

Research Article

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

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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 beehives with potential to produce over 10,000 mt of honey annually. Majority of honey harvested in Nepal is multi-floral origin while some unifloral 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 = $P_c - P_f$ (Acharya & Agrawal, 1999)

Where,

P_c = 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

$P_s = (P_f/P_c) \times 100$ (Kalita, 2017)

Where,

P_f = Farm gate price

P_c = 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 = $(P_r - (P_p + C_m) / P_r) \times 100$ (Kalita, 2017)

Where,

P_p = Purchase price

P_r = Sale Price

C_m = Marketing cost per kg of honey

Acharya's modified marketing efficiency

$MME = [RP \div (MC + MM)] - 1$ (Acharya & Agrawal, 1999).

Where,

MME = Acharya's modified marketing efficiency

RP = Price paid by the consumer

MC = Total marketing costs

MM = Net marketing margin

Indexing

$I = \sum SiFi / N$ (Miah, 1993)

Where,

I= Index Score

Si= Scale value of ith level

Fi= 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.

Table 1: Average annual honey production per hive in Dang valley, 2019/20

Variables	Small beekeeper (n = 34)	Large beekeeper (n = 26)	Overall (N = 60)	Mean difference	t- valu e	Sig. (2- tail ed)
Average annual honey production (kg) / hive	21.2 (11.28)	26.57 (12.69)	23.5 (12.11)	5.37	- 1.73	0.0 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 Pittoragarh district of Nainital as reported in Shukla *et al.* (2010).

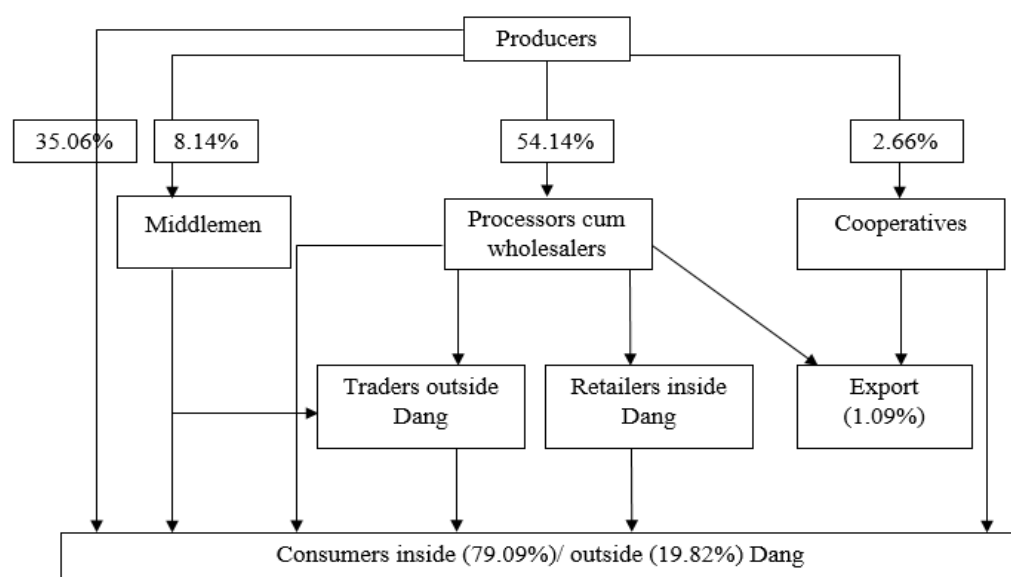


Figure 1: Marketing channel followed for disposal of honey in Dang valley, 2019/20

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 sale (kg)	percentage	Gross receipt per kg (NRs.)	Marketing cost per kg (NRs.)	Farm gate price per kg (NRs.)
Producer to consumer	32030	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 wholesaler, 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 Wholesaler-Consumer	1.58
Producer-Processor cum Wholesaler-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)	percentage Marketing Margin
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 traders 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 through cooperatives. Decreasing bee forage area, insufficient certification and lab tests were the major constraints 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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