Hum Ecol (2012) 40:909–930
DOI 10.1007/s10745-012-9520-5

# Are the Young Less Knowledgeable? Local Knowledge of Natural Remedies and Its Transformations in the Andean Highlands

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Published online: 5 October 2012


**Abstract** A widespread concern among ethnobiologists is the rapid process of erosion of indigenous environmental knowledge observed worldwide. This paper examines the ongoing transformations of knowledge about natural remedies in the Quechua-speaking Andes. Freelisting exercises and interviews were conducted with 36 households at Bolivian and Peruvian study sites. (Generalized) linear mixed-effects models were used to analyze the effects of age on knowledge about medicinal plants, animals, minerals, and their uses. Our study demonstrates that younger participants knew as much about natural remedies as their elders. However, proportional knowledge about some medicinal use categories of natural remedies varied with age. We conclude that knowledge about natural remedies is generally not being lost at the study sites. Nevertheless, it is undergoing transformations in terms of specific medicinal uses. A careful understanding of these complex transformation processes is needed to better orient initiatives for the conservation of biocultural diversity in the Andes and elsewhere.

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**Keywords** Ethnobiology · Indigenous environmental knowledge · Traditional medicine · Bolivia · Peru · Andes

## Introduction

“Will tribal knowledge survive the millennium?,” asked Paul Alan Cox in an essay published at the turn of the century (Cox 2000). The rapid process of erosion of indigenous environmental knowledge observed worldwide is a widespread concern among ethnobiologists, anthropologists, and scholars from related disciplines. Indigenous environmental knowledge is amongst the key features of “biocultural diversity” (Maffi 2005; Pretty *et al.* 2009), a new field that has emerged during the last two decades as a response to the growing concern over the extinction crisis that is threatening biological, linguistic, and cultural diversity (Harmon 1996).

Since the 1980s, concern for and interest in indigenous environmental knowledge have gradually spread outside the academic community to enter the circles of sustainable development and conservation. Both the Brundtland Report of 1987 and the Rio Declaration on Environment and Development of 1992 “specifically identify indigenous knowledge as a critical resource for achieving sustainable development” (Alexiades 2009: 73), and the 1992 Convention on Biological Diversity recognizes its significance for the preservation of biological diversity. Indigenous environmental knowledge encompasses knowledge of plants, animals, soils, and other natural components of the environment (Ellen and Harris 2003). An important part of this knowledge relates to the “use of natural and biological resources in the maintenance and restoration of normal functioning of human health,” which, together with their related cultural practices, constitute the subject of study of medical ethnobiology (Berlin and Berlin 2005: 235).

Interest in indigenous environmental knowledge and its potential contribution to conservation and development is especially relevant in the context of the Andes. Not only is the Andean region home to significant levels of biocultural diversity, as is the case in mountain areas globally (Stepp *et al*. 2005); a process of reaffirmation, strengthening and redefinition of collective identities has also developed among indigenous Andean peoples in the course of recent history (De La Cadena 2010; Chartock 2011). However, several studies affirm that Andean environmental knowledge is currently under great threat as a consequence of rapid modernization and its impact on Andean society (Alba Fernandez 1996; Galvin 2004; Ishizawa and Rengifo 2009).

The present study is part of the BioAndes project, an international cooperation program for conservation of biocultural diversity in the Bolivian, Peruvian, and Ecuadorian highlands (AGRUCO *et al.* 2011). The program was designed based on the assumption that Andean environmental knowledge is an important local resource for more sustainable development that nevertheless is also undergoing a process of erosion. Against this background, and recognizing the importance of ethnomedical knowledge for local livelihoods, this research examines the ongoing transformations of knowledge about natural remedies at two Quechua-speaking study sites in the Andean highlands.

Ideally, research on the transformation of knowledge about natural remedies, and in particular the verification of a presumed loss of knowledge, should be realized by means of a diachronic assessment that compares the levels of knowledge at the same study site, and with the same methodology, at two specific times in history. These types of studies are unfortunately infrequent, due to the lack of previous comparable research or because conditions for carrying out long-term research in a specific area are rarely met. According to Zent (2001), one way of indirectly assessing loss of knowledge about natural remedies in synchronic studies is to look at present patterns of intracultural variability and then to connect these patterns with social variables that are indicators of changing conditions, such as age, education, or language. For instance, a positive correlation between age and medicinal plant knowledge has often been interpreted as an indicator of loss of knowledge among youth and thus of an ongoing process of knowledge erosion between generations (Phillips and Gentry 1993; Zent 2001; Ladio and Lozada 2003; Voeks and Leony 2004; Estomba *et al.* 2005). Other scholars, however, have warned that this positive association with age does not necessarily imply a loss of knowledge over time. It can, for instance, simply reflect the fact that older people had more time to acquire knowledge during their lifetime or that they are more likely to become ill and thus have a greater interest in acquiring knowledge about natural remedies (Voeks and Leony 2004; Giovannini *et al.* 2011). Hence, comparing the knowledge of younger and older participants at a given time may or may not reveal a process of knowledge erosion (Quinlan and Quinlan 2007). The results of such an approach should thus be triangulated with data obtained by other methods.

In this study, we first evaluated existing knowledge about natural remedies and their uses at the research sites and then determined whether there was a relation between age and this particular type of indigenous environmental knowledge by means of statistical tools. The results from this quantitative analysis were then interpreted in light of ethnographic data and existing literature on the study areas.

## Research Setting

Research was conducted in two rural Quechua-speaking areas of the Andes: the sub-central Waca Playa (17°27′30″ S; 66°29′21″W), located at 3,950 m.a.s.l. in Cochabamba Department in the Bolivian Eastern Cordillera, and the district of Pitumarca (13°58′48″S; 71°25′W), located at 3,580 m.a.s.l. in Cusco Department in the Southern Peruvian Andes. A map of the study sites is provided in Mathez-Stiefel and Vandebroek (2012: Fig. 1). The two case study sites were selected from among the BioAndes program's seven implementation areas, owing to their similarities in terms of cultural and ecological characteristics, despite their geographical distance from each other.

The two sites are located in similar altitudinal belts and ecoregions, namely the "Central Andean Puna" for Waca Playa, and the "Central Andean Wet Puna" for Pitumarca; both are home to the "montane grassland and shrubland" biome (Olson *et al*. 2001). However, human pressure and resulting degradation of vegetation cover, soil erosion, and destruction of natural habitats have seriously affected the natural fauna and flora. Nowadays, the two areas feature very diverse anthropogenic landscapes, with irrigated croplands in the lowlands, shrubs and rain-fed croplands on the slopes, and grasslands in the highlands.

Both sites also have very comparable sociocultural settings, with over 95 % of the population being indigenous Quechua-speakers. Both areas were under Inka rule (fourteenth to fifteenth centuries in Waca Playa and thirteenth to fifteenth in Pitumarca), followed by Spanish colonization (sixteenth to nineteenth centuries). Local people are now organized in peasant communities which were created after the agrarian reforms (in 1953 in Bolivia and from 1968 to 1975 in Peru) that led to the redistribution of the land that constituted the *haciendas* (large land-holdings of colonial descendants) to their former indigenous workers. These communities are characterized by common-pool resources (e.g., pastures), communitarian governance processes (decisions are taken at the monthly community assembly), and the celebration of collective festivals (e.g., the community Patron Saint). The inhabitants of the two areas are engaged mainly in small-scale subsistence farming: cultivation of grains, vegetable, fruits, potatoes and other Andean tubers and the herding of livestock. Farming is supplemented by temporal and permanent migration to the Amazonian lowlands and urban centers. (AGRUCO 2006; ETC Andes 2006)

Direct observation showed that the two areas differ slightly in a number of socioeconomic characteristics. While the migration processes are extremely important in Waca Playa, where many young people emigrate permanently from their communities, they have drastically slowed down in recent years in Pitumarca, where there are more local off-farm activity options (e.g., temporal paid work for the municipality). Furthermore, basic services are somewhat better in Pitumarca than in Waca Playa. Whereas the former site is linked to the closest market town by a paved road (35 km.), the latter is accessed by a dirt road (40 km.). Complete secondary education is provided in Pitumarca, whereas it is only available up to the 8th grade in Waca Playa.

Both sites also differ in terms of the availability of biomedical facilities (Mathez-Stiefel *et al*. 2012). In Waca Playa, a rudimentary medical post where an auxiliary nurse provides ambulatory health care to approximately 20 communities was established in 1995. In Pitumarca, a health center has been established since the 1960s, and now has 11 health professionals, including one medical doctor. Andean medicine remains important in both study areas, both among specialists such as healers, midwives and bonesetters and among laypeople. It is characterized by a rich pharmacopeia of plants, animals, and minerals (Hensen 1992; Delgadillo 2004; ETC Andes 2006; INC 2008).

## Methods

### Data Collection

Field work for this study was conducted by the first author in two peasant communities from Waca Playa (Tres Cruces and Lambramani) and two communities from Pitumarca (Huito and Huasapampa). These communities, all typical of the region of Waca Playa and Pitumarca respectively, were selected because of their comparable altitudes (3,330 and 3,450 m.a.s.l. in Waca Playa and 3,680 and 3,700 m.a.s.l. in Pitumarca) and distance to the larger settlement (5 and 9 km. from Waca Playa and 4 and 5 km. from Pitumarca). Data were collected over a period of nine one-to-two-week visits to each study site (between March 2007 and May 2008 in Waca Playa; between June 2006 and April 2010 in Pitumarca).

Initial workshops where prior informed consent for carrying out research was granted were conducted in the local language in each community. At these meetings, the research aims, outputs, and participating households were defined. The community assembly was requested to select a representative sample of young (recently married and/or with small children), middle-aged (with grown-up children that participate in family tasks), and elderly households (couples or widows whose children had left the household unit).

Eighteen households were selected at each research site. In Waca Playa, nine households from the community of Tres Cruces (out of the community's 49 households) and nine from the community of Lambramani (out of 40 households) participated in the study. In Pitumarca, eight households from the community of Huasapampa (out of 63 households) and ten from the community of Huito (out of 61 households) were selected. The age of the main interviewee in each household ranged from 27 to 71 years in Waca Playa and 21 to 76 years in Pitumarca. The interviewees comprised a roughly equal proportion of men and women (9/9 in Waca Playa and 7/11 in Pitumarca). The participating households were laypeople, with the exception of two specialists in indigenous medicine at each study site. In Waca Playa, these specialists were 50 and 71 years old. Both were bonesetters and accoucheurs, but one of them was also considered a *yatiri* (Andean healer) capable of curing *japega* (fright sickness) and other culture-bound illnesses. The two specialists from Pitumarca, aged 63 and 76 years, were considered *yachayniuq* (Andean healers): they were able to make diagnoses by observing *coca* leaves (*Erythroxylum coca* Lam.) and to cure a series of culture-bound illnesses that had spiritual causes, such as *manchariska* (fright sickness), *wayra* and *uraña* (various types of "bad winds"), *qhaha* (lightning) or *hechicería* (witchcraft).

The method employed for determining the households' knowledge about natural remedies and their uses at each study site was freelisting (Quinlan 2005): the adult (husband or wife) most knowledgeable about natural remedies, according to household members, was asked to list all the natural remedies (plants, animals, minerals) that he or she knew, including the ones that were obtained from outside the research area. Moreover, he or she was requested to provide details about their origin, medicinal uses, parts used, preparation, and modes of application. If other household members were present during the freelisting exercise, such as the spouse of the main interviewee or the children, they were allowed to contribute to the answers. Participants were also asked whether or not they transmitted their knowledge about natural remedies to their children. These semi-structured interviews were conducted in Quechua and/or Spanish with the assistance of a native Quechua-speaking interpreter. In order to minimize the methodological limitation of freelisting (participants may omit mention of remedies that they know), interviews were carried out during several visits to each household, and often in the field or during walks with the participants.

At both study sites, additional ethnographic data about local practices related to the use of natural remedies were collected by means of participant observation and informal discussions with the participating households and other community members. When possible, voucher specimens of medicinal plants were collected together with the participants in the two case study areas according to ethnobotanical standards (Martin 1995). These were later identified by specialists at the Herbarium Vargas from the University Nacional de San Antonio Abad del Cusco in Peru, and at the Herbarium Martin Cardenas the University Mayor de San Simon de Cochabamba in Bolivia. The accuracy of plant scientific names and authors' names were verified with The International Plant Names Index (IPNI 2011) and Tropicos (Missouri Botanical Garden 2011) databases. Generally known cultivated plants (such as maize—*Zea Mays* L. or coca—*Erythroxylum coca* Lam.) were not collected, but were identified based on their local names in the Bolivia and Peru checklists of Tropicos (Missouri Botanical Garden 2011). Some plants could not be collected for logistical reasons, either because they grew outside the study area or because they were not available during the field work period. Animals used as remedies were not collected in the field, but were identified by zoologists acquainted with the local fauna, based on their local names and biological description. Minerals were not collected, but their local and sometimes also their Spanish names were recorded.

## Data Analysis

Based on the data obtained through freelisting, inventories of medicinal plants, animals, and minerals were compiled for each study site. The proportions of locally versus externally obtained plants in Waca Playa and Pitumarca were compared with a Chi-square analysis, using a Yates correction for continuity. The total number of use reports for each kind of natural remedy (plants, animals, minerals) was calculated for each study site. A use report is the report by any household of the use of remedy X to treat illness Y. One use report could therefore have been mentioned by several households.

The numbers of natural remedies (plants, animals, minerals, and the sum of all remedies) and their medicinal uses cited by each household during the freelisting exercises were recorded. For each household, the number of medicinal uses mentioned for each remedy was summed to determine the total number of use reports known (plant, animal, mineral, and sum of all remedies uses). When several household members participated in the interviews, the remedies and uses mentioned by each member were summed to obtain the household's total knowledge. The main interviewee in each household contributed approximately 85 % of this information, as opposed to other household members. Additionally, the number of unique plant reports was also recorded. A unique plant report is the mention of a medicinal plant exclusively by one household at a given study site.

A list of illnesses treated with natural remedies at each site was compiled based on the ethnobiological inventories. Based on qualitative analysis, these illnesses were then grouped into medicinal use categories common to the two study sites, in an attempt to reflect local conceptions of illnesses. Each household's proportional knowledge about each medicinal use category was then calculated based on the use reports mentioned during the freelisting exercises by that household. Use reports related to illnesses poorly defined by the participants, such as "serious illness" or "all illnesses," were removed from the data set and not considered in the analysis of medicinal use categories.

The effect of age on knowledge about natural remedies and their medicinal uses was then appraised by means of statistical analyses (R software version 2.13.1) (R Development Core Team 2011) that integrated the data from both study sites, but also considered the effect of the study site on medicinal knowledge and on its age dependence. Linear mixed-effects models for response variables with normal error distribution (R package "nlme," function "lme") (Pinheiro *et al*. 2009) and generalized linear mixed-effects models for response variables with binomial error distribution (R package "lme4," function "lmer") (Bates *et al*. 2011) were applied. Previously logarithmized data on the numbers of remedies (plants, animals, minerals, all remedies), numbers of medicinal uses reported, and numbers of unique plant responses were used as response variables of the linear mixed-effects models. The proportions of use reports for the 11 medicinal use categories mentioned above were analyzed as response variables in the

**Table 1** Parameter estimates for significant fixed effects terms (bold) of age, study site and the interaction of both with knowledge about natural remedies (medicinal plants, animals, minerals and all remedies) and their uses in Pitumarca (Peru) and Waca Playa (Bolivia)

| Fixed effects | # plants (ln) | # plant use-reports (ln) | # unique plant-reports (ln) | # animals (ln) | # animal use-reports (ln) | # minerals (ln) | # mineral use-reports (ln) | # all (ln) | # all use-reports (ln) |
|---|---|---|---|---|---|---|---|---|---|
| Intercept | 3.751 | −0.035 | −7.707 | 1.253 | 0.128 | 0.806 | 0.361 | 3.950 | −0.075 |
| # plants (ln) | nt | **1.112*** ** | **2.387*** ** | nt | nt | nt | nt | nt | nt |
| # animals (ln) | nt | nt | nt | nt | **1.033*** ** | nt | nt | nt | nt |
| # minerals (ln) | nt | nt | nt | nt | nt | nt | **1.033*** ** | nt | nt |
| # all (ln) | nt | nt | nt | nt | nt | nt | nt | nt | **1.109*** ** |
| Age [a] | ns | ns | ns | ns | ns | ns | **−0.006* ** | ns | ns |
| Site (Waca Playa) | **−0.493** ** | ns | **0.777* ** | ns | **−0.110* ** | **−1.568** ** | ns | **−0.532** ** | ns |
| Age:site (Waca Playa) | ns | ns | ns | ns | ns | ns | ns | ns | ns |

Terms; *ns* not significant; *nt* not tested; levels of significance: *$p<0.05$; **$p<0.01$; ***$p<0.001$

generalized linear mixed-effects models. Each model included age, which corresponded to the age of the main interviewee in each household, and study site, and the interaction of both as explanatory variables (fixed effects, see Tables 1 and 2). This interaction allowed quantification of different relationships between age and each response variable for the two study sites. The numbers of remedies reported (plants, animals, minerals, all remedies) were additionally included as corrective explanatory variables. To avoid pseudo-replication, we also considered the random effects of community at each study site. In a stepwise-backward procedure based on likelihood ratio tests (chi-square, $\chi 2$), maximal models were then simplified, as described by Crawley (2007). All non-significant terms ($p>0.05$) ("ns," see Tables 1 and 2) were removed in order to obtain minimal adequate models for each response variable.

The number of households that stated during the interviews that they transmitted their knowledge to their children was summed at each study site. Households that had no children or whose answer was not clear were removed from

**Table 2** Categories of illnesses treated by natural remedies in Waca Playa (Bolivia) and Pitumarca (Peru)

| Illness categories | Description and/or examples |
|---|---|
| Culture-bound | Illnesses with multiple symptoms and/or etiology that can be considered part of Andean culture, such as problems with a social or spiritual cause or links with the hot/cold humoral classification of diseases—e.g. *susto* (fright sickness), *wayra* (bad winds)*, rayo* or *qhaha* (lightening), *colerina* (anger), etc. |
| Dermatological and wounds | Fresh or infected wounds, skin problems, insect bites |
| Fever | Fever events (*calentura* or *chiricalor*) |
| Gastro-intestinal | Stomach ache, diarrhea, intestinal parasites, gastritis |
| Genito-urological | Kidney inflammations or pains, prostate problems |
| Gynecological-obstetric | Conditions including pregnancy, labor, puerperium, infertility, and contraception treatments |
| Headache | Headaches (also when caused by hangover) , dizziness |
| Musculoskeletal | Body pains, (e.g. back pain, sprains, cramps, and rheumatism) fractures |
| Preventive and tonic | Prevention of all types of illnesses or overall body weakness—daily or exceptional use of natural remedies that act as *vitaminas* (vitamins) or *tónicos* (tonics) |
| Respiratory | Flu, common cold, several types of coughs, sore throat. |
| Other illnesses | Little-mentioned ailments (e.g. problems related to child growth, ear aches, eyes infections, teeth problems, measles, and hepatitis) |

this final analysis (three households in Waca Playa and three households in Pitumarca).

## Results

### Knowledge About Natural Remedies in Waca Playa and in Pitumarca

The ethnobotanical inventories compiled revealed a substantial knowledge about natural remedies and their uses at both study sites (Appendices 1 and 2). The households from Waca Playa mentioned a total of 150 medicinal plants with a total of 415 use reports. Sixteen of these medicinal plants grew outside the communities where the research was conducted (10.7 %). Of the 134 medicinal plants grown locally, 26.1 % were cultivated and 73.9 % wild. Most of the externally obtained plants were bought at markets (these were cultivated or wild plants from the lowlands) and a few plants were collected in the neighboring valleys. Twenty of the inventoried plants were only known by the two households who were healers. The participants also listed 24 animals used as remedies (10 domesticated and 14 wild) with a total of 51 use reports, and 8 minerals with a total of 15 use reports. The inventories of natural remedies from Waca Playa are listed in Appendix 1.

In Pitumarca (Appendix 2), the numbers of natural remedies and medicinal use reports were notably larger than in Waca Playa. The participating households listed a total of 249 medicinal plants with a total of 774 use reports. Of these 249 plants, 200 were collected locally and 49 were brought from outside the communities studied (19.7 %). Of the plants found at the study site 25.5 % were cultivated and 74.5 % wild. Approximately half of the externally obtained plants were bought (these were either cultivated plants growing at lower altitudes or wild plants from the Amazon lowlands) and the other half were collected in the highlands of Pitumarca district, in the puna ecological belt. The medicinal plants known only by the two healers amongst the interviewed households amounted to a total of 21. Regarding the number of animal and mineral remedies, the households mentioned respectively 33 with 109 use reports (13 domesticated and 20 wild) and 24 with 49 use reports.

Higher levels of knowledge about natural remedies were thus found in Pitumarca by comparison with Waca Playa. Furthermore, the proportion of externally versus locally obtained plants was also significantly higher at the former site than at the latter ($\chi^2_{(1)}$=4.934; $P$=0.026).

The greater ethnobiological inventories found in Pitumarca by comparison with Waca Playa were confirmed by the linear mixed-effect model analysis (see Table 1). This analysis demonstrated that knowledge about natural remedies (plants, $\chi^2_{(1)}$=7.977, $p$<0.01; minerals, $\chi^2_{(1)}$=8.03, $p$<0.01; all remedies, $\chi^2_{(1)}$=8.86, $p$<0.01) or their uses (animal use, $\chi^2_{(1)}$=5.07, $p$<0.05) was significantly higher in Pitumarca than in Waca Playa, except for the number of unique plant reports in relation to the total number of plants cited, which was slightly higher in Waca Playa than in Pitumarca ($\chi^2_{(1)}$=5.52, $p$<0.05).

### Effects of Age on Knowledge About Natural Remedies and Their Uses

The effects of age on the numbers of medicinal plants, animals and minerals and the number of medicinal uses reported by 36 households from the two study sites are shown in Table 1. In both regions, medicinal knowledge was not affected by age, which suggests that it is not undergoing a process of erosion. The only exception was the number of mineral uses reported, which decreased slightly with age ($\chi^2_{(1)}$=6.45, $p$<0.05).

This finding from the statistical analysis is consistent with the importance of processes of knowledge transmission observed at both study sites. Respectively 80 % and 87 % of the households from Waca Playa and Pitumarca affirmed during the interviews that they transmitted ethnobiological knowledge to their children, either actively through teaching or by giving them the opportunity to observe them as they collected, used, or administered natural remedies to other family members.

Regarding the uses of medicinal plants, animals, and minerals, the participating households cited a total of 74 (Waca Playa) and 93 (Pitumarca) illnesses during the freelisting that were treated with these remedies. For the purpose of the analysis, these illnesses were grouped into eleven medicinal use categories common to the two study sites: (1) culture-bound illnesses; (2) dermatological illnesses and wounds; (3) fever events; (4) gastro-intestinal illnesses; (5) genito-urological illnesses; (6) gynecological-obstetric conditions; (7) headache events; (8) musculoskeletal problems; (9) preventive and tonic remedies; (10) respiratory illnesses; and (11) other illnesses. These illness categories are further detailed in Table 2.

The detailed effects of age, study site and their interactions with the 36 households' proportional knowledge of these eleven illness categories are shown in Table 3. The generalized linear mixed-effects models demonstrated that at both study sites there was no effect of age on the proportional knowledge about fever, gastro-intestinal, genito-urological, gynecological-obstetric, and other uses.

Nevertheless, the statistical analyses also revealed that age had an effect on knowledge about natural remedies for the following use categories: culture-bound, headache, dermatological/wounds, musculoskeletal, preventive/tonic, and respiratory uses. For instance, proportional knowledge about uses for culture-bound illnesses increased with age in Pitumarca, whereas the opposite was found for Waca

**Table 3** Parameter estimates for significant fixed effects terms (bold) of age, study site and their interactions with proportional knowledge about medicinal use categories (culture-bound, dermatological/wounds, fever, gastro-intestinal, genito-urological, gynecological-obstetric, headache, musculoskeletal, preventive/tonic, respiratory, and other uses) mentioned in Pitumarca (Peru) and Waca Playa (Bolivia)

| Fixed effects | Proportion culture-bound | Proportion dermatolo-gical/ wounds | Proportion fever | Proportion gastro-intestinal | Proportion genito-urological | Proportion gyneco-logical-obstetric | Proportion headache | Proportion musculo-skeletal | Proportion preventive / tonic | Proportion respiratory | Proportion other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Intercept | −0.93 | −2.88 | −2.88 | −2.40 | −3.83 | −2.36 | −7.02 | −1.53 | −1.43 | −1.69 | −3.06 |
| Age [a] | 0.01[a] | −0.02[a] | ns | ns | ns | ns | 0.06[a] | −0.00[a] | −0.03[a] | **(−0.02)***** | ns |
| Site (Waca Playa) | 0.30[a] | −1.61[a] | ns | ns | **(−1.04)*** | ns | 3.59[a] | 0.83[a] | −0.46[a] | ns | **0.70**** |
| Age [a]:site (Waca Playa) | **(−0.02)**** | **0.05**** | ns | ns | ns | ns | **(−0.04)*** | **(−0.03)**** | **0.02*** | ns | ns |

[a] Terms in significant interaction; ns, not significant; levels of significance: *$P<0.05$; **$P<0.01$; ***$P<0.001$

Playa. However, when analyzing the two sites separately, the negative effect of age for Waca Playa was not significant ($\chi^2_{(1)}=3.129$, $p=0.077$), while a significant positive effect for Pitumarca remained ($\chi^2_{(1)}=11.947$, $p<0.001$). The proportional knowledge of uses for headache increased with age at both study sites, with an overall lower knowledge but a steeper increase with age in Pitumarca as compared to Waca Playa (significant interaction of age and site: $\chi^2_{(1)}=9.213$, $p<0.01$). The proportional knowledge of dermatological uses and wound treatments also increased with age in Waca Playa, but slightly decreased in Pitumarca (significant interaction of age and site: $\chi^2_{(1)}=5.776$, $p<0.05$). When testing the two sites separately though, the positive effect of age on dermatological uses and wound treatments for Waca Playa was significant ($\chi^2_{(1)}=5.776$, $p<0.05$), whereas the negative effect of age for Pitumarca was not ($\chi^2_{(1)}=3.820$, $p=0.051$). At both sites, age had a negative effect on proportional knowledge about respiratory ($\chi^2_{(1)}=12.566$, $p<0.001$), musculoskeletal, and preventive/tonic uses. For musculoskeletal uses this negative effect was slight in Pitumarca and more marked in Waca Playa (significant interaction of age and site: $\chi^2_{(1)}=6.873$, $p<0.01$), whereas the opposite was shown concerning preventive/tonic uses (significant interaction of age and site: $\chi^2_{(1)}=4.175$, $p<0.05$).

In summary, knowledge about culture-bound (in Pitumarca), headache (both sites), and dermatological and wounds (in Waca Playa) uses increased with age, while knowledge about respiratory, musculoskeletal, and preventive/tonic uses decreased with age at both sites.

## Discussion

This study yielded four major findings. First, the results demonstrated that knowledge about natural remedies and their uses was considerable at both study sites. Even when considering only lay knowledge (i.e., excluding the knowledge of traditional healers), inventories of medicinal plants were as high as 130 in Waca Playa and 228 in Pitumarca. These figures are much higher than those obtained in surveys conducted among laypeople in other Quechua-speaking districts of the Bolivian Andes: Vandebroek *et al.* (2004) inventoried 36 medicinal plants in Cochabamba Department (50 participants, Apillapampa, 3,250 m.a.s.l.) and Fernandez *et al.* (2003) 56 plants in Potosi Department (56 participants, Uncia, 4,400 m.a.s.l.). In the Peruvian Central Andes, 87 plants were identified by means of a survey conducted with 150 participants (Canta, up to 2,800 m.a.s.l.) (De-la-Cruz *et al.* 2007).

Second, contrary to most of the literature on the topic (e.g., Phillips and Gentry 1993; Caniago and Siebert 1998; Zent 2001; Voeks and Leony 2004; Estomba *et al.* 2005), results from the statistical analyses proved that younger participants knew as much about plants, animals and minerals used as remedies as older participants. This finding, together with the high levels of knowledge about natural remedies found, suggest that there is no ongoing loss of this type of knowledge among Andean households at the study sites. We may even predict that this knowledge will prevail during the next decades, as implied by the high levels of parent-to-child transmission found among the participating households. The exception found for knowledge about mineral uses, which decreased slightly with age, is probably the result of the low number of uses reported per household (zero to four uses in Waca Playa and zero to eight in Pitumarca). A few elder households did report a low number of mineral uses, perhaps because they forgot to mention other uses they knew, which influenced the results. Comparison of our data with the literature seems to confirm that knowledge about natural remedies has been maintained in the last several decades at the study sites (Hensen 1992; Delgadillo 2004). In Waca Playa, a comprehensive ethnobotanical study carried out from 1990 to 1992 and published in 2004 lists a total of 123 wild and cultivated local medicinal plants collected with local experts (Delgadillo 2004). Another study carried out in a neighboring area in 1990 registered a total of 112 wild medicinal plants collected with local farmers (Hensen 1992). These figures are comparable to ours (134 local medicinal plants, 100 of which grow in the wild) and indicate that there was no loss of medicinal plant knowledge after the establishment of the Waca Playa medical post in 1995. In Pitumarca and neighboring areas, there exists to the best of our knowledge no other complete inventory of knowledge about natural remedies that could be used as the basis for such a comparison. However, a comparative study between Waca Playa and Pitumarca showed that the increased presence of primary health care services did not displace Andean medicinal practices and knowledge at the latter site (Mathez-Stiefel *et al.* 2012). Our results contradict the findings of researchers in the Andes (Galvin 2004) and elsewhere (Caniago and Siebert 1998; Hanazaki *et al.* 2000) that have interpreted a decline of knowledge about natural remedies as a consequence of the increased presence of biomedicine.

Third, our work showed that there is a variation in the proportional knowledge about several medicinal use categories treated with natural remedies according to age. This last finding implies, in some cases, a transformation of this knowledge from one generation to the other; and, in others, a differential use of natural remedies during an individual's lifespan. For instance, according to our ethnographic data, two explanations may be given for the lower level of knowledge about medicinal uses related to culture-bound illnesses found among the young Pitumarquinos First, it probably indicates a loss of specialized knowledge of Andean medicine, especially that of traditional healers. Second, it may reflect the fact that this specialized knowledge, linked to a deep understanding of Andean culture and cosmology, is acquired later in life, as compared to other types of knowledge. Indeed, culture-bound illnesses include amongst others health problems that specifically require the skills of an Andean healer, such as possession by ancestral spirits, witchcraft, divination and diagnosis, and animal sacrifice (Mathez-Stiefel *et al.* 2012). Moreover, they also include illnesses that can be cured by skilled laypeople, but for which patients generally consult a healer, such as *wayra* or *malviento* (several types of "bad winds"). This interpretation is consistent with both our ethnographic data and statistical analyses. On the one hand, informal discussions with the participants and field observations showed that healers, who are mostly elderly people, were disappearing in Pitumarca. On the other hand, the lower number of unique plant reports —in relation to the total numbers of medicinal plants mentioned—found in Pitumarca as compared to Waca Playa could indicate a loss of specialized knowledge and its replacement by increased general knowledge among the population. The increased presence of biomedical health care facilities at both study sites in recent decades could account for the lower level of knowledge about headaches, dermatological, and especially wound-related uses among the younger generation. We have shown elsewhere that households from Waca Playa and Pitumarca nowadays visit the medical center and use pharmaceuticals as painkillers, including treatment for headaches as well as for wounds and fractures (Mathez-Stiefel *et al.* 2012). Regarding greater knowledge about respiratory uses found among the younger generation, this could be explained by a change in the health context of the research areas in the last several decades and notably a higher occurrence of respiratory infections; but further studies should be done to corroborate this hypothesis. Indeed, both in Waca Playa and in Pitumarca, respiratory infections are currently among the most common illnesses afflicting the population (AGRUCO 2006; INC 2008). The negative effect of age on knowledge about natural remedies for musculoskeletal uses, including the treatment of back pain, sprains and bruises that typically result from hard work in the fields, reflects the fact that households face different types of illnesses during the course of life. Field observations revealed that agricultural activities were mostly carried out by the younger households, while the older ones reduced their physical activities progressively as they advanced in age. From our ethnographic knowledge of the study sites, we believe that the greater knowledge about preventive and tonic uses found among the younger generation mirrors a recent process of revalorization of natural remedies as the best option to remain in good health. Another study confirms that there was such a revalorization in Pitumarca, where there was a clear preference for natural remedies over pharmaceuticals, which were seen as potentially harmful, addictive, and in some cases not efficient (Mathez-Stiefel *et al.* 2012). Furthermore, we observed at both study sites that nowadays community members turn increasingly to agroecological production modes and associate the consumption of "natural," "healthy" agricultural products with the use of "natural," "healthy" remedies.

A last finding that deserves discussion is the contrasting situation found in the levels of knowledge about natural remedies between the two study sites. Not only were the number of natural remedies and medicinal uses reported significantly higher in Pitumarca as compared to Waca Playa, but knowledge about medicinal plants was more idiosyncratic and thus less shared among households at the latter site, as implied by the relatively higher number of unique plant responses found in Waca Playa. This last result is confirmed by a previous study that showed that there was more agreement about commonly known medicinal plants in Pitumarca than in Waca Playa (Mathez-Stiefel and Vandebroek 2012). Our finding is supported by the results of another study that showed that there is a prevalence of Andean medicinal knowledge and practices among households from Pitumarca as compared to Waca Playa (Mathez-Stiefel *et al.* 2012). That study demonstrated that there was both more elaborate knowledge about culture-bound illnesses and a higher preference for natural remedies over pharmaceuticals at the former site. These results are quite surprising, since Pitumarca is the site where there is a higher presence not only of biomedicine, but also of other factors of acculturation generally reported in the literature to account for a loss of knowledge about natural remedies such as formal education (Zent 2001; Quinlan and Quinlan 2007; Reyes-García *et al.* 2010; Wyndham 2010) and the market economy (Alcorn 1999; Reyes-García *et al.* 2005). The higher proportion of externally versus locally grown plants found in Pitumarca as compared to Waca Playa reveals that Pitumarquinos enriched their local therapeutic resource basis by including more elements from other ecological belts. This could result from higher levels of mobility between the Andean highlands and the Amazon lowlands and/or from greater plant and knowledge exchange at local markets in Pitumarca. This hypothesis also partly explains the differences in knowledge about natural remedies found between the study sites. However, it should be further tested in order to accurately interpret our findings.

## Conclusions

Based on the results from this study, we conclude that knowledge about natural remedies is generally not being lost at the two study sites. Nevertheless, it is definitely undergoing transformations in terms of specific medicinal uses. The variation of proportional knowledge about medicinal use categories according to age does correspond in some cases to knowledge erosion. In others, however, it reflects a process of adaptation to a changing context, or simply the diverse health needs encountered during an individual's lifespan. A careful understanding of these complex transformation processes is thus needed to better orient initiatives for the conservation of biocultural diversity and indigenous environmental knowledge in the Andes and elsewhere.

Future studies could enrich the results of this work. For instance, studies that analyze the transformation of knowledge about natural remedies and health-seeking behavior in migration contexts, and more specifically in the lowlands and urban centers, would provide a broader understanding about what is happening with ethnomedical knowledge globally in the Andean region. Comparative studies realized at the same research sites at a future date could confirm whether there is an on-going revalorization of knowledge about natural remedies among laypeople and, parallel to this, a loss of specialized knowledge. Research on the differential occurrence of illness types during individuals' lifespans and about changes in the occurrence of illnesses in the population over time would allow corroboration of our interpretations about the effect of age on medicinal use categories, and make it possible to better specify which of our results can be attributed to processes knowledge erosion. And last, comparative studies between the two research sites on the exchange of knowledge and remedies from different ecological belts could shed more light on the differences in the levels of knowledge encountered.

**Acknowledgments** We sincerely thank members of the communities of Tres Cruces, Lambramani (Waca Playa, Bolivia), Huasampampa, and Huito (Pitumarca, Peru) for their generous participation in this study. Field work logistics were provided by implementing organizations of the BioAndes Program of the Swiss Agency for Development and Cooperation (SDC), namely AGRUCO (Cochabamba, Bolivia), CEPROSI (Cusco, Peru), and ETC Andes (Lima, Peru). We thank the field assistants who helped with interview interpretations and/or translations in Bolivia and in Peru. Plant identifications were done by Magaly Mercado and Fructuosa De La Torre and animal identifications by Eberth Rocha and José Luis Mena. Ina Vandebroek is to be thanked for her contribution to data analysis. Funding for the present study was granted by the Swiss National Centre of Competence in Research (NCCR) North-South (project TN3 and RP13 on Transformation of Agrarian Systems) and by the Swiss Commission for Research Partnerships with Developing Countries (KFPE)'s program "Jeunes Chercheurs" (funded by the SDC).

## Appendix 1

**Table 4** Plants, animals, and minerals used as remedies in Waca Playa, Bolivia. Plant voucher number: SM#(B): Sarah-Lan Mathez-Stiefel # (Bolivia), RB#: Regine Brandt #. Based on freelisting exercises conducted with 18 households

| Local name(s) in Quechua and/or Spanish | Scientific name (plant family, voucher number) or (animal family, order, or class when not identified) | Origin—status | # use reports |
|---|---|---|---|
| Plants | | | |
| Achuma | Possibly *Trichocereus bridgesii* (Salm-Dyck) Britton & Rose (Cactaceae, photo SM(B)) | l—c | 4 |
| Alfalfa | *Medicago sativa* L. (Fabaceae, SM63(B)) | l—c | 2 |
| Alisu | *Alnus acuminata* Kunth (Betulaceae, SM31(B)) | l—w | 3 |
| Allqu kirkiña, kirkiña | Not identified | l—w | 1 |
| Altamisa | *Ambrosia arborescens* Mill. (Asteraceae, SM86(B)) | l—w | 3 |
| Altea | Not identified | l—w | 1 |
| Añawiya | *Adesmia miraflorensis* J. Rémy (Fabaceae, SM95(B)) | l—w | 7 |
| Andreswaylla | *Cestrum parqui* L'Hér (Solanaceae, SM9(B), SM132(B), SM88(B)) | l—w | 12 |
| Apio | *Apium graveolens* L. (Apiaceae, SM35(B)) | l—c | 1 |
| Arroz | *Oryza sativa* L. (Poaceae) | e, b—c | 1 |
| Arveja | *Pisum sativum* L. (Fabaceae) | l—c | 1 |
| Asna muña | Not identified | l—w | 1 |
| Asnakolitches | Not identified | l—w | 1 |
| Berros | *Mimulus glabratus* Kunth (Scrophulariaceae, SM90(B)) | l—w | 6 |
| Betarraga | *Beta vulgaris* L. (Amaranthaceae) | l—c | 1 |
| Burro zapato | *Evolvulus repens* D. Parodi (Convolvulaceae, SM140(B)) | l—w | 1 |
| Cafe | *Coffea arabica* L. (Rubiaceae) | e, b—c | 2 |
| Canela | Not identified. Several possible species. | e, b—c | 2 |
| Cebada | *Hordeum vulgare* L. (Poaceae) | l—c | 2 |
| Cebadilla | *Stipa* sp. (Poaceae, SM99(B)) | l—w | 2 |
| Cedrón | *Aloysia citriodora* Ortega ex Pers. (Verbenaceae, SM26(B)) | l—c | 3 |
| Celestina | *Solanum* spp. (*S.cochabambense* Bitter—*S.* sp.) (Solanaceae, RB 19.7—SM25(B), SM71(B)) | l—w | 4 |
| Chakatia | *Dodonaea viscosa* Jacq. (Sapindaceae, SM43(B)) | l—w | 5 |
| Ch'iki | Not identified | l—w | 1 |
| Chiltuchiltu | Not identified | l—w | 3 |
| Chinchirkuma | *Mutisia acuminata* Ruiz & Pav. (Asteraceae, SM8(B)) | l—w | 2 |
| Ch'iñi muña, muña | *Clinopodium bolivianum* (Benth.) Kuntze (Lamiaceae, SM15(B), SM93(B)) | l—w | 5 |
| Ch'iñi t'ola | *Baccharis* sp. (Asteraceae, SM98(B)) | l—w | 4 |
| Ch'iñi wajranwayu | *Solanum* sp. (Solanaceae, SM44(B)) | l—w | 2 |
| Ch'iri mulli | Not identified. Possibly *Zanthoxylum coco* Gill. ex Hook. & Arn. (Rutaceae) | l—w | 1 |
| Ch'umach'uma | *Salvia haenkei* Benth (Lamiaceae, SM97(B)) | l—w | 3 |
| Clavel, yuraq clavel | *Dianthus* sp. (Caryophyllaceae) | l—c | 4 |
| Coca | *Erythroxylum coca* Lam. (Erythroxylaceae) | e, b—c | 10 |
| Cola de caballo | Not identified | e—w | 1 |
| Condor chaki | Not identified (SM120(B)) | e—w | 3 |
| Condor muña | Not identified (SM56(B)) | l—w | 2 |
| Culandro | *Coriandrum sativum* L. (Apiaceae) | l—c | 1 |
| Disconocera | *Perezia pungens* Less. (Asteraceae, SM112(B)) | l—w | 2 |
| Durazno | *Prunus persica* (L.) Batsch (Rosaceae, SM55(B)) | l—c | 7 |
| Gongona | Not identified (SM5(B)) | l—c | 1 |
| Haba | *Vicia faba* L. (Fabaceae) | l—c | 1 |
| Hierba wiña | Not identified | l—w | 1 |

**Table 4** (continued)

| Local name(s) in Quechua and/or Spanish | Scientific name (plant family, voucher number) or (animal family, order, or class when not identified) | Origin—status | # use reports |
|---|---|---|---|
| Hierbabuena | *Mentha viridis* L. (Lamiaceae, SM4(B)) | l—c | 4 |
| Hinojo | *Foeniculum vulgare* Mill. (Apiaceae, SM39(B), SM69(B)) | l—c | 2 |
| Ichhu maransila | Not identified | l—w | 1 |
| Inti kururu | Not identified | e—w | 1 |
| Iskay sonira | Not identified | l—w | 1 |
| Itapallu | *Caiophora canarinoides* Urb. & Gilg (Loasaceae, RB 23.15) | l—w | 1 |
| Jalajala | Not identified | l—w | 1 |
| Jatun t'ola | *Baccharis papillosa* Rusby (Asteraceae, RB 2.9, RB 3.1, RB 7.10) | l—w | 1 |
| Jusi ch'illka | Not identified | l—w | 1 |
| Kabrunsillo | Not identified | l—w | 1 |
| Kalistu, eucalipto | *Eucalyptus globulus* Labill. (Myrtaceae, SM6(B), SM14(B), SM87(B)) | l—c | 11 |
| Kanglia | Not identified | l—w | 1 |
| K'apak'apa | Not identified | l—w | 2 |
| Khiñi | *Kentrothamnus weddellianus* (Miers) M.C. Johnst. (Rhamnaceae, SM40(B)) | l—w | 5 |
| K'ila | Not identified | l—w | 2 |
| Kinsak'uchu, tres esquinas | Not identified | l—w | 1 |
| Lanti lanti | *Plantago* spp. (*P. orbignyana* Steinh. ex Decne., *P. lanceolata* L.) (Plantaginaceae, SM61 (B), SM103(B)–SM125(B), SM129(B)) | l—w | 9 |
| Layu, lobo | *Trifolium amabile* Kunth (Leguminosae, SM133(B)) | l—w | 2 |
| Limón | *Citrus* spp. (Rutaceae) | e, b—c | 6 |
| Linaza | *Linum usitatissimum* L. (Linaceae) | l—c | 2 |
| Llawi | Not identified | e—w | 4 |
| Llawlli | Not identified | l—w | 1 |
| Loma cedrón | Not identified | l—w | 2 |
| Loq'uloq'u | *Rumex* spp. (Polygonaceae, SM126(B)–SM130(B)) | l—w | 5 |
| Manka p'aki | *Agalinis lanceolata* (Ruiz & Pav.) D'Arcy (Scrophulariaceae, SM49(B), SM96(B)) | l—w | 2 |
| Manzana | *Malus domestica* Baumg. (Rosaceae) | l—c | 1 |
| Manzanilla | *Matricaria chamomilla* L. (Asteraceae, SM62(B)) | l—c | 8 |
| Margarita | *Proustia cuneifolia* D. Don (Asteraceae, SM47(B)) | l—w | 2 |
| Marihuana | *Cannabis sativa* L. (Cannabaceae) | e, b—c | 1 |
| Menta | Not identified. Possibly *Mentha* sp. (Lamiaceae) | l—w | 1 |
| Misi sillu | Not identified | e, b—w | 1 |
| Molle | *Schinus molle* L. (Anacardiaceae, SM16(B), SM89(B)) | l—w | 15 |
| Molle suyku | Not identified | l—w | 1 |
| Muñi | *Bidens pseudocosmos* Sherff (Asteraceae, SM53(B), SM123(B)) | l—w | 3 |
| Mut'uchi | *Senna* sp. (Asteraceae, SM52(B)) | l—w | 4 |
| Mut'uch'ila | *Senna aymara* H.S. Irwin & Barneby (Caesalpiniaceae, SM19(B), SM51(B)) | l—w | 1 |
| Nabu | *Brassica rapa* L. (Brassicaceae, SM106(B)) | l—w | 1 |
| Naranja | *Citrus spp. (Rutaceae)* | e, b—c | 2 |
| Oregano | *Origanum vulgare* L. (Lamiaceae, SM54(B)) | l—c | 2 |
| Palta | *Persea americana* Mill. (Lauraceae) | e, b—c | 3 |
| Papa | *Solanum tuberosum* L. (Solanaceae) | l—c | 1 |
| Payqu | *Chenopodium ambrosioides* L. (Amaranthaceae, SM29(B), SM60(B), SM67(B), SM91 (B)) | l—w | 5 |
| Perejil | *Petroselinum crispum* (Mill.) Fuss (Apiaceae, SM64(B)) | l—c | 5 |
| Piki pijchana, jayaj pijchana | Not identified | l—w | 2 |
| Pinku pinku | Not identified | l—w | 1 |
| P'isqu chaki | Not identified | l—w | 1 |
| P'uchunqura | Not identified | l—w | 1 |

**Table 4** (continued)

| Local name(s) in Quechua and/or Spanish | Scientific name (plant family, voucher number) or (animal family, order, or class when not identified) | Origin—status | # use reports |
|---|---|---|---|
| Puka kullu | Not identified | l—w | 1 |
| Puka llave | Not identified | l—w | 1 |
| Q'ara malva, malva | *Malva parviflora* L. (Malvaceae, SM32(B), SM33(B), SM73(B), SM83(B)) | l—w | 7 |
| Q'ara sapi, qharasa, leche leche | *Sonchus oleraceus* L. (Asteraceae, SM58(B), SM66(B), SM134(B)) | l—w | 7 |
| Q'ara tuwi, tuwi | *Gynoxys psilophylla* Klatt (Asteraceae, SM20(B), SM104(B)) | l—w | 2 |
| Qewiña | *Polylepis subtusalbida* (Bitter) M. Kessler & Schmidt-Leb. (Rosaceae, SM50(B), SM85 (B)) | l—w | 1 |
| Q'otuq'otu | *Aloysia gratissima* (Gillies & Hook.) Tronc. (Verbenaceae, SM42(B)) | l—w | 4 |
| Q'owa | Not identified | e, b—w | 3 |
| Q'owa muña, aya muña, muña | *Minthostachys ovata* (Briq.) Epling (Lamiaceae, SM10(B), SM76(B)) | l—w | 8 |
| Quinua | *Chenopodium quinoa* Willd. (Chenopodiaceae) | l—c | 3 |
| Quinua qara | Not identified | l—w | 1 |
| Raqacha, raqa raqa | *Lepechinia graveolens* (Regel) Epling (Lamiaceae, SM18(B)) | l—w | 6 |
| Rejoncillo | *Lucilia kunthiana* (DC.) Zardini, *Gamochaeta simplicicaulis* (Willd. ex Spreng.) Cabrera (Asteraceae, SM117(B)–SM139(B)) | l—w | 1 |
| Repollo | *Brassica oleracea* L. (Brassicaceae, SM59(B)) | l—c | 1 |
| Retama | *Spartium junceum* L. (Fabaceae, SM28(B)) | l—c | 2 |
| Riwasa | Not identified (SM110(B)) | l—w | 2 |
| Romero | *Rosmarinus officilnalis* L. (Lamiaceae) | l—c | 1 |
| Rosa, yuraq rosa | *Rosa* sp. (Rosaceae, SM142(B)) | l—c | 2 |
| Rosalina | *Verbena* sp. (Verbenaceae, SM101(B)) | l—w | 2 |
| Ruda, ruda blanca, ruda aya | *Senecio* sp. (Asteraceae, SM1(B)) | l—c | 2 |
| Rumansa, lantilanti | *Rumex* sp. (Polygonaceae, SM22(B), SM70(B)) | l—w | 6 |
| Rura ajinku | *Ruta graveolens* L. (Rutaceae, SM3(B)) | l—c | 1 |
| Sabila | *Aloe vera* (L.) Burm.f. (Aloaceae) | l—c | 1 |
| Sabuko | Not identified | l—w | 1 |
| Salvia | Not identified. Possibly *Salvia* sp. (Lamiaceae) | l—w | 4 |
| Santa maría | *Chrysanthemum parthenium* Bernh. (Asteraceae, SM2(B), SM124(B)) | l—c | 4 |
| Sara, yuraq sara, maíz | *Zea mays* L. (Poaceae) | l—c | 3 |
| Sawku | *Sambucus nigra* L. subsp. *peruviana* (Kunth) Bolli (Adoxaceae, SM75(B)) | l—w | 5 |
| Sayaj payqu | Not identified | l—w | 2 |
| Sin verguenzita | Not identified (SM7(B)) | l—w | 1 |
| Sira chillka | *Baccharis pentlandii* DC. (Asteraceae, RB 22.1, RB 23.10) | l—w | 1 |
| Sira payqu, ch'iñi payqu | *Chenopodium ambrosioides* L. (Amaranthaceae, SM128(B)) | l—w | 5 |
| Sultaki, sultana | *Geranium bolivianum* R. Knuth (Geraniaceae, SM77(B)) | l—w | 4 |
| Suyku | Not identified | l—w | 1 |
| Tabaco | *Nicotiana* spp. (Solanaceae) | e, b—c | 1 |
| Tarwi | *Lupinus mutabilis* Sweet (Fabaceae) | l—c | 1 |
| T'eke martingu | Not identified | l—w | 2 |
| Thaqu | *Prosopis laevigata* (Humb. & Bonpl. ex Willd.) M.C. Johnst. (Mimosaceae, SM41(B)) | l—w | 3 |
| Tian tian | Not identified (SM23(B), SM46(B)) | l—w | 8 |
| T'ola | *Baccharis dracunculifolia* DC. (Asteraceae, SM13(B), SM100(B)) | l—w | 6 |
| Tres crucenera | Not identified | l—w | 2 |
| Trigo | *Triticum* sp. (Poaceae) | l—c | 1 |
| Tukampidu | Not identified | l—w | 1 |
| Tuquchi | Not identified | l—w | 1 |
| Tuwi | *Eupatorium lasiophthalmum* Griseb. (Asteraceae, SM27(B)) | l—w | 1 |

**Table 4** (continued)

| Local name(s) in Quechua and/or Spanish | Scientific name (plant family, voucher number) or (animal family, order, or class when not identified) | Origin—status | # use reports |
|---|---|---|---|
| Uchuy tuna | Not identified | l—w | 1 |
| Ulala | *Cleistocactus buchtienii* Backeb. (Cactaceae, photo SM(B)) | l—w | 2 |
| Ulluku, papa lisa | *Ullucus tuberosus* Caldas (Basellaceae) | l—c | 1 |
| Uri uri | *Pluchea fastigiata* Griseb. (Asteraceae, RB 47.14) | l—w | 4 |
| Verbena | *Verbena hispida* Ruiz & Pav. (Verbenaceae, SM72(B)) | l—w | 7 |
| Violeta | Not identified | l—w | 3 |
| Wajranwayu | *Dunalia brachyacantha* Miers (Solanaceae, SM11(B)) | l—w | 3 |
| Wakansa | Not identified | l—w | 2 |
| Wakanwayu | *Iresine* aff. *diffusa* Humb. & Bonpl. ex Willd. (Amaranthaceae, SLS 113 (Bolivia)) | l—w | 2 |
| Waych'a | *Senecio clivicolus* Wedd. (Asteraceae, SM30(B), SM48(B)) | l—w | 4 |
| Willka ch'iti | Not identified | e, b—w | 1 |
| Wira wira | *Gnaphalium dombeyanum* DC. (Asteraceae. SM94(B), SM127(B)) | l—w | 4 |
| Wurajas | Not identified | l—w | 2 |
| Yakuyakuni | *Sigesbeckia jorullensis* Kunth (Asteraceae, SM68(B)) | l—w | 1 |
| Zzanahoria | *Daucus carota* Michx. (Apiaceae) | l—c | 1 |
| Zapatillan | *Calceolaria engleriana* Kraenzl. (Calceolariaceae, SM21(B), SM78(B)) | l—w | 3 |
| Total plant use-reports | | | 415 |
| Animals | | | |
| Allqu, perro | *Canis familiaris* | l—d | 3 |
| Aña thuya, zorrino | *Conepatus chinga* | l—w | 1 |
| Atoq, zorro | *Pseudalopex culpeus* | l—w | 2 |
| Cabra | *Capra hircus* | l—d | 2 |
| Ch'ijririnka | Not identified (class: Insecta) | l—w | 1 |
| Ch'iñi, murciélago | Not identified (order: Chiroptera) | l—w | 1 |
| Condor | *Vultur gryphus* | l—w | 1 |
| Huallpa, gallina | *Gallus gallus* | l—d | 4 |
| Jamp'atu, sapo | Probably *Rhinella arenarum* | l—w | 5 |
| Jurkuta, paloma | Probably *Metriopelia ceciliae* | l—w | 2 |
| K'ayla, rana | Probably *Hypsiboas andinus* | l—w | 2 |
| Lajato | Not identified | l—w | 1 |
| Llama | *Lama glama* | l—d | 1 |
| Misky huayronq'o, abeja | *Apis melifera* | l—d | 1 |
| Oveja | *Ovis aries* | l—d | 3 |
| Pichichiwan | *Zonotrichia capensis* | l—w | 1 |
| Pili, pato | *Anas* sp. | l—d | 1 |
| Q'orik'enti, picaflor | *Sappho sparganura* | l—w | 1 |
| Q'uchi, cerdo | *Sus scropha* | l—d | 1 |
| Quita q'uy, conejo | *Galea musteloides* | l—w | 7 |
| Runa, humano | *Homo sapiens* | l—d | 6 |
| Taraqachi, tordo | *Agelaloides badius* | l—w | 1 |
| Waca, vaca | *Bos taurus* | l—d | 2 |
| Wawa k'iro | Not identified (order: Lepidoptera) | l—w | 1 |
| Total animal use-reports | | | 51 |
| Minerals | | | |
| Churu | – | e | 2 |
| Jusk'u rumi | – | l | 1 |

**Table 4** (continued)

| Local name(s) in Quechua and/or Spanish | Scientific name (plant family, voucher number) or (animal family, order, or class when not identified) | Origin—status | # use reports |
|---|---|---|---|
| Kabranso | – | l | 1 |
| K'ewita | – | e | 3 |
| Kopala | – | e, b | 1 |
| Millu, azufre | – | e, b | 5 |
| Rumi runto, huevo de piedra | – | e | 1 |
| Yana rumi, piedra negra | – | l | 1 |
| Total mineral use-reports | | | 15 |

*l* locally collected, *e* externally obtained, *b* bought at markets, *w* wild, *c* cultivated, *d* domesticated

## Appendix 2

**Table 5** Plants, animals, and minerals used as remedies in Pitumarca, Peru. Plant voucher number: SM#(P): Sarah-Lan Mathez-Stiefel # (Peru). Based on freelisting exercises conducted with 18 households

| Local name(s) in Quechua and/or Spanish | Scientific name (plant family, voucher number) or (animal family, order, or class when not identified) | Origin—status | # use reports |
|---|---|---|---|
| Plants | | | |
| Acelga | *Beta vulgaris* var. *cicla* L. (Amaranthaceae) | l—c | 1 |
| Achanqaray | *Begonia veitchii* Hook.f. (Begoniaceae, SM13(P), SM30(P)) | l—w | 4 |
| Ajana | Not identified | e—w | 2 |
| Aji amarillo | *Capsicum baccatum* var. *pendulum* (Willd.) Eshbaugh (Solanaceae) | l—c | 1 |
| Ajinku | *Artemisia absinthium* L. (Asteraceae, SM73(P)) | l—c | 4 |
| Ajo | *Allium sativum* L. (Alliaceae) | l—c | 2 |
| Akhanako | Not identified | e—w | 2 |
| Alcachofa | *Cynara scolymus* L. (Asteraceae) | l—c | 1 |
| Alfalfa | *Medicago sativa* L. (Fabaceae, SM52(P)) | l—c | 5 |
| Allqu kiska | *Acanthoxanthium ambrosioides (*Hook. & Arn.) D. Loeve (Asteraceae, SM10(P)) | l—c | 12 |
| Alucema | *Lavandula* sp. (Lamiaceae) | e, b—c | 6 |
| Añanway kiska | Not identified | l—w | 1 |
| Angel tokay | *Stevia cuzcoensis* Hieron. (Asteraceae, SM102(P)) | l—w | 2 |
| Anis, tanta anis | *Tagetes filifolia* Lag. (Asteraceae, SM107(P)) | e, b—c | 3 |
| Ankaraya | Not identified | l—w | 1 |
| Añu | *Tropaeolum tuberosum* Ruiz & Pav. (Tropaeolaceae) | l—c | 2 |
| Apio | *Apium graveolens* L. (Apiaceae) | l—c | 3 |
| Aqaqata | Not identified | l—w | 3 |
| Arwiarwi | *Cuscuta grandiflora* Kunth (Convolvulaceae, SM45(P)) | l—w | 2 |
| ato qallu | Not identified | e—w | 2 |
| ayrampu | Not identified | l—w | 2 |
| Betarraga | *Beta vulgaris* L. (Amaranthaceae) | l—c | 1 |
| Bolsa bolsa | *Capsella bursa-pastoris* (L.) Medik. (Brassicaceae, SM41(P)) | l—w | 2 |
| Cacao | *Theobroma cacao* L. (Sterculiaceae) | e, b—c | 1 |
| Cáncer qora | *Stachys arvensis* L. (Lamiaceae, SM123(P)) | l—w | 8 |
| Canela | Not identified, several possible species. | e, b—c | 1 |
| Capuli | *Prunus serotina* Ehrh. subsp. *capuli* (Cav. ex Spreng.) McVaugh (Rosaceae, SM57(P)) | l—w | 2 |
| Cascarilla | Not identified | e, b—w | 2 |
| Cebada | *Hordeum vulgare* L. (Poaceae, SM122(P)) | l—c | 6 |
| Cebolla | *Allium cepa* L. (Alliaceae) | l—c | 1 |

**Table 5** (continued)

| Local name(s) in Quechua and/or Spanish | Scientific name (plant family, voucher number) or (animal family, order, or class when not identified) | Origin —status | # use reports |
|---|---|---|---|
| Cebolla china | *Allium* sp. (Alliaceae) | l—c | 1 |
| Cedrón | Not identified. Possibly *Aloysia citriodora* Ortega ex Pers. *(Verbenaceae)* | l—c | 1 |
| Chachakuma | Not identified | e, b—w | 1 |
| Ch'akiri | Not identified | e, b—w | 1 |
| Chanka piedra | Not identified | l—w | 1 |
| Chawi chawi | Not identified | l—w | 1 |
| Chichira | *Coronopus didymus* (L.) Sm. (Brassicaceae, SM55(P)) | l—w | 1 |
| Chilichili | Not identified | e—w | 3 |
| Chillka | *Baccharis latifolia* Pers. (Asteraceae, SM75(P)) | l—w | 2 |
| China kanlli | Not identified | l—w | 3 |
| Chinchamale | Not identified | l—w | 3 |
| Chinchirkuma | *Mutisia acuminata* Ruiz & Pav. (Asteraceae, SM43(P), SM69(P)) | l—w | 5 |
| Chiqchi | *Berberis carinata* Lechl. (Berberidaceae, SM35(P)) | l—w | 3 |
| Chiqchipa | *Tagetes multiflora* Kunth (Asteraceae, SM68(P)) | l—w | 3 |
| Ch'iqmo | *Melilotus indicus* (L.) All., *Trifolium amabile* Kunth (Leguminosae SM24(P)–SM40(P)) | l—w | 1 |
| Chirichiri | *Grindelia boliviana* Rusby (Asteraceae, SM91(P)) | l—w | 8 |
| Chonta | *Bactris gasipaes* Kunth (Arecaceae) | e, b—c | 2 |
| Chupelika | Not identified | l—w | 1 |
| Clavel, clavel rojo, clavel negro | *Dianthus* sp. (Caryophyllaceae, SM83(P)) | l—c | 7 |
| Coca | *Erythroxylum coca* Lam. (Erythroxylaceae) | e, b—c | 16 |
| Cola de caballo | *Ephedra americana* Endl. var. *rupestris* (Benth.) Ball (Ephedraceae, SM3(P)) | l—w | 6 |
| Comino | *Cuminum cyminum* L. (Apiaceae) | e, b—c | 3 |
| Cóndor chiuchi | Not identified | l—w | 1 |
| Culandro | *Coriandrum sativum* L. (Apiaceae) | l—c | 2 |
| Dulserama | Not identified | l—w | 4 |
| Erwaymoro | Not identified | l—w | 1 |
| Estrella kiska, estrella | *Acicarpha tribuloides* Juss. (Calyceraceae, SM92(P)) | l—w | 4 |
| Eucalipto | *Eucalyptus globulus* Labill. (Myrtaceae, SM78(P)) | l—c | 16 |
| Forajas | Not identified | l—w | 3 |
| Fresa | *Fragaria vesca* L. (Rosaceae) | l—c | 1 |
| Grama | *Pennisetum clandestinum* Hochst. ex Chiov. (Poaceae, SM54(P)) | l—w | 3 |
| Grama dulce | Not identified | l—w | 3 |
| Haba | *Vicia faba* L. (Fabaceae) | l—c | 2 |
| Hawaq'ollay | *Echinopsis cuzcoensis* (Britton & Rose) H. Friedrich & G.D. Rowley (Cactaceae, photo SM(P)) | l—c | 2 |
| Hayaq pilli, mayu pilli | *Hypochoeris* sp. (Asteraceae, SM59(P)) | l—w | 4 |
| Hierba luisa | *Cymbopogon citratus* (DC.) Stapf (Poaceae) | e, b—c | 2 |
| Hierbabuena | *Mentha viridis* (L.) L. (Lamiaceae, SM5(P)) | l—c | 8 |
| Higo | *Ficus* sp. (possibly *F. carica* L.) (Moraceae) | l—c | 1 |
| Hinojo | *Foeniculum vulgare* Mill. (Apiaceae, SM51(P)) | l—c | 4 |
| Huacatay | *Tagetes minuta* L. (Asteraceae) | l—c | 1 |
| Huk'ucha kisa | Not identified | l—w | 3 |
| Husq'a | *Astragalus garbancillo* Cav. (Fabaceae, SM64(P)) | l—w | 3 |
| Inti sunka | Not identified | e—w | 1 |
| Iru ichhu | Not identified | l—w | 2 |
| Isla puña | Not identified (SM34(P)) | l—w | 1 |
| Jatun oqoruru | Not identified (SM62(P)) | l—w | 6 |
| Kanlli | *Margyricarpus pinnatus* (Lam.) Kuntze (Rosaceae, SM89(P)) | l—w | 6 |

**Table 5** (continued)

| Local name(s) in Quechua and/or Spanish | Scientific name (plant family, voucher number) or (animal family, order, or class when not identified) | Origin —status | # use reports |
|---|---|---|---|
| Kantus | Not identified | l—w | 1 |
| K'aska rupu | Not identified | l—w | 1 |
| Khanakhana | *Sonchus asper* (L.) Hill (Asteraceae, SM113(P)) | l—w | 1 |
| Kharu | *Colletia spinosissima* J.F. Gmel. (Rhamnaceae, SM21(P)) | l—w | 5 |
| Kharwa | Not identified | l—w | 1 |
| Khunuka | *Satureja vana* Epling (Lamiaceae, SM99(P)) | l—w | 3 |
| Kiko | *Bidens triplinervia* Kunth (Asteraceae, SM28(P)) | l—w | 2 |
| Kinsa k'ochu | Not identified | l—w | 2 |
| Kisa | Not identified | l—w | 2 |
| Kiska khana | Not identified | l—w | 2 |
| Kiswar | *Buddleja incana* Ruiz & Pav. (Loganiaceae) | l—w | 1 |
| Konfray | Not identified (SM56(P)) | l—c | 3 |
| K'upi k'upi | Not identified (SM58(P)) | l—w | 2 |
| K'uri kisa | Not identified | l—w | 4 |
| K'usmayllu | *Solanum radicans* L.f. (Solanaceae, SM7(P)) | l—c | 2 |
| Labrán | *Alnus acuminata* Kunth (Betulaceae, SM74(P)) | l—w | 1 |
| Limón | *Citrus aurantiifolia* (Christm.) Swingle (Rutaceae) | e, b—c | 3 |
| Linaza | *Linum usitatissimum* L. (Linaceae) | l—c | 3 |
| Llampu rup'u | Not identified | l—w | 1 |
| Llantén | *Plantago major* L. (Plantaginaceae, SM96(P)) | l—w | 7 |
| Llauli, china llauli | *Barnadesia horrida* Muschl. (Asteraceae, SM26(P)) | l—w | 6 |
| Llausap'anku | Not identified | e, b—w | 2 |
| Lloqe pako | Not identified | l—w | 1 |
| Lorapa | Not identified (SM15(P)) | l—w | 3 |
| Maiz | *Zea mays* L. (Poaceae) | l—c | 5 |
| Malva | *Malvastrum* sp. (Malvaceae, SM18(P)) | l—c | 9 |
| Mamani alqa | Not identified | l—w | 2 |
| Mani | *Arachis hypogeae* L. (Fabaceae) | e, b—c | 1 |
| Manka phaki | *Ageratina sternbergiana* (D.C.) R.M. King & H. Rob. (Asteraceae, SM27(P), SM109(P)) | l—w | 5 |
| Manzana | *Malus domestica* Baumg. (Rosaceae) | l—c | 1 |
| Manzanilla | *Matricaria recutita* L. (Asteraceae, SM82(P)) | l—c | 16 |
| Maransira | Not identified | l—w | 1 |
| Marqu | Not identified | l—w | 4 |
| Matapalo | Not identified | e, b—w | 5 |
| Maych'a | *Senecio rudbeckiifolius* Meyen & Walp. (Asteraceae, SM71(P)) | l—w | 4 |
| Mayu cidra | Not identified | l—w | 1 |
| Mayu kisa | Not identified | l—w | 1 |
| Mayu rabanos | Not identified | l—w | 1 |
| Mejorana | Not identified | l—w | 1 |
| Menta | Not identified | l—w | 1 |
| Miskiqallara | *Puya ferruginea* (Ruiz & Pav.) L.B.Sm. (Bromeliaceae, SM36(P)) | l—w | 1 |
| Molle | *Schinus molle* L. (Anacardiaceae, SM8(P)) | l—w | 4 |
| Mula verbena | *Verbena* spp. (*V. litoralis* Kunth, *V. hayekii* Moldenke (Verbenaceae, SM29(P)–SM42(P)) | l—w | 4 |
| Muña | *Minthostachys* spp. (*M. setosa* (Briq.) Epling, *M. spicata* (Benth.) Epling (Lamiaceae, SM33(P)–SM120(P)) | l—w | 10 |
| Muñak'a | *Muehlenbeckia volcanica* (Benth.) Endl. (Polygonaceae, SM31(P)) | l—w | 7 |
| Mutuy | *Senna birostris* (Vogel) H.S. Irwin & Barneby (Caesalpinaceae, SM20(P)) | l—w | 15 |
| Nabo, yuyo | *Brassica rapa* subsp. *campestris* (L.) A. R. Clapham (Brassicaceae, SM4(P)) | l—w | 7 |

**Table 5** (continued)

| Local name(s) in Quechua and/or Spanish | Scientific name (plant family, voucher number) or (animal family, order, or class when not identified) | Origin —status | # use reports |
|---|---|---|---|
| Naranja | *Citrus* sp. (*Rutaceae)* | e, b—c | 2 |
| Naywa | Not identified | l—w | 1 |
| Nina goncha | Not identified | l—w | 1 |
| Oca | *Oxalis tuberosa* Molina (Oxalidaceae) | l—c | 1 |
| Oqa oqa | *Oxalis picchensis* R. Knuth (Oxalidaceae, SM16(P)) | l—w | 4 |
| Oqayqora | *Descurainia myriophylla* R.E.Fr. (Brassicaceae, SM118(P)) | l—w | 1 |
| Oqaysuru | Not identified | l—w | 1 |
| Oq'e thurpa | Not identified | e—w | 3 |
| Oqoruru, allqu oqoruru | *Mimulus glabratus* Kunth (Scrophulariaceae, SM19(P), SM38(P)) | l—w | 10 |
| Orégano | *Origanum vulgare* L. (Lamiaceae) | l—c | 2 |
| Orqu chiqchi | Not identified | l—w | 1 |
| Orqu grama | Not identified | l—w | 1 |
| Orqu kisa | *Urtica urens* L. (Urticaceae, SM72(P)) | l—w | 4 |
| Orqu llauli | *Dasyphyllum leiocephalum* (Wedd.) Cabrera (Asteraceae, SM77(P)) | l—w | 2 |
| Orqu muña | *Satureja boliviana* Briq (Lamiaceae, SM658(P)) | l—w | 3 |
| Orqu q'olo | Not identified | l—w | 1 |
| Orqu wamanlipa | Not identified | e—w | 1 |
| Orqu zapatilla | *Calceolaria engleriana* Kraenzl. (Scrophulariaceae, SM46(P)) | l—w | 1 |
| Pacha husqa | Not identified | e—w | 2 |
| Pacha muña | Not identified (SM60(P)) | l—w | 6 |
| Pacha thurpa | Not identified | e—w | 1 |
| Palma real | Not identified | l—c | 2 |
| Palmayver | Not identified | l—w | 1 |
| P'alta kisa | Not identified | l—w | 3 |
| Pampa anis | *Spergularia andina* Rohrb. (Caryophyllaceae, SM37(P)) | l—w | 3 |
| Pampa comino | Not identified | l—w | 1 |
| Pampa culandro | *Oreomyrrhis andicola* (Kunth) Endl. ex Hook. f. (Apiaceae, SM22(P)) | l—w | 3 |
| Pampa rosas | Not identified | l—w | 1 |
| Papa | *Solanum tuberosum* L. *(Solanaceae)* | l—c | 3 |
| Papaya | *Carica papaya* L. (Caricaceae) | e, b—c | 1 |
| Patakiska | *Austrocylindropuntia subulata* (Muehlenpf.) Backeb. subsp. *exaltata* (A. Berger) D.R. Hunt (Cactaceae, photo SM) | l—w | 6 |
| P'ataku | Not identified | l—w | 1 |
| Payqu | Not identified | l—w | 4 |
| Pensamiento, michimichi | *Cypella herrerae* Diels ex R.C. Foster (Iridaceae, SM80(P)) | l—c | 3 |
| Perejil | *Petroselinum sativum* Hoffm. (Apiaceae, SM9(P)) | l—c | 9 |
| Pergolares | *Basella alba* L. (Basellaceae, SM12(P)) | l—w | 2 |
| Phallcha | Not identified | e—w | 1 |
| Phasku qollana | *Hesperoxiphion herrerae* (R.C. Foster) Ravenna (Iridaceae, SM119(P)) | l—w | 1 |
| Phuña | Not identified | e—w | 1 |
| Pilipili, diente de leõn | *Taraxacum officinale* F.H. Wigg. (Asteraceae, SM6(P)) | l—w | 5 |
| Pimpinilla | *Pimpinella anisum* L. (Rosaceae, SM79(P)) | l—c | 5 |
| Pinku pinku | Not identified | l—w | 5 |
| Pino | *Pinus* spp. (Pinaceae) | l—c | 1 |
| P'irka | Not identified (SM70(P)) | l—w | 4 |
| Pomelo | *Citrus* sp. *(Rutaceae)* | e, b—c | 1 |
| Puka phallcha | Not identified | l—w | 2 |
| Puka thurpa | Not identified | e—w | 7 |
| Puka t'ikaq achanqaray | Not identified | l—w | 2 |

**Table 5** (continued)

| Local name(s) in Quechua and/or Spanish | Scientific name (plant family, voucher number) or (animal family, order, or class when not identified) | Origin—status | # use reports |
|---|---|---|---|
| Puka t'ikaq chili chili | Not identified | e—w | 1 |
| Puka t'ikaq kisa | *Cajophora cirsiifolia* C. Presl (Losaceae, SM25(P)) | l—w | 11 |
| P'uku p'uku | *Dichondra* sp. (Convolvulaceae, SM39(P)) | l—w | 4 |
| Pupusa | *Xenophyllum poposum* (Phil.) V.A. Funk (Asteraceae, SM93(P)) | e—w | 9 |
| Pura pura | Not identified | e—w | 3 |
| Putapaya | *Pelargonium fragrans* Willd. (Geraniaceae, SM81(P)) | l—c | 2 |
| Qalawala | *Polypodium angustifolium* var. *amphostenon* (Kunze ex Klotzsch) Baker (Polypodiaceae, SM103(P)) | l—w | 2 |
| Qalyara | Not identified | l—w | 3 |
| Qamasayri | *Nicotiana glauca* Graham (Solanaceae, SM17(P)) | l—w | 2 |
| Q'ellu t'ikaq kisa | Not identified | l—w | 3 |
| Q'era | Not identified | l—w | 1 |
| Q'eto q'eto | *Achyrocline saturejoides* (Lam.) DC. (Asteraceae, SM23(P)) | l—w | 1 |
| Qhayan qhayan | *Valeriana decussata* Ruiz & Pav. (Valerianaceae, SM61(P)) | l—w | 3 |
| Queuña | *Polylepis incana* Kunth (Rosaceae, SM87(P)) | l—w | 2 |
| Quwimirachi | *Erodium cicutarium* (L.) L'Her. ex Aiton (Geraniaceae, SM32(P)) | l—w | 2 |
| Retama | *Spartium junceum* L. (Fabaceae, SM76(P)) | l—c | 2 |
| Rokotorokoto | *Abutilon hirtum* (Lam.) Sweet (Malvaceae, SM85(P)) | l—c | 2 |
| Romero | *Rosmarinus officinalis* L. (Lamiaceae) | l—c | 5 |
| Ruda | *Ruta* spp. (*R. chalepensis* L., *R. graveolens* L. (Rutaceae, SM11(P)–SM111(P)) | l—c | 5 |
| Rumiunku | Not identified | l—w | 1 |
| Runa oqoruru | Not identified | l—w | 2 |
| Rup'u rup'u | Not identified | l—w | 1 |
| Sabila | *Aloe vera* (L.) Burm.f. (Aloaceae) | l—c | 5 |
| Sachaparaqay | *Colignonia parviflora* subsp. *biumbellata* (Ball) J.E. Bohlin (Nyctaginaceae, SM73(P)) | l—w | 1 |
| Salvia | *Lepechinia meyenii* (Walp.) Epling (Lamiaceae, SM88(P), SM106(P)) | l—w | 5 |
| Sangre de grado | Not identified | e, b—w | 6 |
| Sano sano | Not identified | e, b—w | 2 |
| Santa maría | *Tanacetum parthenium* Sch. Bip. (Asteraceae, SM14(P)) | l—w | 3 |
| Sapan qari | Not identified | l—w | 1 |
| Sapan t'ika kisa | Not identified | l—w | 1 |
| Sarsaparilla | Not identified | l—w | 1 |
| Sasawi | *Leucheria daucifolia* (D. Don) Crisci (Asteraceae, SM94(P)) | e—w | 9 |
| Sauco | *Sambucus peruviana* Kunth (Caprifoliaceae, SM49(P)) | l—w | 5 |
| Sink'awi | *Echinopsis maximiliana* Heyder ex A. Dietr. (Cactaceae, photo SM(P)) | l—w | 3 |
| Soldakisolda | Not identified | l—w | 1 |
| Solema | Not identified | l—w | 1 |
| Sotuma | Not identified | e—w | 8 |
| T'ankar | *Lycianthes lycioides* Hassl. (Solanaceae, SM86(P)) | l—w | 2 |
| T'antara | Not identified | l—w | 2 |
| Thurpa | Not identified | e—w | 6 |
| Tikle tikle | Not identified | e, b—w | 2 |
| Toronjil | *Melissa officinalis* L. (Lamiaceae) | l—c | 5 |
| Trigo | *Triticum* sp. (Poaceae) | l—c | 1 |
| Uña de gato | Not identified | e, b—w | 8 |
| Uñaka | Not identified | l—w | 2 |
| Up'usuru | *Bowlesia sodiroana* H. Wolff (Apiaceae, SM44(P) | l—w | 1 |
| Uva | *Vitis vinifera* L. (Vitaceae) | e, b—c | 3 |

**Table 5** (continued)

| Local name(s) in Quechua and/or Spanish | Scientific name (plant family, voucher number) or (animal family, order, or class when not identified) | Origin —status | # use reports |
|---|---|---|---|
| Valeriano | Not identified | l—w | 1 |
| Verbena | *Stachys bogotensis* Kunth (Lamiaceae, SM47(P)) | l—w | 1 |
| Vicuña thurpa | Not identified | e—w | 2 |
| Violeta ambarones | *Chrysanthemum* sp. (Asteraceae, SM84(P)) | l—c | 4 |
| Waca muñu | Not identified | l—c | 1 |
| Wachanccay | Not identified | l—w | 1 |
| Walpa walpa | Tropaeolum peregrinum L. (Tropaeolaceae, SM90(P)) | l—w | 1 |
| Wamanlipa | *Senecio tephrosioides* Turcz. (Asteraceae, SM95(P)) | e—w | 7 |
| Waraqo | *Opuntia floccosa* Salm-Dyck (Cactaceae, photo SM) | e—w | 7 |
| Watakhawa | Not identified | l—w | 1 |
| Waylwa | Not identified | l—w | 4 |
| Wayra kopal | Not identified | l—w | 2 |
| Wayurkuma | Not identified | l—w | 6 |
| Wichullu | Not identified | l—w | 8 |
| Wikiki | Not identified | e, b—w | 1 |
| Wikuntuy | Not identified | e—w | 1 |
| Wiraqoya | Not identified | e, b—w | 1 |
| Yana kisa | *Urtica urens* L. (Urticaceae, SM50(P)) | l—w | 8 |
| Yanaruku | Not identified | l—w | 1 |
| Yaqay | Not identified | l—w | 1 |
| Yarita | Not identified | e—w | 2 |
| Yawarch'unka | *Oenothera multicaulis* Ruiz & Pav. (Onagraceae, SM63(P)) | l—w | 11 |
| Yunka p'irka | Not identified | l—w | 2 |
| Yunka wichullu | Not identified | e, b—w | 1 |
| Yuraq rosa | *Rosa* sp. (Rosaceae) | l—c | 1 |
| Yuraq t'ikaq cáncer | *Stachys herrerae* Epling (Lamiaceae, SM48(P)) | l—w | 2 |
| Yuraq t'ikaq oqa oqa, pampa vinagrera | Not identified | l—w | 2 |
| Yuraq verbena | Not identified | l—w | 2 |
| Zanahoria | *Daucus carota* Michx. (Apiaceae) | l—c | 3 |
| Zaptilla, pukuchu pukuchu | *Calceolaria* spp. (*C. sparsiflora* Kunze, *C. virgata* Ruiz & Pav., *C. aurea* Pennell) (Calceolariaceae, SM1(P)–SM111(P) -, SM110(P)) | l—w | 4 |
| Total plant use-reports | | | **774** |
| Animals | | | |
| Abeja | *Apis melifera* | l—d | 5 |
| Añas, zorrino | *Conepatus* spp. | l—w | 6 |
| Atoq, zorro | *Lycalopex* spp. | l—w | 2 |
| Burro | *Equus asinus* | l—d | 1 |
| Caballo | *Equus caballus* | l—d | 1 |
| Cabra, cabra negra | *Capra hircus* | l—d | 4 |
| Cóndor | *Vultur gryphus* | e—w | 3 |
| Culebra | Not identified (suborder: Serpentes) | l—w | 3 |
| Cuy, cuy negro, cuy tricolor | *Cavia porcellus* | l—d | 4 |
| Gallina, gallina negra, gallina roja | *Gallus gallus* | l—d | 11 |
| Gato negro | *Felis catus* | l—d | 2 |
| Gusano de qayara | Not identified | l—w | 1 |
| Hacchi, águila | Not identified (family: Accipitridae) | l—w | 2 |
| Hak'ajllu | Not identified (class: Aves) | l—w | 1 |
| Huku, búho | Not identified (family: Stripidae) | l—w | 1 |

**Table 5** (continued)

| Local name(s) in Quechua and/or Spanish | Scientific name (plant family, voucher number) or (animal family, order, or class when not identified) | Origin —status | # use reports |
|---|---|---|---|
| Khallwa, golondrina | Not identified (family: Hirundinidae) | l—w | 3 |
| Llama | *Lama glama* | l—d | 1 |
| Mula | Hybrid between *Equus asinus* and *Equus caballus* | l—d | 3 |
| Murciélago | Not identified (order: Chiroptera) | l—w | 1 |
| Oveja, cordero, oveja negra | *Ovis aries* | l—d | 10 |
| Parihuana | *Phoenicoparrus* spp., *Phoenicopterus* chilensis | e—w | 2 |
| Qalaiwa, lagartija | Not identified (suborder: Lacertilia) | l—w | 4 |
| Q'ente, picaflor | Not identified (class: Aves) | l—w | 2 |
| Q'uchi, cerdo | *Sus domesticus* | l—d | 3 |
| Rana | Not identified (order: Anura) | l—w | 4 |
| Runa, humano | *Homo sapiens* | l—d | 10 |
| Suri | *Pterocnemia pennata* | e—w | 1 |
| Taparako | Not identified (order: Lepidoptera) | l—w | 1 |
| Taruka, venado | *Hippocamelus antisensis* | l—w | 3 |
| Thiscu thiscu, saltamonte | Not identified (class: Insecta) | l—w | 1 |
| Uru, araña | Not identified (order: Araneae) | l—w | 3 |
| Vicuña | *Vicugna vicugna* | e—w | 4 |
| Waca, vaca, vaca crespa | *Bos taurus* | l—d | 6 |
| Total animal use-reports | | | **109** |
| Minerals | | | |
| Apachik jallp'a, apachita qopa, tierra de apachetas | – | l | 2 |
| Barro podrido | – | l | 1 |
| Ch'aqu, arcilla | – | l | 10 |
| Cheka taku | – | e | 1 |
| Dolaquispe | – | l | 1 |
| Hasnaq t'uro | – | l | 1 |
| Iglesias jallp'a, tierra de las iglesias | – | l | 1 |
| Kuti parqay | – | l | 1 |
| Lisa rumi, qespi rumi | – | l | 3 |
| Machu rumi, llampu | – | l | 2 |
| Mayu qopa, resíduos del rio | – | l | 3 |
| Mayu rumi, piedra del rio | – | l | 2 |
| Mujo rumi | – | l | 1 |
| Panteon qopa, tierra de cementerio | – | l | 3 |
| Perra hima | – | l | 1 |
| Qhaha chunta | – | l | 1 |
| Qhaha kuti | – | l | 1 |
| Rumi, cualquier piedra | – | l | 1 |
| Sal | – | e, b | 1 |
| Santuara | – | e, b | 1 |
| Taku rumi | – | l | 2 |
| Tierra donde se asustó, no vista por el sol, donde se cruzan caminos | – | l | 3 |
| Torre, cuarzo | – | l | 1 |

*l* locally collected, *e* externally obtained, *b* bought at markets, *w* wild, *c* cultivated, *d* domesticated

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