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Farmers' knowledge in the Swiss canton Valais: cultural heritage with future significance for European veterinary medicine?

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Abstract

Background The demand for natural product-based treatment options for livestock is increasing by animals' owners, veterinarians and policy makers. But at the same time, the traditional knowledge about it is at risk of falling into oblivion in Europe. The present study recorded this knowledge for the linguistically and geographically interesting Swiss canton of Valais.

Method Open, semi-structured interviews were used to collect detailed information on formulations and applications, including plant species and natural substances, origin of material, extraction and preparation of herbal products, indication and type of application, dosage, sources of knowledge, frequency of usage and self-assessment of the treatment.

Results and discussion In the course of 43 interviews, 173 homemade single species herbal remedy report (HSHR) were recorded. They included 53 plant species from 30 botanical families. Plant species from the botanical families of Asteraceae, Rubiaceae and Cupressaceae were mentioned the most, while the most frequently documented plant species were *Coffea arabica* L., *Juniperus sabina* L., *Arnica montana* L. and *Matricaria chamomilla* L. For the 173 HSHR, a total of 215 uses were mentioned, most of which were for the treatment of gastrointestinal and metabolic disorders, followed by skin lesions and genito-urinary tract problems. Regional peculiarities emerged, such as the use of *Leontopodium alpinum* Cass. for diarrhea in the French-speaking Valais, while *Matricaria chamomilla* and *Camellia sinensis* L. were used in the German-speaking part instead. In comparison with other regions of Switzerland, 10 plants were reported for the first time, including *Juniperus sabina* with 18 use reports.

Conclusion The daily use on farms and the high satisfaction of farmers with homemade herbal remedies demonstrate their high practical relevance. In conclusion, the traditional regional knowledge about the use of medicinal plants is not only a cultural heritage worth protecting, but also an essential resource for the further development of European veterinary medicine.

Keywords Ethnoveterinary research, Livestock diseases, Medicinal plants, Switzerland (Valais)

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Introduction

The demand for natural products to support animal health and welfare is increasing; on the part of animal owners as well as veterinarians [1–3], and as part of political concepts and European guidelines, for example, as outlined in the European Green Deal [4], organic farmers, in consideration of consumer demands and expectations, are severely restricted in their permitted use of pesticides, antibiotics, synthetic antiparasitic agents and other synthetic products, but encouraged to use herbal products as a first-line treatment; or as part of the One Health concept [5], which in its holistic approach recognizes that human health is intimately linked to the health of animals and the environment. This includes to close current knowledge gaps and to provide novel solutions and tools to prevent and treat infectious diseases [6].

The Swiss Alps have an ancient tradition of utilizing plants from the wild as medicine and nutrition for humans and animals. However, this knowledge is falling more and more into oblivion and is mainly limited to rural areas [7]. The generally recognized structural change in European agriculture is also clearly apparent in the Swiss mountain regions. While there were 63,627 farms in Switzerland in 2005, there were 53,232 in 2015, with the percentage decline during these 10 years in the canton of Valais amounting to 28.6%, which is higher than in Switzerland overall [8].

The canton of Valais in Switzerland is a rural mountain region that has undergone profound changes since the second half of the twentieth century. Traditional agriculture has declined dramatically in the Alpine valleys, while the number of tourist facilities and construction projects has increased significantly [9]. Small-scale farms are particularly affected by this decline in farms.

Therefore, it is time to collect traditional empirical knowledge on the use of medicinal plants in animals and translate it into a contemporary context. Research on ethnoveterinary medicine plays an essential role in this, as it deals with "the systemic investigation and application of folk veterinary knowledge, theory and practice" [10].

In the field of ethnobotany, several studies [11–15] as well as mainstream books in French [16–19] are available from the Valais. These books deal mostly with medicinal and edible plants and provide personal recipes and practical advice from elderly local people [7]. The results of these sources show that in this rural mountain region with its geographical and cultural peculiarities, traditional knowledge of the local flora and its use by humans remains. So far, this traditional knowledge has not been documented for animals and veterinary use.

The aim of the present study was to continue the comprehensive recording of traditional veterinary knowledge (including data on dosage and frequency of use) in Switzerland, specifically in the south-western canton Valais. We specifically investigated the differences in traditional knowledge between the native French speakers of the Lower Valais and the German speakers in the Upper Valais, and the extent to which this knowledge represents possible alternative and complementary strategies for the treatment of important animal diseases. Therefore, this study was based on the following research questions:

- Are there particularities in the use of medicinal plants for animals due to the geographical location and meteorological characteristics of the region?
- Do the linguistic variances have an influence on knowledge, as has been shown in other studies [20–22], and do they entail clear regional boundaries for the use of medicinal plants?
- Does the remaining knowledge not only harbors a cultural and historical heritage that should be preserved, but also provides valuable input for the further development of veterinary phytotherapy in Europe?

Material and methods

Study area

The research area was situated in the south-western part of Switzerland and included the bilingual canton Valais which comprises the Rhône valley from Rhône Glacier to Lake Geneva and several side valleys. The study area was located between 6°46′ and 8°28′E and 45°51′ and 46°39′N [23], and the altitude was between 372 and 4634 m above sea level with an average annual temperature at a mean altitude of 1441 m above sea level of 4.4 °C [24, 25]. The Valais has a dry climate with 500 to 600 mm of precipitation per year and represents the driest region of Switzerland. The area is characterized by cold winters and dry summers and by strong temperature differences. The reason for this dry climate is the location between the mountain massifs of the Valais Alps in the South and the Bernese Alps in the North. Both Alps rise up to over 4000 m and intercept much of the precipitation which flows from the North or from the Mediterranean to the Alps [26]. The vegetation in Valais is mainly characterized by small-scale pastures and meadows, succession forests, forest edge communities, shrubs, steppe vegetation and the *Juniperus sabina* heath [27, 28]. According to the national institution responsible for mapping the Swiss flora, 1841 and 879 plant species have been listed

that grow in Valais below and above 1300 m above sea level respectively [7, 29]. The study area covers a region of 5224 km^2 and has 327,000 inhabitants. The majority (67%) of the inhabitants are French native speakers; 27% speak German and the remaining inhabitants speak mainly Italian or English [30]. German is the main language in the Upper Valais (VS-g) east of Sierre, while French is spoken in the Lower Valais (VS-f) located in the West. The language border is between Sierre and Salgesch (Fig. 1).

At the time the study was conducted, there were 3446 farms in the canton Valais. A total of 1219 farms kept cattle followed by 744 farms with sheep, 455 farms with horses and 293 farms had goats. In total, there were 346 organic farms in the study area. In the Upper Valais 237 out of 1196 farms (562 farms kept sheep, 482 farms had cattle, 199 had horses and 174 farms kept goats) were organic farms. In the Lower Valais there were 109 organic farms out of a total of 2250 farms (737 farms had cattle, 256 farms kept horses, 182 farms had sheep and 119 farms kept goats). Out of the 3446 farms in the canton a total of 1540 were full-time farms [31].

Dialog partners

To find dialog partners, different methods were used according to a previously described approach [32]. In a first step all organic farmers in the research area were contacted by letter, since "phytotherapeutic […] products" are one of the preferred methods for the treatment of livestock diseases in organic farming [4]. In addition, the project was presented at two general assemblies of farmers in the Upper Valais and the Lower Valais. Also, an article was published in a local newspaper. Farmers of the livestock-farm research network of the Research Institute of Organic Agriculture (FiBL) were contacted by phone. A total of 43 dialog partners (DPs) were found. Of these, five farmers spontaneously agreed to become a DP, and one farmer of the livestock-farm research network of FiBL also served as a DP. The remaining 37 DPs were found with the aid of the snowball sampling method [33] (Fig. 2). In the Upper Valais several farmers were referred by one informant as he helped to establish contact with these farmers by informing them about the project. This informant works in the agriculture center in Visp and there he is head of the farming estate. Because of his

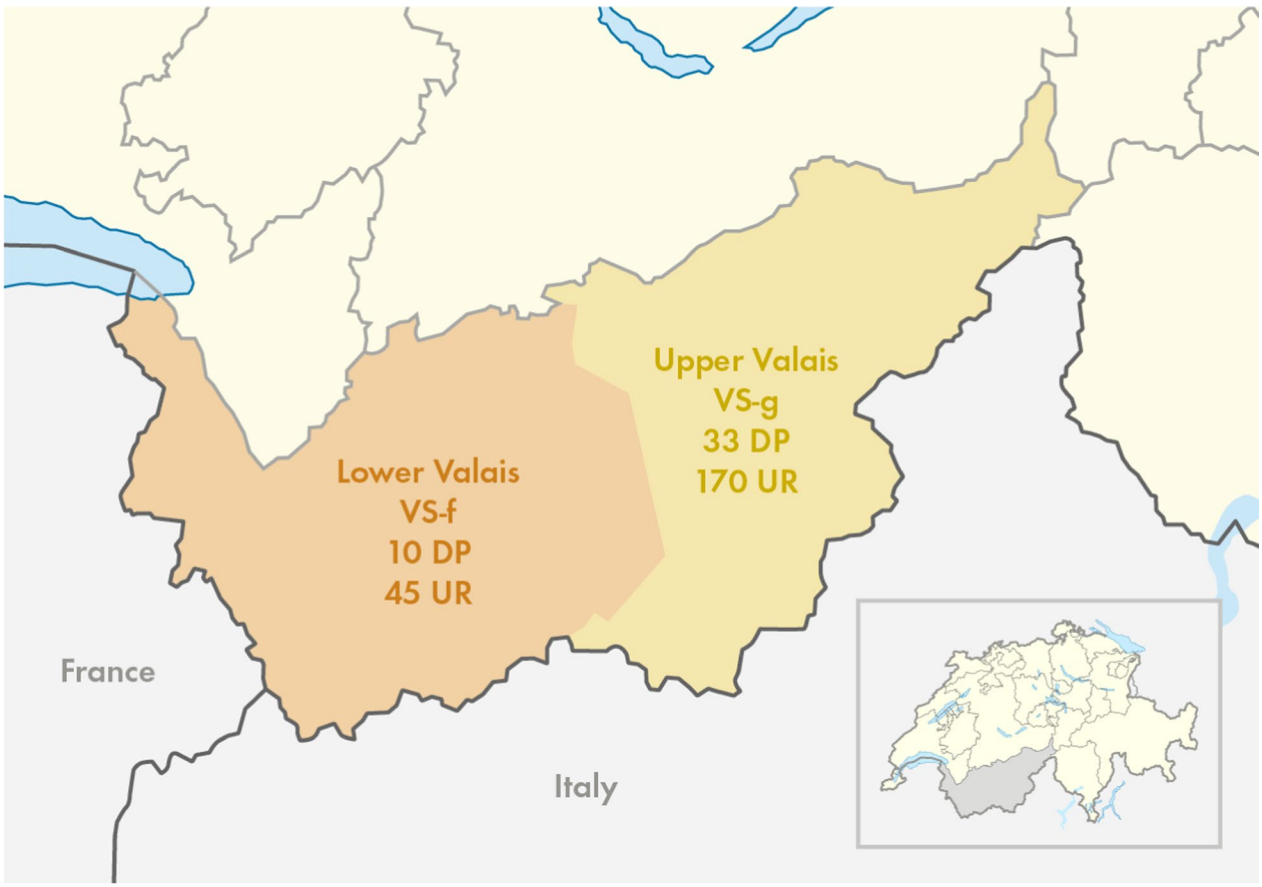

Fig. 1 Research area of the project: Upper Valais (yellow), Lower Valais (orange), modified from [71]

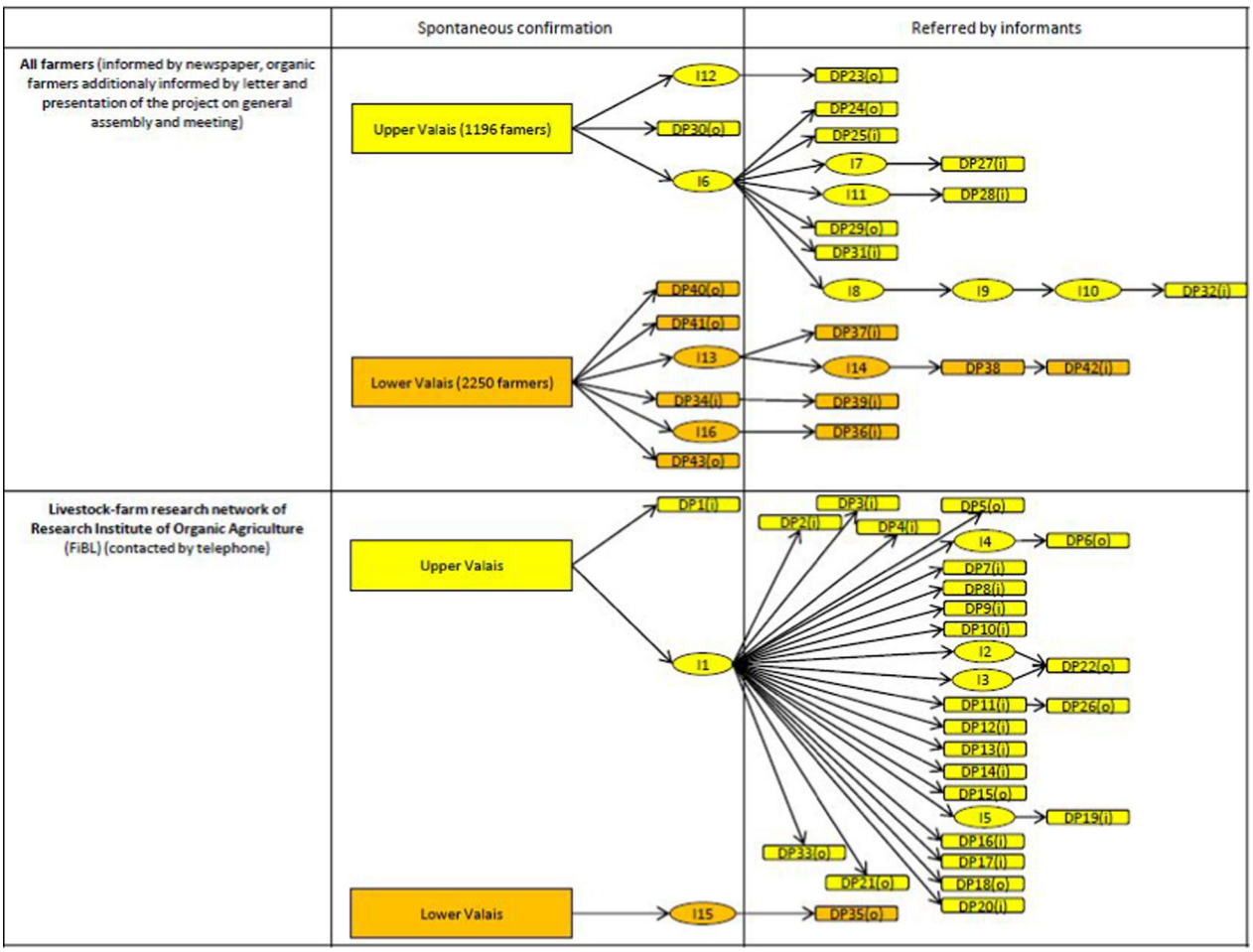

Fig. 2 Snowball sampling: DP = dialog partner; I = informants; (i) = integrated production; (o) = organic farms

job, he visits regularly all farms in the Upper Valais and has personal contact to nearly all farmers. The following criteria had to be fulfilled by the farmers to qualify as a dialog partner.

The farm had to be in the research area, the dialogue partner must be actively involved in working with farm animals or have been in the past, and the dialogue partner had to agree sharing his/her knowledge to the research team, for analysis and publication of the data in an anonymized form. The interviews were conducted between mid-February and early May 2015. Overall 35 of the DPs were interviewed alone. On eight farms between one and three assisting persons (mainly family members of the particular DP) supported the dialog partner in the interview. In total, the information came from 55 persons, namely 45 men (82%) and 10 women (18%) with an age between 29 and 83 (57 ± 12) years. The answers given by persons assisting the dialog partners were added to the data of the main DP and were not analyzed separately as the descripted homemade herbal remedies were generally used on the same farm. A total of 33 (77%) interviews were held in the Upper Valais, and 10 (23%) in the Lower Valais. The interviewer was bilingual (German and French), and the DPs were therefore interviewed in their native language.

Of the 43 DPs, only one DP did not own a farm but had broad knowledge of medicinal plants and was regularly asked for advice by the other farmers of his village. A total of 24 (57%) DPs were full-time farmers, and 18 (43%) kept animals (mainly goats and sheep) as a part-time occupation.

Farms

All 42 farms were situated between 500 and 1600 m above sea level (1104 m ± 292 m). Thirteen farms were located between 500 and 900 m, 16 between 1000 and 1300 m, and 13 higher than 1300 m above sea level (12 in the Upper Valais and one in the Lower Valais). A total of

39 farms were situated in the mountain zones (one farm in mountain zone one, five in mountain zone two, 19 in mountain zone three and 14 in mountain zone four; 23). Of these 42 farms 16 (38%) were organic and 26 (62%) non-organic farms.

For 15 farms the agricultural area was less than ten hectares, and for seven farms between 11 and 25 hectares. A total of 20 farms had an agricultural area larger than 25 hectares. Only five of the 42 farms had a crop rotation area which was between one and five hectares. The others produced only on permanent grassland. The animal species kept on these farms were mainly cattle, goat, sheep and some further species (Table 1).

Table 2 Metabolic body weight of different species based on estimated average body weights [37, 38]

Species	Weight (kg)	Metabolic bodyweight (MBW) ($kg^{0.75}$)
Adult cattle	650	128.7
Calf	75	25.5
Goat	50	18.8
Sheep	80	27.0
Medium-sized dog	25	11.2
Human	65	22.9

Data collection and analysis

The data collection and the corresponding analysis were done as previously published [32, 33]. At the beginning of an interview the dialog partners were asked to sign a declaration of consent for recording the interview (recorded by OLYMPUS WS-812 Digital Voice Recorder, Olympus Imaging Europa GmbH, Hamburg, Germany). These recordings were not transcribed, but repeatedly replayed to extract detailed information. During the interview on the farm the answers were noted on questionnaire forms and subsequently entered into a database [34]. The semi-structured interviews included three parts: (a) general information about the dialog partners and their farm; (b) a semi-structured part comprising seven "free-listing" questions not least to achieve a pleasant atmosphere; and (c) to gain details about the homemade remedy reports and their use.

For wild-harvested and cultivated plant species the identity was checked with the aid of the "Flora Helvetica" [35]. Commercial products and dried plants purchased in a pharmacy were specified by the product labeling.

To determine the concentration in g dry plant equivalent in 100 g of finished product the plant was weighted with a scale (KERN EMB 2000-2, KERN & Sohn GmbH, Balingen, Germany). If the original plant material was not available, the weight was determined with a reference drug from the interviewer's collection of herbal drugs. In some cases, an approximate volume of plant was determined and the weight of the drug was measured afterward by the interviewer. For external administrations the concentration in g dry plant equivalent in 100 g finished product was determined, and for oral administrations the daily dosage of medicinal plant (in g dry plant equivalent) was calculated. To compare the daily dosages between different animal species (and humans), the daily dosages were normalized by a conversion of all dosages into dosage per kilogram metabolic bodyweight (MBW = bodyweight$^{0.75}$): The following formula was used [36]:

$$daily\ dose\left(\frac{g}{kg^{0.75}}\right) = \frac{drug\ dose\ per\ administration(g) \times repetition\ per\ day}{metabolic\ bodyweight\left(kg^{0.75}\right)}$$

The metabolic bodyweight was calculated with the estimated live weight of animals (Table 2) [37, 38].

The use reports of the homemade remedy reports were divided in different categories based on Anatomical Therapeutic Chemical classification system for veterinary products (ATCvet Code [39]): alimentary tract and metabolism (QA), dermatologicals (QD), genito-urinary system and sex hormones (QG), mastitis (QG52), musculo-skeletal system (QM), antiparasitic products, insecticides and repellents (QP), respiratory system (QR), sensory organs (QS), and Various (QV) [39]. In addition, "behavior" and "general strengthening" were introduced as categories.

Table 1 Animal species kept on the 42 farms, participating in the study

Animals kept on farm:	Cattle only	Cattle + further species[a]	Sheep only	Sheep + further species[b]	Goat only	Goat + further species[c]	No animals[d]
Number of farms:	12	10	7	3	6	3	1

[a] Other animal species: poultry: 7; goats: 4; horses: 3; bees: 1; donkeys: 1; pigs: 1; rabbits: 1; sheep: 1

[b] Other animals: poultry: 2; bees: 1; donkeys: 1; geese: 1; goats: 1; horses: 1; pigs: 1

[c] Other animals: donkeys: 1; horses: 1

[d] One farmer living in the Lower Valais had several medicinal plants in cultivation and reported some preparations he made to treat his son's cattle

The origin of knowledge for homemade remedy reports, the frequency of use during the last five years before the interviews were held and the date of the last use were recorded for each use report (UR). Additional treatments were also recorded. The satisfaction with the outcome of the UR was evaluated with a visual analog scale (VAS) of 100 mm, whereby 0 mm corresponded to "no effect" (0 mm), and 100 mm to "very good effect" [40].

Definitions

The same definitions as in previous Swiss studies were used [20, 21, 32, 42, 43] for the description of a preparation from one dialogue partner (homemade single species herbal remedy report) and to make a connection of this remedy report with an application (use report):

> *Homemade single species herbal remedy report (HSHR)* [dialogue partner] x [one single plant species alone or combined with other natural product] x [plant part] x [manufacturing process of the finished product].
> *Use Report (UR)* [HSHR] × [category of use] × [specification of use] × [animal species] × [animal age classification] × [administration procedure].

Results

During the 43 interviews a total of 244 homemade remedy reports were collected. The dialog partners listed between one and twelve remedy reports (mean 5.7 ± 2.8) and mentioned between one and five different use reports (UR) for each homemade remedy report (mean 1.2 ± 0.7). In total these remedy reports contained 75 plant species belonging to 37 botanical families. Of the 244 homemade remedy reports a total of 27 (11%) referred to mixtures of two to five plant species. In addition, there were 44 (18%) homemade remedies without plants but containing other natural products, such as pure alcohol, honey, sugar, lard, eggs, milk, vinegar, coal, loam, flower of sulfur, soap and yogurt. Of all remedy reports, 173 (71%, including five homemade remedy reports based on commercial products) contained only one plant species (homemade single species herbal remedy reports, HSHR).

Ingredients and manufacturing process of 173 HSHR

The 173 HSHR contained 53 plant species belonging to 30 botanical families. Plants out of the family Asteraceae were the most often reported (46 HSHR; 27%), followed by Rubiaceae (18 HSHR; 10%) and Cupressaceae (16 HSHR; 9%). The four most frequently reported plant species were *Coffea arabica* (18 HSHR; 10%), *Juniperus sabina* (16 HSHR; 9%), *Arnica montana* (12 HSHR; 7%) and *Matricaria chamomilla* (11 HSHR; 6%; Table 3).

The most commonly used plant parts were flowers, including inflorescences (43 HSHR; 25%), followed by fruits, seeds and berries (41 HSHR; 24%). In 39 HSHR (23%) herbs (aerial parts of herbaceous plant, without roots), and in 23 HSHR (13%) the leaves were used. The other 27 HSHR included twigs/branches, roots/tubers, barks and bulbs, but also plant secretions such as resins.

In 102 HSHR (59%) wild-harvested plants were used, while commercial products and dried plants bought in the pharmacy were utilized in 60 HSHR (35%). Cultivated plants were used in 11 HSHR (6%).

Fresh plants were used in 37%, and dried plants in 60% of the HSHR. For 3% of HSHR the state of the herbal material could not be determined given that the HSHR was based on one of five commercial products: Kamillosan® (MEDA Pharma GmbH, Wangen-Brüttisellen; Switzerland, containing *Matricaria chamomilla*); Tanaisie TE (Comptoir des plantes médicinales, Chamberet; France, containing *Tanacetum vulgare*), and Aubépine Solution (Comptoir des plantes médicinales, Chamberet; France, containing *Crataegus monogyna*), and two products of the drugstore such as Gaulthérie odorante (*Gaultheria fragrantissima*), and Euphrasia (*Euphrasia rostkoviana*).

Beside the five commercial products (3%) further 45 HSHR (26%) were reported to be used without any extraction process on the farm. These included four different plant oils, including sunflower oil (3 HSHR), olive oil (1 HSHR), rape oil (1 HSHR) and black cumin oil (1 HSHR). In 95 HSHR (55%) extraction was done with water, and these preparations were mainly used for oral or external administration (as a bath or for wound cleansing). Alcoholic extraction was used in 16 HSHR (9%), while oil or fat was used in 12 HSHR (7%) aimed for external administration (Table 3).

A total of nine ointments (5.2%) were reported. They contained *Calendula officinalis* (4 HSHR), *Larix decidua* (2 HSHR), *Picea abies* (2 HSHR) and *Arnica montana* (1 HSHR). Six ointments were prepared with fresh plant material, and in the remaining three preparations dried plants were utilized. Beeswax as an ointment base was used in two cases. In the other seven cases, the ointment base (lard, milking grease and butter) served directly as extraction medium.

In 68 HSHR (39%) it was possible to determine the amount of plant used in the remedies directly on the farm. In 32 cases this was done with the original drugs from the interview partner, and in 36 HSHR the amount was determined with the aid of reference herbal material brought by the interviewer. Furthermore, in 84 cases

Table 3 Extraction procedure to prepare the 173 homemade single species herbal remedy reports (HSHR) mentioned by farmers in Valais, Switzerland

Botanical family (Number of plant species in the family)	Plant species with ≥ 3 HSHR (Number indicate the frequency of mentioned 173 HSHR)*	Commercial products	On farm extraction procedure (Number indicate the frequency of mentioned 173 HSHR)						
			None	Water			Alcohol	Oil/Fat	
				Room temperature	Infusion	Decoction	Room temperature	Room temperature	Elevated temperature
Asteraceae (10)	All Asteraceae (46)	2	6		22		10	4	2
	Arnica montana L. (12)								
	Flos (12)						9	2	1
	Matricaria chamomilla L. (11)								
	Flos (11)	1[a]			10				
	Tanacetum vulgare L. (6)								
	Flos (5)		1		4				
	n.a. (1)	1[b]							
	Calendula officinalis L. (4)								
	Flos (4)		1[c]					2	1
	Artemisia absinthium L. (3)								
	Herba (3)		1		2				
	Helianthus annuus L. (3)								
	Semen (3)		3[d]						
	Leontopodium alpinum Cass. (3)								
	Flos (3)				3				
	Others[1] (4)				3		1		
Rubiaceae (1)	*Coffea arabica* L. (18)								
	Semen (18)				18				
Cupressaceae (1)	*Juniperus sabina* L. (16)								
	Herba (16)		3		13				
Poaceae (2)	All Poaceae (10)		7		1	2			
	Triticum aestivum L. (7)								
	Fructus (7)		6		1				
	Oryza sativa L. (3)								
	Fructus (3)		1			2			
Pinaceae (3)	All Pinaceae (9)		6					1	2
	Picea abies (L.)H. Karst. (6)								
	Resina (4)		2					1	1
	Herba* (2)		2						
	Others[2] (3)		2[e]						1
Malvaceae (1)	*Malva neglecta* Wallr. (9)								
	Herba (8)		2		6				
	Folium (1)				1				
Apiaceae (3)	All Apiaceae (7)			2	4		1		
	Peucedanum ostruthium (L.) Koch (5)								
	Folium (5)			2	2		1		
	Others[3] (2)				2				
Theaceae (1)	*Camellia sinensis* (L.) Kuntze (6)								
	Folium (6)		1		5				
Hypericaceae (1)	*Hypericum perforatum* L. (4)								
	Flos (3)						1	2	
	Herba (1)							1	
Lamiaceae (2)	All Lamiaceae (4)				4				
	Thymus vulgaris L. (3)								
	Herba (3)				3				
	Others[4] (1)				1				

Table 3 (continued)

Botanical family (Number of plant species in the family)	Plant species with ≥ 3 HSHR (Number indicate the frequency of mentioned 173 HSHR)*	Commercial products	On farm extraction procedure (Number indicate the frequency of mentioned 173 HSHR)						
			None	Water			Alcohol	Oil/Fat	
				Room temperature	Infusion	Decoction	Room temperature	Room temperature	Elevated temperature
Fagaceae (1)	*Quercus pubescens* Willd. (4)								
	Cortex (3)			2	1				
	Folium (1)		1						
Linaceae (1)	*Linum usitatissimum* L. (3)								
	Semen (3)				3				
Oleaceae (2)	All Oleaceae (4)		3		1				
	Fraxinus excelsior L. (3)								
	Folium (2)		2						
	Herba* (1)				1				
	Others[5] (1)		1[f]						
Plantaginaceae (1)	*Plantago lanceolata* L. (3)								
	Folium (2)		1		1				
	Flos (1)				1				
Solanaceae (1)	*Solanum tuberosum* L. (3)								
	Tuber (3)		3						
Others[6] (22)	22 other plant species (27)	3	12[g]		8		4		
Total (53)	Total (173)	5	45	4	89	2	16	8	4

[1] *Achillea millefolium* L. (2), *Arctium lappa* L. (1), *Artemisia abrotanum* L. (1)

[2] *Larix decidua* Mill. (2), *Abies alba* Mill. (1)

[3] *Carum carvi* L. (1), *Foeniculum vulgare* Mill. (1)

[4] *Mentha longifolia* L. (1)

[5] *Olea europaea* L. (1)

[6] *Allium cepa* L. (Liliaceae) (2), *Berberis vulgaris* L. (Berberidaceae) (2), *Ilex aquifolium* L. (Aquifoliaceae) (2), *Symphytum officinale* L. (Boraginaceae) (2), *Urtica dioica* L. (Urticaceae) (2), *Brassica napus* L. (Brassicaceae) (1), *Brassica oleracea* L. (Brassicaceae) (1), *Capsella bursa-pastoris* L. (Brassicaceae) (1), *Capsella rubella* Reut. (Brassicaceae) (1), *Chrysosplenium alternifolium* L. (Saxifragaceae) (1), *Crataegus laevigata* (Poir.) DC. (Rosaceae) (1), *Echium vulgare* L. (Boraginaceae) (1), *Euphrasia rostkoviana* Hayne (Scrophulariaceae) (1), *Gaultheria fragrantissima* Wallr. (Ericaceae) (1), *Geranium robertianum* L. (Geraniaceae) (1), *Nigella sativa* L. (Ranunculaceae) (1), *Paradisea liliastrum* (L.) Bertol. (Asparagaceae) (1), *Rubus fruticosus* L. (Rosaceae) (1), *Sambucus nigra* L. (Caprifoliaceae) (1), *Sorbus aucuparia* L. (Rosaceae) (1), *Vaccinium myrtillus* L. (Ericaceae) (1), *Viscum album* L. (Loranthaceae) (1)

[a] Kamillosan® used in two use reports

[b] Tanaisie TE (Comptoir des plantes médicinales, France) used in one use report

[c] Plant part: twigs/branches

[d] The extraction medium could not be determined because the mother in law (1) respectively the brother (1) of DP prepared the ointment

[e] Sunflower oil

[f] Olive oil

[g] Rape oil (1) and black cumin oil (1)

(49%) the weight was estimated by assessment of the administered volume of a given plant and subsequent weighting. In the remaining 21 HSHR (12%), the determination of the amount of plant material was not possible.

Categories of use of the 215 use reports of the 173 HSHR

A total of 215 use reports (UR; Additional file 1) for the 173 HSHR could be determined to treat cattle, goats, sheep, horses, dogs and rabbits. Of the 215 UR, 207 UR were reported for therapeutic, and 8 UR for prophylactic use. The largest number of UR addressed disorders of the alimentary tract and metabolism (ATCvet Code QA) (62 UR; 29%), followed by dermatological ailments (QD) (58 UR; 27%), disorders of the genito-urinary system (QG) (28 use reports; 13%) and the musculo-skeletal system (QM) (23 UR; 11%). Other categories of use were mastitis (QG52, 10 UR; 5%), parasitosis (QP, 6 UR; 2%), diseases of the respiratory system (QR, 3 UR; 1%), and others (treatment of sensory organs (QS), behavior (QN), general strengthening and various indications (QV) (25 UR; 14% in total)).

The most frequently mentioned plants for the treatment of disorders of the alimentary tract and metabolism (QA) were *Coffea arabica* (16 UR; usually in combination with schnaps), *Matricaria chamomilla* (8 UR) and *Camellia sinensis* (6 UR). *Calendula officinalis* (8 UR)

had the highest number of UR in the category QD (dermatologicals), followed by *Arnica montana* (7 UR), *Matricaria chamomilla* (6 UR) and *Malva neglecta* (6 UR). For the treatment of the category QG (genito-urinary system and sex hormones) *Juniperus sabina* (16 UR), *Tanacetum vulgare* (4 UR) and *Malva neglecta* (2 UR) are the most often mentioned plants (Table 4).

Half (108 UR) of all 215 mentioned UR were for treatment of cattle. A total of 49 UR (23%) were for goats, 41 UR (19%) for sheep and 17 UR (8%) for other animal species (Table 4).

Route of administration

Oral administration (109 UR, 51%) was most frequently used, in particular for the treatment of disorders of the alimentary tract and metabolism like diarrhea, colic or rumination problems, for general strengthening, as well as for problems in the category QG (including the cleaning of the uterus after calving). External administration on altered and sore skin (including claws, conjunctiva and navels) was mentioned in 76 UR (35%). Thereby, various forms of preparation of the medicinal plants were described, such as compresses, washes, baths or the direct administration of fresh plants, oils, ointments and tinctures. A total of 24 UR (11%) for intact skin were mentioned, including treatment of injuries of the musculo-skeletal system and subcutaneous tissue (contusions, pulled muscles, sprains, swellings and tensions). Two UR (1%) described intravaginal/intrauterine applications. *Tanacetum vulgare* was utilized to prepare the animal for pregnancy, and *Malva neglecta* was used to clean the uterus after birth. Only one preparation (1%) with *Thymus vulgaris* was used to treat respiratory tract diseases by inhalation. Three preparations (1%) were not directly applied on the animal but were employed as treatment of the housing environment. Twigs of *Berberis vulgaris* and *Ilex aquifolium* were suspended in the stable for half a year to treat and prevent cattle ringworm (Table 4). Furthermore, the four different commercial oils (sunflower oil, olive oil, rape oil and black cumin oil) were administered orally or were directly applied on the skin as a topical treatment.

Further information concerning the UR

The last use of all UR was determined. A total 141 UR (66%) were used within the last year preceding the interviews, and further 54 UR (25%) had been utilized in the last decade. For 20 UR (9%) the last time of use was more than 10 years ago, or the UR were only heard of by the dialog partners. Furthermore, the frequency of use within the last five years at the time of the interview, was asked. Frequent use (more than 10 times) was reported for 82 UR (38%) of the 215 UR. A use between six and nine times during the last five years was mentioned for 13 UR (6%), and between two and five uses were reported for 72 UR (34%). For the remaining 48 UR (22%) a use less than two times was mentioned.

In 171 (80%) cases the UR were without other accompanying therapies. In the remaining cases (20%) the farmers typically used other homemade remedies or homeopathy as an additional therapy. In wound care two UR were frequently combined. First, the wound was cleaned (this corresponds to one UR), followed by application of, for example, an ointment (the second UR). In a few exceptional cases (if the condition of the animal further deteriorated during the treatment with an UR), the farmers needed an additional therapy from their veterinarian.

For 149 UR (70%) the source of knowledge were ancestors and relatives, and for 39 UR (18%) the knowledge was received from friends. Personal experience of the farmers was the source of information for 10 UR (5%), medical specialists were the source for 5 UR (2%), books and journals for other 5 UR (2%), courses for 4 UR (2%) and other sources (3 UR; 1%).

For 212 UR the degree of satisfaction could be evaluated with the aid of a visual analog scale (VAS). In three cases it was not possible to determine the degree of satisfaction because the remedy had not been used by the farmer, but only heard of from friends. Overall, the farmers were satisfied with the efficacy of their homemade herbal remedies (on average 79.4 mm of a maximum of 100 mm; Fig. 3).

Different plant species and 215 UR for the 173 HSHR—Upper and Lower Valais in comparison

Of the 53 plant species reported in the survey 29 plant species were mentioned to be used only in the Upper Valais, and 12 plant species only in the Lower Valais. A total of 12 species were used both in the Upper and Lower Valais. During the 33 interviews in the Upper Valais, 170 UR were determined, and in the Lower Valais 45 UR were mentioned in 10 interviews (Fig. 4; Additional file 2).

Discussion

General aspects

For the 173 HSHR in the study region, a total of 215 use reports (UR) were collected, corresponding to 53 plant species from 30 botanical families. The four most frequently reported species were *Coffea arabica* (18 HSHR), *Juniperus sabina* (16 HSHR), *Arnica montana* (12 HSHR) and *Matricaria chamomilla* (11 HSHR). This corresponded, in part, with the results of the OESS [20, 21, 32, 41–43] where *Matricaria chamomilla* and *Arnica montana* were used in every study in more than 10 HSHR. In contrast, the DP in Valais used *Coffea arabica* more frequently and in higher doses than OESS. Compared to

Table 4 215 use reports (UR) for 173 homemade herbal remedy reports containing a single herb (HSHR) mentioned by farmers in Valais, routes of administration, categories of use and target animal species

Botanical family (Number of named plant species in the family)	Plant species with ≥ 3 named HSHR (Number indicate the frequency of use reports)	(Numbers indicate the frequency of use reports, 215 use reports)																		
		Routes of administration						Categories of use								Target animal species				Total different use reports
		External		Internal			Treatment of housing environment													
		I	A	OR	IH	IU		QD	QA	QG	QG52	QM	QP	QR	Others[7]	Cattle	Goat	Sheep	Others[8]	
Asteraceae (10)	All Asteraceae (67)	8	32	26		1		23	19	4	3	9	3		6	30	16	14	7	67
	Arnica montana L. (20)																			
	Flos (20)	7	13					7			2	7			4	9	5	3	3	20
	Matricaria chamomilla L. (15)																			
	Flos (15)		7[a]	8				6[a]	8						1	8	4[a]	3		15
	Tanacetum vulgare L. (6)																			
	Flos (5)			4		1				4					1	3		2		5
	n.a. (1)			1[b]									1[b]				1[b]			1
	Calendula officinalis L. (9)																			
	Flos (9)		9					8			1					1	3	1	4	9
	Artemisia absinthium L. (3)																			
	Herba (3)			3					2				1				1	2		3
	Helianthus annuus L. (3)																			
	Semen (3)		2	1				1	1				1			2		1		3
	Leontopodium alpinum Cass. (4)																			
	Flos (4)			4					4							4				4
	Others[1] (7)	1	1	5				1	4			2				3	2	2		7
Rubiaceae (1)	*Coffea arabica* L. (20)																			
	Semen (20)			20					16	1					3	12	4	4		20
Cupressaceae (1)	*Juniperus sabina* L. (18)																			
	Herba (18)			18						16					2	3	9	6		18
Poaceae (2)	All Poaceae (11)	3	3	5				1	4		5				1	8	1	1	1	11
	Triticum aestivum L. (7)																			
	Fructus (7)	3	3	1				1			5				1	6		1		7
	Oryza sativa L. (4)																			
	Fructus (4)			4					4							2	1		1	4

Table 4 (continued)

Botanical family (Number of named plant species in the family)	Plant species with ≥ 3 named HSHR (Number indicate the frequency of use reports)	(Numbers indicate the frequency of use reports, 215 use reports)																			Total different use reports
		Routes of administration						Categories of use								Target animal species					
		External		Internal			Treatment of housing environment														
		I	A	OR	IH	IU		QD	QA	QG	QG52	QM	QP	QR	Others[7]	Cattle	Goat	Sheep	Others[8]		
Pinaceae (3)	All Pinaceae (10)	2	6	2				6	1			2			1	4	3	3			10
	Picea abies (L.)H. Karst. (6)																				
	Resina (4)	1	3					3				1				2	1	1			4
	Herba* (2)			2					1						1		2				2
	Others[2] (4)	1	3					3				1				2		2			4
Malvaceae (1)	*Malva neglecta* Wallr. (10)																				
	Herba (9)		7	1		1		6		2					1	7		2			9
	Folium (1)		1									1				1					1
Apiaceae (3)	All Apiaceae (7)		4	3				4	2	1						6		1			7
	Peucedanum ostruthium (L.) Koch (5)																				
	Folium (5)		4	1				4		1						5					5
	Others[3] (2)			2					2							1		1			2
Theaceae (1)	*Camellia sinensis* (L.) O. Kuntze (6)																				
	Folium (6)			6					6							3	2	1			6
Hypericaceae (1)	*Hypericum perforatum* L. (8)																				
	Flos (5)	3	2					2				3				2	1		2		5
	Herba (3)	1	2					2				1						3			3
Lamiaceae (2)	All Lamiaceae (5)			4	1				3					2		5					5
	Thymus vulgaris L. (4)																				
	Herba (4)			3	1				2					2		4					4
	Others[4] (1)			1					1							1					1
Fagaceae (1)	*Quercus pubescens* Willd. (4)																				
	Cortex (3)		2	1				1	1						1	2		1			3
	Folium (1)			1											1		1				1
Linaceae (1)	*Linum usitatissimum* L. (3)																				
	Semen (3)			3					3							3					3

Table 4 (continued)

Botanical family (Number of named plant species in the family)	Plant species with ≥ 3 named HSHR (Number indicate the frequency of use reports)	(Numbers indicate the frequency of use reports, 215 use reports)																		
		Routes of administration						Categories of use								Target animal species				Total different use reports
		External		Internal			Treatment of housing environment													
		I	A	OR	IH	IU		QD	QA	QG	QG52	QM	QP	QR	Others[7]	Cattle	Goat	Sheep	Others[8]	
Oleaceae (2)	All Oleaceae (5)	1	1	3					2		1	1			1	2	2	1		5
	Fraxinus excelsior L. (3)																			
	Folium (2)			2					1						1		2			2
	Herba* (1)			1					1									1		1
	Others[5] (2)	1	1								1	1				2				2
Plantaginaceae (1)	*Plantago lanceolata* L. (3)																			
	Folium (2)		2					2									2			2
	Flos (1)		1					1								1				1
Solanaceae (1)	*Solanum tuberosum* L. (3)																			
	Tuber (3)		3					3								2		1		3
Others[6] (22)	22 other plant species (35)	6	10	16			3	7	5	4	1	6	3	1	8	17	8	3	7	35
Total (53)	Total (215)	24	76	109	1	2	3	58	62	28	10	23	6	3	25	108	49	41	17	215

I: intact skin; A: altered or sore skin; OR: oral; IH: inhalation; IU: intra uterin

[1] *Achillea millefolium* L. (4), *Arctium lappa* L. (1), *Artemisia abrotanum* L. (2)

[2] *Larix decidua* Mill. (3), *Abies alba* Mill. (1)

[3] *Carum carvi* L. (1), *Foeniculum vulgare* Mill. (1)

[4] *Mentha longifolia* L. (1)

[5] *Olea europaea* L. (2)

[6] *Allium cepa* L. (Liliaceae) (2), *Berberis vulgaris* L. (Berberidaceae) (2), *Ilex aquifolium* L. (Aquifoliaceae) (2), *Symphytum officinale* L. (Boraginaceae) (4), *Urtica dioica* L. (Urticaceae) (2), *Brassica napus* L. (Brassicaceae) (1), *Brassica oleracea* L. (Brassicaceae) (1), *Capsella bursa-pastoris* L. (Brassicaceae) (1), *Capsella rubella* Reut. (Brassicaceae) (1), *Chrysosplenium alternifolium* L. (Saxifragaceae) (1), *Crataegus laevigata* (Poir.) DC. (Rosaceae) (1), *Echium vulgare* L. (Boraginaceae) (1), *Euphrasia rostkoviana* Hayne (Scrophulariaceae) (4), *Gaultheria fragrantissima* Wallr. (Ericaceae) (2), *Geranium robertianum* L. (Geraniaceae) (1), *Nigella sativa* L. (Ranunculaceae) (3), *Paradisea liliastrum* (L.) Bertol. (Asparagaceae) (1), *Rubus fruticosus* L. (Rosaceae) (1), *Sambucus nigra* L. (Caprifoliaceae) (1), *Sorbus aucuparia* L. (Rosaceae) (1), *Vaccinium myrtillus* L. (Ericaceae) (1), *Viscum album* L. (Loranthaceae) (1)

QD: Dermatologicals; QA: Alimentary tract and metabolism; QG: Genito urinary system and sex hormones; QM: Musculo-skeletal system; QP: Antiparasitic products, insecticides and repellents; QR: Respiratory system

[7] Behaviour, general strengthening, sensory organs, varia

[8] Dogs, horses, rabbits

[a] Kamillosan® used in two use reports

[b] Tanaisie TE (Comptoir des plantes médicinales, France) used in one use report

* Plant part: twigs/branches

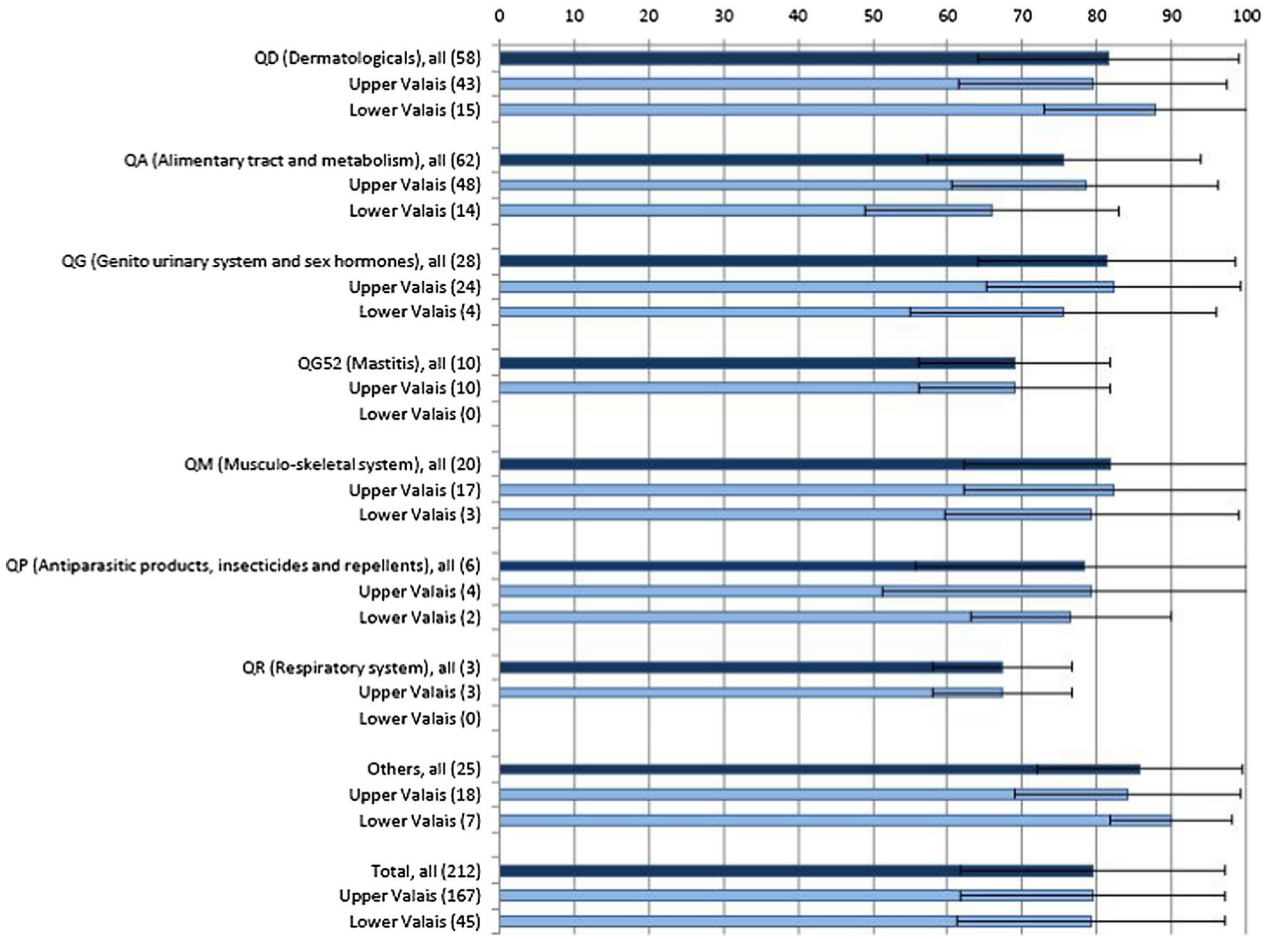

Fig. 3 Degree of satisfaction of users with the treatment outcomes, based on a Visual Analog Scale (VAS). Mean value and standard deviation of the VAS are represented

OESS 10 plant species were described for the first time for ethnoveterinary use in Switzerland (new-spec-VS, Fig. 4) [20, 21, 32, 41–43]. Of these, *Juniperus sabina* (18 UR) and *Quercus pubescens* (4 UR) were determined most frequently. In this context, the first description of the use of *Juniperus sabina* is likely due to the fact that Valais is the only region in Switzerland where *Juniperus sabina* grows (in the so-called Sefi shrub heath) [7]. This finding underlines the assumption that the locally growing flora has a significant influence on the (medicinal) flora used [44].

Regarding the use within the last year (141 UR; 66%), the frequency of use within the last 5 years (82 UR > 10 times; 38%) and the degree of satisfaction (average of 79.4 mm on the visual analog scale (VAS), Fig. 3), the results in this survey were comparable with those of OESS [20, 21, 32, 41–43].

Differences between Upper Valais VS-g and Lower Valais VS-f

VS-g and VS-f are geographically close, but separated by a clear language boundary (Fig. 1). There were some differences between the two different language regions. Variations between linguistically and/or geographically different regions were also found in other regions of Switzerland [20, 21], as well as in four territories of the Catalan language area in Spain [22].

In VS-g almost all farms kept animals, while in the VS-f only half of all farms had animals [24]. In VS-f farms frequently grow special crops (fruits, vegetables, vines), and even the farmers keeping livestock oftentimes produce special crops. These differences may explain the lower ration of VS-f farmers participating in our study. An uneven distribution of livestock within a region, correlating with the cultivation areas of certain crops, has also been observed in other ethnoveterinary studies, for example in Bavaria [45].

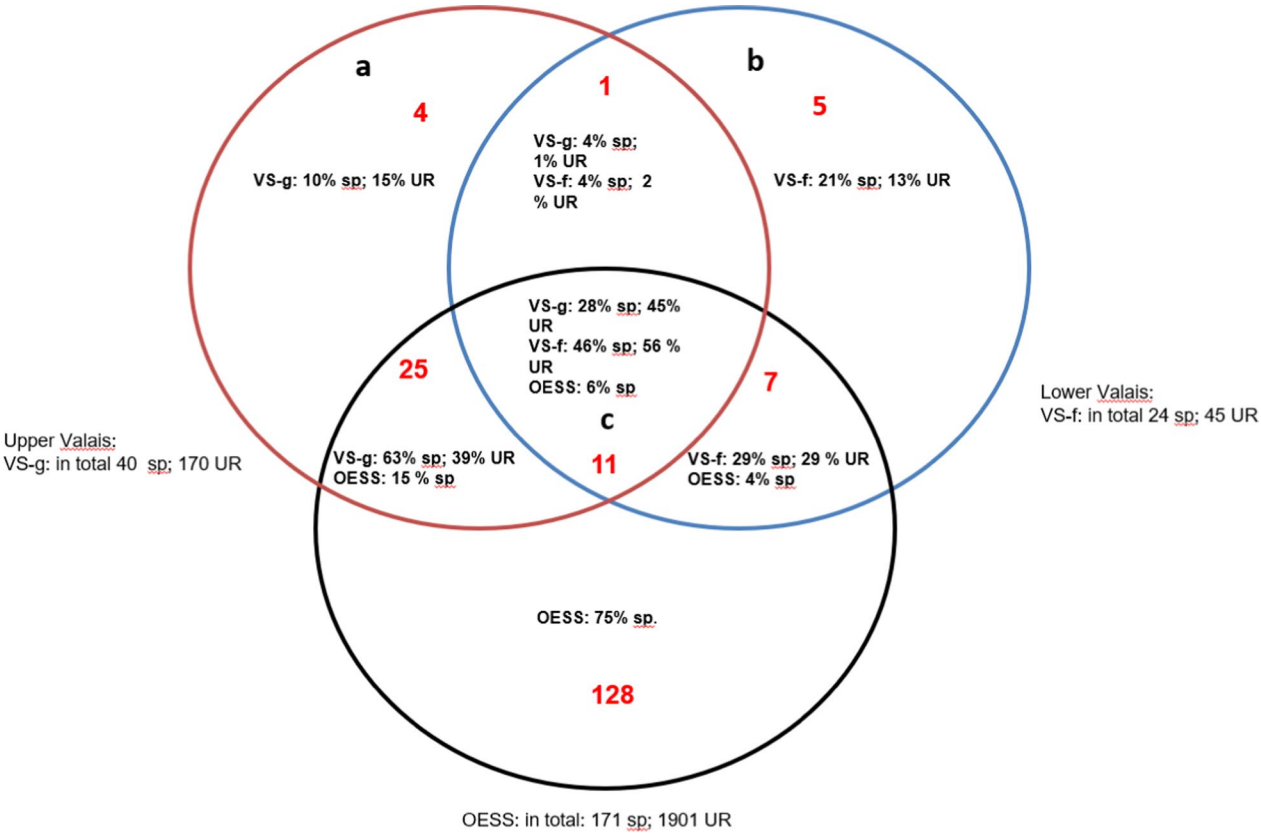

Fig. 4 Number of different plant species and connected use reports (UR) reported in the Upper Valais (red) and Lower Valais (blue) and in the six other ethnoveterinary Swiss studies (OESS) carried out in Mid-Northern, North-Eastern and Central Switzerland (black). VS-g = Upper Valais; VS-f = Lower Valais; Sp. = Plant species; UR = Use Report (which were determined for the number of different plant species). Plant species only mentioned in Upper Valais = Sectore a): *Artemisia abrotanum* L., *Juniperus sabina* L., *Paradisea liliastrum* (L.) Bertol. and *Quercus pubescens* Willd.; Plant species only recorded in Lower Valais = b): *Arcticum lappa* L., *Capsella rubella* Reut., *Chrysosplenium bonus-henricus* L., *Echium vulgare* L. and *Gaultheria fragrantissima* Wallr: Plant species mentioned in all region of Switzerland = c): *Arnica montana* L., *Calendula officinalis* L., *Coffea arabica* L., *Helianthus annuus* L., *Hypericum perforatum* L., *Linum usitatissimum* L., *Malva neglecta* Wallr., *Oryza sativa* L., *Peucedanum ostruthium* (L.) Koch, *Tanacetum vulgare* L., *Thymus vulgaris* L.,

A total of 43 plant species reported in this study had been previously described in other ethnoveterinary studies in Switzerland OESS [20, 21, 32, 41–43]. Of these 43 species 25 were used in VS-g and were described as well in OESS, while 7 were reported in VS-f and were used also in OESS. The remaining 11 species were described in VS-f, VS-g, and in the OESS (Fig. 4). There is higher correspondence of plant species between VS-g and OESS than between VS-f and OESS. One reason for this could be that the farmers in VS-g had more contact to farmers living in other German-speaking cantons (farmers of OESS), and maybe they exchanged their knowledge on plants. The contact of farmers in VS-f with those in OESS was likely less intense because of the different language. This is in contrast to the findings of Mayer et al. [20] who studied the Italian-speaking cantons of Switzerland and found that the political border with Italy had more influence on the plants used than the linguistic difference. Compared to Mertenat et al. [21] who also investigated French-speaking regions of western Switzerland, a more marked difference was found in Valais between the German and French-speaking regions. Furthermore, the comparison of the French-speaking DP in Valais (VS-f) with the native French speakers in Mertenat et al. [21] did not show any significant similarity with respect to the plants and preparations reported by DP. Thus, there appear no communalities that could be attributed to the mother tongue. When comparing the list of plants in OESS with that of the present investigation, only 10 species were "unique" for the canton Valais. The major part of the mentioned UR was linked to plants which were used in VS-g (45% of all VS-g UR), VS-f (56% of all VS-f UR), as well as in OESS (Fig. 4).

Special findings in Valais compared to OESS

Among the 10 species reported here for the first time *Juniperus sabina* was by far the most frequently mentioned plant (16 HSHR and 18 UR reported in VS-g). Plant that are only mentioned in one region are usually reported infrequently and with few UR [21]. All plant species from VS-f that were mentioned for the first time in Swiss ethnoveterinary medicine had each only one to two UR, while the other plant species reported for the first time from VS-g also had only one to four UR each. With 18 UR *Juniperus sabina* is therefore an exception, also in comparison with regional particularities reported in other European ethnoveterinary studies (Schlittenlacher et al. 1–3 UR per "unique" plant species [45], Markovic et al. (1–5 UR) [46]).

Another peculiarity in Valais was that the DP used *Coffea arabica* significantly more often and in higher concentrations than in OESS. The farmers in our research area prepared *Coffea arabica* as an infusion and usually in combination with schnaps. The calculated daily dosage was three times higher in average than described in the OESS (Table 5). Ethnoveterinary studies from Bavaria, Austria and Spain also reported the use of *Coffea arabica* [45, 47, 48]. *Coffea arabica* has been mainly used to treat gastrointestinal problems and for general strengthening (e.g. after a difficult birth). This is in line with human ethnomedical reports [49]. Further studies, particularly dosage-finding studies and other clinical trials might be useful. However, species-dependent toxicity of caffeine needs to be considered.

All in all, the information came from 55 persons (45 men and 10 women). In the OESS nearly the same numbers of women and men have participated in the interviews.

Brazilian research group underlines that there is no gender difference in knowledge about herbal substances and preparations (neither local nor global) [50]. A Swiss study from the Napf region [51] showed that men and women in this region have common, similar level of plant knowledge, particularly about herbaceous grass species and woody species. With regard to the influence of the gender-specific division of labor, however, a specialized plant knowledge of men with regard to grasses (which are relevant in relation to livestock farming) and of women with regard to home gardening was clearly visible. However, when interviewing healers and shamans, it seems to be more common to find and interview more men than women in a region, for example Eshetu et al. [52] describes a study in Ethiopia with 27 men and 4 women. Looking at the individual regions of Valais, the distribution in VS-f is similar to that in OESS, with an almost equal gender distribution (40% women and 60% men), whereas among the people who participated in the interviews from VS-g, only 13% were women and 87% men which is more similar to the gender distribution in e.g. Ethiopian studies. A possible bias in our study in Valais could be an informant who generated the majority of participants from the Upper Valais (Fig. 2). This person was closely networked in the agricultural school, which courses are predominantly filled with male participants. Furthermore, an expansion of the search for DPs could possibly have created a better gender balance. However, the interviews were limited in time to the spring months before the work peak on farms during summer. The final reason for this unequal gender distribution remains open.

In Valais the most frequently reported areas of use were in the treatment of the alimentary tract (QA) and dermatological problems (QD). This is consistent with the reports from OESS and the European studies so far [53].

Indication area QA and *Leontopodium alpinum* (the edelweiss)

Matricaria chamomilla, *Camellia sinensis*, *Coffea arabica*, *Achillea millefolium*, *Linum usitatissimum* were the most frequently mentioned plants used in the indication area QA. This was in line with reports in the OESS.

A regional particularity in Valais was the use of *Leontopodium alpinum* (edelweiss). While farmers in VS-g mainly used chamomile and black tea to treat diarrhea in cattle, calves and lambs, farmers in VS-f used infusion of *Leontopodium alpinum* instead. The use of *Leontopodium alpinum* has also been reported in other Swiss cantons, but only infrequently [21, 42, 43]. The daily doses of 0.09 to 0.24 g/kg$^{0.75}$ determined in Valais are consistent with those reported in the other cantons. Other recommended veterinary doses are not available to date. Tannins and flavonoids are the main active ingredients of *Leontopodium alpinum*. It is a protected species but meanwhile available from cultures. *Leontopodium alpinum* is described in folk medicine for the treatment of diarrhea, dysentery and fever in humans as well as in livestock [54, 55]. Cultivated *Leontopodium alpinum* is currently mainly used for cosmetics (anti-aging and sun creams) and in some food preparations [56]. In vitro and few in vivo studies showed anti-inflammatory, antimicrobial and analgesic effects for extracts and isolated compounds, such as leontopodium acids, caffeoylquinic acids, flavonoids, lignans and essential oil. Inhibition of gastrointestinal peristalsis was also reported [57, 58]. These experimental findings corroborate the empirical uses of *Leontopodium alpinum* in folk medicine [59].

Indication area QD and the use of *Arnica montana*

The farmers in the canton Valais prepared oils, ointments, tinctures and water extracts and administered

Table 5 All values for daily dosage in dry plant equivalent per kg metabolic body weight (g/kg$^{0.75}$) from reports on single species homemade herbal remedies (HSHR) used in orally administered preparations by different DP in Valais, as well as dosage recommendations from the literature and previous OESS studies

Plant species with ≥ 3 named HSHR and documented dosage	Daily dosage [g/kg$^{0.75}$]						Determined daily dosage [g/kg$^{0.75}$] (21; 43; 20 (it); 20 (ge); 42; 32; 41)	Converted animal daily dose [g/kg$^{0.75}$] (74)	Converted human daily dose [g/kg$^{0.75}$]
	Calf (75 kg) (MWB = 25.5 g/kg$^{0.75}$)	Cattle (650 kg) (MWB = 128.7 g/kg$^{0.75}$)	Goat (50 kg) (MWB = 18.8 g/kg$^{0.75}$)	Sheep (80 kg) (MWB = 27.0 g/kg$^{0.75}$)	Dog (25 kg) (MWB = 11.2 g/kg$^{0.75}$)	Arithmetic mean (median; minimum value-maximum value)			
Coffea arabica L.									
Semen (20)	2.94	0.51, 0.59, 0.68, 0.78, 0.85, 0.86, 1.02, 1.19, 1.64, 1.64, 2.33	0.79, 0.91, 1.60, 2.93	0.32, 0.80, 1.11, 1.62		**1.25;** (0.97; 0.32–2.94)	0.93; 0.35; 1.67; 1.19; 0.34; 0.35; 0.37		
Juniperus sabina L.									
Herba (17)		0.26, 0.42	0.04, 0.89, 0.89, 0.92, 0.94, 0.97, 1.56, 3.19, 7.98	0.11,0.12, 0.21, 0.26, 0.38, 0.77		**1.17**; (0.77; 0.04–7.98)	–; –; –; –; –; –; –[a]		
Matricaria chamomilla L.									
Flos (8)	0.24, 0.28, 0.28, 0.42, 2.35	0.03	0.02, 0.02			**0.46**; (0.26; 0.02–2.35)	0.29; 0.26; 0.63; 0.27; 0.35; 1.12; 0.22	0.19–0.39 (cattle), 0.27–0.53 (goat), 0.19–0.37 (sheep)	0.39–0.52[b]
Camellia sinensis (L.) O. Kuntze									
Folium (6)	0.31, 0.47, 0.94		0.32, 0.32	0.27		**0.44**; (0.32; 0.27–0.94)	0.65; 0.29; –; 0.38; 0.45; 0.64; –	0.389–0.622 (cattle), 0.196–0.314 (calf)	0.22–0.33[c]
Leontopodium alpinum Cass.									
Flos (4)	0.09, 0.24	0.09, 0.17				**0.15**; (0.13; 0.09–0.24)	0.02; 0.28; –; –; –; –; –		
Oryza sativa L.									
Fructus (4)	23.53	7.77	15.96		40.18	**21.86**; (19.74; 7.77–40.18)	–; –; 17.54; –; –; –; –; –		
Tanacetum vulgare L.									
Flos (4)		0.12, 0.19, 0.28		0.44		**0.26**; (0.23; 0.12–0.44)	–; –; –; –; –; –; –		
Artemisia absinthium L.									
Herba (3)			0.11	0.30, 0.93		**0.44**; (0.30; 0.11–0.93)	–; –; –; –; 0.03; –; –	0.19–0.39 (cattle), 0.27–0.53 (goat), 0.19–0.37 (sheep)	0.13–0.20[b]
Linum usitatissimum L.									
Semen (3)	0.44	0.26, 0.30				**0.33**; (0.30; 0.26–0.44)	3.21; 1.16; 5.79; –; 6.89; 5.16; 2.92	0.39–0.78 (cattle), 1.33–2.66 (goat), 0.93–1.85 (sheep)	0.66[b] (obstipation), 0.22–0.44[b] (gastritis/enteritis)

Table 5 (continued)

Plant species with ≥ 3 named HSHR and documented dosage	Daily dosage [g/kg$^{0.75}$]						Determined daily dosage [g/kg$^{0.75}$] (21; 43; 20 (it); 20 (ge); 42; 32; 41)	Converted animal daily dose [g/kg$^{0.75}$] (74)	Converted human daily dose [g/kg$^{0.75}$]
	Calf (75 kg) (MWB = 25.5 g/kg$^{0.75}$)	Cattle (650 kg) (MWB = 128.7 g/kg$^{0.75}$)	Goat (50 kg) (MWB = 18.8 g/kg$^{0.75}$)	Sheep (80 kg) (MWB = 27.0 g/kg$^{0.75}$)	Dog (25 kg) (MWB = 11.2 g/kg$^{0.75}$)	Arithmetic mean (median; minimum value-maximum value)			
Thymus vulgaris L.									
Herba (3)	0.07, 0.18	0.07				**0.10**; (0.07; 0.07–0.18)	0.18; –; 0.35; –; –; 2.47	0.19–0.39 (cattle), 0.11–0.53 (goat), 0.07–0.37 (sheep)	0.04–0.26[b]

[a] No values available; [b]ESCOP monographs [72]; [c]Wichtl, *Teedrogen und Phytopharmaka, Ein Handbuch für die Praxis auf wissenschaftlicher Grundlage* [73]; it = Italian part, ge = German part

The numbers written in bold are the arithmetic mean

these preparations directly on altered and sore skin (58 UR). *Calendula officinalis*, *Arnica montana*, *Matricaria chamomilla* and *Malva neglecta* were most frequently used, followed by *Hypericum perforatum* and *Peucedanum ostruthium.*

In the OESS *Arnica montana* is well described to treat problems in the category QM [20, 21, 32, 41–43]. In the canton Valais several farmers used *Arnica montana* also to treat inflammations, wounds and injuries of cattle, calves and sheep, as well as for treatments in the category QM. The calculated drug equivalent concentration in the finished product (tinctures and extracts in oil) was higher than described in the OESS (Table 6), but lower than recommended for humans [60]. Human clinical studies showed a significantly lower incidence of postoperative ecchymosis and edema with local application of preparations of *Arnica montana* [61, 62]. Moreover, it should be considered that medicinal plant monographs explicitly advise against the use of arnica in the case of open wounds, but "only on the intact skin" due to a risk of delayed hypersensitivity reactions [60]. Thus, the use of *Arnica montana* on open wounds by the farmers in Valais may be problematic. Other plants, such as *Calendula officinalis* or *Matricaria chamomilla*, have been proven to be effective in wound care.

Indication area QG (Genito urinary system and sex hormones) with *Juniperus* sabina and *Tanacetum* vulgare

In Valais *Juniperus sabina* (savin) and *Tanacetum vulgare* (tansy) were the most often mentioned plants in the category QG (a total of 28 UR). They were used to treat cattle, goats and sheep.

Juniperus sabina contains essential oil (3–5%), with sabinene, α-pinene, and myrcene as major constituents [63], and non-volatile isoprenoids and lignans [64]. The essential oil has a stimulating effect on muscular smooth fibers in the uterus and intestine, leading to a filling of the blood vessels of the pelvis and a hypertonic contraction of the uterus. The abortive effect of *Juniperus sabina* has also been demonstrated in mice [65, 66]. Farmers in the Upper Valais prepared an infusion of *Juniperus sabina* to trigger the afterbirth, or to clean the uterus after birth. An oral daily dosage could be determined. *Juniperus sabina* has been documented here for the first time in a Swiss ethnoveterinary context. In OESS [20, 21, 32, 41–43] two botanically related plant species (*Thuja occidentalis* and *Juniperus communis*) are also used to clean the uterus after birth. However, *Juniperus sabina* is likely more toxic given that the essential oil is highly irritating to mucous membranes and skin [67]. Steiner et al. [68] analyzed five historical books by the veterinarian Carl Ammann-Honegger (1879–1960) who also described the use of *Juniperus sabina* for the treatment of uterine disorders, infertility, and for general birth preparation and obstetrics. The (still current) use of *Juniperus sabina* in Valais is therefore highly interesting from a historical point of view, but questionable due to its potential toxicity.

In Valais, tea made from *Tanacetum vulgare* was also used as an oral, and in one case as an intravaginal/ intrauterine treatment to trigger the afterbirth, or to clean the uterus after birth and to prepare for the next pregnancy. In the other Swiss cantons *Tanacetum vulgare* was not reported for this indication. Disler et al. described the external use of tea from *Tanacetum vulgare* to treat infestation of mites and lice in cattle [32]. *Tanacetum vulgare* contains essential oil and shows in vitro antiproliferative, anti-inflammatory, antioxidant and antimicrobial properties [69]. In human folk medicine tea from *Tanacetum vulgare* has been used as an anthelminthic, carminative, antispasmodic, tonic, antidiabetic and diuretic [70]. The oral administration of these plants to prevent or treat or complement the treatment of postpartum disorders is interesting, especially as antibiotics are often used instead. However, further studies are needed regarding the potential toxicity of these plants.

Conclusion

Homemade remedies mainly based on plants are manufactured and used by farmers in the Swiss canton Valais still today. Plants that are frequently used in all cantons of Switzerland and in other European regions, such as *Matricaria chamomilla*, *Camellia sinensis*, *Coffea arabica*, *Achillea millefolium* and *Linum usitatissimum*, are of particular interest for the further development of European veterinary phytotherapy, as they consistently show a high level of user satisfaction. When properly used, especially in the early stages or for mild courses of a disease and/or as an accompanying treatment, herbal preparations can help to lower the use of antibiotics and other synthetic drugs. In the field of veterinary medicine, particular attention has to be paid to consumer safety.

The traditional use of regionally grown plants due to the geographical location and meteorological characteristics of the region was demonstrated distinctly in the Valais, for instance on *Juniperus sabina* and *Leontopodium alpinum.* In this context, aspects of nature conservation and the potential toxicity of traditionally used plant preparations have to be considered. In comparison with OESS, VS-g showed a higher agreement with OESS than VS-f with OESS. This may be an indication of a less intensive exchange due to the language barrier. In general, the question of the extent to which language influences exchange and traditionality is an interesting aspect that should continue to be investigated in ethnoveterinary medicine.

Table 6 All values for concentration of medicinal plants in homemade single species homemade herbal remedy reports (HSHR) in preparations for topical use by different DP in Valais, and recommendations from the literature for veterinary and human medicine

Plant species with ≥ 3 named HSHR and documented dosage	g dry plant equivalent in 100 g finished product				Arithmetic mean other parts of Switzerland (21; 43; 20 (it); 20 (ge); 42; 32)	Recommended concentration g dry plant equivalent in 100 g finished product (ESCOP monographs (59))			Recommended concentration g dry plant equivalent in 100 g finished product [74]
	Extraction with water	Extraction with alcohol	Extraction with oil/fat	Arithmetic mean (median; minimum value-maximum value)		Extraction with water	Extraction with alcohol	Extraction with oil/fat	
Arnica montana L.									
Flos (20)		0.13, 0.24, 0.24, 0.39, 0.39, 0.39, 0.39, 0.39, 2.81, 3.52, 3.80, 4.81, 6.29, 8.38, 8.38, 8.38	0.40, 0.40, 1.22, 12.00	**3.06**[a] (1.6; 0.13–8.38)	–; 1.82; 1.37; –; 1.29; 1.55	2.00	10.00–33.33		10.00
Calendula officinalis L.									
Flos (7)			0.26, 0.26, 0.26, 8.91, 8.91, 8.91, 8.91	**5.20** (8.91; 0.26–8.91)	1.71; 1.42; 2.00; 0.83; 1.32; 0.91	0.67–1.33	20.00 (40% ethanol)	1.00–5.00	11.11
Malva neglecta Wallr.									
Herba (6)	0.12, 0.12, 0.67, 0.76, 0.95, 2.00			**0.77** (0.72; 0.12–2.00)	–; 0.53; 0.31; –; –; 0.40				
Hypericum perforatum L.									
Flos (5)		0.43, 0.43, 0.43	2.15, 5.86	*	3.02; 1.56; 2.50; –; –; 1.69	5.00–10.00		5.00	5.00–10.00
Matricaria chamomilla L.									
Flos (5)	0.25, 0.56, 0.56, 0.68, 0.85			**0.58**[b] (0.56; 0.25–0.85)	0.28; 0.53; 0.50; 0.50; 0.38; 0.40	0.50			10.00
Peucedanum ostruthium (L.) Koch									
Folium (4)	0.50, 1.33, 1.33	12.06		**1.05** (1.33; 0.50–1.33)	–; –; –; –; –; –				

[a] Arithmetic mean from values for extraction with alcohol, [b]arithmetic mean from values for extraction with water; *determination of arithmetic mean not possible; it = Italian part, ge = German part

The numbers written in bold are the arithmetic mean

In conclusion, the traditional regional knowledge on the ethnoveterinary use of medicinal plants is not only a cultural heritage worth protecting, but also an essential resource for the further development of European veterinary medicine.

Abbreviations

CNS	Central nervous system
DP	Dialog partner
HSHR	Homemade single species herbal remedy report
MBW	Metabolic bodyweight
new-spec-VS	Plant species which were described for the first time for ethnoveterinary use in Switzerland
OESS	Other ethnoveterinary Swiss studies
QA	Alimentary tract and metabolism
QD	Dermatologicals
QG	Genito urinary system and sex hormones
QG52	Mastitis
QM	Musculo-skeletal system
QP	Antiparasitic products, insecticides and repellents
QR	Respiratory system
QS	Sensory organs
QV	Various
UR	Use report
VAS	Visual analog scale
VS-f	French-speaking region Lower Valais
VS-g	German-speaking region Upper Valais

Supplementary Information

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Additional file 1.

Additional file 2.

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