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Role of Medicinal Plants in Provision of Livelihood. A case study of District Shangle, Khyber Pakhtunkhwa

Abstract: Harvesting of medicinal plants species one of the most economical esteemed biological resources for the mountainous community livelihood of district Shangla Khyber Pakhtunkhwa-Pakistan. This study estimates medicinal plants contribution to the local community livelihood of the district. The study was based on primary data collected through semi-structured questionnaires from medicinal plants harvesters and the local community of the district. The empirical analysis of the study was examined through descriptive statistics and two-stage least square method. The result found that medicinal plants have a great potential to contribute to the local community livelihood. Medicinal plants contribute 26 % which is the second largest source of income after the agriculture sector 30% in the total income of farmer per-month. However, reported mention that these species of plants are declining due to several factors such as deforestation, overgrazing (grazing of livestock), and unsustainable harvesting, losses during collection and storage. Therefore, there is a needed to sustain these species of medicinal plants through community partnership among formal and informal local institutions. The national government is playing a significant role in the conservation of medicinal plants and sustained the livelihood of the mountainous community of district Shangla.

Keywords: Medicinal plants, Livelihood

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1. Introduction

Human well-being is interrelated to biodiversity through ecosystem services (MEA, 2005). Ecosystem system services are includes provisioning (i.e., food, water) and the harvesting of wild species (Shrestha & Bawa, 2014). Ecosystem system services provide a significant contribution to the livelihood and well-being of rural people in developing countries through wild plants and animals (Vira and Kontoleon, 2013). In rural areas, especially mountainous people prominently depends on the status and condition of natural resources available in the forest for their livelihood security (Tiwari & Champbell, 1997; Saxena, 2003; Mahapatra et al., 2005). Across the globe, 60 million indigenous people directly depend on forest products for their livelihoods (Birchall, 2004). These include fuel product, food, fodder, medicinal plants and other non-cultivated products to meet their subsistence needs and generate cash income (Byron & Arnold, 1999, World Bank, 2004; Sunderlin et al., 2005; FAO, 2008). Among them, medicinal plants species being a valuable resource (Sharma & Kala, 2018) and harvested from the wild (Schippmann et al., 2006). Harvesting of medicinal plants significantly contributes to community livelihood and local economic development (Neumann and Hirsch, 2000; Hamilton, 2004; Belcher et al., 2005). Throughout World in many regions like in Africa (Moyo et al.,2015; Cunningham et al.,2016), Asia (Rasual et al., 2012; Sher et al., 2014) and Latin America (Lima et al., 2016) medicinal plants harvesting are considering is a main source of cash income. MPs have a role in the economic wellbeing of collectors, traders, and healers (Phondani et.al., 2011). Besides they offer a significant base of income to rural people in developing countries, particularly through the sale of wild harvested materials (Carloo, 2013). The selling of these plants contributes 15 to 30 % share to the total annual income of poorer households (Lim, 2014). The significance of MPs is known in the Himalayan region mostly from ecological, social, and economic perspectives (Joshi & Joshi, 2014).

Pakistan has famous for its variety of flora in Himalayas, Hindukush, and Karakorum with the highest altitude ranging from 0 to 8611m. There are 6000 plants exists in Pakistan (Akhtar et al., 2000). Medicinal plants and animals are a source of economic return to local communities and for the country as a whole, when collected and managed for export. In the 1990s about 50 tons of dried morels (mushrooms) were collected and exported from the northern mountains of Pakistan (USAID, 2012). Harvesting and sale of medicinal plants and other non-timber forest resources are

a vital economic activity in the Northern parts of Pakistan. About 500 families in northern areas are involved in the gathering and processing of medicinal plants in the region. The women and children are also involved in the collection of medicinal plants, the MPs are a source of income for the collectors (Gulshan et al., 2012).

2. Material and methods

2.1 Study area

District Shingle is located in Khyber Pakhtunkhwa province of Pakistan. The district has three tehsils (i.e. Alpuri, Puran and Chakesar). Before 1995 it was a part of swat district, but after 1995 it was upgraded a separate district by the chief minister Aftab Ahmad Khan Sheerpao. The district has 1586 square meter area 36% is cultivated and 64 % is uncultivated, among uncultivated 32% area is covered by forest. The landscape of the district is dominated by high mountains and narrow valleys in western boundaries of Himalaya. The general elevation of the district is 2000 to 3500 meter above from the sea level. Kuz Gansahl is the highest point in district Shangla (Razaq et al., 2013). The total population of the district is 757,810 with a number of household 89,695 (Pakistan Bureau of Statistics, 2017). District Shangle is bounded by Kohistan in the north in the east by Battgram district, in the west by district Swat, similarly in the south by district Buner. Local people depend on the agriculture sector and forest based resources. District Shangle is full of natural resources such as water, forest, medicinal plants, diamonds, and wild life. There are 76 different medicinal plants species were identified, among them 12 plants are shrubs, 52 plants species are herbs, 11 tress and one is fungus (Razaq et al., 2010). The most economically valuable species identified in the study area is *Morchellaesculenta, Aconitum hetrophyllum, Dactylorhiza hatagirea, Podophyllum emodi, Trila lium govanianum, Viola canescens, Thymus linearis, Thalictrum foliosum and Geranium wallichianum* (Shah & Hussain, 2012).

2.2 Data collection

This study was based on primary data. The data was collected through semi-structured questionnaire from medicinal plants harvesters. This study was conducted among harvesters dig out medicinal plants in the district. District Shangla has been selected purposively. The district has

three tehsils Alpuri, Puran and Chakeser. The data was collected from all three tehsils and multistage sampling techniques were employed. At the first stage, two villages from each tehsil were selected randomly. At the second stage, 15 respondents from each village were purposely selected which are shown in Table 1. We interviewed a total 90 harvesters of MPs in the district. For estimation, the quantitative analysis two-stage least square (2SLS) IV regress was employed.

Table 1 Sample size allocation for each tehsil and village

Tehsils	Villages	Medicinal plants harvesters
Alpuri	Ajmer	15
	Leloni	15
Chakasar	Opal	15
	Galabat	15
Puran	Chagam	15
	Yakhtangy	15
Total		90

Source: Author own survey

Medicinal plants is one of the rich source of income contributing in total household income in district Shangla, indicating an important role in improving the livelihood of the community. Total 90 medicinal plants collectors are purposively selected to get information about the amount of MPs and income received from MPs. Our data revealed that selling of medicinal plants is an income generating activity that contributes relatively a significant amount of money in the family's total income. It is observed that majority of the MPs collectors are collecting species that have high economic values such as *Viloa Canesence, Meseufeera, Valeriana Jatamansi, Trillum Govaninum Wall, Germinium Wallichiaum, Geradina Wall, Thalictrum Folisioum, Phedophylum Emodi, Dactylorhiza Hatagreia, and Morchella Esulenta.* Six most popular markets of medicinal plants are surveyed in study area (Olander, Shahpur, Karora, Alpuri, Besham, and Puran) to find the true economic value (Market price) of each species of medicinal plants. The average price of each species based on six markets is reported in Table 2.

Table 1 Average market price (based on six market) of different species of medicinal plants in study area

S.No	Botanical Name	Local Name	Habitat	Price per-kg

1	Morchellaa esculenta	Gojai	Fungi	18000
2	Viloa Caneesence	Banfshaan	Herb	1100
3	Mesufeeraa	Laldanaa	Herb	800
4	Valeriania Jatamansi	Muashkibala	Herb	600
5	Trillum Gaovaninum	Yakaha Jarri	Herb	500
6	Germiniuam Wallichiaum	Sarrai Jarri	Herb	500
7	Geraidina Wall	Ghwaira Jarri	Herb	400
8	Thaliactrum Folisioum	Mamiera	Shrub	300
9	Phedoaphylum Emodi	Kakoora	Shrub	300
10	Dactyloarhiza Hatagreia	Panjaa	Shrub	250

Source: Authors own survey

It is observed that Morchella esulenta has highest price in the market (Rs.18000/kg) followed by Viloa Caneesence (Rs.1100/kg).

Average annual income earned from different species of medicinal plants is given in Table 3. The table provides empirical evidence that how forest diversity (i.e. diversity in species) contribute to improve the livelihood in the study area. Our finding reveals that maximum contribution to improve livelihood is made by Morcella Essulenta (Gojjai), followed by Viloa Canesence (Banfsahah) and Mesufeera (Laldana), implying that these three species are highly economical and valuable for local community. These three species are difficult to find and takes longer time to search them, because the price of these species is higher than other species. Besides these three species seven other species are also contributing reasonably to improve the livelihood in the study. However, price depend on various factors like quality, grading and experience of collection. However, grading is assumed to be contribute largely in the price received.

Table 3 Average income from medicinal plants in year from each species

Income source/Plants Name	Observation	Mean
Viloa Canesence	84	5804
Mesufeera	89	5835
Trillum Govaninum	72	3845
Valeriana Jatamansi	86	3135
Germinium Wallichiaum	64	2933

Geradina Wall	35	2649
Thalictrum Folisioum	19	2053
Phedophylum Emodi	79	2568
Dactylorhiza Hatagreia	4	2300
Morchella Esculenta	76	6504
Total income per-year		37,626

Source: Authors own survey

3. Result

3.1 Descriptive statistics

The descriptive statistics of variables employed in both livelihood model to investigate the factors affecting the livelihood of medicinal plants collectors is reported in Table 4. Among these variables, income, working members in the family, total education of working members having age more than twenty years, experience of household head (collectors), quantity of collection, distance, working hours are all continuous variables, while grading of plants is a dummy variable. The average monthly income of farmer from MPs and from other sources is Rs.8856/month and the average number of working members is 2.2. The average education of family members is 8.4 years while average experience of collecting medicinal plants is more than 7 years. It is observed that on average each family collects 45.5 kg of medicinal plants each year. Further our result reveal that collectors cover a long distance of 6.4 hours to collects MPs and on an average they work 8.5 hours in the filed every day.

Table 4 Descriptive statistics of medicinal plants and livelihood of farmer

Variable	Mean	Std. Dev.
Income of MPs collectors from medicinal plants and from other sources per-month (R.s)	8856.2	1403.94
Working members in the family (numbers)	2.22	0.57
Education of family members having age more than twenty years (year of schooling)	8.45	2.82
Grading of plants (dummy)	0.44	0.59

Experience in terms of year about collection and selection of species (year)	7.67	1.97
Quantity collection of MPs per-month (kg)	3.8	9.18
Distance from home to collection area (hour)	6.43	1.31
Working hours in a day (hour)	8.45	1.74
Income from medicinal plants per-month (R.s)	3160	688.8

3.1 Role of medicinal plants in rural livelihood

In order to investigate the relationship between incomes from medicinal plants with other explanatory variables two stage least square (2SLS) model has been employed. The result is reported in Table 5. In this analysis income from MPs is dependent variable, among independent variables grading of MPs, experience of collectors (in year) and quantity collection of MPs per-month. However, quantity collection of MPs is not exogenous rather it is indigenous variable, so as a result it create indigeneity problem in model. Therefore proper instrumental variables has been identified for quantity collection of MPs including working hour in the field and distance from home to collection point. The procedure of analysis is: in the first stage regression quantity collection of MPs (per-month) is regress on working hour in the field and distance from home to collection point. While in the second stage regression income from MPs is regress on above mention variables except from instrumental variables. The coefficient of grading of plant is positively correlated to quantity collection of MPs, it implies that if a collector of MPs is properly grading the plants then they will be receive higher profit form the selling of MPs, so as a result they have be more motivated to collect more medicinal plants. Thus the relationship between quantity collection and grading of plants is positive. Our result revealed that one unit increase in grading of plants it lead to increases quantity collection of MPs by 0.23 kg per month. Similarly the relationship between quantity collection of MPs and experience of collector is also positive, it indicate that if a collector have more experience about collection and selection of MPs then they will be collected more medicinal plants instead of those who have not sufficient experience. Our result show that one year increase in the experience of MPs collector it lead to increase quantity collection of MPs by 0.06 kg per-month. In addition working hour in field is also positively

correlated to quantity collection of MPs, it implies that if a harvester of MPs spend more time in the filed then they will be collect more medicinal plants. Our result indicates that one hour increase on the collection of MPs in the filed it lead to increases quantity collection of MPs by 0.8 kg per-month. Similarly distance from home to collection point is negatively correlated to quantity collection of MPs. It indicates that if distance from home to collection is increase then definitely MPs collector have do not potential to work hard in the field, thus as a result the quantity collection of MPs will be decline. Our result revealed that one hour increase in the distance it lead to decreases quantity collection of MPs by 0.28 kg per-month. Grading, experience, working hour and distance are statistically significant at 10% and 1% level of significance respectively.

In the second stage regression grading of plants is positively correlated to income from medicinal plants, it indicates that if a collector of MPs is properly grading the plants then they will be receive more profit from the selling of MPs. Resultantly, the relationship between grading of plants and income from is positive. Our finding show that one unit increase in grading of plants it lead to increases income from MPs by 312 rupees per-month. Grading of plants is statistically significant at 5% level of significance. Experience of collector is also positively correlated to income from MPs, it indicates that more experience of collectors has great advantage on income they are receive form medicinal plants. Therefore the relationship between experience of collectors and income (medicinal plants) is positive. Our result revealed that one year increase in the experience of collector it lead to increases income from MPs by 149 rupees per-month. Experience of collector is statistically significant at 1% level of significance. Lastly quantity collection of MPs is positively correlated to income (from medicinal plants), it implies that if a collector harvest more medicinal plants then they will be obtain higher income from the selling of MPs. Our result indicates that one kg increase in the quantity collection of MPs it lead to increases 207 rupees per-month. However, quantity collection of MPs is not statistically significant.

Table 5 Factors determining the livelihood from MPs collection

Variables	First stage regression		Second stage regression	
	Quantity collection of medicinal plants per-month		Income from MPs per-month	
	Coefficient	Probability	Coefficient	Probability

Grading of plants	0.23*	0.06	312**	0.05
	(0.12)		(159.5)	
Experience of collectors	0.06*	0.08	149***	0.01
	(0.04)		(43.12)	
Working hour	0.18***	0.00		
	(0.04)			
Distance from home to collection point	-0.28***	0.00		
	(0.04)			
Quantity collection of medicinal plants per-month			207	0.25
			(182)	
Constant	3.77***	0.00	1106***	0.00
	(0.54)		(499.22)	
R^2	0.57		0.59	
Observation	90			

*, **, *** represent significance level at 10%, 5%, 1% respectively and value in parenthesis are standard error

3.2 Factor affecting rural livelihood of medicinal plants collector

In previous analysis the focus is only on income which collectors are obtained from medicinal plants. But actually it is not sufficient to analyse the livelihood of collector only take income from MPs, because MPs is a part of total income. Therefore, we move one step further to see that, is medicinal plants also affecting total income (livelihood) of collector. So we take total income (income from medicinal plants and other sources) is dependent variable.

In order to investigate the relationship between total income (income from MPs and other sources) with other explanatory variables two stage least square (2SLS) model has been employed. The result are reported in Table 6. In this analysis total income (livelihood of collector) is dependent variable, among independent variables education of household members having have age above twenty year, working members in the family, experience of collector (year), grading of plants and quantity collection of MPs (per-month). However, quantity collection of MPs is not exogenous rather it is indigenous variable. Without correcting endogeneity problem an instrumental variable (IV) approach is suggested. Two instrumental variables, working hour in the field and distance

from home to collection point are suggested to correct the endogeneity of the amount of medicinal plants. Hence two stage least square is suggested.

In the first stage regression quantity collection of MPs (per-month) is regressed on working hour in the field and distance from home to collection point along with other variables. While in the second stage regression, income from MPs (per-month) is regressed on above mention variables except from instrumental variables. The result indicates that coefficient of grading of plant is positively correlated to quantity collection of MPs. It implies that if a collector of MPs is properly grading the plants then they will be receives higher profit from the selling of MPs, higher profitability motivate to collect more medicinal plants. Thus the relationship between quantity collection and grading of plants is positive. Our result revealed that one unit increase in grading of plants lead to increases quantity collection of MPs by 0.23 kg per-month. Similarly the relationship between quantity collection of MPs and experience of collector is also positive. It indicate that if a collector have more experience about collection and selection of MPs then they will be collected more medicinal plants instead of those who have not sufficient experience. Our empirical findings indicates that one year increase in experience of MPs collection lead to increases in quantity collection by 0.07 kg per-month. In addition working hour in field is also positively correlated to quantity collection of MPs it implies that if a harvester of MPs spend more time in the filed then the amount he collects will be higher. Our result reveals that one hour increase in the field will lead to increases quantity collection of MPs by 0.17 kg per-month. Similarly distance from home to collection point is negatively correlated with the quantity collection of MPs. It indicates that if distance from home to collection point increase then amount of MPs collection will be decline. It is because if collectors spend more time to reach to destination then he/she has less hour to work in the field and moreover his energy level will be reduces which will lead to decline in the quantity collection. Our result revealed that one hour increase in distance spend in travelling lead to decreases in quantity collection by 0.20 kg per-month. Grading, experience, working hour and distance are statistically significant at 10% and 1% level of significance respectively. Our empirical analysis find that working members in the family is negative impact on the collection of MPs, it might be because they have be better other sources of income for their livelihood. Our result revealed that one unit increase in working member in the family lead to decreases collection of MPs by 0.01 kg per-month. Similarly total education of household members (having age above

twenty years) have also negative impact on collection of MPs. This implies that when education are increases in the family members they will be prefer other sources of income for livelihood instead of collection of MPs. It might be because there are a lot of other opportunities for educated person to earn income. Resultantly, relationship between collection of MPs and total education of household members are negative. Our empirical finding indicates that one year increase in education of household members lead to decreases collection of MPs by 0.01 kg per-month. In the second stage regression total income of collector (income from MPs and other sources per-month) is regressed on working members in the family, total education of family members having age above twenty years, grading of plants, experience of collector, and quantity collection of MPs (per-month). The empirical result find that quantity collection of MPs is positively affecting total income of collectors. This implies that if a collector harvests more medicinal plants then the total income of farmer will be increased and better will be the livelihood. Because if a collector harvest more medicinal plants then he/she obtains higher income from MPs. Our result revealed that one kg increase in the collection of MPs lead to increases total income of collectors by Rs.698 per-month. Similarly education of household members (having age more than twenty year) has also positively correlated with total income (livelihood) of collector. This indicates that more educated members in the family play an important role for the betterment of livelihood of collectors as well for improving their living standard. Our result find that one year increase in education of household members lead to increases total income (livelihood) of collector by Rs.120 per-month. It is observed that coefficient of quantity collection of MPs and education of household members is statistically significant at 1% level of significance. In addition working members in the family are also contributing in the total income (livelihood) of MPs collector. The empirical result revealed that there is positive relationship between working members in the family and total income (livelihood) of MPs collector. This implies that more working members in the family have great potential of earning for the whole family, hence more working members in the family better will be the income (livelihood) of MPs collector. Our empirical result find that one unit increase in working members in the family lead to increases total income (livelihood) of collector by Rs.363.73 per-month. Grading of plants is also positive impact on total income of MPs collector. The positive relationship between grading of plants and total income (livelihood) indicates that if a collector properly grading the plants then he/she receives higher profit on each unit of MPs.

Therefore, grading of MPs is increases total income of MPs collector. Our empirical findings show that one unit increase in grading of plants lead to increases total income (livelihood) of MPs harvester by Rs.484.70 per-month. It is observed that working members in the family and grading of plants is statistically significant at 1% and 5% level of significance respectively. Similarly the relationship between total income (livelihood) of MPs collector and experience about collection and selection of medicinal plants is positive. This implies that more experienced collectors have advantages to earn more profit by selling medicinal plants. This is because if collectors have more expertise in terms of years about collection and the selection of species, then the total income (livelihood) will be higher. Our empirical result revealed that one year increase in the experience of MPs collection lead to increases income (livelihood) by Rs.137.65 per-month. However, experience of MPs collector is not statistically significant. It is because the independent variable (experience) does not contribute in the variation of (total income) dependent variable, and hence it is not relevant considering such independent variable.

Table 6 Factors determining rural livelihood

Variables	First Stage Regression		Second Stage Regression	
	Quantity collection of medicinal plants per-month		Total income (from MPs and other sources) per-month	
	Coefficient	Probability	Coefficient	Probability
Education of household members having age more than twenty years	-0.01	0.53	120***	0.00
	(0.02)		(41.81)	
Working member in the family (numbers)	-0.01	0.91	363.73***	0.01
	(0.09)		(150.91)	
Grading of plants	0.23**	0.08	484.70*	0.03
	(0.13)		(233.96)	
Experience of collectors (years)	0.07*	0.08	137.65	0.14
	(0.04)		(93.36)	
		0.08	115.11	0.64

Income from livestock	0.25*		(246.73)	
(milk, desi ghee,) Rupees	(0.15)	0.59	-352.73*	0.09
Income from services (Daily	0.06		(212.03)	
wages) per month/ Rupees	(0.13)	0.93	-231.61	0.25
Income from Agriculture	0.01		(203.04)	
sector per-month (Rupees)	(0.14)			
Working hour in the field	0.17***	0.00		
(hour)	(0.04)			
Distance from home to	-0.20***	0.00		
collection point (hour)	(0.05)			
Quantity collection of			698.76***	0.01
medicinal plants per-month			(296.77)	
Constant	2.87	0.00	3290.93	0.00
	(0.55)		(967.63)	
R^2	0.58		0.63	
Adjusted R^2	0.54			
Observation	90			

*, **, *** represent significance level at 10%, 5%, 1% respectively and value in parenthesis are standard error

4. Conclusion

The result shows that there is positive relationship between medicinal plants and the livelihood of local community in district Shingle. Similarly ten most economical medicinal plants species have been identified in study area, such as (*Morchellaa esculenta, Viloa Caneesence, Mesufeeraa, Valeriania Jatamansi, Trillum Gaovaninum, Germiniuam Wallichiaum, Geraidina Wall, Thaliactrum Folisioum, Phedoaphylum Emodi, and Dactyloarhiza Hatagreia).* These species of plants are contributing to the livelihood of local community. Medicinal plants relatively high contributing to income for the mountainous rural people in the district make them highly economical valuable species. Its economic contribution along with the fact that most of the rural people harvesting the medicinal plants species, makes its feasibility to generate interest among local and national government as well as local community for conservation of medicinal plants and its natural habit. Thus it is important for national and local government to build a proficient agenda for the conservation of medicinal plants.

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