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RESEARCH ARTICLE

Knowledge Evaluation of the One Health Approach in Ecuadorian Veterinary Medicine Students

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Abstract: Currently, the understanding of the One Health Approach among veterinary medicine students in Ecuador is necessary to ensure human, animal, and environmental health. This study aimed to assess students' knowledge of the One Health Approach and its relevance in their academic training, providing the first nationwide evaluation of this concept among veterinary students in Ecuador. An online cross-sectional study was conducted among veterinary medicine students from 19 Ecuadorian universities to evaluate their knowledge of the One Health Approach and their perception of its relevance in their professional training. It was found that the 56.07% (291/519) of students had satisfactory knowledge of the One Health Approach and that their perception was positive (>50%) towards its practical application in the veterinary area. Furthermore, there was a significant variation between knowledge of the concept and academic level ($p<0.001$), with a higher proportion being satisfactory among students from the sixth to the tenth cycle or semester. It is essential to improve education on the One Health Approach in the veterinary medicine curriculum in Ecuador to prepare future professionals to comprehensively address public, animal, and environmental health challenges. This improvement in training can contribute significantly to the promotion of public health and animal welfare in the country.

Keywords: One Health, Ecuador, Veterinary Education

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Introduction

In the current landscape of veterinary education, the One Health Approach emerges as an essential paradigm that recognizes the interdependence between human, animal, and environmental health [1]. This approach promotes a holistic understanding of health problems, underscoring the importance of interdisciplinary collaboration to address complex challenges [2].

"One Health" appeared in 2004, becoming a trend throughout the world, given that in the last 5 years its search has increased. In developing countries in Latin America, the topic is relatively new and is just beginning to be implemented [3].

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In Ecuador, there have been significant advances in the integration of the One Health Approach in the training of veterinary medicine students. In recent years, various government and academic initiatives have promoted the inclusion of this approach in study plans and research work [4, 5], recognizing its relevance to addressing public health and animal welfare problems.

Despite progress, knowledge gaps persist regarding the understanding and practical application of the One Health approach among veterinary medicine students in Ecuador. This gap needs to be addressed to ensure comprehensive training that prepares future professionals to meet challenges effectively [6].

The importance of this integration lies in its ability to prepare future veterinary professionals to effectively face emerging challenges in public health and animal welfare in Ecuador [7]. By understanding the interconnection between human, animal, and environmental health, these students will be better equipped to promote public health and prevent the spread of zoonotic diseases [8].

We further hypothesize that greater integration of the One Health Approach into the veterinary medicine curriculum will contribute to better student understanding of the interconnection between human, animal, and environmental health and promote more effective practices in the management of zoonotic diseases.

Some research has been conducted to assess the knowledge and understanding of “One Health” and zoonotic diseases in veterinary medicine students [9-12]. Considering they are healthcare professionals and play a fundamental role in the prevention and control of diseases in humans and animals. However, in Ecuador, this is the first nationwide study that aimed to evaluate the knowledge and perception of the One Health Approach among veterinary medicine students, identifying areas for improvement in academic training.

Materials and Methods

Study Area

This work was carried out on veterinary medicine students from Ecuador. The country is located in South America, bordering Colombia to the north; to the south and east with Peru; and the west with the Pacific Ocean. It has an area of 256,370 km2. In the research, an online survey was applied in 19 faculties or courses of veterinary medicine in the 11 provinces of the country that have such academic offerings (Fig. 1).

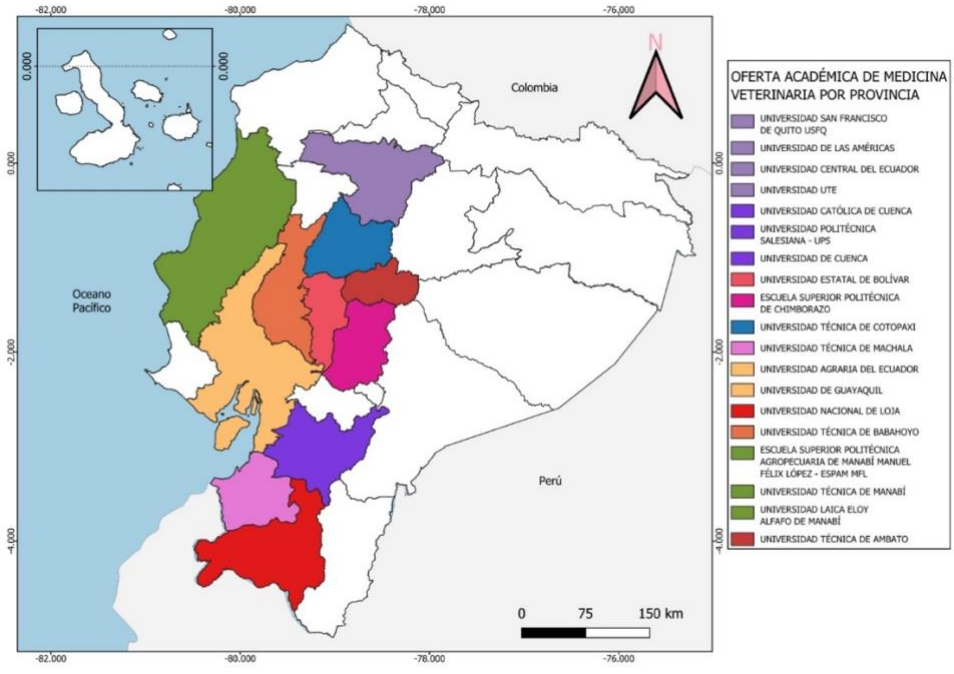

Fig. 1: Provinces that have veterinary medicine in Ecuador

Sample Design and Sample Size

An online cross-sectional study was conducted from August to September 2022. This research had responses from 519 students from 19 faculties or degrees of veterinary medicine in Ecuador.

Design, Pre-test, and Questionnaire Administration

The questionnaire was structured with 29 items related to demography, knowledge, and perception of the benefits of the concept of “One Health”. In the demography section, the survey had variables of age, genre, region, university, and academic level; as for the knowledge evaluation section, the concept, components, importance, applications, and zoonotic diseases in Ecuador. The third section was about the perception according to the approach, inconvenience, benefits, progress in capabilities, surveillance, and disease prevention.

We Use the Likert Scale to Measure this Perception

The questionnaire was pretested among twenty veterinary students at the National University of Loja. Once standardized, the questions were uploaded to Google Forms, and the link was sent through WhatsApp to veterinary medicine students across the country.

Data Processing and Analysis

Variables were presented in a descriptive way; absolute and relative frequencies were used for categorical variables. To evaluate associated factors with the knowledge of "One Health", a dependent variable called “knowledge” was created using a numerical scoring system based on previous references [10, 13]. In this method, the answers to the knowledge section were scored as “1” to “0” for “correct” and “incorrect”, respectively. The ones who selected the “Do not know” option were considered incorrect answers. Then, all the answers were added and were categorized in a binary variable as "satisfactory" or "unsatisfactory" using a defined cut-off point. The punctuations of knowledge in the participants vary between one and 15 (with a mean of 12.2±3.0) from a maximum of 15 possible points. The cut-off point for satisfactory scores was set as any score greater than the mean of 12.2.

Once the dependent variable was created, it was related to the demographic variables using two statistical analyses, one bivariate using the Chi-square or Fisher statistical test when Cochran's assumptions were not met, and another multivariate using binomial regression. In all cases, a significance level of 5% was considered, and the statistical program R version 4.2.3 was used.

Results

Perception and Knowledge of the Concept of One Health

In the present research, a total of 519 students from 17 out of the 19 universities that have a degree in veterinary medicine in the country were surveyed. More than a third were under 24 years of age (78.81%), and the majority were women (65.32%) from the mountain region (55.11%). At least three students from each institution responded to the survey sent, and more than a quarter of responses were from the National University of Loja (27.94%). Regarding the academic level, there was greater participation by students in the first and ninth cycles or semesters (Table 1).

Regarding knowledge of the “One Health” concept, it was evident that a large percentage of respondents (95.38%) understand that it is an integrated and unified approach for the sustainable balance and optimization of human, animal, and ecosystem health. Likewise, more than a third of the students (93.83%) know that the components of the “One Health” concept are: animal health, human health, and environmental health. A high percentage (82.66%) know that the importance of "One Health" lies in its ability to develop and implement programs, policies, and laws to improve the health of all species.

Similarly, a greater proportion of participants (82.66%) stated that the "One Health" concept is aimed at disease control, antibiotic resistance, food security, climate change, and other threats. It is also highlighted that the majority (>50%) know that the diseases: rabies, tuberculosis, brucellosis, leptospirosis, COVID-19, leishmaniasis, toxoplasmosis, salmonellosis, and heartworms are zoonotic, and almost half of those surveyed do not consider Q fever (43.74%) and eosinophilic meningitis

(45.66%) as zoonotic diseases. Overall, the majority of students (56.07%) demonstrated satisfactory knowledge scores of the "One Health" approach (Table 2).

Table 1: Demographic characteristics from the survey

Characteristics	n	%
Age		
Older than 24	110	21.19
Younger than 24	409	78.81
Genre		
Male	172	33.14
Female	339	65.32
Other	8	1.54
Region of origin		
Coast	199	28.34
Insular	2	0.39
Amazon	32	6.17
Highlands	286	55.11
The university to which they belong		
Chimborazo Polytechnic Higher School	7	1.35
Agrarian University of Ecuador	4	0.77
Catholic University of Cuenca	5	0.96
Central University of Ecuador	22	4.24
Cuenca University	31	5.97
Guayaquil University	126	14.28
University of the Americas	39	7.51
Bolivar State University	5	0.96
Loja National University	145	27.94
Salesian Polytechnic University	6	1.16
San Francisco de Quito University	8	1.54
Technical University of Ambato	35	6.74
Babahoyo Technical University	11	2.12
Technical University of Cotopaxi	4	0.77
Technical University of Machala	45	8.67
Technical University of Manabi	3	0.58
Equinoccial Technological University	23	4.43
Academic level		
First	84	16.18
Second	32	6.17
Third	27	5.20
Fourth	50	9.63
Fifth	40	7.71
Sixth	66	12.72
Seventh	57	10.98
Eight	32	6.17
Nineth	84	16.18
Tenth	47	9.06

When evaluating the perception of the benefits of "One Health", it was noted that a high percentage (86.90%) agreed that the concept seeks to focus the mobilization of various academic disciplines and society to promote well-being and avoid health threats. health and the environment. A total of 78.03% were in favour of antimicrobial resistance being a problem

considered by the "One Health" approach, in the same way as environmental contamination (82.85%), food safety and security (83.24%), zoonotic diseases (93.45%), and climate change (65.70%).

Table 2: Knowledge of One Health in the surveyed

Knowledge	Yes (n, %)	No (n, %)	Do not know (n, %)
One Health is an integrated and unified approach for the sustainable equilibrium and the optimization of human, animal, and ecosystem health.	495 (95.38)	1 (0.19)	23 (4.43)
The components of the “One Health" concept are animal health, human health, and environmental health.	487 (93.83)	5 (0.96)	27 (5.20)
The importance of “One Health” lies in its ability to develop and implement programmes, policies, and laws that will improve the health of all living beings.	429 (82.66)	14 (2.70)	76 (14.64)
The concept “One Health” is oriented to the control of diseases, antibiotic resistance, food safety, climate change, and other threats.	429 (82.66)	20 (3.85)	70 (13.49)
¿What diseases do you consider zoonotic?			
Q fever	159 (30.64)	133 (25.63)	227 (43.74)
Rabies	459 (88.44)	38 (7.32)	22 (4.24)
Tuberculosis	351 (67.63)	87 (16.76)	81 (15.61)
Brucellosis	412 (79.38)	37 (7.13)	70 (13.49)
Leptospirosis	366 (70.52)	54 (10.40)	99 (19.08)
COVID-19	330 (63.58)	127 (24.47)	62 (11.95)
Eosinophilic meningitis	145 (27.94)	137 (26.40)	237 (45.66)
Leishmaniasis	271 (52.22)	77 (14.84)	171 (32.95)
Toxoplasmosis	387 (74.57)	52 (10.02)	80 (15.41)
Salmonellosis	406 (78.23)	52 (10.02)	61(11.75)
Dirofilariasis	239 (46.05)	121 (23.31)	159 (30.64)

Table 3: Perception of “One Health” benefits in the surveyed

Perception	Agree (n, %)	Disagree (n, %)	Null (n, %)
One Health seeks to focus on the mobilization of various academic disciplines and society to promote well-being and avoid threats to health and the environment.	451 (86.90)	9 (1.73)	59 (11.37)
Problems considered by the "One Health" concept			
Antimicrobial Resistance	405 (78.03)	35 (6.74)	79 (15.22)
Environmental Contamination	430 (82.85)	50 (9.63)	39 (7.51)
Food safety and security	432 (83.24)	38 (7.32)	49 (9.44)
Zoonotic diseases	485 (93.45)	13 (2.50)	21 (4.05)
Climate Change	341 (65.70)	77 (14.84)	101(19.46)
The multiple benefits of "One Health" range from agriculture to science, from education and training to politics, and from information to the economy.	361 (69.56)	46 (8.86)	112 (21.58)
The One Health approach helps provide more information and knowledge through knowledge sharing and transfer, and enhances capacity development.	415 (79.96)	26 (5.01)	78 (15.03)
The "One Health" approach leads to the control and prevention of diseases for humans and/or animals, such as in pandemic situations.	467 (89.98)	13 (2.50)	39 7.51)

Most participants (69.56%) agreed that the multiple benefits of “One Health” range from agriculture to science, from education and training to politics, and from information to the economy. Also, around three-quarters of respondents (79.96%) agree that the One Health approach helps provide more information and knowledge through knowledge sharing and transfer and improves capacity development, although a minority of respondents (15.03%) took a neutral stance. Finally, a total of 89.98% of students agreed that the "One Health" approach leads to the control and prevention of diseases for humans and/or animals, such as in pandemic situations (Table 3).

Table 4: Factors that influence the knowledge of One Health in the surveyed

Characteristics	Satisfactory (n, %)	Unsatisfactory (n, %)	p
Age			
Older than 24	69 (62.70)	41 (37.30)	0.113
Younger than 24	222 (54.30)	187 (45.70)	
Genre			
Male	100 (58.10)	72 (41.90)	0.759
Female	187 (55.20)	152 (44.80)	
Other	4 (50)	4 (50)	
Region of origin			
Coast	108 (54.30)	91 (45.70)	0.904
Insular	1 (50)	1 (50)	
Amazon	18 (56.20)	14 (43.80)	
Highlands	164 (57.30)	122 (42.70)	
The university to which they belong			
Coast	99 (52.40)	90 (47.60)	0.200
Highlands	192 (58.20)	138 (41.20)	
Academic level			
1-5 cycles or semesters	103 (44.20)	130 (55.80)	0.001*
6-10 cycle or semester	188 (65.70)	98 (24.30)	

*It is referred to as significant values in p<0.05

Subsequently, in the regression models, it was also found that the frequency of satisfactory knowledge was higher in students from the 6th to 10th academic semester compared to those from the 1st to 5th (PR: 1.49; 95%CI 1.25-1.76). This significant association remained after adjusting for age, gender, region of origin, and university to which it belongs; therefore, the prevalence of satisfactory knowledge in students from the 6th to 10th academic year was 52% higher compared to the students from 1st to 5th academic cycle (PR: 1.52; 95%CI 1.28-1.80) (Table 5).

Table 5: Prevalence ratios adjusted to the factors that affect the knowledge of One Health in the surveyed

Characteristics	Bivariate analysis			Multiple Regression*		
	PR	95%CI	p	PR	95%CI	p
Age						
Older than 24	Ref.			Ref.		
Younger than 24	0.87	0.73 – 1.02	0.094	1.01	0.85 – 1.20	0.914
Genre						
Male	Ref.			Ref.		
Female	0.95	0.81 – 1.11	0.517	0.96	0.83 – 1.12	0.592
Other	0.86	0.43 – 1.74	0.675	0.81	0.38 – 1.71	0.576
Region of origin						
Coast	Ref.			Ref.		

Insular	0.92	0.23 – 3.71	0.908	1.23	0.72 – 2.09	0.448
Amazon	1.04	0.74 – 1.44	0.832	0.86	0.58 – 1.26	0.426
Highlands	1.06	0.90 – 1.24	0.506	0.93	0.73 – 1.19	0.583
The university to which they belong						
Coast	Ref.			Ref.		
Highlands	1.11	0.94 – 1.31	0.209	1.21	0.94 – 1.55	0.142
Academic level						
1-5 cycles or semesters	Ref.			Ref.		
6-10 cycles or semesters	1.49	1.26 – 1.76	<0.001	1.52	1.28 – 1.80	<0.001

* Adjusted by age, gender, region of origin, university of origin, and academic level. PR: Prevalence ratio. 95% CI: 95% confidence interval

Discussion

The present study examined the knowledge and perception of the “One Health” approach among veterinary medicine students in Ecuador. It was found that the majority of students had a satisfactory understanding of the concept, demonstrating that they know the approach and its interrelationship with human, animal, and ecosystem health. Furthermore, their perception was positive about its practical application in the veterinary area; the participants agreed that the approach promotes well-being and avoids health and environmental threats since the majority consider that the problems addressed by this concept concern antimicrobial resistance, environmental contamination, food safety and security, and zoonotic diseases, and climate change. Knowledge of the concept and the academic level was associated, demonstrating that there is more satisfactory knowledge in students from the sixth to the tenth cycle or semester.

The findings of this study are consistent with previous research that has demonstrated high knowledge about "One Health" among veterinary medicine students, for example, in a work by Subedi et al. [10] carried out in Nepal, it is noted that more than 90% of respondents know about the approach. Also, Wong and Kogan [12], in their survey applied to veterinary medicine students at Colorado State University, stated that 74.2% of students were familiar with “One Health” since 34.4% participated in activities related to the concept. Likewise, a study carried out in Chile by Troncoso et al. [11] on the knowledge of veterinary medicine students about infections transmitted from vertebrate animals to humans indicates that 58.6% had a very good level of knowledge.

The elements that contribute to students knowing “One Health” are the courses related to the approach taught by some universities, either through subjects included in the curriculum of the degree or faculty, conferences, or programs. These courses are mostly related to ethology and animal welfare, epidemiology, sanitary control, microbiology, public health preservation, ecology and environment, and food quality and safety. In addition, there are clubs or programs where students actively participate, for example in Ecuador there is the FUCOBI foundation of the Technical University of Machala, the “One Health” program of the San Francisco University of Quito, the Research Center for Health in Latin America (CISeAL) of the Pontifical Catholic University of Quito and the “One Health” research group of the University of the Americas of Quito. However, in veterinary medicine faculties or careers, there are still no mandatory activities related to “One Health” that contribute to the satisfactory knowledge of students.

Regarding the perception of the benefits of "One Health", some works also show a positive effect, such as Subedi et al. [10], presented results in which 91.3% of respondents agreed with the usefulness of focusing on the challenges that threaten the health of living beings, considering antimicrobial resistance (88.6%), zoonotic diseases (97.3%), food safety and security (89.9%), vector-borne diseases (86.5%) and environmental contamination (92.2%). This is due to the courses, conferences, clubs, and programs that have directly and indirectly influenced the knowledge of the participants.

Likewise, Kovacevic et al. [9], in their work aimed at knowledge and understanding of antimicrobial administration among veterinary students in Serbia and Croatia, show that more than half of the participants (56.8%) consider that the veterinary use of antimicrobials contributes strongly to the antimicrobial resistance (AMR), although there is a quarter of students (13.1%) who do not know how to use antibiotics to minimize the risk of developing AMR, since they think that the amount of teaching time in the subject of pharmacology is little. However, there are studies in which there is not a completely favourable perception towards an approach such as the one developed in Spain by Franco-Martínez et al. [14], which determines that only between

40 and 50% of veterinary students agree that “One Health” improves the lives of people, the lives of animals, and the environment.

On the other hand, in the present investigation, a statistical association was determined between the academic level and knowledge of "One Health" since the sixth to the tenth cycle or semester, they show satisfactory knowledge of the approach (65.7%), in comparison with the students of first to fifth cycle (44.2%). These results agree with the study by Subedi et al. [10], which showed satisfactory knowledge in recent graduates and postgraduate students compared to lower cycle students (71.4%). In another work by Dhakal et al. [15], it is also evident that veterinary students at higher levels tend to have satisfactory knowledge of topics related to One Health compared to those at lower levels. Similarly, in a study by Fasina et al. [16] regarding the use of antimicrobials, final-year students had significantly higher levels of confidence than pre-final-year students.

This could be because the majority of the subjects or subjects that they receive in the higher cycles or semesters address topics related to the concept of “One Health”, they also develop their degree work to finish the degree and therefore delve into the topic or even Students usually participate in conferences or groups that contribute to greater knowledge, unlike the lower cycles where the majority of students initially receive general or basic courses.

The lack of depth in knowledge of the One Health approach among veterinary medicine students could negatively impact their ability to effectively address public health and zoonotic issues in the future. It is critical to integrate more robust One Health education into the veterinary medicine curriculum to prepare students for emerging challenges in the healthcare field.

A major limitation of this study is its limited scope to veterinary medicine students in Ecuador, which could make it difficult to generalize the results to other student populations or educational contexts. Additionally, the methodology used could have been improved with the inclusion of qualitative interviews to obtain a deeper understanding of perceptions and attitudes in students.

Conclusion

In this study, it was found that the majority of Ecuadorian veterinary medicine students had a satisfactory comprehension of the One Health concept; moreover, their perception of its application. There was a significant association between the concept of knowledge and academic level, showing more satisfactory knowledge in students from superior cycles or semesters. However, greater integration of the One Health approach in the veterinary medicine curriculum is necessary to address emerging challenges in the field of public health and zoonoses. It is advisable to develop more comprehensive study programs and practical experiences that allow students to better understand the interrelationship between human, animal, and environmental health.

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Author's Contributions

Roberto Bustillos-Huilca: Designed the study, coordinated the data analysis, and drafted the article.
Viviana Jiménez: Collected samples, provided statistical analysis, and drafted.
Jessica Valdivieso-Tituana: Critically reviewed for intellectual content.
Stephanie Chávez-Arrese: Critically reviewed for intellectual content.
Jenny Carrillo-Toro: Critically reviewed for intellectual content.
Jhuliana Luna-Herrera: Provided statistical analysis of the study and drafted.

Ethics

This study was approved by the Research Committee of the School of Veterinary Medicine (COIF-CMVZ), University of Loja (UNL-CMV-DEC-2023-114-O).

Informed consent was obtained online using Google Forms. Participants needed to express their agreement with all necessary statements before starting the survey. They were informed that their participation was voluntary and that they could choose not to participate without providing a reason, and they were provided with the contact details of the researchers.

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