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Revenue and Employment Generation from Medicinal Herbs in Darchula, Nepal

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Abstract

The research regarding employment creation and revenue generation from export of the medicinal herbs in Darchula, Nepal was not explored yet so this study was objectively conducted to assess trend of exported quantity of medicinal herbs, revenue generation and employment creation from this in Darchula, Nepal. Two focus group discussions and forty three key informant interviews to know the medicinal species traded, number of persons working for collection, processing and exporting the medicinal herbs in Darchula, Nepal. Secondary information associated to quantity of exported medicinal herbs and revenue generation since 2015 to 2019 were collected from Divisional Forest Office and Api-Nampa Conservation Area, Darchula Nepal. These data were analyzed using descriptive and inferential statistics. Exported quantity of medicinal herbs was approximately 212.96 Mt in 2015 through Division Forest Office Darchula but it was the highest around 316.73Mt in 2018. Statistically, independent t-test and Levene test showed that there was significance difference at 95% confidence level in quantity of export of medicinal herbs and trend of exported quantity was not consistent since co-efficient variance values were high 0.32 and 0.45 respectively. Estimated revenue was US\$ 59646 was the highest from export of medicinal herbs in 2016 through Api-Nampa Conservation Area and highest revenue was from export of *Ophiocordyceps sinensis*. Importantly, export of medicinal herbs in this district creating upto 15746 employments in 2016. The local people have super level of employment opportunity from *Ophiocordyceps sinensis* so this will be useful to understand the value of medicinal herbs of high altitude.

Keywords: Medicinal herbs; Revenue; Employment; Tradable; Apinampa; Darchula

Introduction

It is the fact that human civilization has been deeply linked with the plants especially with the forest [1,2]. Our ancestor used the plants for food which we have been using now; they used the plants for medicinal purpose that we have been continued [3,4]. So, the medicinal and aromatic plants are very valuable. It is believed that herbs have been used for medicinal purpose before 2800 to 1700BC in China [5]. Now, there has been increasing scope of medicinal herbs all over the world. The modern society is more incline towards the English medicine but the number of users of medicinal herbs has already been increasing [6,7]. Medicinal herbs are the Non-wood forest products consist of goods of biological origin other than wood, derived from forests, other wooded land and trees outside forests [8].

Updated research showed that, total 391,000 plant species were documented and out of this total 369,000 plant species (94%) are flowering plants and rests of them were other categories. Importantly, world health organization reported that over 50,000 plants are useful for the medicinal purpose [9]. Some research showed that around 2500 plants species have been used for the medicinal purpose in India but the research is still continued [10]. There are more than 38000 plants species in Asia which have

medicinal value [11]. Altogether, 302 plants species were used for medicinal purpose in Sri Lanka by the local indigenous people and they exported to other countries as well [12]. Indigenous people in India have been using over 20,000 plants species for medicinal purpose [13]. Around 8300 plants have been used for medicinal purpose and out of this, 400 plants species are used to produce medicinal drug in pharmaceutical industries in Nepal [13].

The importance of medicinal herbs has been increasing annually. Europe alone annually imports about US\$ 1 billion in MAPs from Africa and Asia [14]. It was imported around 673,564 tones in European countries such as German, Switzerland and France in 2014 which worth around US\$ 2,724 [15]. Over 500 households were professionally engaged in the business of medicinal and aromatic plants at Swat in Pakistan [16] and they have been generating income. The projection showed that the increasing attraction towards use of medicinal herbs, its demand may worth over US \$5 trillion by 2050 [17]. The trade of medicinal herbs was high in India, it worth about US\$ 1 billion annually but it depends up on the quantity demand and export as well [18]. In addition, most of raw medicinal plants exported to India and China from Nepal and most of these are endemic from China, India and Nepal [19,20].

Nepal is very rich in biodiversity. There are over 9000 flowering species. Out of this, over 6500 plant species are used for medicinal purpose [21]. Plant species found in high altitude have high value medicinal use [22]. Medicinal and Aromatic Plants (MAPs) are key source of income generation for livelihood subsistence and promotion. Thousands of households have been engaged to collect and trade the medicinal herbs in Hindkush Region of Himalayas [23,24]. Over 10,167 plant species are recognized in Himalaya in Nepal and around 7,000 species are flowering. Among these approximately 1,600 species are useful for medicine and aroma in Nepal. Some *Ophiocordyceps sinensis*, *Allium wallichii*, *Paris polyphylla*, etc. are highly valuable species in Himalayan region especially in Darchula district in Nepal. So, the collection, packaging, processing and exporting of these plants are creating enormous opportunity of employment and income generation including revenue collection. The medicinal herbs in Himalayan region are not only source of income for livelihood of the local people but also revenue collection for nation. However, the research regarding quantity of collection of medicinal herbs and revenue generation and employment creation from this sector are very limited so far in high Himalayan districts like Darchula Nepal in particular. Realizing the gap, this research was objectively conducted to assess the export quantity of medicinal herbs, revenue generation and employment generation from in Darchula district, Nepal.

Materials and Methods

Study Area

Darchula lies in province no. 7 and covers an area of 2,322 sq. km. It is located at 29 °22" to 30 °15" North latitude and 80 °22" to 81 °9" west longitude and altitudinal range is 518 - 7132 m above mean sea level. This district links international boundary of India in west and China in north. Average maximum temperature is 18.6 °C and minimum is 5.7 °C. District comprises Tropical to Alpine type of climate with annual rainfall of 2,129mm [25]. The total population of district is 121996 and literacy rate of the district is about 49.5 %. The medicinal herbs were exported getting the permission of government authorities like Api-Nampa Conservation Area (ACA) and Division Forest Office (DFO), Darchula [26,27]. Data collection: Primary and secondary data were collected for the study purpose. The secondary data and information were gathered from permit letters issued for exporting the medicinal herbs through Api-Nampa Conservation Area and Division Forest Office, Darchula so permit letters from 2015 to 2019 were gathered.

Focus group discussion and key informant interview: Two focus group discussions were conducted to know the employment generation and inconsistency in the export of medicinal herbs. The participants of this discussion were professional engaged in collection and trade of the medicinal herbs. In addition, the key informants were staff from Api-Nampa Conservation Area, Division Forest Office, Darchula and business men. Total 43 key informants were interviewed particularly 25 and 18 from Api-Nampa Conservation Area and Division Forest Office, Darchula respectively [28].

Data Analysis

The statistical and mathematical calculation was applied to analyze the collected data. Trend calculation: Trend pattern of tradable medicinal herbs were calculated using trend analysis of different years. The trend considered the year wise quantity

of medicinal and aromatic herbs traded and revenue generated from this. Calculation procedure of employment and income:

$$\text{Total Mandays} = 30 \times \text{Total Employed Number of Month} \times \text{Total Employed Population}$$

$$\text{Total Income Generation Calculation: Total Mandays} \times \text{Per Day Wages Rate}$$

Calculation of employment and income potentiality: Most of the people collect the medicinal herbs for 3 months. It was about 90 days for each person. Similarly, the income potentiality was calculated based on the rate of increasing trend. Statistical analysis: Statistically, t-test and Levene test were employed to compare the quantity exported, revenue generated and employment created from export of medicinal herbs through Api-Nampa Conservation Area and Division Forest Office, Darchula. Moreover, the consistency of export quantity, revenue generation and employment creation was evaluated applying the co-efficient variance.

Result

Export Quantity of Medicinal Herbs from Darchula District

The trend of export quantity of medicinal herbs varied in Division Forest Office, Darchula and Api-Nampa Conservation Area since 2015 to 2019. It was exported around 212.96 Mt medicinal herbs in 2015 by Division Forest Office Darchula which was only 32.569 Mt through Api-Nampa Conservation Area. The highest quantity of medicinal herb was exported approximately 316.73 Mt by Division Forest Office, Darchula in 2018 but it was only 46.856 Mt by Api-Nampa Conservation Area (Table 1). Moreover the quantity of export of medicinal herbs through Division Forest Office, Darchula and Api-Nampa Conservation Area respectively was not so consistent since the values of co-efficient of variance were 0.32 and 0.45 respectively. Independent-t test and Levene's test showed there was significant difference in exported quantity of medicinal herbs by these entities at 95% confidence level.

Table 1: Export Quantity of Medicinal Herbs.

Export quantity of medicinal herbs (Mt)					
Year	2015	2016	2017	2018	2019
DFO	212.96	260.03	255.795	316.73	118.79
ACA	32.569	86.796	70.061	46.856	31.844

Altogether 20 species exported by Division Forest Office and Api-Nampa Conservation Area from 2015 to 2019. The highest quantity of exported species was of 153.29Mt of *Cinnmomum tamala* in 2016 from Division Forest Office and while it was the highest export 35.935 Mt of *Berginia ciliate* from Api-Nampa Conservation Area. However, a valuable medicinal species like *Ophiocordyceps sinensis* was also exported from Api-Namapa Conservation Area, it was the highest around 10.25 Mt in 2018 (Table 2).

Revenue Generation from Export of Medicinal Herbs in Darchula District

The trend of revenue generation from export of medicinal herbs through Division Forrest Office and Api-Nampa Conservation Area, Darchula was varied from 2015 to 2019. The highest revenue was generated around US\$ 59646 from export of medicinal herbs in 2016 from Api-Nampa Conservation Area, Darchula while this was only US\$ 3880 from Division Forest, Darchula (Table 3). The trend of revenue generation from export

Table 2: Species Wise Export Quantity of Medicinal Herbs in Darchula.

Spp.	Quantity Mt	2019		2018		2017		2016		2015	
	Scientific name	DFO	ACA	DFO	ACA	DFO	ACA	DFO	ACA	DFO	ACA
Yarsha Gumba	<i>Ophiocordyceps sinensis</i>	0	1.214	0	10.25	0	6.621	0	1.029	0	0.833
Satuwa	<i>Paris polyphylla</i>	0.15	3.331	5.6	3.388	5.164	2.697	6.32	1.63	0.64	4.921
Ban Lasun	<i>Fritillaria cirrhosa</i>	0	3.973	2.03	5.166	2	1.207	1.99	0.04	0.25	1.301
Jatamshi	<i>Nardostachys grandiflora</i>	0	0.3	0	0	0	4.95	0	3.55	0	0.34
Setak chini	<i>Polygonatum verticillatum</i>	5.6	4.495	2.14	0.9	1	6.2	0	0	0.09	0
Pashanbed	<i>Berginia ciliata</i>	6.6	2.5	20.12	8	12.34	15.07	52.5	35.935	3.7	2.2
Tejpat	<i>Cinnamomum tamala</i>	18	0.242	150.4	5	118.1	12.8	153.29	15.5	143.9	5.5
Ritha	<i>Sapindus mukorossi</i>	84.75	6.236	117.11	5	110.26	10.7	25.8	8	50.48	3.001
Kutki	<i>Neopicrorhiza scrophulariflora</i>	0	3.979	0	0.2	0	5.42	0	6.19	0	0
Sugandhwal	<i>Valeriana jatamansi</i>	0.2	0	0	0.1	0.49	0.085	0.64	0.471	1.47	0.15
Amla	<i>Phyllanthus emblica</i>	0	0.5	0.2	0.3	0	2.82	1.2	0.5	0	0
Allo	<i>Girardinia diversifolia</i>	0	0	0.3	3.8	0.3	0	7.9	5.7	0	8.8
Guchi Chyau	<i>Morchella conica</i>	0.04	3.766	1.9	4.552	2.527	0.645	2.88	4.528	0.78	2.774
Chiraito	<i>Swertia chiraita</i>	0.7	0	3.23	0.1	3	0	0.1	2.623	2.19	2.3
Timur	<i>Zanthoxylum armatum</i>	0.35	0.392	0.63	0.1	0.614	0	0	1.1	0.6	0.25
Dalchini bokra	<i>Cinnamomum tamala</i>	2.2	0.916	0.83	0	0	0	1.41	0	5.81	0.2
Kachur jara	<i>Curcuma zedoria</i>	0	0	1.1	0	0	0.846	0	0	0	0
Kaulo	<i>Persea odoratissima</i>	0	0	3.79	0	0	0	1.8	0	3.04	0
Chutro	<i>Berberis aristata</i>	0.2	0	7.35	0	0	0	4	0	0	0
Bhiring raj	<i>Eclipta prostrata</i>	0	0	0	0	0	0	0.2	0	0	0
Total		118.8	31.84	316.7	46.86	255.8	70.061	260	86.8	213	32.57

Table 3: Revenue Generation from Export of Medicinal Herbs.

Revenue generation (US\$)					
Year	2015	2016	2017	2018	2019
DFO	2080	3880	2499	2708	729
ACA	22934	46874	49548	59646	17364

of medicinal herbs through Division Forest Office and Api-Nampa Conservation Area was not so consistent since the co-efficient of variance was high specifically 0.48 and 0.46 respectively. The highest revenue generation was around US\$ 56887.6 in 2018 from export of *Ophiocordyceps sinensis* from Api-Nampa Conservation Area. On the other hand, the highest revenue generation was US\$ 1077.00 from export of *Sapindus mukorossi* from Division Forest Office, Darchula Nepal (Table 4).

Employment Generation from Trade of Medicinal Herbs in Darchula

The export of medicinal herbs obviously engaged several types of manpower from collection to trade. The trend employment of showed it was decreasing trend of total number of people engaged from collection of medicinal herbs to export. It was the highest total people 15746 in medicinal herbs profession in 2016 according to Api-Nampa Conservation Area. The record of total people engaged in 2019 was only 7337, out of this was 1474 through Division Forest Office and 5863 through Api-Nampa Conservation Area (Table 5). Mann-Whitney U test showed that employment generation from export of medicinal herbs through Division Forest Office and Api-Nampa Conservation Area was not

significantly differed at 95% confidence level. In addition, the estimated values of coefficient of variance were high 0.535 and 0.605 of employment generation from export of medicinal herbs through Division Forest Office and Api-Nampa Conservation Area. It showed that, there was no consistency in employment generation from export of medicinal herbs through Division Forest Office and Api-Nampa Conservation Area.

Discussion

Altogether 20 species of medicinal herbs were exported through Division Forest Office and Api-Nampa Conservation Area. Most common traded species were *Ophiocordyceps sinensis* (Yarsha Gumba), *Cinnamomum tamala* and *Sapindus mukorossi*. The *Ophiocordyceps sinensis* was not traded through Division Forest which is very valuable medicinal herbs in Nepal. Moreover, *Paris polyphylla* (Satuwa), *Berginia ciliate* (Pashanbed) and *Cinnamomum tamala* (Tejpat) were continuously traded from the year 2015 to 2019 by both Division Forest Office and Api Nampa Conservation Office. Some studies were done related to medicinal herbs and that support high altitude areas are source of many valuable medicinal plant species [29]. The traded species from this district provides the evidence that Darchula district is rich in medicinal and aromatic plants. About 7,000 plant species are found at higher altitudes of Nepal, and 5% of them are endemic and 10% are medicinal and aromatic plants. Malla & Shakya in Majpuria reported about 510 species of medicinal herbs frequently traded from different parts of Nepal. About twenty species of high value medicinal and aromatic plants were exported India from high altitude of Nepal [30].

Table 4: Revenue Generation from Export of Medicinal Herbs in Darchula.

Revenue (US\$)	2019		2018		2017		2016		2015	
Scientific Name	DFO	ACA	DFO	ACA	DFO	ACA	DFO	ACA	DFO	ACA
<i>Ophiocordyceps sinensis</i>	0	14862.5	0	56887.6	0	45408.8	0	38384.1	0	20344
<i>Paris polyphylla</i>	0.018	583.46	47.9	579.39	50.4	526.91	94.24	486.42	6.29	961.3
<i>Fritillaria cirrhosa</i>	0	521.94	17.4	662.59	19.5	176.86	29.69	8.95	2.44	190.6
<i>Nardostachys jatamansi</i>	0	52.55	0	0	0	967.08	0	1059.39	0	66.42
<i>Polygonatum verticillatum</i>	0.655	196.84	18.3	38.48	9.77	302.82	0	0	0.88	0
<i>Berginia ciliata</i>	0.772	109.48	172	342.03	121	736.06	783.4	2680.92	36.14	107.4
<i>Cinnmomum tamala</i>	2.105	4.24	1286	85.51	1154	250.07	2287	462.55	1406	107.4
<i>Sapindus mukorossi</i>	724.69	53.32	1001	128.26	1077	313.57	384.9	358.1	493.1	87.92
<i>Picrorhiza kurrooa</i>	0	522.73	0	25.65	0	794.18	0	1385.41	0	0
<i>Valeriana jatamansi</i>	0	0	0	12.83	4.79	12.45	9.55	105.42	14.33	21.98
<i>Phyllanthus emblica</i>	0	4.38	1.71	2.57	0	27.55	17.91	7.46	0	0
<i>Girardinia diversifolia</i>	0	0	2.57	162.46	2.93	0	117.8	425.25	0	429.8
<i>Morchella conica</i>	0.004	369.03	16.25	699.1	24.68	31.5	42.98	575.5	7.61	247
<i>Swertia chiraita</i>	0.082	0	27.6	12.83	29.3	0	1.49	587.06	21.43	337
<i>Zanthoxylum armatum</i>	0.041	27.47	5.38	6.84	6	0	0	131.3	5.82	19.54
<i>Cinnamomum tamala</i>	0.259	56.16	7.05	0	0	0	21.04	0	56.7	13.67
<i>Curcuma zedoria</i>	0.000	0	9.41	0	0	0	0	63.12	0	0
<i>Persea odoratissima</i>	0.000	0	32.4	0	0	0	26.86	153.54	29.66	0
<i>Berberis aristata</i>	0.023	0	62.9	0	0	0	59.68	0	0	0
<i>Eclipta prostrata</i>	0	0	0	0	0	0	2.98	0	0	0
Total US \$	728.649	17364.1	2707.87	59646.1	2499.37	49547.9	3879.52	46874.5	2080.4	22934

Table 5: Employment Creation from Medicinal Herbs in Darchula.

Employment Creation	2019		2018		2017		2016		2015	
	DFO	ACA	DFO	ACA	DFO	ACA	DFO	ACA	DFO	ACA
Labour	1454	5818	8207	5205	5055	7623	9023	15636	4592	4028
Middle man	16	33	45	28	26	42	48	88	31	22
Export trade	4	12	14	11	11	14	14	22	14	11
Total	1474	5863	8266	5244	5092	7679	9085	15746	4637	4061

The exported quantity of medicinal herbs was approximately 212.96 Mt in 2015 through Division Forest Office Darchula but it was the highest around 316.73Mt in 2018. However the quantity of exported medicinal herb was low through Api-Nampa Conservation Area. Another important finding revealed that the exported quantity was not consistent because it depends upon the investment and market demand particularly of India as about 10,000 to 15,000 tons of plant products from over 100 species are exported into India as well as international markets [30].

The revenue generation was higher from export of medicinal herbs through Api-Nampa Conservation Area, than through Division Forrest Office. The record showed that, around US\$ 59646 was the highest revenue generated from export of medicinal herbs in 2016 from Api-Nampa Conservation Area, Darchula. The

revenue generation depends up on the royalty of species and quantity exported. The *Ophiocordyceps sinensis* was the major medicinal herb exported through Api-Nampa Conservation Area which shared most of the revenue [31] therefore it was higher revenue generation than it of Division Forrest Office. The income getting from the export of medicinal herbs ultimately contributes to economic uplifting of the national as well as local peasants. However, the revenue generation was also not consistent. Medicinal and aromatic plants are only the additional support for economic development particularly in remote areas [32]. It was estimated that over 50 million people depend on the trade of medicinal herb in India [33]. The study done by Negi [34] showed that, *Ophiocordyceps sinensis* is the economically valuable species in Himalaya which support economic uplifting of local tenancy.

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Another important aspect of medicinal herb was the employment creation and about 15746 was the highest number of people engaged in medicinal herbs profession in 2016 according to Api-Nampa Conservation Area. The fluctuation was estimated in the employment in different year. The local people have super level of employment opportunity from *Ophiocordyceps sinensis* collection and trade [34,35]. The medicinal herbs collection and trade are the main employment generation in high altitude region [36].

Conclusion and Recommendation

The *Ophiocordyceps sinensis* was the most exported medicinal herbs through Api-Nampa Conservation Area while *Sapindus mukorossi* and *Cinnamomum tamala* were the most traded species through Division Forest Office Darchula, Nepal. The revenue generation was higher through Api-Nampa Conservation Area than it through Division Forest Office, Darchula and employment generation was so as higher. Medicinal and aromatic herbs specifically in High Himalayan region are the good source of income but it was not consistent. So, it is essential to find the challenge related to regular income generation from the export of medicinal herbs.

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