Publisher: Sapienza Grupo Editorial
R. Santa Cruz, 2187, Vila Mariana
São Paulo, Brazil
editor@sapienzaeditorial.com

Sapienza
International Journal of Interdisciplinary Studies
ISSN: 2675-9780

Knowledge of Aymara inhabitants about the ancestral knowledge and interpretation of nature, fauna, and flora in agricultural culture

Conocimiento de los habitantes aimaras sobre los saberes e interpretación de la naturaleza fauna y flora en la cultura agrícola

Conhecimento dos habitantes aimarás sobre os saberes e a interpretação da natureza, fauna e flora na cultura agrícola

Eleonor Vizcarra Herles
https://orcid.org/0000-0002-8363-5399
Professor at the Faculty of Educational Sciences of the National University of Altiplano, Peru
nvizcarra@unap.edu.pe (correspondence)

Francisco Tipula Mamani
https://orcid.org/0000-0002-8531-1443
Professor at the Faculty of Legal and Political Sciences of the National University of Altiplano, Peru

Marisol Yana-Salluca
https://orcid.org/0000-0001-7223-1201
Professor and researcher at the National University of Altiplano, Peru

Javier Montesinos Montesinos
https://orcid.org/0000-0003-0693-5619
Professor and researcher at the National University of Altiplano, Peru

Mariela Cueva Chata
https://orcid.org/0000-0003-2386-172X
Professor and researcher at the National University of Altiplano, Peru

ARTICLE HISTORY

Received: 14-12-2024
Revised Version: 20-02-2025
Accepted: 10-03-2025
Published: 31-03-2025

Manuscript type: Article

ARTICLE INFORMATION

Science-Metrix Classification (Domain):
Economic & Social Sciences
Main topic:
Decolonial Studies
Main practical implications:
The study of Aymara knowledge provides evidence into the preservation and integration of indigenous cultural systems in modern education and policymaking. By understanding the Aymara worldview and cognitive frameworks, this research can inform the design of culturally relevant educational curricula, promote the inclusion of indigenous perspectives in sustainable development programs, and strengthen efforts to safeguard intangible cultural heritage.
Originality/value:
This study provides a relevant perspective by exploring Aymara knowledge through its worldview and cognitive frameworks, highlighting its significance in contemporary contexts. Its value lies in the integration of ancestral knowledge with academic approaches, offering a foundation for the development of inclusive cultural policies and intercultural educational practices.

ABSTRACT

This research aimed to determine the knowledge level possessed by Aymara inhabitants from the *Ilave, Acora, and Huancané* areas regarding the knowledge and interpretation of nature, fauna, and flora in agricultural culture. A quantitative, non-experimental, descriptive, and cross-sectional study was conducted. The sample consisted of 50 inhabitants of both genders, selected through non-probabilistic sampling, who were administered the Questionnaire on the Perception of Nature, Flora, Fauna, and Agricultural Culture, an instrument with adequate internal consistency. The results show that the level of knowledge of 52% of Aymara inhabitants was high, 36% was very high, and 12% was moderate. Additionally, the level of knowledge about the interpretation and meaning of nature (48%), the transmission of knowledge (40%), and social and cultural integration (84%) among the inhabitants was predominantly very high. On the other hand, knowledge related to relevance and adaptation reached a high level (48%). It was concluded that the level of knowledge of the Aymara inhabitants in the *Ilave, Acora, and Huancané* areas regarding the knowledge and interpretation of nature, fauna, and flora in agricultural culture was predominantly high. Therefore, it is recommended that educational strategies and community programs be implemented to promote the preservation and transmission of this traditional knowledge.

Keywords: Aymara; ancestral knowledge; cultural adaptation; flora; fauna; decolonial studies.

RESUMO

O objetivo desta pesquisa foi determinar se existe uma relação entre a autoeficácia acadêmica e a dependência da inteligência artificial em uma amostra de estudantes universitários peruanos. Foi desenvolvido um estudo quantitativo, não experimental, correlacional e transversal. A amostra foi composta por 186 estudantes de ambos os sexos, selecionados por meio de amostragem probabilística, a quem foram aplicadas a Escala de Autoeficácia Percebida em Situações Acadêmicas e a Escala de Dependência de Inteligência Artificial, instrumentos que apresentaram propriedades métricas adequadas. Os resultados mostraram que o nível de autoeficácia acadêmica era médio, enquanto a dependência da inteligência artificial foi categorizada como moderada. Além disso, foi encontrado que os homens e os estudantes com idades entre 25 e 34 anos apresentaram níveis ligeiramente superiores de autoeficácia acadêmica, enquanto aqueles com idades entre 16 e 24 anos experimentaram maiores níveis de dependência da inteligência artificial. Por outro lado, determinou-se que o coeficiente de correlação de Pearson (r) entre ambas as variáveis foi de -0,299 ($p<0,05$). Concluiu-se que existe uma relação inversa e significativa entre a autoeficácia acadêmica e a dependência da inteligência artificial na amostra de estudantes universitários peruanos. Ou seja, à medida que a autoeficácia acadêmica aumenta, diminui o nível de dependência em relação às ferramentas de inteligência artificial.

Palavras-chave: aimará; saberes ancestrais; adaptação cultural; flora; fauna; estudos decoloniais.

RESUMEN

El objetivo de la presente investigación fue determinar nivel de conocimiento poseen los habitantes aimaras de las zonas Ilave - Acora y Huancané sobre los saberes e interpretación de la naturaleza fauna y flora en la cultura agrícola. Se desarrolló un estudio cuantitativo, no experimental, descriptivo y transversal. La muestra estuvo conformada por 50 habitantes de ambos sexos seleccionados mediante un muestreo no probabilístico a quienes se les aplicó el Cuestionario sobre la Percepción de la Naturaleza, Flora, Fauna y la Cultura Agrícola, un instrumento con adecuada consistencia interna. Los resultados muestran que el nivel de conocimiento del 52% de habitantes aimaras era alto, del 36% era muy alto y del 12% era moderado. Además, el nivel de conocimiento sobre la interpretación y significado de la naturaleza (48%), la transmisión del conocimiento (40%) y la integración social y cultural (84%) entre los pobladores fue predominantemente muy alto. Por otro lado, el conocimiento relacionado con la vigencia y adaptación alcanzó un nivel alto (48%). Se concluyó que el nivel de conocimiento de los habitantes aimaras de las zonas de Ilave - Acora y Huancané sobre los saberes e interpretación de la naturaleza, fauna y flora en la cultura agrícola fue predominantemente alto. Por lo tanto, se recomienda que se implementen estrategias educativas y programas comunitarios que promuevan la preservación y transmisión de estos saberes tradicionales.

Palabras clave: aimara; saberes ancestrales; adaptación cultural; flora; fauna; estudios decoloniales.

INTRODUCTION

The ancestral knowledge of indigenous peoples constitutes an invaluable source of knowledge that allows understanding the relationships between human communities and their environment (Jessen et al., 2022). In the Andes, where ecological conditions are particularly challenging, indigenous cultures have developed knowledge systems that integrate agroecological practices, cosmovision and sustainable management of natural resources (Saylor et al., 2017). The Aymara culture stands out for its holistic approach, in which nature is not only a utilitarian resource, but a living entity with which a constant dialogue is established (Claros, 2012). This issue becomes relevant in the current context, where indigenous cultures face risks of loss and marginalization, while their wisdom can offer concrete solutions to address global problems such as climate change, food security and environmental sustainability (Incacutipa et al., 2022).

Since the conquest period, the understanding of Andean thought has challenged the structures of western epistemology, since the Aymara worldview transcends traditional perspectives, offering a holistic understanding of the relationship between human beings and their environment (Chambers, 2020). This relationship between Andean peoples and nature is based on deep respect and harmonious coexistence, rather than on a logic of domination (Godden, 2021). According to Mantari et al. (2024), Aymara interaction with the environment is based on principles of mutual care and ecological reciprocity. In this context, Pachamama, or Mother Earth, is not perceived as an abstract entity, but as a living being that sustains life through the provision of essential ecosystem services, fostering biodiversity and agricultural sustainability (Inquilla & Chambi, 2019).

Andean knowledge is distinguished by its practical and dynamic character, always oriented towards solving daily challenges. As indicated by Jamioy (1997), this wisdom integrates "doing" with "knowing", fusing theory and praxis in agroecosystem management. This knowledge has been transmitted orally through generations, consolidating as a fundamental body of traditional ecological practices that sustain life in the Andes (Huambachano, 2019). A distinctive feature of Aymara culture is its ability to adapt and appropriate new knowledge without losing its cultural essence. Bastidas et al. (2009) emphasize that the Aymara manage to establish a creative interaction between their ancestral knowledge and agroecological innovations, through a process of "dialogue of knowledge". This not only strengthens the resilience of their agricultural systems but also allows their practices to adapt to the challenges of the modern context, ensuring the continuity and sustainability of their cultural legacy.

The interpretation of natural signs by the Aymara reflects a deep understanding of their environment, based on meticulous and sustained observation over time (Boillat & Berkes, 2013). These signals, comprising phenological, ethological and meteorological indicators, form an intricate system of bioindicators that guides agricultural decisions and ensures the sustainability of their practices. According to Berkes (1999), similar systems in other indigenous cultures demonstrate the sophistication and precision inherent in this ethnoecological knowledge. In Andean agriculture, bioindicators play an essential role in allowing farmers to synchronize their activities with natural rhythms. Studies such as that of Soejarto et al. (2000) have shown that these biological indicators help to determine the ideal times for planting and harvesting, achieving a precise adaptation to the climatic and ecological fluctuations characteristic of the agroecosystems of the altiplano.

As stated by Viguera et al. (2017), knowledge of the behavior of natural elements in the face of climate change not only facilitates adaptation, but also optimizes the planning of annual agricultural production, ensuring the resilience of these communities in the face of environmental challenges. The Aymara farmer's relationship with nature is based on a vision of reciprocity and brotherhood, which contrasts significantly with the western perspective of dominance over the environment. According to Van & Enriquez (2002), for the Andean, the coexistence between humans and the element of nature is fundamentally different. He does not consider himself the owner or king of creation, but rather a brother of other beings, because he basically shares the same universal life coming from the same Mother Earth. This conception of brotherhood transcends the symbolic, integrating itself into the interpretation and use of bioindicators for agriculture.

The interpretation of faunal signs is one of the richest and most complex manifestations of Aymara ethnoecological knowledge (Lezama et al., 2018). Farmers of this culture have developed a deep understanding of the behavior of key species such as the fox, certain amphibians and diverse birds, using them as reliable bioindicators of environmental conditions and their impact on agroecological cycles (Villarroel et al., 2024). This knowledge, inherited and perfected over generations, constitutes a valuable legacy that combines ancestral knowledge with potential modern applications in the design of sustainable and resilient agroecological systems in the Andes (Cocarico et al., 2024).

The observation of natural signals emitted by wildlife not only guides essential agricultural practices but also fosters a relationship of balance and respect towards the environment (Giagnocavo et al., 2022). As highlighted by Nugent & Laporte (2017), for centuries traditional farmers have employed behavioral patterns of fauna to anticipate seasonal changes and determine the most conducive conditions for each stage of the agricultural cycle. In parallel, Bodmer et al. (2024) document how Amazonian hunter-gatherers interpret mammal tracks and footprints to optimize their management of the territory and

ensure sustainable use of available resources. These practices reinforce the idea that local knowledge, when integrated with contemporary scientific approaches, has the potential to enrich sustainability and adaptation in the face of current climate challenges.

In the area of flora, the Aymara have cultivated a vast knowledge of the phenological cycles of native plants, using them as precise indicators of soil and climatic conditions and suitability for different crops (Sepúlveda et al., 2022). This ancestral knowledge has allowed a coevolution between traditional Andean agriculture and local biodiversity, generating agroecological practices that stand out for their diversity and resilience in the face of environmental challenges (Cocarico et al., 2025).

The use of plant signs as an agricultural guide is not exclusive to the Andes, but is part of the ethnoecological legacy of numerous indigenous communities in Latin America (Pancorbo et al., 2024). Fernández-Llamazares et al. (2017) describe how certain plant species act as bioindicators in different cultures. For example, Tsimane' farmers in Bolivia consider the appearance of the herb known as "chuchio" as an omen of favorable harvests, while the Mapuche of Chile interpret the abundance of the herb "ñocha" as a warning of possible bad harvests (Berkes et al., 2000). These observations, based on empirical knowledge transmitted from generation to generation, underscore the need to integrate traditional and scientific knowledge to promote more sustainable and adaptive agricultural systems.

According to Vizcarra et al. (2024), in order to evaluate the knowledge of the Aymara inhabitants about the knowledge and interpretation of nature, fauna and flora, four aspects should be considered: interpretation and meaning, knowledge transmission, validity and adaptation, and social and cultural integration. Interpretation and meaning implies understanding the difference between empirical and meta-empirical signs, as well as recognizing the symbolism of mythological figures, linking the signs with Andean cosmic ethics and the importance of special days and the role of the yachaq/yatiri in their interpretation. The transmission of knowledge highlights intergenerational learning, teaching young people, participation in community spaces, and efforts to document and keep this ancestral knowledge alive. In terms of validity and adaptation, the traditional signs remain relevant today, with a potential for integration with modern technologies, adapting to climatic changes and maintaining significant ritual practices. Finally, social and cultural integration highlights how the signs strengthen cultural identity, community ties and social organization, reflecting a profound relationship with nature and promoting collective decision-making.

This research is justified by the need to preserve, value and revitalize worldviews and ancestral knowledge in a globalized world, where indigenous cultures face increasing threats of disappearance, marginalization and loss of identity due to cultural homogenization. Indigenous peoples, such as the Aymara, possess knowledge systems that not only reflect a unique understanding of nature, spirituality and human relationships, but also offer viable alternatives for addressing contemporary challenges such as the climate crisis, sustainability and social cohesion. By recognizing and analyzing the cognitive, social and epistemological frameworks of this culture, the research seeks not only to preserve its legacy, but also to facilitate its integration into contemporary contexts, fostering social justice and the recognition of the collective rights of indigenous peoples. Likewise, by addressing these dimensions, intercultural dialogue is promoted, which is essential for building more equitable multicultural societies that respect and value the contributions of all cultures.

Finally, the objective of this research was to determine the level of knowledge of the Aymara inhabitants of the *Ilave - Acora and Huancané* areas about the knowledge and interpretation of nature, fauna and flora in the agricultural culture.

METHODS

Design

The study was carried out under a descriptive quantitative approach, which allowed the collection and analysis of numerical data for the purpose of identifying and characterizing the variable under investigation. A non-experimental design was used, since no deliberate manipulation of the variable was carried out; the variable was observed and recorded as it manifested itself in its natural context. In addition, a descriptive cross-sectional design was used, which allowed the characteristics of the variable to be analyzed by collecting data at a single time point.

Population and sample

The population consisted of the Aymara inhabitants of the area of South *Ilave - Acora and Huancané* in the Department of Puno (Peru). On the other hand, the sample consisted of a total of 50 inhabitants, a number determined by non-probabilistic convenience sampling. As shown in Table 1, of the total number of participants, 68% were men and 32% were women. In addition, 60% belonged to the communities of *Ilave - Acora*, while 40% belonged to the community of *Huancané*.

Table 1. Distribution of the sample.

Variables	Sociodemographic characteristics	n= 50	%
Sex	M	34	68.0
	F	16	32.0
Source	Ilave - Acora Zone	30	60.0
	Huancané Zone	20	40.0

Note. Authors' development with the research data

Instrument

An instrument specifically designed for data collection was used: the Questionnaire on the Perception of Nature, Flora, Fauna and Agricultural Culture, developed by the authors of this research. This questionnaire evaluates the participants' knowledge, perceptions and attitudes about the relationship between nature and agricultural practices, as well as the importance attributed to flora and fauna in their cultural context. It consists of 20 Likert-type items with five response options (totally disagree, disagree, neither agree nor disagree, agree and totally agree), distributed in four dimensions of five items each: interpretation and meaning, knowledge transmission, validity and adaptation, and social and cultural integration. In this study, the instrument presented a high level of internal consistency ($\alpha = 0.726$), which supports its reliability.

Procedures

For data collection, an organized and systematic process was carried out in person. First, authorization was obtained from the communities to conduct the study, guaranteeing respect for their customs and cultural norms. Once approved, visits were made to each of the target areas, where the objective of the study was explained to the participants. Subsequently, the questionnaire was administered in a suitable environment to minimize distractions and guarantee understanding of the items, providing support in case of doubts or clarifications. Finally, the questionnaires were checked for completeness before collection, ensuring the quality and validity of the data obtained.

Data analysis

Data analysis was carried out in several stages. First, the results were described through the elaboration of figures representing the distribution of percentages of the main variable and its dimensions. Next, a detailed analysis of the responses to the items was carried out, which made it possible to characterize the data collected in a clear and precise manner. This procedure facilitated the identification of trends and patterns aligned with the research objective. Finally, correlations between the main variable and its dimensions were evaluated using Spearman's rho correlation coefficient, given that the variables did not follow a normal distribution. Correlations with a p-value of less than 0.05 were considered significant.

Ethical aspects

This research was conducted following the ethical principles established in the Declaration of Helsinki. Participants were provided with a clear and detailed explanation of the objectives and nature of the study, ensuring their full understanding before obtaining their informed consent, which was given freely and voluntarily. Their autonomy was always respected, guaranteeing them the right to withdraw from the study if they so wished, without any negative consequences. In addition, rigorous protective measures were adopted to preserve the privacy and confidentiality of the data, ensuring the anonymity of the participants and managing the information collected in a secure and responsible manner.

RESULTS AND DISCUSSION

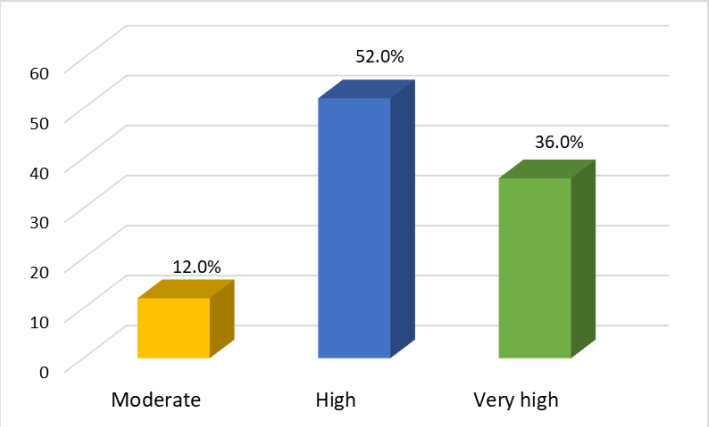
According to Figure 1, the percentage distribution of the level of knowledge of the Aymara inhabitants of the areas of *Ilave - Acora and Huancané* about the knowledge and interpretation of nature, fauna and flora in the agricultural culture shows that 52% of the participants have a high level of knowledge, followed by 36% in the very high level and 12% in the moderate level. It is important to note that no participant was placed in the low or very low levels. These results reflect that most of the participants have a considerably high level of knowledge about the evaluated topic.

In this regard, dimension "interpretation and meaning" was assessed, and the results in Figure 2 show that 48% of the participants have a very high level of knowledge about the signposts and their relationship with the Andean cosmovision, followed by 32% at the high level, 16% at the moderate level, while 4% are at the low level. It should be noted that no participant is at the very low level. This suggests that, in general, most of the Aymara inhabitants have a good knowledge about the interpretation of the signposts and their connection with nature and agricultural culture.

Furthermore, as shown in Figure 3, 40% of the participants have a very high level in the "knowledge transmission" dimension, followed by 28% in the high level, 18% in the moderate level and 14% in the low level, while no participant is in the very low level. These results reflect that a considerable proportion of the Aymara inhabitants maintain an active role in teaching, preserving and disseminating this knowledge within their communities.

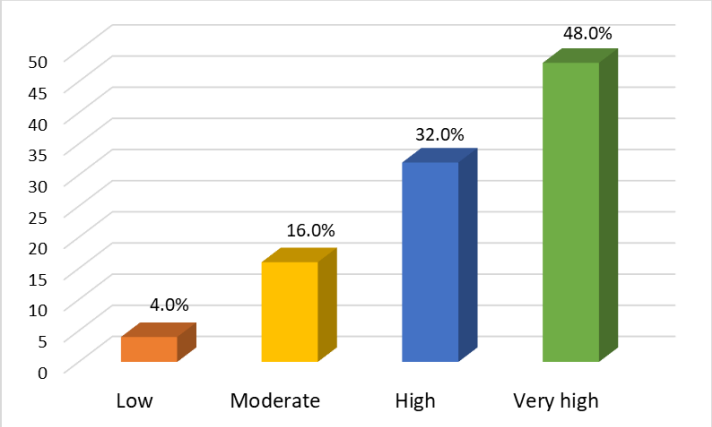
As can be seen in Figure 4, the results of the "validity and adaptation" dimension show that 48% of the participants present a high level in this dimension, followed by 22% in both the very high and moderate levels, while 8% are in the low level. It is important to note that no participant is at the very low level. These results reflect that a significant proportion of the Aymara inhabitants consider that the knowledge about signalers maintains its usefulness and relevance in the current context, adapting to climatic and technological changes, and that the practices related to this knowledge continue to be valid in the community.

Figure 1. Descriptive results for the variable knowledge about the knowledge and interpretation of nature, fauna and flora in the agricultural culture.



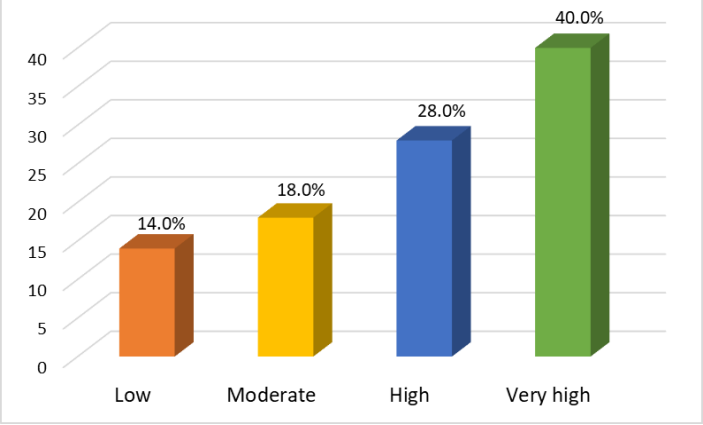
Note. Authors' development with the research data

Figure 2. Descriptive results for the interpretation and meaning dimension.



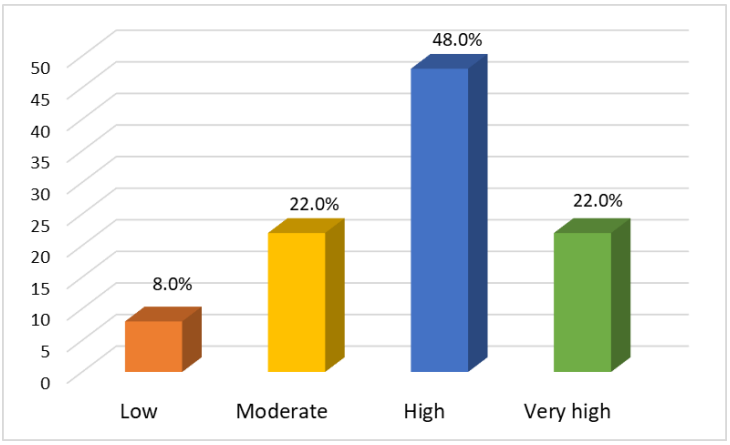
Note. Authors' development with the research data

Figure 3. Descriptive results for the knowledge transmission dimension.



Note. Authors' development with the research data

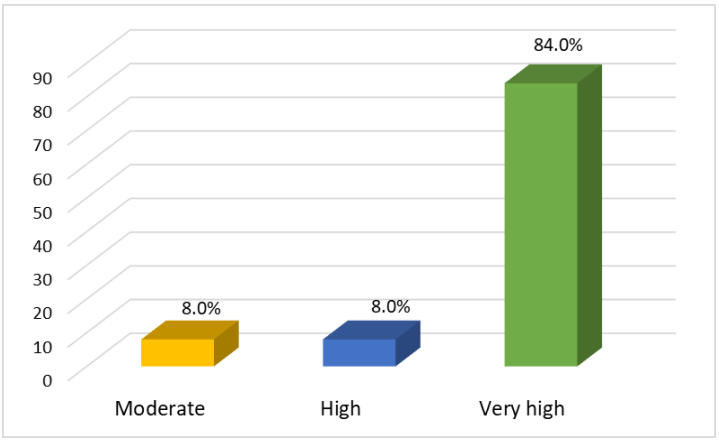
Figure 4. Descriptive results for the dimension of validity and adaptation.



Note. Authors' development with the research data

In sequence, the Figure 5 reflects the percentage distribution of the level of knowledge related to the dimension "social and cultural integration" shows that 84% of the participants are in the very high level, while 8% are in the high level and another 8% in the moderate level. It is important to note that no participant is in the low or very low levels. This result shows that the great majority of the Aymara inhabitants perceive that the signs of nature, flora and fauna play a significant role in social cohesion and the preservation of the cultural identity of their communities.

Figure 5. Descriptive results for the social and cultural integration dimension.



Note. Authors' development with the research data

Noting the results of the questionnaire, Table 2 shows that, in the dimension "interpretation and meaning", the participants stand out mainly for their high level of agreement with the importance of special days for the observation of signs and the role of the *yachaq/yatiri* in sign interpretation. In the "knowledge transmission" dimension, the most prominent item is "I have learned about signers from my parents and grandparents", followed by "teaching the young people in the family about sign interpretation".

In the dimension "validity and adaptation", participants agree with the usefulness of traditional signs in the current context. Finally, in the "social and cultural integration" dimension, participants especially value that sign interpreting contributes to maintaining cultural identity and that nature signs strengthen the bonds between community members. These results reflect a strong knowledge of and support for traditional knowledge and its relevance to daily life and social cohesion.

In that context, the Table 3 shows the correlations using Spearman's rho correlation coefficient. In this sense, a direct and highly significant correlation was found between knowledge about the knowledge and interpretation of nature, fauna and flora in agricultural culture and the dimensions interpretation and meaning ($rho = 0.554$, $p < 0.01$); knowledge transmission ($rho = 0.766$, $p < 0.01$); validity and adaptation ($rho = 0.440$, $p < 0.01$) and social and cultural integration ($rho = 0.544$, $p < 0.01$).

Table 2. Responses to the items of the Questionnaire on the Perception of Nature, Flora, Fauna and the Agricultural Culture

Dimensions	Items	TD	ED	NAND	DA	TA	Total
Interpretation and meaning	1. I understand the difference between empirical and meta-empirical signalers.	26.0%	2.0%	16.0%	12.0%	44.0%	100.0%
	2. I can interpret the symbolic meaning of the mythological signposts (fox, toad, lizard).	6.0%	0.0%	32.0%	16.0%	46.0%	100.0%
	3. I understand the relationship between the signs and the Andean cosmic ethics.	8.0%	0.0%	32.0%	18.0%	42.0%	100.0%
	4. I recognize the importance of special days for observing signs.	0.0%	0.0%	10.0%	40.0%	50.0%	100.0%
	5. I understand the role of the *yachaq/yatiri* in sign interpretation.	6.0%	0.0%	14.0%	28.0%	52.0%	100.0%
Transmission of knowledge	6. I have learned about signalers from my parents and grandparents.	0.0%	0.0%	8.0%	6.0%	86.0%	100.0%
	7. I teach the young people in my family about sign interpretation.	22.0%	2.0%	4.0%	14.0%	58.0%	100.0%
	8. I participate in community spaces where this knowledge is shared.	22.0%	0.0%	10.0%	22.0%	46.0%	100.0%
	9. Document or otherwise record the signs observed.	68.0%	4.0%	4.0%	12.0%	12.0%	100.0%
	10. I contribute to keep alive the knowledge about signalmen in my community.	10.0%	6.0%	16.0%	20.0%	48.0%	100.0%
Validity and adaptation	11. Traditional signs are still useful in today's context.	0.0%	2.0%	2.0%	12.0%	84.0%	100.0%
	12. It is possible to combine the knowledge of signalers with modern technologies.	14.0%	8.0%	38.0%	12.0%	28.0%	100.0%
	13. Community youth show interest in learning about signage.	52.0%	6.0%	16.0%	2.0%	24.0%	100.0%
	14. The signaling system adapts to current climatic changes.	18.0%	8.0%	20.0%	10.0%	44.0%	100.0%
	15. Ritual practices related to signalmen are still in force.	12.0%	4.0%	18.0%	22.0%	44.0%	100.0%
Social and cultural integration	16. Signs of nature, flora and fauna strengthen the bonds between members of the community.	0.0%	2.0%	12.0%	8.0%	78.0%	100.0%
	17. Sign interpretation contributes to maintaining our cultural identity.	0.0%	2.0%	8.0%	8.0%	82.0%	100.0%
	18. The signaling system reflects our way of relating to nature.	0.0%	2.0%	14.0%	10.0%	74.0%	100.0%
	19. Signs are important for the social organization of the community.	0.0%	4.0%	8.0%	10.0%	78.0%	100.0%
	20. Collective observation of signalers strengthens community decision making.	4.0%	0.0%	10.0%	14.0%	72.0%	100.0%

Note. Authors' development with the research data
Legend: TD= strongly disagree; ED= disagree; NAND= neither agree nor disagree; DA= agree; TA= strongly agree

Table 3. Correlation between the variable and the dimensions of the study

	Variable and dimensions	1	2	3	4	5
1.	Knowledge about the knowledge and interpretation of nature, fauna and flora in the agricultural culture.	1	-	-	-	-
2.	Interpretation and meaning	0.554**	1	-	-	-
3.	Transmission of knowledge	0.766**	0.326*	1	-	-
4.	Validity and adaptation	0.440**	-0.298*	0.210*	1	-
5.	Social and cultural integration	0.544**	0.062	0.238*	0.330*	1

Note. Authors' development with the research data
**. Correlation is significant at the 0.01 level (bilateral).
*. The correlation is significant at the 0.05 level (bilateral).

Discussion

In recent years, knowledge about the knowledge and interpretation of nature, fauna and flora in agricultural culture has gained significant relevance due to its essential role in environmental sustainability and the preservation of cultural traditions. These ancestral practices not only reflect a deep connection with ecosystems, but also offer valuable tools to face contemporary challenges, such as climate change and environmental degradation. Moreover, this knowledge is a key component for strengthening the cultural identity of farming communities and ensuring the transmission of values and practices to new generations. Therefore, this research focused on determining the level of knowledge possessed by the Aymara inhabitants of the *Ilave - Acora and Huancané* areas about the knowledge and interpretation of nature, fauna and flora in the agricultural culture.

Our main finding shows that the level of knowledge of 52% of the Aymara inhabitants of the areas of *Ilave - Acora and Huancané* was high, 36% was very high and 12% was moderate. This indicates that most of the population has a solid and deep knowledge about the knowledge and interpretation of nature, fauna and flora in the agricultural culture, showing a close relationship with the traditional practices transmitted from generation to generation. This level of understanding not only reflects the ability to interpret natural phenomena and their relationship with daily life, but also a cultural rootedness that strengthens community identity. It also shows how this knowledge plays a key role in the adaptation and sustainability of agricultural activities, while ensuring the continuity of an invaluable legacy that combines elements of empirical observation, spirituality and social cohesion within these Aymara communities.

The exposed result is consistent with what was pointed out by Alanoca & Apaza (2018), who highlighted that environmental protection strategies still in force in Aymara communities persist despite homogenization efforts promoted by different development programs and academia. This knowledge, deeply rooted in the conception of "mother earth" as the central axis of life, sustains Aymara cultural practices and ways of life. They also constitute a strength for local organizations, since they are activated as defense mechanisms against external threats or attacks. These traditional practices not only reflect cultural resistance but also position themselves as viable and hopeful alternatives to the challenges of social and environmental collapse facing contemporary society.

In addition, it is related to that reported by Calisaya et al. (2023), who found that the ancestral knowledge of the Aymara communities, such as practices related to the "*achachilas*" and other cultural manifestations, play a fundamental role in the connection with the natural environment and the preservation of cultural heritage. These authors emphasize that knowledge management can be a key tool for rescuing and promoting oral traditions and ancestral practices, ensuring their continuity and fostering a change of attitude towards their valuation. Thus, both studies agree on the relevance of traditional knowledge as a basis for cultural identity and its potential as an educational and social strategy to strengthen the appropriation of this legacy by communities and society in general.

From an epistemological perspective, this knowledge constitutes a knowledge system of its own, built from respectful interaction with the environment and transmitted through orality and daily practice. Far from being "primitive" knowledge, the complexity of signal reading demonstrates the depth of Aymara thinking about natural cycles and ecosystemic interrelationships (Vizcarra et al., 2024). This dynamic and situated knowledge has validity in its own terms, framed in the cosmovision that gives it origin. In addition, scientific studies support these practices by evidencing the close relationship between the biological cycles of fauna and the climatic and phenological patterns that determine the success of harvests (Bixler et al., 2020).

Another finding shows that the level of knowledge about the interpretation and meaning of nature, knowledge transmission and social and cultural integration among the villagers was predominantly very high. On the other hand, knowledge related to survival and adaptation reached a high level. These results indicate that the inhabitants have a deep and well-founded understanding of the knowledge and practices associated with their natural environment, as well as their relevance and application in daily life. This level of knowledge not only reflects a strong attachment to ancestral traditions, but also the capacity to transmit and apply this knowledge in a socially integrated manner, which reinforces cultural continuity and its adaptation to current challenges.

The above is consistent with the findings of Apaza (2019), who determined that the traditional knowledge of native peoples, such as the Aymara, is deeply rooted in a relationship of complementarity and respect with nature, in which not only the environment is understood materially, but also spiritually. The author points out that the vision of Pachamama, in the Aymara cosmovision, is not limited to an anthropocentric understanding, but establishes an interrelationship that is fundamental for sustainability and community life. This argument, which emphasizes the deep and holistic connection with the natural environment, is reflected in the high levels of knowledge and respect for ancestral knowledge that predominate in the Aymara communities, as observed in the results obtained in this research

This research has the strength of rescuing and making visible the Aymara ancestral knowledge related to the interpretation of nature, fauna and flora in the agricultural culture, offering a perspective that values and legitimizes this knowledge as an own and dynamic system. In addition, a detailed analysis was carried out that integrates both cultural dimensions and agricultural practices, which made it possible to identify patterns of deep and significant knowledge in the population studied. This not only contributes to the preservation of cultural heritage but also establishes a bridge between traditional knowledge and scientific evidence, strengthening the understanding of ecosystemic interrelationships and their importance for agricultural sustainability in local contexts.

Limitations of the study

It should be noted that this study has certain limitations that should be considered when interpreting the results. First, the research was conducted in a single region, which restricts the generalizability of the findings to other localities. In addition, the use of a self-administered instrument could have introduced biases in the responses, such as the tendency of participants to respond in a socially desirable manner. On the other hand, the cross-sectional design of the study provides a look at the perceptions and behaviors of the villagers at a specific moment in time, without allowing us to analyze their evolution over time. To address these limitations, it would be advisable to expand the sample, include participants from different regions and use complementary data collection methods, such as qualitative interviews or longitudinal studies, to obtain a deeper and more dynamic view of the phenomenon under investigation.

FINAL REMARKS

Nature's signals from flora and fauna throughout the year play an important role in the understanding and adaptation of both ecosystems and the Aymara people. These signals, which include changes in animal behavior, flowering patterns, bird migration and other natural phenomena, act as environmental indicators that guide agricultural, pastoral and ceremonial activities. They also reflect an ancestral knowledge deeply rooted in the Aymara cosmovision, where an interconnection between the elements of nature and the cycle of life is perceived. This knowledge not only allows communities to predict climatic events and prepare survival strategies but also fosters a respectful and symbiotic relationship with their environment, ensuring cultural and ecological sustainability over time.

The present study determined that the level of knowledge of the Aymara inhabitants of the *Ilave - Acora and Huancané* areas about the knowledge and interpretation of nature, fauna and flora in the agricultural culture was predominantly high. This means that these communities retain a deep and significant understanding of natural patterns, as well as their relationship with agricultural and climatic cycles. This knowledge, transmitted through generations, reflects the importance of the Aymara cosmovision in decision-making related to agriculture, animal husbandry and ritual practices. It also evidences the ability of these communities to interpret signals from the natural environment, such as changes in the behavior of fauna or the flowering of certain plants, which allows them to adapt and respond effectively to seasonal and climatic variations. This is confirmed when analyzing the dimensions of interpretation and meaning, knowledge transmission, validity and adaptation, and social and cultural integration, where the predominant levels of knowledge were found to be in the high and very high categories.

Therefore, it is recommended that educational strategies and community programs be implemented to promote the preservation and transmission of this traditional knowledge. It is also essential to encourage the active participation of new generations in the interpretation and practice of knowledge related to nature, fauna and flora, thus ensuring its validity and adaptation to social and environmental changes. In addition, it is suggested that complementary research be carried out to broaden the understanding of this knowledge in other regions and cultural contexts, strengthening its integration into sustainable development and intercultural education policies.

REFERENCES

Alanoca, V., & Apaza, J. (2018). Saberes de protección ambiental y discriminación en las comunidades de aymaras de Ilave. *Revista de Investigaciones Altoandinas - Journal of High Andean Research, 20*(1), 95–108. https://doi.org/10.18271/ria.2018.333

Apaza, Y. K. (2019). Non-western epistemology and the understanding of the Pachamama (environment) within the world(s) of the Aymara identity. *International Journal for Crime, Justice and Social Democracy, 8*(3), 6–22. https://doi.org/10.5204/ijcjsd.v8i3.1241

Bastidas, A. M., Perez, B. F., Torres, J. N. Ospina, P. G., Arango, C. A., & Peñaranda, C. F. (2009). El diálogo de saberes como posición humana frente al otro: referente ontológico y pedagógico en la educación para la salud. *Investigación y Educación en Enfermería, 27*(1), 104–111. http://www.scielo.org.co/pdf/iee/v27n1/v27n1a11.pdf

Berkes, F. (1999). *Sacred ecology: Traditional ecological knowledge and resource management*. Taylor & Francis.

Berkes, F., Colding, J., & Folke, C. (2000). Rediscovery of traditional ecological knowledge as adaptive management. *Ecological Applications, 10*(5), 1251-1262. https://doi.org/10.2307/2641280

Bixler, R. D., Koskella, B., Pickersgill, I., & Schumer, G. (2020). Phenology links wildlife ecology with sustainable agriculture. *Nature Food, 1*(3), 145-146.

Bodmer, R. E., Puertas, P., Fang, T., Antúnez, M., Soplín, S., Caro, J., Pérez, P., El Bizri, H. R., Arenas, M., Nieto, J. C., Kirkland, M., & Mayor, P. (2023). *Management of subsistence hunting of mammals in Amazonia: A case study in Loreto, Peru*. Springer. https://doi.org/10.1007/978-3-031-43071-8_10

Boillat, S., & Berkes, F. (2013). Perception and interpretation of climate change among Quechua farmers of Bolivia: Indigenous knowledge as a resource for adaptive capacity. *Ecology and Society, 18*(4). https://doi.org/10.5751/ES-05894-180421

Calisaya, J. D. C., Yana-Salluca, M., Adco-Valeriano, H., Monrroy, D. E. H., Yana-Salluca, N., Herles, N. E. V., & Huanca-Arohuanca, J. W. (2023). Knowledge Management: The Siku, an Aboriginal Aymara Ethnic Group and Cultural Heritage of the Andean Highlands. *Journal of Law and Sustainable Development, 11*(11), e1531. https://doi.org/10.55908/sdgs.v11i11.1531

Chambers, P. A. (2020). Epistemology and domination: Problems with the coloniality of knowledge thesis in Latin American decolonial theory. *Dados, 63*(4), e20190147. https://doi.org/10.1590/dados.2020.63.4.221

Claros, E. (2012). Fauna y flora en el Vocabvlario de la lengva aymara de Ludovico Bertonio. *Revista Ciencia y Cultura, 16*(28), 175–216. https://cienciaycultura.ucb.edu.bo/a/article/view/394

Cocarico, S., Rivera, D., Beck, S., & Obón, C. (2024). Qarasiña culinary tradition: Conserving quinoa (Chenopodium quinoa) as an intangible cultural heritage in Jach'a Puni (Andean community), Bolivia. *Heritage, 7*(10), 5390–5412. https://doi.org/10.3390/heritage7100254

Cocarico, S., Rivera, D., Beck, S., & Obón, C. (2025). Agrobiodiversity as a reservoir of medicinal resources: Ethnobotanical insights from Aymara communities in the Bolivian Andean Altiplano. *Horticulturae, 11*(1), 50. https://doi.org/10.3390/horticulturae11010050

Fernández-Llamazares, Á., Díaz-Reviriego, I., Luz, A. C., Cabeza, M., Pyhälä, A., & Reyes-García, V. (2017). Rapid ecosystem changes challenge the adaptive capacity of local environmental knowledge. *Global Environmental Change, 31*, 272-284. https://doi.org/10.1016/j.gloenvcha.2015.02.001

Giagnocavo, C., De Cara-García, M., González, M., Juan, M., Marín-Guirao, J. I., Mehrabi, S., Rodríguez, E., Van der Blom, J., & Crisol-Martínez, E. (2022). Reconnecting farmers with nature through agroecological transitions: Interacting niches and experimentation and the role of agricultural knowledge and innovation systems. *Agriculture, 12*(2), 137. https://doi.org/10.3390/agriculture12020137

Godden, N. J. (2021). Community work, love and the indigenous worldview of buen vivir in Peru. *International Social Work, 64*(3), 354–370. https://doi.org/10.1177/0020872820930254

Huambachano, M. (2019). Traditional ecological knowledge and indigenous foodways in the Andes of Peru. *Review of International American Studies, 12*(1), 87–110. https://doi.org/10.31261/rias.6866

Incacutipa, D. J., Puma, J. S., & Cahuanihancco, C. (2022). Trayectorias migratorias de los aymaras del altiplano peruano. *Alteridades, 1*(63), 107-118. https://doi.org/10.24275/uam/izt/dcsh/alteridades/2022v32n63/Incacutipa

Inquilla, J., & Chambi-Apaza, E. (2019). Symbolic communication and the notion of "Pachamama" in the "Quechua" and "Aimara" cultures. *International Journal of English Literature and Social Sciences, 4*(2), 504–512. https://doi.org/10.22161/ijels.4.2.47

Jamioy, J. (1997). Los saberes indígenas son patrimonio de la humanidad. *Nómadas, 4*(2), 64–73. https://www.redalyc.org/pdf/1051/105118909006.pdf

Jessen, T. D., Ban, N. C., Claxton, N. X., & Darimont, C. T. (2021). Contributions of Indigenous Knowledge to ecological and evolutionary understanding. *Frontiers in Ecology and the Environment, 20*(2), 93–101. https://doi.org/10.1002/fee.2435

Lezama, P. R., Santos-Fita, D., & Vallejo, J. R. (2018). Herding ecologies and ongoing plant domestication processes in the Americas. *Frontiers in Plant Science, 9*, 649. https://doi.org/10.3389/fpls.2018.00649

Mantari, M. A., Pari, Y. L. C., Cruz, R. G. A., & Flores-Mamani, E. (2024). Suma jakaña: Interacción socio-ética familiar y comunitaria aimara. *Revista de Gestão Social e Ambiental, 18*(5), e08122. https://doi.org/10.24857/rgsa.v18n5-166

Nugent, R., & Laporte, N. (2017). Naturenomics: Incorporating nature into urban economic policy plans and practices. *Economía Agraria y Recursos Naturales, 17*(2), 119-137.

Pancorbo, M., Parra-Rondinel, F., Torres-Guevara, J., Cruz-Soriano, A., & Casas, A. (2024). Gathering, agriculture, and exchange: an ethnoecological approach to the study of food patterns and feedstuff sources in communities of the Central Andes, Peru. *Journal of Ethnobiology and Ethnomedicine, 20,* 69. https://doi.org/10.1186/s13002-024-00705-9

Saylor, C. R., Alsharif, K. A., & Torres, H. (2017). The importance of traditional ecological knowledge in agroecological systems in Peru. International *Journal of Biodiversity Science, Ecosystem Services & Management, 13*(1), 150–161. https://doi.org/10.1080/21513732.2017.1285814

Sepúlveda, G., Muñoz, I., Cifuentes, D., & Muñoz-Torres, P. (2022). Agricultural activities and economic projections of Aymara communities in the Lluta river basin and Precordillera of the Arica and Parinacota Region. *Idesia (Arica), 40*(3), 103-118. https://dx.doi.org/10.4067/S0718-34292022000300103

Soejarto, D. D. (2000). Forest plot as a tool in a biodiversity-based plant selection approach in a natural products drug discovery program. *Advances in Natural Science (Hanoi), 1*(S1), 9–15.

Van, J., & Enríquez Salas, P. (2002). *Señas y señaleros de la santa tierra agronomía andina*. Abya Yala.

Viguera, B., Martínez-Rodríguez, M.R., Donatti, C., Harvey, C.A. y Alpízar, F. (2017). *Impactos del cambio climático en la agricultura de Centroamérica, estrategias de mitigación y adaptación. Materiales de fortalecimiento de capacidades técnicas del proyecto CASCADA*. Conservación Internacional.

Villarroel, G., Gavilán, V., Apaza, R. D., & Roel, P. (2024). *Aymara. Conocimientos, saberes, prácticas y rituales agropecuarios y alimentarios*. CRESPIAL.

Vizcarra, E., Tipula, F., Yana-Salluca, M., Montesinos, J., & Cueva, M. (2024). Interpretation of nature, fauna, and flora in the agricultural culture of Aymara people: A qualitative study. *Evolutionary Studies in Imaginative Culture, 8*(2), 1952–1967. https://doi.org/10.70082/esiculture.vi.1889. https://doi.org/10.1006/ceps.1999.1016

Contribution of each author to the manuscript:

	% of contribution of each author				
Task	**A1**	**A2**	**A3**	**A4**	**A5**
A. theoretical and conceptual foundations and problematization:	20%	20%	20%	20%	20%
B. data research and statistical analysis:	20%	20%	20%	20%	20%
C. elaboration of figures and tables:	20%	20%	20%	20%	20%
D. drafting, reviewing and writing of the text:	20%	20%	20%	20%	20%
E. selection of bibliographical references	20%	20%	20%	20%	20%
F. Other (please indicate)	-	-	-	-	-

Indication of conflict of interest:

There is no conflict of interest

Source of funding

The research was funded by the National University of Altiplano in Puno, Peru, and was developed within the research project PI FEDU-2023-2187-UNAP.

Acknowledgments

There is no acknowledgment