, 1976). Inappropriate materials used for honey handling and careless storage conditions of honey leads to reduce its quality (Yetimwork, 2015).

According to Gizachew (2012) there is large and growing demand for honey, as well as for beeswax and other bee products with nutritional or medicinal qualities. The inferior quality of honey comes from the mishandling of the product starting from harvesting through storage to marketing (Gemechis, 2015). Honey marketing is also affected by its quality resulting from its harvesting, processing methods and storage condition (Iuliana et al., 2007). Therefore, it is important to know the suitability of honey for processing to meet the demand of the market. However, compiled data on postharvest handling practices and marketing systems of honey in a Gamo zone in general and Arba Minch Zuria District in particular are not available so far. It is strongly believed that availing such important information for the study area is very helpful for the development plan of the district. Therefore, this study was conducted to assess the postharvest handling practices and marketing systems of honey produced in Arba Minch Zuria District of Gamo Zone, Southern Ethiopia.

2. MATERIALS AND METHODS

2.1 Description of the Study Area

The study was conducted in Arba Minch Zuria District, Gamo Zone of Southern Nations, Nationalities and People Regional State. The general elevation of the District ranges from 1150 to 3300 meters above sea level. The annual rainfall ranges from 800 to 1500 mm and mean annual temperature ranges

from 16.3^{0}C to 37 ^{0}C. The climatic condition of the District is characterized as 14% highland, 53% midland and 33% lowland.

2.2 Sampling Procedure and Sample Size Determination

Multi-stage sampling procedure was followed at three different stages. In the first stage, the study District was stratified into three distinctive agro-ecologies. These three strata were lowland (<1500 m.a.s.l), midland (1500-2300 m.a.s.l) and highland (>2300masl) (MoARD, 2007). In the second stage, seven representative *Kebeles* from the District were selected proportional to the agro-ecological variation following purposive sampling technique based on beekeeping potential of the *kebeles*. In the third stage, individual household heads with honeybee colonies were identified and selected using systematic random sampling technique from a list of households in each *kebele*. Beekeepers in the District were used to represent the study population. The sampling units were households keeping honeybee colonies. The sample size required for the study was determined by the formula recommended by Arsham (2005) for survey studies:

$$N = \frac{0.25}{SE^2}$$

Where, N = sample size and SE = the standard error.

With the assumption of 4% standard error, a total of 156 households was sampled. From 156 households 22, 83 and 51 beekeepers were selected from highland, midland and lowland, respectively, proportional to agro-ecological representation.

2.3 Data collection

Cross-sectional type of study was conducted to collect primary data through formal survey, focus group discussions, key informants' interview and field observations. Relevant information was further collected through discussions with the District honey bee experts, DAs, NGOs and other relevant institutions that play significant role in beekeeping activities of the District. Secondary data, which is used to supplement the primary data, was obtained from Gamo Zone Livestock and Fishery Resource Department (GZLFRD), Arba Minch Zuria District Livestock and Fishery Resource Offices (AMZDLFRO) and each *Kebele* farmers training centers. Besides, the reports of previous research findings, guidelines, manuals and other published and unpublished documents were also reviewed.

2.4 Data Management and Statistical Analysis

All the collected data were analyzed using SPSS software version 24. The analyzed data were presented using tables, frequencies, percentages, means and standards. The means of quantitative data among agro-ecologies were compared with employing one-way ANOVA. The means were separated using the Tukey HSD test whenever they were statistically significant at $P < 0.05$. Statistical differences among qualitative variables were analyzed in a cross-tabulation.

3. RESULTS AND DISCUSSIONS

3.1 Socio-economic Characteristics of the Respondents

All interviewed beekeepers were male headed households. This might be partly due to psychological fear exhibited by women towards the profession coupled with the time of major activities, which were either late evening or early morning hours, which were not convenient for women due to household workloads. Significant ($P < 0.001$) difference were observed across agro-ecologies in relation to the educational status of respondents. The highest (50%) level of illiterates was recorded in the highland. As a result, the adoption of new beekeeping technology is weaker in highland than midland and lowland locations. This implies that the education status is a hindering factor for the adoption of new bee keeping technologies in the study area. The overall mean age of the interviewed bee keepers was 42.90±0.56 years, with a range of 26–68 years. The study revealed that beekeeping can be performed by all age groups and reasonably without any difficulties and more actively performed by younger age groups.

The level of beekeepers' experience was taken to be the numbers of years that an individual was continuously engaged in beekeeping. The overall experience of the respondents in beekeeping was 14.85±0.68 years, with a minimum of 3 years and a maximum of 42 years. Differences in beekeeping experience might influence the attitude and adoption of new beekeeping technologies (Hussien *et al*., 2015). Besides, the correlation between age of beekeepers and beekeeping experience ($r = 0.84$, $P = 0.000$) indicated a strong positive significant relationship implying high engagement in beekeeping from an early age leading to becoming independent beekeeper at later age. The average landholding of the respondents was found to be highly significant ($P < 0.001$) across agro-ecologies. The highest landholding was recorded in lowland whereas the lowest farmland size was recorded in highland agro-

ecology (Table 1). The overall average farmland holding of the respondents was 1.27±0.06 hectares. This result is comparable with the mean national landholding (1-1.5 ha) (CSA, 2017).

Table 1. Socio-economic characteristics of the respondents

Variables	**Agro-ecology (Mean ± SEM)**				***P***
	HL (N=22)	ML (N=83)	LL (N=51)	Overall (N=156)	
Average age (*years*)	43.36±2.22	42.58±0.80	43.22±0.59	42.90±0.56	0.849
Bee keeping experience (*years*)	14.73±2.36	14.08±0.92	16.16±1.08	14.85±0.68	0.400
Avg. family size	6.86±0.74	7.05±0.24	7.02±0.31	7.01±0.17	0.940
Avg. land holding (*ha*)	0.68±0.07^{c}	1.12±0.06^{b}	1.78±0.14^{a}	1.27 ±0.06	<0.001

HL= highland; ML= midland; LL= lowland; N = number of interviewed bee keepers; SEM = standard error of means; ^{a,} ^{b} *means followed by different superscript letters in a row are significantly different*

3.2 Processing and Storage of Honey

The study indicated that only 29.7% of the sampled households strain their honey before sale using sieve (68.4%), cloth (10.5%) and the rest (21.1%) simply crush and squeeze the honey comb and remove the floating impurities by hands. The reasons for not straining honey in the study area are the belief that some amount of honey is reduced if strained (45.5%), lack of knowledge on how to strain the honey (29.3%), lack of straining materials (15.2%) and the less acceptance of strained honey (9.1%) (Table 2).

In general, in the study area, processing of crude beeswax into pure form is not practiced by the beekeepers. The study indicated that beeswax and honey were crushed together and, in most cases, sold as a single product. In this regard, only 10.9% of the interviewed bee keepers collect crude beeswax from empty honeycomb during harvesting and after home utilization of honey. Accordingly, smearing hives to attract bee swarms and foundation sheet making for modern hives were common uses of beeswax in the study area. According to the respondents the main reasons for not collecting beeswax were lack of knowledge (68.3%) on the importance of beeswax as an income generating hive product, lack of processing skills (19.4%), lack of market for wax in their locality (8.6%) and lack of processing material (3.6%). In order to make the beekeeping sector profitable and generate income, beekeepers should collect, process, and sell this highly valuable hive product instead of throwing it

away or discarding. Most of the respondents with modern beehives reported lack of access to pure beeswax which resulted in low colonization and production.

Table 2. Straining materials and straining practice of honey in the study area

Variables	**Response**	**Agro-ecology**				**X^2**	**P-value**
		HL	ML	LL	Overall		
Strain honey	Yes	13.6	15.7	60	29.7	29.69	< 0.001
	No	86.4	84.3	40	70.3		
Reason for not straining:						30.83	<0.001
Lack of straining material(s)		0	10.3	57.1	15.2		
Lack of knowledge how to strain		35.3	25	42.9	29.3		
Consumer do not prefer strained honey		11.8	10.3	0	9.1		
The amount of honey will be reduced if strained		52.9	52.9	0	45.5		
Strained honey deteriorated easily		0	1.5	0	1		
Materials used for straining	Cloth	33.3	15.4	4.5	10.5	5.42	0.247
	Sieve	33.3	53.8	81.8	68.4		
	Hand	33.3	30.8	13.6	21.1		

HL=highland, ML=midland and LL=lowland

3.3 Honey Storage Materials and Storage Duration

Once honey is produced it should be handled properly to maintain its quality for a longer time. Temperature and humidity are the most important environmental factors that can deteriorate the quality of honey (Tewodros *et al*., 2015). Hence, the type of container and honey storage place should be carefully selected so as to keep the quality of honey. Bogdanov (2009) reported that the optimum temperature and relative humidity of honey storage rooms are 10 -16 ^{0}C and less than 65%, respectively. It is important to store honey in air-tight containers which helps it from external air which the honey could absorb. Honey storage containers should be made out of aluminum, stainless steel and plastic materials (Bogdanov, 2009).

The majority of the interviewed beekeepers (70.3%) do not store their honey; they sell it immediately to their customers or consume it, while the remaining small portion of the interviewed bee keepers store their honey (Table 3). The length of storage period ranged from less than a month (13.5%) to a maximum of eight months (1.3%). The bee keepers who store honey from one month to four months do so with the intention to sell in times of money shortage (47.5%) and to fetch a better price (42.5%).

These groups of beekeepers store the greater portion of honey, they produce till the price of honey rises. On the other hand, the beekeepers who store honey for more than four months, store a small portion of their produce and they do so for food and its medicinal value (5%) and both to fetch a better price and use as food and medicine. According to Tewodros *et al*. (2015) honey is stored for the purpose of its medicinal value, to get higher price, for feeding women who will give birth and to entertain respected guests in Oromia region. Beekeepers that have no critical financial problems keep their honey for an extended period of time to get a better price of honey in the off season as reported by Yetimwork (2015) at Kilte Awlaelo District of Tigray region.

Containers of honey in Ethiopia vary from place to place due to tradition, culture and availability of materials. In the study area, majority (64.7%) of the interviewed beekeepers used plastic containers and tin and gallon (32.7%) for storage of honey. Besides, polyethylene plastic sacks (2.6%) were also used to store honey by a few respondents (Table 3). In line with this study, Getachew (2018) reported plastic container (31.9), polyethylene sack (31.3), gourd (21.3%) and clay pot (15.9%) to be various types of containers to handle honey in Gesha District of Keffa Zone, South-West Ethiopia. As of the report of Mohammed *et al*. (2017), plastic containers and silver metals were the most common containers in Shabe Sombo and Seka Chekorsa Districts of Jimma Zone, Oromia region. On the other hand, 100% of beekeepers in Jigjiga zone of Somali regional state used plastic buckets to store honey (Sisay *et al*., 2015).

The investigation revealed that the former most common storage materials for honey were gourd and clay pot but now plastic containers replaced them completely as the discussion with key informants indicated. The key informants also added that the main reasons for adoption of plastics as honey containers in the study area were: ease of portability, the preference of customers, relatively cheap price and easy access. As reported by some of the respondents, the drawbacks when using clay pots were heavy to transport and there was a traditional belief that says when there was high lightning (thunder cloud) during the rainy season, the clay pot stored with honey become damaged (broken down) thereby causing loss and deterioration of entire honey. Besides, the use of containers with the incompatible lid with the main body of the container allow the entrance of pests such as ants that causes deterioration of honey.

Table 3. Honey handling materials, reason for storing and storage duration in the study area

Variables	Response	Agro-ecology				X^2	*P*
		HL	ML	LL	Overall		
Storage duration	Don't store; sale or consume after harvest	59.1	73.5	76.5	72.4	6.64	0.591
	< 1 month	22.7	12	11.8	13.5		
	1-4 months	18.2	12	11.8	12.8		
	5-8 months	0	2.4	0	1.3		
Storage containers	Tin and gallon	31.8	41	19.6	32.7	7.15	0.128
	Plastic sack	4.5	2.4	2	2.6		
	Plastic bucket	63.6	56.6	78.4	64.7		
Reason for storage	To fetch better price	55.6	33.3	50	42.5	4.39	0.624
	As food and medicine	11.1	4.8	0	5		
	To fetch better price and food and medicine	0	9.5	0	5		
	To sell in times of money shortage	33.3	52.4	50	47.5		

Figure 1. Honey marketing and storage materials in the study area

3.4 Purpose of Honey Production and Marketing Practices

The study indicated that the main purpose of honey production in the study area was for income generation. Most (90.4%) of the bee keepers sell honey to generate income and only 9.6% used honey for both sale and home consumption. In line with this result, similar finding was reported by Yetimwork (2015) who stated that the main purpose of keeping honeybees at Kilte Awlaelo district of Tigray region was for income generation (82.7%), which is mainly sold at the nearby markets and to beekeeper associations.

The study also revealed that producers, consumers, retailers, tej houses and collectors were major factors involved in honey value chain (Table 4). There was no cooperative or association formed for the purpose of facilitating honey marketing in the study area. About 30.8% of the respondents reported that they sold their honey directly to end consumers. About 25.6% of the respondents sold to both retailers and tej brewers while 23.1% sold their produce to consumers and retailers. Retailers alone account for 14.7% of market share and some producers (4.5%) also sell to tej houses and the rest (1.3%) of producers sold to collectors/traders. According to the present study, majority (46.2%) of beekeepers sold honey at farm gate and nearby markets while 32.1% of the beekeepers' sell at farm gate directly to the consumers. Only 1.9% of the beekeeper sold their produce at major marketing place (Arba Minch town) where there is only one collector of honey who collected honey from producers and other retailers in local markets and then sold it back to tej houses and consumers. According to the report of Kenesa (2018), almost all (90%) of the honey produced in Ethiopia is sold for income generation, of this 70% is estimated to be used for 'tej' brewing, while the remaining 10% is consumed by the beekeeping households.

Table 4. Purpose of honey production and honey selling place price in the study area

Variables	**Response**	**Agro-ecology**				**X^2**	***P***
		HL	**ML**	**LL**	**Overall**		
Purpose of honey production	Sale	90.9	90.4	90.2	90.4	0.09	0.995
	Sale and consumption	9.1	9.6	9.8	9.6		
Selling place/area	Farm gate	9.1	3.6	51	19.9	56.23	<0.001
	Nearby market	45.5	38.6	15.7	32.1		
	Farmgate and nearby market	45.5	57.8	27.5	46.2		
	Major marketing place	0	0	5.9	1.9		
Customers	Tej houses	0	7.2	2.0	4.5	35.70	<0.001
	Retailers	0	24.1	5.9	14.7		
	Retailers and tej houses	36.4	25.3	21.6	25.6		
	Consumers	36.4	14.5	54.9	30.8		
	Consumers and retailers	27.3	27.7	13.7	23.1		
	Collectors	0	1.2	2.0	1.3		

3.5 Honey Price and Price Fixing Factors

According to the present study, the price of honey is governed by different factors such as customs and cultural ceremonies (0.6%), table honey and crude honey (1.3%), both market force and table and crude honey (28.2%) and market force (30.1%). Majority (39.7%) of the beekeepers in the study area fix the price of honey based on the market force, i. e. supply and demand at the market and colour and taste of the honey (Table 5). The price of honey is subjected to fluctuation with the highest price in the dry seasons especially during wedding time (January to April) and also during wet seasons (June to August) in the period when there was no or less honey production and lowest price during honey harvesting time (October to December and around the month of May) indicating that seasons and ceremonies could also influence price of honey.

The mean prices of crude and strained honey were 140.5±13.2 ETB and 184.4±16.7 ETB, respectively. The market price of crude and strained honey in highland and midland areas had significantly ($P<0.001$) lower than lowland areas. The average price of honey in the current finding is five times

higher than the average price (28.96 birr) reported by Nebiyu and Mesele (2013) in the three agro-ecological districts of Gamo zone. This implies that how the price of honey has been increasing from time to time and beekeepers are getting better income from honey sale.

Table 5. Honey price and price fixing factors in the study area

Variables	**Response**	**Agro-ecology**				**X^2**	***P***
		HL	ML	LL	Overall		
Price fixing factors	Market force (demand and supply)	27.3	12.0	60.8	30.1	46.92	0.057
	Market force and colour	45.5	56.6	9.8	39.7		
	Table honey and crude honey	4.5	0	2.0	1.3		
	Market force and table and crude honey	22.7	30.1	27.5	28.2		
	Customs and cultural ceremonies	0	1.2	0	0.6		
Honey price/kg (ETB)	Strained honey	173.6± 12.8^{b}	177.3± 15.6^{b}	200.4± 2.8^{a}	184.4± 16.7	-	<0.001
	Unstrained honey	133.2± 9.1^{b}	135.8± 13.7^{b}	151.3± 3.9^{a}	140.5± 13.2	-	<0.001

^{a,b} *means followed by different superscript letters in a row are significantly different (P<0.05).*

4. CONCLUSIONS

Beekeeping is mainly considered as men's job and is performed by only male headed households of economically active age groups. Honey is mainly sold without being strained in the form of crude honey. Processing and collection of crude beeswax into pure form are not practiced by the beekeepers due to lack of knowledge on how to strain. Most of the beekeepers do not store honey due to the need for immediate cash to cover basic expenses of the family. The main purpose of honey production in the study area is for sale and home consumption. Producers, consumers, retailers, tej houses and collectors were major actors involved in honey value chain. There was no cooperative or association formed for the purpose of facilitating honey marketing, thus majority of producers sell their honey directly to consumers at farm gate and nearby markets. Market force is the major criteria to fix the price of the honey at the market. The bee keepers in lowland areas get the premium price due to better road access to major honey market, thus obtained better income. Therefore, creating awareness on the market value of beeswax and other hive products, organizing bee keepers into cooperatives and

developing organized marketing channel to improve the quality, quantity and marketing of honey and other products are important to ensure the right benefit from the beekeeping operation.

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Competing interests

The authors declare that they have no competing interests.

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