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Reaserch Paper

Evaluation of diversity in consumption of medicinal plants by settled nomadic households living under different management and livelihood status (Case study: Divarouieh region in Bardsir township, Kerman province)

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Abstract

Since the evaluation of the diversity indicators in consumption of medicinal species by the beneficiary's households and its driving factors is of utmost importance in marketing, multi-purpose planning of rangelands and sustainable development, a questionary-based study was carried out to determine the diversity indices of medicinal species consumption in settled nomadic communities living under different management and livelihood situations in the rangelands of Dyvaroeieh in Bardsir township, Kerman province, Iran. To this end, the medicinal species consumed by each household (as a study unit) in addition to the diversity indicators of consumption (i.e., dominance coefficient and Shannon-Weiner index) were evaluated under two management sites comprising Rangeland Management Plan (RMP) (i.e.,Dyaroeieh 1) and the nearest adjacent rangeland without RMP (i.e., Dyaroeieh 2, as control treatment) and three livelihood levels (i.e., very poor (<50 million Rials monthly income), poor (50-100 million Rials monthly income) and moderate (100-150 million Rials monthly income)) under factorial test in SPSS software environment. The study's results revealed that both of management and livelihood factors can be applied by manager to increase diversity indices in medicinal plants consumed by beneficiaries. More specifically, management through RMP was more powerful and effective tool in this way. Therefore, it could conceivably be argued that RMP can be considered as a driving factor in increasing the diversity of medicinal plant consumption and also be a suitable platform to meet the needs and demands of rangelands' beneficiaries in this field.

Introduction

Rangelands are the sources of medicinal plants for millions of pastoralists (Bagheri, 2011). Rangeland ecosystems can have different functions in terms of fodder production, secondary medicinal metabolites, nectar and pollen production, preservation of water and soil resources, carbon sequestration, and beauty for tourists (Amiri et al, 2013; Arzani and Abedi 2015; Yeganeh et al. 2016a; Yeganeh et al. 2016b; Fazilati and Hosseini Araghi 2017; Hamzehnejad et al. 2020; Bagheri & Peymanfard, 2021). Relying on the single-pole services of rangeland (i.e., fodder production and traditional animal husbandry livelihood) in Iran has a long history, and during the last half century, the number of livestock in the country has not been proportional to the production of vegetative elements of the country's natural ecosystems. As a consequence,

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the negative feedback of ecosystems, which is called the destruction of pastures, has caused to a disruption in the livelihoods of rangelands' beneficiaries (through the reduction of the weight of the livestock and the total weight of the herd) (Bagheri et al. 2010; Mesdaghi 2008). Since 1967, the executive bodies of rangeland management, which are in charge of natural resources departments, have prioritized the implementation of RMPs as an effective and problem-solving solution in their programs throughout the country (Badripour et al., 2006). So that the technical guide for the preparation of RMPs by the executive bodies of the country since 2015 (numbered 1/1/95/14105 and dated 6/2/1395) has been changed to a consolidated, synthesized, and multi-purpose form (Technical office of rangelands 2016).In this regard, the natural habitats of Kerman province have received more attention from the point of view of by-product and pharmaceutical services due to the harshness of nature leading to the richness of secondary metabolites (Bagheri and Arjomand Tajadini 2012). Since in rangeland management, the use of medicinal by-products of rangeland is an effective step to operationalize multipolar livelihoods, the effects of the implementation of RMPs and livelihoods status on the pattern and diversity of medicinal plant consumption become doubly necessary. Although the effects of the implementation of RMPs on the production of plant species and the condition of pastures (e.g., Ghaemi, 2003; Rahimi & Sadeghi 2005; Sanaii et al., 2010; Nekooie et al. 2012; Borhani et al. 2014; Kohestani & Yeganeh, 2016) and medicinal aspects (Mehrebani et al. 2013; Mostafaei 2014) have already been reported, but the research conducted on the effects of these plans and the livelihood status of the beneficiaries on the indicators of consumption diversity and also its fitting to rangelands' supply is very limited and under-researched. This become important, while by examining the indicators of the diversity of consumption of medicinal species in the families of the Pastoralists and exploring their driving factors, it is possible to reach the type of medicinal plant species needed for cultivation and development on the one hand and the controlling factors of the Pastoralists' households demand via implementing different livelihood and management strategies on the other hand.

Since the consumption of medicinal by-products of rangelands is an effective and hopeful step to operationalize multipolar livelihoods in the country's RMPs, the study of the effects of the implementation of RMPs and the livelihood status of the beneficiaries on the pattern and diversity of consumption of medicinal plants is of considerable importance. Therefore, this research sought to evaluate the diversity of consumption of medicinal species in the households of users (settled nomadic communities) under different management and livelihood conditions in Dyvaroeieh area of Bardsir city of Kerman province.

Material and Method

Study area

Comprising a site under RMP (Dyaroeieh 1) and without plan as control treatment (Dyaroeieh 2), study area is related to Kerman province of Iran (Fig. 1). These two sites, with similar ecological conditions, have been extended between 479779 to 4914213 east longitudes and 3285094 to 3300074 north latitudes in the UTM system, having a total area of 5907 and 4906 hectares, respectively. The altitude range of the region is between 2398 and 2090 meters and its average height is 2180 meters. The annual rainfall is 211.8 mm, most of which is spring. The average annual temperature of the region in the hottest and coldest months of the year is 19.2 and -0.5 degrees Celsius, respectively. Quaternary formations including lithology units (Qt2, Qm) that belong to the Holocene epoch of the Quaternary period occupy most of the region (<90%). Two plant communities including *Artemisia sieberi-Salsola imbricata* and

Zygophyllum eurypterum-Artemisia sieberi with poor and very poor ecological conditions were covered these studied sites.

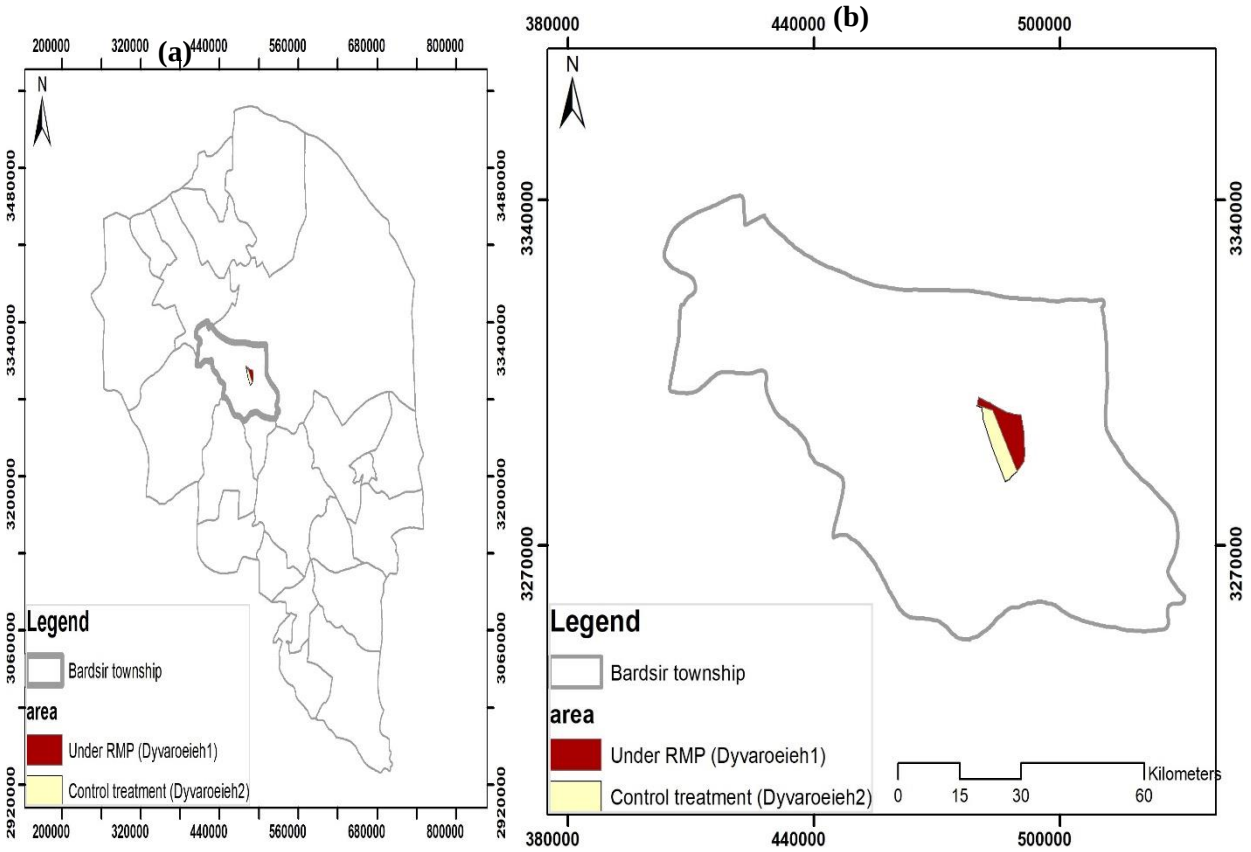

Fig. 1. Location of study area in Kerman province of Iran (a) associated with its township (b)

Research methodology

Based on the purpose of the study, first of all, the number of beneficiaries and the border of the two sites under RMP (Dyaroeieh 1) and the nearest adjacent rangeland without RMP plan (Dyaroeieh 2) were investigated based on their files in the General Department of Natural Resources and Watershed Management of Kerman province. In this regard, the number of beneficiary households in Dyaroeieh 1 and Dyaroeieh 2 were 13 households and 12 households, respectively, which were located in Negar and Hasan Abad cities (a county about 1 km from Negar). This research was carried out by referring to each beneficiary household as a study unit and completing designed questionnaire. Investigations showed that in the past, the beneficiaries of the region lived in the form of nomads in Kaper (i.e., tent) in the area. In other words, nomadic families with their livestock were present in the summer rangelands in Dyaroeieh 1 and Dyaroeieh 2 areas, but in recent years, the families of the pastoralists in all the days of the year are established in Hasan Abad settlement (on the edge of the study area) and Negar - in the form of a settlement plan - and only their livestock are guided to the area by shepherds during the year to use rangelands, and in unfavorable seasons of the year their livestock are fed by hand.

After the design of the questionnaire and field operations, the variables of the types of medicinal plants used in addition to livelihood status in the classes of the Likert spectrum including very poor - monthly income less than 50 million Rials (class 1), poor - monthly income between 50 and 100 million Rials (class 2), moderate - monthly income less than 100 to 150 million Rials (class 3), good - monthly income less than 150 to 200 million Rials (class 4), and very good - monthly income above 200 million Rials (class 5) were considered. It is worth to note that the last two levels of livelihood status did not exist in the families. Then, three diversity indices including the number of species used, dominance of consumption and Shannon-Weiner diversity based on presence and absence were calculated in the PAST software based on the following formulas:

Table 1. Formula of diversity, richness, and dominance indices

References	Formula	Indicator	Criteria
(McIntosh, 1967)	$\frac{S}{sampling\ unit}$	Number of species	Richness
(Shannon and Wiener, 1949)	$H = -\sum_{i=1}^{s}\left[\frac{n1}{n}\right]\mathrm{Ln}\left[\frac{n1}{n}\right]$	Shannon-Wiener	diversity
(Berger and Parker, 1970)	D=nmax/N	Berger-Parker	Dominance

In which, S: number of species, n: total numbers of individuals in sampling unit (household), n = total numbers of individuals in i species

Finally, the effect of two management levels (rangeland covered by RMP plan and rangeland without RMP plan) and three livelihood levels (poor, very poor and medium) were tested in the form of a factorial design applying the SPSS software environment.

Results

Effect of the management and livelihood status on the number of species consumed

The results of the ANOVA analysis are displayed in Table 2. From the table below we can see that the management status had a significant effect at a 0.01 confidence level on the number of species variable. On the other hand, no significant effect was found for the number of species variable under different income status.

Further analysis performed by Duncan's multi-domain method (Figure 2) shows a remarkable increase in the number of species in cases where rangeland is under RMP compared to without RMP one. Accordingly, the RMP status as a triggering factor increased number of species used by approximately 57.14 percent (Fig. 2a). Moreover, as seen in Fig. 2b, number of species did not change significantly with income levels. Generally, these results indicate that the management status is more effective in comparison to the income one.

Table 2 Main and interaction effects of managerial and livelihood situations on number of species consumed of Dyvaroeieh's rangeland beneficiaries by ANOVA test

Source	df	Mean Square	F	Sig.
Management	1	84.250	22.779	.000**
Income	2	6.670	1.803	.192 ns
Management* Income	2	2.091	.565	.577ns
Error	19	3.699		
Total	25			

*, ** =Significant at 5%, 1%, respectively and ns=Nonsignificant

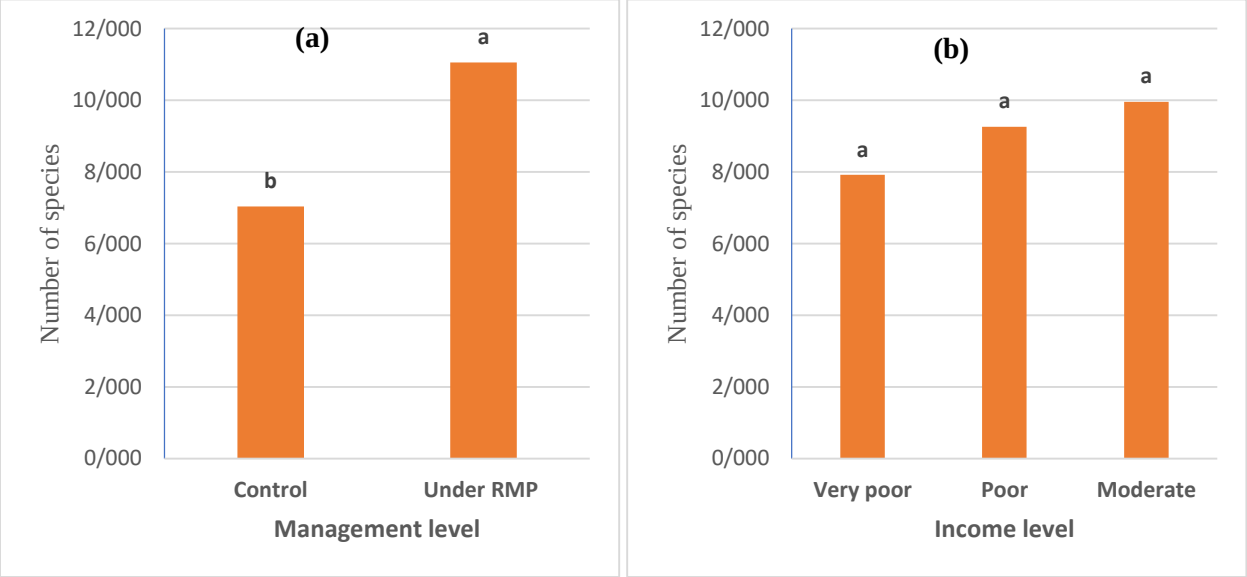

Fig. 2 Compare mean graph for number of species consumed under different management status(a) and livelihood ones(b)

Effect of the management and livelihood status on dominance coefficient

The results of the ANOVA analysis are displayed in Table 3. From the table below we can see that the management status had a significant effect at a 0.01 confidence level on the dominance coefficient. On the contrary, no significant effect was found for dominance coefficient under different income situations.

Further analysis performed by Duncan's multi-domain method (Figure 3) shows a remarkable decrease in the Dominance coefficient in beneficiaries when the rangeland underwent RMP compared to without RMP. Accordingly, the RMP status as a triggering factor for declining dominance coefficient by 81 percent (Fig. 3a). Additionally, as shown in Fig. 3b, dominance coefficient in usage is increased significantly with very poor income status by 46.27 percent in comparison to both the poor and moderate-income situations. Taken together, these results indicated that both of Management and livelihood status were able to change dominance coefficient

in usage by beneficiaries in dyvaroeieh's rangelands. More specifically, management is more powerful tool in this way.

Table 3 Main and interaction effects of managerial and livelihood situations on dominance coefficient in usage by Dyvaroeieh's rangeland beneficiaries applying ANOVA test

Source	df	Mean Square	F	Sig.
Management	1	.029	17.086	.001**
Income	2	.005	2.945	.077
Management* Income	2	.004	2.179	.141
Error	19	.002		
Total	25			

*, ** =Significant at 5%, 1%, respectively and ns=Nonsignificant

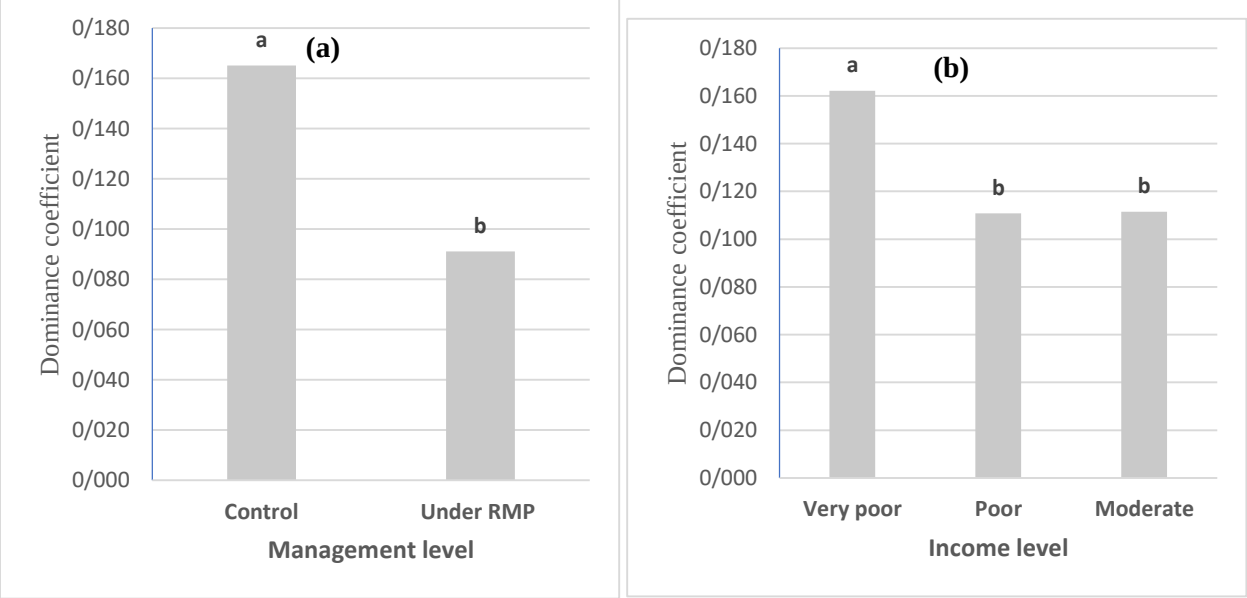

Fig. 3 Compare mean graph for dominance coefficient under different management status(a) and livelihood ones(b)

Effect of the management and livelihood status on Shannon-Weiner diversity index

The findings of the ANOVA analysis are illustrated in Table 4. What stands out in the table is a significant difference of Shannon-Weiner diversity index under the management situation groups. In contrast, no significant effect was found for Shannon-Weiner diversity index under income status.

In Fig.4 illustrating Duncan's method results, there is a clear increasing of Shannon-Weiner diversity index as 0.55 when management status of rangeland changes from control treatment (i.e., without RMP) to RMP one. Shannon-Weiner diversity index increased meaningfully by 18

percent when the income of beneficiaries changed from very poor to moderate categories. Whereas the effect of moderate position on income level was significantly higher than that of the very poor position, no meaningful difference was found between the poor and very poor positions in terms of Shannon-Weiner diversity index.

Table 4 Main and interaction effects of managerial and livelihood situations on Shannon-Weiner diversity index of Dyvaroeieh's rangeland beneficiaries by ANOVA test

Source	df	Mean Square	F	Sig.
Management	1	1.583	20.079	.000**
Income	2	.202	2.562	.104
Management* Income	2	.089	1.124	.346
Error	19	.079		
Total	25			

*, ** =Significant at 5%, 1%, respectively and ns=Nonsignificant

Fig. 4 Compare mean graph for Shannon-Weiner diversity index under different management status(a) and livelihood ones(b)

Discussion

Examining the impact of management and livelihood conditions on diversity indices via ANOVA and Duncan's multi-domain method analysis, this study showed that RMP status as a triggering factor than control treatment (i.e., without RMP one) increased the indices of diversity in usage including number of species used and Shannon-Weiner by 57.14 and 29.3 percent, respectively. On the other hand, RMP status in comparison to control treatment caused to lower the dominance coefficient with the decreasing rate reported to be 81 percent.

The results showed that livelihood status had no significant effect on the number of species variable. Whereas the dominance coefficient decreased significantly from 0.162 to 0.11 where livelihood class reached from very poor to moderate, Shannon-Weiner index increase meaningfully from 1.96 to 2.31 where livelihood class changed from very poor to moderate.

Due to the fact that the dominance coefficient and Shannon-Weiner index was affected significantly by improving the livelihood status from very poor to moderate categories, it becomes possible for managers to expand the medicinal species consumption by households (i.e., increasing diversity in usage) and eliminate the concentration on limited species (i.e., decreasing dominance coefficient) through organizing and focusing on improvement of beneficiaries' livelihood situations in the body of RMPs.

Conclusion

It could conceivably be argued that RMP can be considered as a driving factor in increasing the diversity of medicinal plant consumption and also be a suitable platform to meet the needs and demands of rangelands' beneficiaries in this field.

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