Economic analysis and marketing system of *Apis mellifera* honey production in Dang, Nepal

Pratibha Budhathoki-Chhetri1*, Srawan Kumar Sah2, Mahesh Regmi3 and Sabitri Baral4

1Faculty of Agriculture, Agriculture and Forestry University, Rampur, Chitwan, Nepal
2Department of Agronomy, Agriculture and Forestry University, Rampur, Chitwan, Nepal
3Prime Minister Agriculture Modernization Project, Project Implementation Unit, Bee zone, Dang, Nepal
4Department of Agriculture, Hariharbhawan, Kathmandu, Nepal

*Correspondence: pratibhabc00@gmail.com

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ABSTRACT

Dang valley, the major honey producing district in Nepal, contributes 14 percent of national honey production in the country. Understanding the constraints and opportunities contributes in improving production and productivity of honey bee (*Apis mellifera*), in Dang, the study was initiated to find out the status, constraints and opportunities of honey production and its marketing system in the valley so as to increase the productivity and effective marketing. Total 60 beekeepers, 35 from Ghorahi and 25 from Tulsipur sub-metropolitan municipality having more than 20 beehives were selected based on proportionate stratified random sampling method and 2 processor cum wholesalers, 2 retailers, 2 middlemen and 2 cooperatives were selected based on simple random sampling method for interview. Personal interview, focus group discussion, key informant survey was used to collect primary data and secondary data were collected from topic related publications of various institution. The average annual honey productivity was 23.5 kg/hive with benefit cost ratio of 2.15 in 2019/20. Producers disposed their honey through nine marketing channels. Out of nine honey marketing channels, maximum portion i.e. 54.14% of honey disposed through producers to processor cum wholesalers to retailers/ traders inside or outside Dang to consumers, and only 2.66% of honey disposed through producers to cooperatives to consumers. Strengthening the appropriate management practice, quality testing and product certification of honey is must to enhance production and marketing of honey.

Keywords: Beekeeping, honey, production system and marketing

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INTRODUCTION

In Nepal, honey production is successfully achieved from altitude of 70 to 4200 m above sea level (Joshi, 2008). Eight out of nine honeybee species identified in world lives in Asia. Among them five species are economically important and they are namely: *A. cerana* (asiatic honey bee), *A. dorsata* (giant honeybee), *A. laboriosa* (rock honeybee or himalayan honey bee), *A. florea* (little honeybee), *A. mellifera* (european honeybee). Except *A. mellifera* other four
species are native to Nepal (Panthi, 2013). Besides A. m. ligustica, an Italian honey bee species was introduced in 1990 A.D in the country (INCLUDE, 2014).

Government of Nepal took first step to provide training and technical assistance through Department of Cottage Industry and Remote Area Development Committee in 1968. The objective was to increase the productivity of indigenous species A. cerana (Joshi, 2008).

At present, Nepal is producing only 3,990 mt of honey annually in 2018/19 (MoALD, 2019). However Nepal has capacity to hold 1 million bee hives with potential to produce over 10,000 mt of honey annually. Majority of honey harvested in Nepal is multi-floral origin while some uniflora honey include floral individual plant hosts of chiuri (Diploknema butyracea), mustard (Brassica rapa), buckwheat (Fagopyrum esculentum), rudilo (Pogostomone spp), sunflower (Helianthus annuus) and litchi honey (Litchi chinensis) (INCLUDE, 2014). Benefit derived from the honeybee pollination is 40-140 folds greater than that of honey and bee products (Neupane, 2006).

Nepal Trade Policy 2009 has classified honey as a product qualifying for “Thrust Area Development” (MoCS, 2009). The Government of Nepal has recognized honey as an important high value agricultural product (FNCCI/AEC, 2006).

There are 10,532 modern bee hives for A. mellifera and 2,178 traditional bee hives for A. cerana in Dang district of Nepal. Mustard is cultivated in 18,000 ha and there is abundant forest area with Indian butter tree (Diploknema butyracea) to sustain 25,000 bee colonies. Due to suitable climatic condition and availability of honeybee fauna, Dang valley is suitable for bee keeping (DADO, 2016). This study is expected generating useful scientific information to formulate honey production and marketing development projects and guidelines for interventions to help improve the honey productivity and efficiency of honey marketing system in the country.

MATERIALS AND METHODS

Study site and sampling methods
The study was conducted in the Dang district of Nepal from January to May 2020. Sixty commercial beekeepers (35 from Ghorahi and 25 from Tulsipur sub-metropolitan municipality) having more than 20 beehives were included in the study. Proportionate stratified Random Sampling without replacement was followed. Beekeepers were categorized into 2 categories (namely large beekeepers and small beekeepers) based on mean beehives size per farm. Beekeepers having more than 70 beehives were categorized as large beekeepers while those having less than or equal to 70 beehives were categorized as small beekeepers. Two processor cum wholesalers, 2 retailers, 2 middlemen and 2 cooperatives were selected based on simple random sampling method for interview. Pretesting of questionnaire was carried in 10 respondents. Primary data were collected by Key Informant Survey (KIS), Focus Group Discussion (FGD), Interview and Questionnaire Survey in March 2020. Secondary data were collected from different published article, journals, books, internet materials and reports issued from District Agriculture Development Office (DADO), Federation of Nepalese Chamber of Commerce and Industry/ Agro Enterprise Centre (FNCCI/AEC), Ministry of Agriculture and Livestock Development (MoALD), Ministry of Commerce and Supplies (MoCS), Inclusive Development of the Economy Programme (INCLUDE) etc. The collected data and information were recorded, processed and analyzed using statistical packages like MS Excel 2013, SPSS version 20. Independent sample t-test was performed.
Cost of production of honey
All variable cost and fixed cost were considered in determining cost of production. All cost were valued at present market price of 2020.
Thus,
Total cost of production = [Total variable cost + Total fixed cost] (Devkota, 2006)

Gross return and gross margin analysis
Gross return is the multiplication of total volume of farm output whether it is sold or not, and average price of the period during some accounting period (Dillon & Hardaker, 1993).

Gross return (NRs/hive) = Total quantity produced of main and by products x Price (NRs/kg)
Where, main product was honey, and by products were wax and additional colonies

Gross margin (NRs/hive) = Gross return (NRs/hive) – Total variable cost (NRs/hive) (Olukosi et al., 2006)

Benefit cost analysis
Benefit/cost ratio = Gross return (NRs/hive) / Total variable cost (NRs/hive) (Dhakal et al., 2017)

Marketed surplus
Marked surplus was calculated after accounting the retention amount by farmers (Thakur et al., 1997)

Price spread and producer’s share
Price spread = Pc – P_F (Acharya & Agrawal, 1999)
Where,
Pc = Price paid by consumer
P_F = Farm gate price
And farm gate price = Gross price received by producer – Marketing cost
Marketing cost = Cost of honey transportation + Cost of container
Producer’s share in the consumer’s rupee

P_S = (P_F/P_R) x 100 (Kalita, 2017)
Where,
P_F = Farm gate price
P_R = Retail price/ Price paid by consumer
P_S = Producer’s share in the consumer’s rupee

Marketing margin and marketing efficiency
Absolute margin = P_R – (P_P + C_M) (Kalita, 2017)

And, percentage margin = P_R – (P_P + C_M) / P_R x 100 (Kalita, 2017)
Where,
P_P = Purchase price
P_R = Sale Price
C_M = Marketing cost per kg of honey
Acharya's modified marketing efficiency

\[ \text{MME} = \left( \frac{\text{RP}}{\text{MC} + \text{MM}} \right) - 1 \] (Acharya & Agrawal, 1999).

Where,

\( \text{MME} = \) Acharya's modified marketing efficiency
\( \text{RP} = \) Price paid by the consumer
\( \text{MC} = \) Total marketing costs
\( \text{MM} = \) Net marketing margin

Indexing

\[ I = \frac{\sum S_i F_i}{N} \] (Miah, 1993)

Where,

\( I = \) Index Score
\( S_i = \) Scale value of ith level
\( F_i = \) Frequency of ith level
\( N = \) Total number of observation.

RESULTS AND DISCUSSION

Production of honey

Honey (sweet, viscous food substance made by honeybees) and bee wax were found to be respectively, major bee product and by product in the study area. The average number of bee hives per farm was found to be 69.55 producing an average 23.5 kg honey per hive per year in 2019/20. The average honey production per annum of large beekeepers (26.57 kg/ hive) was found insignificant as compare to small beekeepers (21.2 kg/ hive) at 5% level of significance as presented in Table 1.

The average annual honey production per hive from *A. mellifera* in the study area was much lower than 36 kg per hive per year in Chitwan, Nepal (Dhakal *et al*., 2017) and 40.71 kg per hive per year in Karaj state, Iran (Vaziritabar & Esmaeilzade, 2016) but slightly less than as reported by Singh and Sekhon (2014) in Punjab, India. According to beekeepers in Dang, the lockdown imposed by Government of Nepal in 2020 due to COVID19 pandemic is one of the reason for low production of honey. Due to this, they couldn’t manage their bee hives and couldn’t harvest honey as beehives were out of district for migration.

| Variables | Small beekeeper \((n = 34)\) | Large beekeeper \((n = 26)\) | Overall \((N = 60)\) | Mean difference | t-value | Sig. (2-tailed) |
|-----------|-------------------------------|---------------------------|----------------------|-----------------|---------|---------------|
| Average annual honey production (kg) / hive | 21.2 (11.28) | 26.57 (12.69) | 23.5 | 5.37 | - | 0.0 |
| (12.11) | | | (12.11) | | 1.73 | 9 |

Note: Figures in parentheses indicate standard deviation.

Gross return, margin and benefit cost ratio

Average gross return obtained from honey and by product was found to be NRs. 9,862.84 per hive (Table 2). The gross return of honey production from *A. mellifera* in Dang was higher than NRs.7,482.12/hive in Chitwan, Nepal (Dhakal *et al*., 2017).

In the study area gross margin, benefit cost ratio and net margin of honey production were found to be NRs. 5,281.60/hive, 2.15 and NRs. 3,540.27/hive respectively (Table 3). Gross margin found similar to NRs. 5,068/hive and but B/C ratio was higher than 1.56 as reported by
Bhattarai *et al.* (2020) in Chitwan. However, Shrestha (2017) reported lower net margin i.e. NRs. 2,987.05 per hive in Bardia.

**Table 2: Gross return per hive in Dang valley, 2019/20**

| Particulars                     | Amount (NRs.) |
|--------------------------------|---------------|
| Gross return/hive from honey    | 6841.92       |
| Gross return/hive from wax      | 177.27        |
| Gross return from additional colonies | 2843.65     |
| Total                           | 9862.84       |

**Table 3: Statement of gross margin and benefit cost ratio in Dang valley, 2019/20**

| Particulars              | Small beekeeper | Large beekeeper | Average value |
|--------------------------|-----------------|-----------------|---------------|
| Gross return (NRs./hive) | 7826.71         | 9902.3          | 9862.84       |
| Total Variable cost (NRs./hive) | 4291.37     | 3882.4          | 4581.24       |
| Total fixed cost (NRs./hive) | 1725.66      | 1665.02         | 1741.33       |
| Total cost (NRs./hive)    | 6017.03         | 5547.42         | 6322.57       |
| Gross Margin (NRs./hive)  | 3535.34         | 6019.9          | 5281.60       |
| Net Margin (NRs./hive)    | 1809.68         | 4354.88         | 3540.27       |
| B:C ratio                | 1.82            | 2.55            | 2.15          |

**Marketing status: marketing channel and marketed surplus**

Nine marketing channels were identified in the study area. Similar result was obtained by Paudel (2003) in Chitwan. Processor cum wholesaler, retailers, cooperatives, traders outside dang, middleman/collectors are the major marketing intermediaries involved in marketing of honey (Figure 1). The maximum share of honey i.e. 54.14% marketed channelized through producers to processor cum wholesalers to retailers/ traders outside Dang to consumer inside/outside Dang. Similarly, Bhattarai *et al.*, (2020), reported that 62.7% of honey marketed through processor cum wholesalers to retailers to consumers in Chitwan, Nepal. About 34.16% of honey was marketed directly from producers to consumers, 8.14% of honey was marketed through producers to middlemen to consumers while only 2.66% of honey was marketed through producers to cooperatives to consumers. The reason behind this little percent of honey marketed through cooperatives was processor cum wholesalers, middlemen, consumers directly visited producers site for honey but cooperatives did not. Similarly, Shrestha *et al.* (2017) also reported that consumers directly visit producer site and wholesalers also visit to producer’s house, purchase honey then sale to retailer after packaging it in Lamjung. About 79.09% of honey was consumed at local market, 19.82% was consumed market outside Dang district and 1.09% was exported to Germany by cooperatives and processor cum wholesalers on personal contact basis.

Marketed surplus is defined as gross quantity of produce actually sold by farmers (Jabbar, 2010). In the study area, total marketed surplus was found to be 96.80% (Table 4). Marketed surplus of honey was found similar to 96 % for stationary and lower than 99 % for migratory bee farms in Pitoragarh district of Nainital as reported in Shukla *et al.* (2010).
Figure 1: Marketing channel followed for disposal of honey in Dang valley, 2019/20

Table 4: Overall marketed surplus of honey in Dang valley, 2019/20

| Particulars            | Quantity of honey (kg) | Share percentage |
|------------------------|------------------------|------------------|
| Total use              | 3027                   | 3.20%            |
| Total marketed surplus | 91360                  | 96.80%           |
| Total production       | 94387                  | 100%             |

Farm gate price, price spread and producer’s share

The overall farm gate price of honey was found to be NRs. 268.51/kg (Table 5). Overall price spread of raw honey was NRs. 83.99/kg and that of processed honey was NRs. 252.57/kg. Price spread of raw honey was higher than NRs. 71/kg and that of processed was lower than NRs.312/kg as reported by Bhattarai et al. (2020) in Chitwan. In case of raw honey price spread was higher when it passed through middlemen and price spread of processed honey was higher when it passed through processor cum wholesalers. The producer’s share in consumer rupee was 76.17 % and 49.49 % in raw and processed honey from A. mellifera respectively (Table 6).

Table 5: Farm gate price of honey in Dang valley, 2019/20

| Variables                                | Quantity/percentage | Gross receipt per kg (NRs.) | Marketing cost per kg (NRs.) | Farm gate price per kg (NRs.) |
|------------------------------------------|---------------------|-----------------------------|------------------------------|-------------------------------|
| Producer to consumer                     | 3027 35.06%         | 355.08                      | 23                           | 332.08                        |
| Producer to Processor cum Wholesaler     | 49460 54.14%        | 259.86                      | 15                           | 244.86                        |
| Producer to Cooperatives                 | 2430 2.66%          | 265                         | 15                           | 250                           |
| Producer to Middle man/ Collection agent/ Market facilitator | 7440 8.14% | 259.09 | 12 | 247.09 |
| Total                                    | 91360 100%          | 284.76                      | 16.25                        | 268.51                        |
Table 6: Price spread and producer’s share of honey in Dang valley, 2019/20

| Mode of selling                      | Retail price per kg (NRs.) | Farm gate price of raw honey per kg (NRs.) | Price spread per kg (NRs.) | Producer’s share |
|--------------------------------------|-----------------------------|---------------------------------------------|-----------------------------|------------------|
| Raw honey                            |                             |                                             |                             |                  |
| Producer to Consumer                 | 350                         | 332.08                                      | 23                          | 94.88%           |
| Producer to Processor cum wholesaler to Consumer | 350                         | 244.86                                      | 105.14                      | 69.96%           |
| Producer to Cooperatives to Consumer | 350                         | 250                                         | 100                         | 71.43%           |
| Producer to Middle man to Consumer   | 400                         | 247.09                                      | 152.91                      | 61.77%           |
| Total                                | 352.5                       | 268.50                                      | 83.99                       | 76.17%           |
| Processed honey                      |                             |                                             |                             |                  |
| Producer to Processor cum wholesaler to Retailer to Consumer | 550                         | 244.86                                      | 305.14                      | 44.52%           |
| Producer to Cooperatives to Consumer | 450                         | 250                                         | 200                         | 55.56%           |
| Total                                | 500                         | 247.43                                      | 252.57                      | 49.49%           |

Marketing cost, marketing margin and efficiency of honey marketing

Overall marketing cost of producers, processors cum wholesalers, middlemen/collectors, cooperatives, retailers in the study area were NRs. 16.25/kg, NRs. 62.89/kg, NRs. 23/kg, 61.5/kg, NRs. 5/kg respectively (Table 8). The marketing cost for cooperatives and processor cum wholesalers was found NRs.61.5/kg (in Dang, Kailali, Surkhet, Pyuthan districts) similar to the report of INCLUDE (2014) but the marketing cost for middlemen/collectors was found slightly higher than NRs. 16/kg.

The marketing margin for processor cum wholesalers, cooperatives, middlemen/collectors, retailers from marketing of honey of *A. mellifera* were 23.15%, 15.87%, 26.72%, 17.27% respectively as presented in Table 8. The marketing margin of processor was found similar to report of Bhattarai *et al.* (2020).

Marketing efficiency index of honey from *A. mellifera* was found highest (1.67) when it was channelized through cooperatives and was lowest (0.84) when channelized through an involvement of both processor cum wholesalers and retailers (Table 7). However, Oyuga (2008) reported retailers were the most price efficient in Kenya.

Table 7: Marketing efficiency index of marketing functionaries under different marketing channel of honey in Dang valley, 2019/20

| Mode of selling / Marketing channel | Marketing Efficiency Index |
|------------------------------------|---------------------------|
| Producer-Processor cum Wholesale-Consumer | 1.58                      |
| Producer-Processor cum Wholesale-Retailer-Consumer | 0.84                      |
| Producer-Cooperatives-Consumer     | 1.67                      |
| Producer-Middleman-Consumer       | 1.61                      |
Table 8: Marketing cost and margin of different intermediaries in honey in Dang valley, 2019/20

| Marketing Intermediaries                     | Mode of Selling                        | Purchase price (NRs./kg) | Marketing Cost (NRs./kg) | Selling price (NRs./kg) | Marketing margin (NRs./kg) | Marketing margin percentage |
|-----------------------------------------------|----------------------------------------|--------------------------|--------------------------|-------------------------|---------------------------|-----------------------------|
| Processor cum Wholesaler                      | Raw to consumer                        | 259.86                   | 30                       | 350                     | 60.14                     | 17.18%                      |
|                                               | Processed to consumer                  | 259.86                   | 78                       | 450                     | 112.14                    | 24.92%                      |
|                                               | Processed to Retailer inside Dang      | 259.86                   | 80.27                    | 450                     | 102.87                    | 22.86%                      |
|                                               | Raw to trader outside Dang             | 259.86                   | 39.09                    | 350                     | 51.05                     | 14.58%                      |
|                                               | Processed to traders outside Dang      | 259.86                   | 87.09                    | 500                     | 153.05                    | 30.61%                      |
|                                               | Total                                  | 259.86                   | 62.89                    | 420                     | 97.25                     | 23.15%                      |
| Cooperatives                                  | Raw to consumer                        | 265                      | 35                       | 350                     | 50                        | 14%                         |
|                                               | Processed to Consumer                  | 265                      | 83                       | 450                     | 102                       | 22.67%                      |
|                                               | Raw to trader outside Dang             | 265                      | 40                       | 350                     | 45                        | 12.86%                      |
|                                               | Processed to traders outside Dang      | 265                      | 86                       | 400                     | 49                        | 12.25%                      |
|                                               | Total                                  | 265                      | 61                       | 387.5                   | 61.5                      | 15.87%                      |
| Middleman/Collector                           | Raw to consumer                        | 259.09                   | 20                       | 400                     | 120.91                    | 30.22%                      |
|                                               | Raw to trader outside Dang             | 259.09                   | 26                       | 370                     | 84.91                     | 22.94%                      |
|                                               | Total                                  | 259.09                   | 23                       | 385                     | 102.91                    | 26.72%                      |
| Retailer                                      | Processed to Consumer                  | 450                      | 5                        | 550                     | 95                        | 17.27%                      |
|                                               | Total                                  | 450                      | 5                        | 550                     | 95                        | 17.27%                      |

Opportunities of beekeeping

Indexing/scaling technique as described in section materials and methods was employed as a tool for analysis of opportunities of beekeeping. Suitable environment/climate remained major opportunities in the study area (Table 9).

Table 9: Perception of beekeepers regarding opportunities of beekeeping in Dang valley, 2019/20

| Opportunities                                | 1 | 0.8 | 0.6 | 0.4 | 0.2 | Weightage | Index | Rank |
|----------------------------------------------|---|-----|-----|-----|-----|-----------|-------|------|
| Suitable environment/ climate                | 48| 12  | 0   | 0   | 0   | 57.6      | 0.96  | I    |
| Availability of queen rearing centre         | 0 | 2   | 2   | 25  | 31  | 19        | 0.32  | V    |
| High market demand                           | 1 | 14  | 30  | 15  | 0   | 36.2      | 0.60  | III  |
| Year round availability of forage            | 11| 29  | 20  | 0   | 0   | 46.2      | 0.77  | II   |
| Availability of microfinance/subsidy from government | 0 | 3   | 8   | 20  | 29  | 21        | 0.35  | IV   |

Constraints of beekeeping

Constraints of beekeeping were ranked in the study area. Decreasing bee forage was one among the major constraints. A categorically constraints detail is presented in Table 10.
Table 10: Perception of beekeepers regarding constraints of beekeeping in Dang valley, 2019/20

| Constraints                                      | 1 | 0.8 | 0.6 | 0.4 | 0.2 | Weightage | Index | Rank |
|--------------------------------------------------|---|-----|-----|-----|-----|-----------|-------|------|
| Decreasing bee forage area                       | 19 | 22  | 9   | 10  | 0   | 46        | 0.77  | I    |
| Shortage of quality beekeeping equipment         | 13 | 14  | 19  | 4   | 10  | 39.2      | 0.65  | II   |
| Pests, predators and pesticide threats           | 8  | 16  | 1   | 15  | 20  | 31.4      | 0.53  | IV   |
| Lack of trained manpower                        | 10 | 2   | 26  | 6   | 15  | 32.6      | 0.54  | III  |
| High cost of production                         | 10 | 6   | 5   | 24  | 15  | 30.4      | 0.51  | V    |

Problems of marketing of honey

The honey marketing problem in the study area is ranked in Table 11. The major marketing problem found was insufficient certification and lab tests.

Table 11: Perception of beekeepers regarding problems of honey marketing in Dang valley, 2019/20

| Problems                                         | 1 | 0.75 | 0.5 | 0.25 | Weightage | Index | Rank |
|--------------------------------------------------|---|------|-----|------|-----------|-------|------|
| Lack of market information                       | 0 | 4    | 7   | 49   | 18.75     | 0.31  | IV   |
| Insufficient certification and lab tests         | 41| 14   | 5   | 0    | 54        | 0.9   | I    |
| Lack of collection and processing unit           | 4 | 12   | 35  | 9    | 32.75     | 0.55  | III  |
| High competition with foreign honey              | 15| 30   | 13  | 2    | 44.5      | 0.74  | II   |

CONCLUSION

Higher net profit (NRs. 3,540.27/hive) and benefit cost ratio (2.15) advocates very strongly on profitable potential of beekeeping in the study area. Market efficiency index (1.67) was found the highest when honey disposed though cooperatives. Decreasing bee forage area, insufficient certification and lab tests were the major contraints of bee keeping in the Dang valley.

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Authors’ contributions

P Budhathoki-Chhetri conducted research and collected data, analyzed and prepared the final manuscript. SK Sah guided from the starting of designing research up to manuscript write up and revised the article for the final approval of the version to be published. M Regmi and S Baral supervised the research.

Conflict of Interest

The authors declare that there are no conflicts of interest regarding the publication of this manuscript.
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