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Comparación del tratamiento de fitoterapia vs tratamiento convencional de otitis bacteriana “cocos” en perros

Comparison of phytotherapy vs conventional treatment of bacterial otitis in dogs

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Palabras claves:
Tratamiento, fitoterapia, convencional, otitis, perros.

Resumen

Introducción. La otitis bacteriana en caninos, marcada por la inflamación del canal auditivo y acumulación de secreciones, tradicionalmente tratada con antibióticos, está siendo reconsiderada debido al interés creciente en la fitoterapia. El árbol de Neem, reconocido por sus propiedades antimicrobianas y antiinflamatorias gracias a componentes como la nimbidina, ha demostrado efectividad en estudios veterinarios para tratar infecciones como la otitis externa en perros. **Objetivo.** Evaluar el efecto del tratamiento convencional de otitis bacteriana producida por cocos frente a la fitoterapia y comparar el efecto de la fitoterapia en relación al tratamiento convencional. **Metodología.** Se realizó dos tratamientos para otitis en perros, dividiendo 30 pacientes en dos grupos. El Grupo 1 recibió gel con ciprofloxacina, prednisolona, ketoconazol, lidocaína y corticoides (prednisolona 20 mg) a dosis de 1 mg por kg. Durante 3 días; mientras que el Grupo 2 recibió fitoterapia compuesta por agua, aceite de ricino, aceite de Neem, aceite de menta, preservante y regulador de pH y corticoides (prednisolona 20 mg) a dosis de 1 mg por kg. Durante 3 días. **Resultados.** El estudio investigó tratamientos para la otitis externa producida por cocos en perros, evidenciando que el tratamiento convencional mostró mayor eficacia en reducir el eritema, la hiperqueratosis y el dolor, mientras que la fitoterapia destacó en controlar la inflamación. La citología reveló diferencias significativas en la disminución de cocos entre ambos tratamientos, siendo la fitoterapia más efectiva. **Conclusión.** El tratamiento convencional demostró ser más efectivo en reducir los síntomas de la otitis externa en perros, mientras que la fitoterapia mostró potencial en el control de la inflamación y reducción de ciertos microorganismos. Se destaca la importancia del control efectivo del biofilm mediante la limpieza adecuada del oído, para el éxito del tratamiento de la otitis externa en perros producida por cocos. **Área de estudio general:** Medicina veterinaria **Área de estudio específica:** Dermatología **Tipo de estudio:** Artículos originales

Keywords:
Treatment, phytotherapy,

Abstract

Introduction. Bacterial otitis in canines, characterized by inflammation of the ear canal and accumulation of secretions,

conventional, otitis, dogs.

traditionally treated with antibiotics, is being reconsidered due to the growing interest in phytotherapy. The Neem tree, renowned for its antimicrobial and anti-inflammatory properties attributed to components like nimbidin, has shown effectiveness in veterinary studies for treating infections such as otitis. objective. Assess the effect of conventional treatment for bacterial otitis caused by cocci compared to phytotherapy and compare the effect of phytotherapy in relation to conventional treatment. Methodology. The study on otitis in dogs divided 30 patients into two groups. Each group received a weekly treatment for one month and was evaluated for another month. Group 1 was administered gel containing ciprofloxacin, prednisolone, ketoconazole, lidocaine, and corticosteroids for 3 days, while Group 2 was treated with phytotherapy composed of water, natural oils, and corticosteroids for the same duration. Results. The study investigated treatments for canine otitis, showing that the conventional one demonstrated greater efficacy in reducing erythema, hyperkeratosis, and pain, while the phytotherapy stood out in controlling inflammation. Cytology revealed significant differences in reducing cocci between both treatments, with phytotherapy being more effective. Conclusion. The conventional treatment has proven to be more effective in reducing the external symptoms of canine otitis, whereas herbal therapy has shown potential in controlling inflammation and reducing certain microorganisms. Additionally, the critical importance of effectively controlling the biofilm in the ear for the success of otitis treatment is highlighted.

Introduction

Bacterial otitis is a common pathology in canines, which affects the ear canal and is characterized by inflammation, irritation and accumulation of secretions.(1)In particular, otitis externa is concentrated in the external auditory canal and involves the auricle. This condition can manifest itself in acute or chronic forms, the latter being defined by its persistence or recurrence over a continuous period of at least three months.(2)Traditionally, conventional treatment of bacterial otitis in dogs has involved the use of antibiotics and topical medications prescribed by a veterinarian. However, in

recent years, phytotherapy has gained interest as a possible alternative or complement to conventional treatment.(3). Phytotherapy, according to Nabi et al.(4)uses natural phytochemical compounds present in plants with medicinal properties that have been used for centuries in the prevention and treatment of various diseases. In veterinary practice, doctors may use herbal phytopharmaceuticals to treat conditions such as bacterial infections, oxidative stress and digestive problems.

Azadirachta indica, known as the Neem tree, has been used for centuries in traditional medicine and agriculture, with research into its potential in various areas such as dentistry, food safety, mycology, virology, bacteriology and parasitology, mainly due to its antimicrobial properties.(5)The properties of this plant are attributed to the combination of various components such as terpenoids, triterpenoids, limonoids and flavonoids, these elements have a significant biological potential, including antimicrobial and anti-inflammatory properties that contribute to its therapeutic effects.(6). Nimbidin, a bitter component of Neem seed oil, has several biological properties. Moreover, Neem oil and extracts from its parts have been used in the treatment of various conditions such as leprosy, skin infections, respiratory disorders, and more. Neem extracts also demonstrate efficacy against human fungi.(7).

Some recent studies have investigated the use of Neem extracts in health-related treatments for dogs and cats. Barbosa et al.(8)evaluated the efficacy of Neem and propolis extracts in the treatment of otitis in canines. They found that 30% Neem and propolis formulations were effective against the Enterococcus sp. bacteria and could be viable alternatives to treat infections caused by this bacteria in dogs with otitis. In another study, Nuñez et al.(9)examined the effect of Neem essential oil on cats with dermatological conditions; the results showed significant improvements in the skin and coat of cats affected by dermatophytosis, demonstrating that Neem oil is effective in treating this condition. Furthermore, Daniel et al.(10)investigated different therapeutic protocols in dogs with malasseziosis and found that topical application of Neem oil effectively managed this canine condition, improving both clinically and cytologically. In a previous study by Labrada et al.(11)The acaricidal activity of Azadirachta indica essential oil against Demodex canis was evaluated. The different doses studied were effective in treating this disease, and the 1% formulation was considered the most suitable from a clinical, toxicological and economic point of view.

The traditional use of antibiotics, corticosteroids and conventional systemic therapies as a primary treatment strategy is currently challenged by the increasing resistance observed in some patients towards these therapeutic approaches.(12)In this context, phytotherapy emerges as a promising therapeutic alternative based on natural phytochemical compounds with medicinal properties. This approach is characterized by its potential to

be less invasive and safer compared to certain conventional treatments, which supports the need to investigate and consider this therapeutic modality.(13).

Therefore, the present study aims to evaluate the tolerance of phytotherapy in dogs through a meticulous diagnostic confirmation, using exfoliative cytology to accurately determine the bacterial load and morphology of the cocci present, a solid starting point was established to assign, control and evaluate, with scientific rigor, the phytotherapeutic treatments administered.

Methodology

The present study is framed as a descriptive experimental clinical investigation involving 30 canine patients, distributed in two treatment groups, each composed of 15 dogs. The clinical evaluation of the patients' ears was carried out, followed by the collection of samples using the swab technique and their subsequent microscopic analysis. The ear canals and the auricle were thoroughly cleaned, prioritizing the control of biofilm during this procedure.

Laboratory diagnosis was made by reading cytology samples using Giemsa staining. Then, specific treatment was given for each group. Weekly assessments were carried out over a month, including clinical examinations, taking samples for cytology, control cytology, ear cleaning and the application of conventional treatments and phytotherapy, depending on the group to which the dogs belonged.

Finally, the results obtained during the study were collected and analyzed. Group 1 received gel with ciprofloxacin, prednisolone, ketoconazole, lidocaine and corticosteroids (prednisolone 20 mg) at a dose of 1 mg per kg for 3 days; while Group 2 received phytotherapy consisting of water, castor oil, neem oil, mint oil, preservative and pH regulator and corticosteroids (prednisolone 20 mg) at a dose of 1 mg per kg for 3 days.

Results and discussion

In order to meet the general objective of the research and following the guiding thread of an article dedicated to carrying out the evaluation of a case study, the results obtained are presented below. Firstly, a statistical description of the participants is made. The clinical signs are described in each of the stages for each of the treatments. Finally, the results obtained from each treatment are compared.

Descriptive Analysis of the Data Set

Table 1 presents the number of participants in each treatment, providing information on the distribution of the sample in relation to the different treatments used in the research.

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Table 1. Number of participants in each treatment

Treatment	Frequency	Percent	Valid Percentage	Cumulative Percentage
Conventional	15	50.0	50.0	50.0
Phytotherapy	15	50.0	50.0	100.0
Total	30	100.0	100.0	

Source: own elaboration

In Table 1, the treatment column lists the specific treatments used in the research. In this case, the conventional treatment and another called herbal treatment are mentioned. The frequency column indicates the number of participants assigned to each treatment. There are 15 participants in the conventional treatment and another 15 in the herbal treatment. The percentage column represents the percentage of participants in each treatment in relation to the total number of participants. It is a balanced data set, there is an equal percentage for each treatment. The valid percentage column, similar to the percentage column, shows the percentage of participants in relation to the total, but excludes those cases that can be considered invalid or that do not meet certain specific criteria; in this case, no cases are excluded. The cumulative percentage indicates the cumulative percentage of participants as you move down the table. For example, the cumulative percentage after the conventional treatment is 50.0%, and after the herbal treatment it reaches 100.0%, since it is the last treatment listed. In the last row, the total sum of participants in all treatments is presented. In this case, there are a total of 30 participants in the sample.

Table 2. Number of participants by race

Race	Frequency	Percent	Valid Percentage	Cumulative Percentage
BULLDOG	1	3.3	3.3	3.3
BULL TERRIER	1	3.3	3.3	6.7
CASTILIAN	1	3.3	3.3	10.0
GOLDEN	1	3.3	3.3	13.3
HUSKY	1	3.3	3.3	16.7
LABRADOR	1	3.3	3.3	20.0
MESTIO	1	3.3	3.3	23.3
MESTIZO	1	3.3	3.3	26.7
MESTIZO	12	40.0	40.0	66.7
PITBULL	3	10.0	10.0	76.7
PITBULL_MX	1	3.3	3.3	80.0
PUG	1	3.3	3.3	83.3
SCHNAUZER	2	6.7	6.7	90.0
SHARPEI_MESTIZO	2	6.7	6.7	96.7
WEST HIGHLAND	1	3.3	3.3	100.0
Total	30	100.0	100.0	

Source: own elaboration

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Table 2 presents the distribution of participants by breed of dogs in the study, providing detailed information on the frequency and percentage of participants in each breed category. Fifteen different breeds participated, but the mixed breed predominated. The second most frequent breed was the pitbull.

Table 3. Number of participants associated with the type of diet

Feeding	Frequency	Percent	Valid Percentage	Cumulative Percentage
BALANCED	29	96.7	96.7	96.7
MIXED	1	3.3	3.3	100.0
Total	30	100.0	100.0	

Source: own elaboration

Table 3 provides a clear overview of the distribution of participants according to diet type, highlighting the significant prevalence of a balanced diet in the sample.

Table 4. Number of participants associated with sterilization

Sterilized	Frequency	Percent	Valid Percentage	Cumulative Percentage
No	2	6.7	6.7	6.7
Yeah	28	93.3	93.3	100.0
Total	30	100.0	100.0	

Source: own elaboration

Table 4 provides a clear overview of the distribution of participants based on their sterilization, highlighting the high proportion of sterilized participants in the sample.

Descriptive Analysis of Clinical Signs

Figure 1 shows the signs present in the group under study, where erythema, hyperkeratosis and the taking of samples for analysis can be seen.

Figure 1. Signs of Otitis in Dogs

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Next, we will visualize using tables and graphs the descriptive analysis of the evolution of the different clinical signs. The first clinical sign to be evaluated is erythema. It is important to note that erythema itself is not a specific disease, but rather a clinical sign, as already stated, that indicates an inflammatory or vascular response in the skin. As the treatment time increases, this clinical sign should decrease. If erythema persists, it is a cause for concern.

Clinical Sign Erythema

Table 5. Evaluation of the clinical sign Erythema

Treatment	Ear	Answer	Week 1	Week 2	Week 3	Week 4
Conventional	**Right**	**Yeah**	12	7	3	3
	Right	**No**	3	8	12	12
	Left	**Yeah**	15	7	2	2
	Left	**No**	0	8	13	13
Phytotherapy	**Right**	**Yeah**	14	7	6	5
	Right	**No**	1	8	8	9
	Left	**Yeah**	13	9	4	4
	Left	**No**	2	6	11	10

Source: own elaboration

The table presents data on the response to treatment according to the clinical sign erythema that may be present in both ears, over a 4-week period, using two treatments: conventional and phytotherapy. In general, phytotherapy treatment exhibits a more pronounced presence of “yes” responses compared to conventional treatment. Variations in response over time are observed in both ears, with the right ear showing fluctuations and the left ear tending to decrease in the “yes” response. These results suggest the existence of differences in the treatments. To determine which of the treatments is more effective in reducing erythema and in providing “no” responses (absence of erythema), it is necessary to analyze the data provided in the table. For conventional treatment in the right ear the response "no" increases from 3 cases in week 1 to 12 cases in week 4. Meanwhile, in the left ear the response "no" increases from 0 cases in week 1 to 13 cases in week 4. For phytotherapy treatment, in the right ear the response "no" increases from 1 case in week 1 to 9 cases in week 4, while in the left ear, the response "no" increases from 2 cases in week 1 to 11 cases in week 4. Based on the information provided, in the last week of treatment (Week 4), conventional treatment appears to be more effective in reducing erythema and providing "no" responses than conventional treatment. Phytotherapy treatment also shows a reduction, but not as pronounced as conventional treatment. It is important to note that these results are specific to the context provided and may vary by population and other factors. Other clinical signs will continue to be evaluated.

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Clinical Sign Hyperkeratosis

Another clinical sign is hyperkeratosis. Hyperkeratosis in the context of coccidial otitis in dogs refers to an abnormal thickening of the keratin layer in the ear canal, specifically in response to chronic inflammation and bacterial infection in the ear. When a dog suffers from bacterial otitis, inflammation occurs in the external ear canal. This inflammation can trigger a response from the body that includes excessive production of cerumen (ear wax) and the buildup of dead epithelial cells and keratin. This process can lead to hyperkeratosis in the ear canal, where the keratin layer thickens abnormally. Hyperkeratosis in bacterial otitis in dogs can contribute to blockage of the ear canal, making it difficult for the ear to clean itself naturally and promoting persistent infection. In addition, the buildup of cerumen and keratin can create an environment conducive to bacterial growth, which worsens inflammation and infection in the ear.

Table 6. Evaluation of the clinical sign Hyperkeratosis

Treatment	Ear	Answer	Week 1	Week 2	Week 3	Week 4
Conventional	Right	Yeah	5	6	6	5
	Right	No	9	9	9	10
	Left	Yeah	4	5	4	3
	Left	No	11	10	11	12
Phytotherapy	Right	Yeah	6	6	5	4
	Right	No	9	9	10	10
	Left	Yeah	4	3	5	4
	Left	No	11	12	10	10

Source: own elaboration

Table 6 provides data on the evaluation of the clinical sign of hyperkeratosis in both ears of dogs treated with the two different approaches: “Conventional” and “Phytotherapy”, over a period of 4 weeks. For the Conventional treatment, the right ear remained practically stable from week 1 to week 4. It showed a decrease from 5 cases in week 1 to 5 cases in week 4. In the case of the left ear it decreased by 1 from the first week to the last. For the treatment with phytotherapy, the right ear decreased from 6 cases to 4 over the course of 4 weeks. The left ear did not show great variability. Both treatments show a tendency to decrease the presence of hyperkeratosis in both ears over the weeks. In general, there does not seem to be significant differences between the treatments in terms of the response to hyperkeratosis in this period of time. Both treatments seem to have a moderate effect in reducing hyperkeratosis.

Clinical Sign of Inflammation

Another clinical sign is inflammation. Inflammation in canine otitis refers to the body's response to irritation, infection or injury in a dog's ear. It can manifest in various forms and ranges of severity. In this case we evaluate how it evolves with both treatments.

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Table 7. Evaluation of the clinical sign Inflammation

Treatment	Ear	Answer	Week 1	Week 2	Week 3	Week 4
Conventional	Right	Grade 1	3	3	6	12
		Grade 2	0	6	6	3
		Grade 3	6	4	3	0
		Grade 4	3	2	0	0
		Grade 5	3	0	0	0
	Left	Grade 1	1	4	12	10
		Grade 2	2	6	1	3
		Grade 3	5	4	2	2
		Grade 4	5	1	0	0
		Grade 5	2	0	0	0
Phytotherapy	Right	Grade 1	0	4	10	9
		Grade 2	6	9	3	3
		Grade 3	6	1	0	2
		Grade 4	3	1	0	0
		Grade 5	0	0	0	0
	Left	Grade 1	2	6	9	8
		Grade 2	5	7	3	6
		Grade 3	6	1	2	0
		Grade 4	2	1	0	0
		Grade 5	0	0	0	0

Source: own elaboration

Table 7 provides the assessment of the clinical sign of inflammation for two treatments, conventional and phytotherapy, in different ears and weeks. Analyzing the data, it is observed that phytotherapy treatment presents a more favorable evolution compared to conventional treatment. In general, phytotherapy treatment shows a constant decrease in the degrees of inflammation throughout the evaluation weeks, both in the right ear and in the left ear. On the other hand, conventional treatment shows variability in the results, with some cases experiencing improvements, but others showing no significant changes or even worsening. These findings suggest that phytotherapy could be more effective in managing and reducing clinical inflammation compared to the conventional approach used in this study.

Clinical Sign Cerumen

In canine cocci-induced otitis externa, the amount and colour of cerumen can provide clues about the condition of the ear. In cases of inflammatory or infectious otitis, excessive cerumen production is common, which may have a thick texture and a yellow or dark brown colour. In advanced stages of the disease or in chronic otitis, cerumen may be scant and dry. However, evaluation of cerumen and its colour is not sufficient for an accurate diagnosis, as it requires a complete veterinary evaluation, including cytological analysis and possibly microbiological cultures.

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Table 8. Evaluation of the clinical sign Cerumen

Treatment	Ear	Answer	Week 1	Week 2	Week 3	Week 4
Conventional	Right	Grade 1	1	6	8	8
		Grade 2	1	4	5	4
		Grade 3	9	2	1	3
		Grade 4	2	3	1	0
		Grade 5	2	0	0	0
	Left	Grade 1	0	3	8	8
		Grade 2	2	6	7	5
		Grade 3	9	6	0	2
		Grade 4	3	0	0	0
		Grade 5	1	0	0	0
Phytotherapy	Right	Grade 1	0	1	5	5
		Grade 2	4	7	6	7
		Grade 3	7	5	3	2
		Grade 4	4	2	0	0
		Grade 5	0	0	0	0
	Left	Grade 1	0	1	7	6
		Grade 2	2	6	6	6
		Grade 3	10	7	0	1
		Grade 4	3	1	0	0
		Grade 5	0	0	0	0

Source: own elaboration

Table 8 shows theEvaluation of the clinical sign cerumen in dogs with otitis that have received two different treatments. In the table we can see that, for the conventional treatment, the right ear shows a tendency to decrease in cases in grades 2, 3, and 4. While, for the left ear, there is also a decrease in cases of grades 2, 3, and 4 over time. For the treatment with phytotherapy, in the right ear, over the four weeks, there is variability, but a significant presence in grades 2 and 3 is maintained. The left ear presents a similar behavior to the right ear, with some variability in cases of grades 2 and 3 during the treatment. In general, conventional treatment seems to show a more consistent decrease in otitis cases compared to phytotherapy. Phytotherapy shows variability in response over time, with some cases persisting in grades 2 and 3. Both treatments show a decrease in the most severe cases (grades 4 and 5), but the conventional treatment seems to have a faster response.

In all cases where cerumen color was evaluated, 13 dogs reported having brown cerumen and 2 yellow cerumen, all of them in the conventional treatment for both ears. In the case of dogs treated with phytotherapy treatment, 14 reported having brown cerumen and only one reported having yellow. Brown is the most common cerumen color in dogs. The presence of brown cerumen is usually normal and does not necessarily indicate a problem. Yellow can also be considered normal; however, it should be noted that biofilm control also contributes to reducing the amount of cerumen in the ear.

Clinical Sign Pain

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Pain is a common clinical sign in cases of otitis externa in dogs. Otitis is inflammation of the ear, and can affect the external ear (otitis externa), the middle ear (otitis media), or both. Pain in otitis in dogs can manifest in different ways and can vary in intensity. In this case, Table 9 shows the degrees of pain intensity and its evolution over four weeks after applying the different treatments.

Table 9. Evaluation of clinical signs Pain

Treatment	Ear	Answer	Week 1	Week 2	Week 3	Week 4
Conventional	Right	Grade 1	3	6	11	11
		Grade 2	3	4	2	3
		Grade 3	2	4	2	1
		Grade 4	5	1	0	0
		Grade 5	2	0	0	0
	Left	Grade 1	1	4	12	11
		Grade 2	3	5	3	2
		Grade 3	3	3	0	2
Conventional	Left	Grade 4	7	1	0	0
		Grade 5	1	0	0	0
Phytotherapy	Right	Grade 1	3	6	12	8
		Grade 2	6	4	0	2
		Grade 3	5	2	1	1
		Grade 4	1	1	0	0
		Grade 5	0	0	0	0
	Left	Grade 1	2	4	11	9
		Grade 2	10	6	1	2
		Grade 3	2	2	1	0
		Grade 4	1	1	0	0
		Grade 5	0	0	0	0

Source: own elaboration

Table 9 presents an evaluation of the clinical sign of pain in dogs with otitis externa, and shows how different treatments (conventional and phytotherapy) affect the pain response over four weeks of treatment. The analysis of the table shows how, for conventional treatment, in general, for both ears, there is a tendency for pain to decrease over time. In the right ear, grades 1 and 2 decrease significantly after the first week. In the left ear, a constant decrease is observed in grades 1, 2 and 3. Grades 4 and 5 practically disappear. For phytotherapy treatment, a decrease in pain is also evident over the weeks. In the right ear, grades 1 and 2 decrease significantly from the first week. In the left ear, there is a marked reduction in grades 1 and 2 from the first week. The comparison between both treatments shows a positive trend in pain reduction over the weeks. Phytotherapy seems to have a faster response in some cases, especially in the right ear.

Cytology evaluation

In addition to the evaluation of clinical signs, laboratory tests can provide much more reliable results. One such test is cocci cytology. Cytology is a technique used in veterinary

medicine to examine the cells of a sample, in this case, from an ear infection in dogs (otitis). Cocci cytology refers to the identification of bacteria that are commonly known as cocci, during microscopic examination of the sample. The presence of cocci in a cytology sample may indicate the presence of a bacterial infection. It is important that cytology be performed as part of a complete veterinary examination, as it provides valuable information for the proper diagnosis and treatment of otitis. In addition to identifying the presence of bacteria, cytology can also help evaluate inflammation, presence of white blood cells, and other findings that contribute to the overall understanding of the status of the dog's ear.

Table 10. Evaluation of cocci cytology

Treatment	Ear	Answer	Week 1	Week 2	Week 3	Week 4
Conventional	Right	Grade 1	4	8	10	12
		Grade 2	4	4	3	3
		Grade 3	4	3	1	0
		Grade 4	3	0	0	0
		Grade 5	0	0	0	0
	Left	Grade 1	3	8	13	13
		Grade 2	3	7	1	2
		Grade 3	7	0	0	0
		Grade 4	2	0	0	0
		Grade 5	0	0	0	0
Phytotherapy	Right	Grade 1	1	3	8	3
		Grade 2	9	7	5	7
		Grade 3	3	3	2	4
		Grade 4	2	2	0	0
		Grade 5	0	0	0	0
	Left	Grade 1	4	5	9	5
		Grade 2	6	8	5	7
		Grade 3	4	1	1	1
		Grade 4	0	0	0	1
		Grade 5	1	1	0	0

Source: own elaboration

Table 10 presents the evaluation of cytology for the presence of cocci in dogs with otitis, in relation to the two treatments: conventional and herbal medicine. In conventional treatment, in the right ear there is an overall decrease in the number of cocci over the weeks for all grades. In the left ear there is an increase in the number of cocci in grade 1, showing that the infection decreases. For herbal treatment, in the right ear, there is some variability in the response, but higher grades of infection decrease. In the left ear there is a decrease in the number of cocci for most grades over the weeks. By comparison, both treatments show reductions in the number of cocci over the weeks in general. In some cases, herbal medicine seems to have a more marked decrease, especially in the right ear and for certain grades. It is important to note that the precise interpretation of these data depends on the scale used to classify the grades and other factors that could influence the

clinical evaluation. In summary, the table suggests that both treatments have a positive impact in reducing the presence of cocci on cytology over time, but phytotherapy might have a more pronounced response in some cases.

To perform a statistical analysis of the cytology in the fourth week and determine whether there are significant differences between the results obtained from conventional treatment and phytotherapy, an independent samples test was developed. This procedure allows comparing the mean of two groups of cases. The first step is to find the average values of each of the treatments in this week. The average values obtained are shown in Table 11.

Table 11. Report of the analysis of the mean values obtained from cytology in the 4th week

Treatment		Cytology_Cocos_4Week_OD	Cytology_Cocos_4Week_OI
Conventional	Average Value	2.0714	1.8571
	N	14	14
	Standard Dev.	.41404	.35187
Phytotherapy	Average Value	1.2000	1.1333
	N	15	15
	Standard Dev.	.73005	.86444

Source: own elaboration

As can be seen in Table 11, the average value of the grade of cytology in the fourth week is slightly lower in the treatment using phytotherapy than in the conventional treatment. Based on these results, the independent samples test is then performed to determine whether these differences are significant.

Table 12. Statistical test of independent samples

	t	*df*	*p*	Difference of the means	Standard deviation of the error of the differences
Cytology_Cocos_4Week_OD	3.989	27	0.001	.87143	.21843
Cytology_Cocos_4Week_OI	2.991	27	0.006	.72381	.24197

Source: own elaboration

Table 12 shows the results of the statistical test. The result yielded a value of $p < 0.05$ in both cases, thus demonstrating that there are significant differences between the results of the two tests, both for the right ear and for the left ear.

Discussion

Conventional treatments often include antibiotics, antifungals or other medications prescribed by veterinarians. Comparing the effectiveness and potential side effects of these treatments with herbal medicine is crucial. Some breeds, such as schnauzers with a frequency of 11%, may be more prone to ear problems due to their ear canal structure.(14). Clinical signs of erythema showed that conventional treatment was slightly better and signs of hyperkeratosis showed improvement in both treatments for its

reduction, these data are similar to those reported by Gouda et al.(15)evaluated three different treatments: 1% clotrimazole, 2% ketoconazole and a cream containing Cassia alata and Azadirachta indica. The results indicated that 2% ketoconazole was the most effective treatment, followed by 1% clotrimazole, for treating otitis media.

On the other hand, signs of inflammation showed improvements in treatment with phytotherapy. According to Singh et al.(16)Neem extract is highlighted as a therapeutic agent due to its broad spectrum of properties, including anti-inflammatory, antibacterial, analgesic, antiviral, antifungal, immunomodulatory and antioxidant actions, justifying its application in skin therapies. The evolution of cerumen in dogs with otitis externa demonstrated that conventional treatment presented a more constant decrease in otitis, while phytotherapy showed variability in response over time, with persistent cases in moderate degrees. In the research by Borriello et al.(17)I analyse cerumen samples obtained from dogs affected by otitis externa, revealing the presence of considerable diversity in terms of bacterial phyla. The most prevalent phyla were Proteobacteria, Firmicutes, Actinobacteria and Bacteroidetes, with Proteobacteria and Firmicutes being the most prominent with relative frequencies above 2%. This detailed analysis of the bacterial composition in cerumen from dogs with otitis externa provides crucial information on the microbial diversity present in this condition.(18).

Phytotherapy, particularly the use of Neem, has emerged as a possible alternative to conventional methods for treating inflammatory conditions such as otitis externa in dogs. Studies indicate that the anti-inflammatory properties of Neem could be beneficial in reducing the pain associated with this specific condition.(19)This promising perspective highlights the potential of phytotherapy as a natural therapeutic avenue in the treatment of such conditions in animals, offering an alternative that deserves further exploration in academic research.(20).

Finally, phytotherapy was shown to be more effective in reducing the degree of cytology in the fourth week compared to conventional treatment. In the context of chronic and recurrent bacterial otitis, both culture and antibiogram are fundamental and essential. Over time, the particularities of cultures and bacterial sensitivity in dogs with otitis externa have been widely investigated. However, considerable variability has been observed in the results in relation to the frequency of isolated microorganisms and the sensitivity patterns detected.(21)In the research by Barbosa et al.(8)investigated the efficacy of Neem and propolis extracts as treatments for canine otitis. Twenty-nine samples from dogs with otitis were evaluated, and 30% Neem and propolis extracts were found to be effective against the Enterococcus sp. bacteria. Gentamicin, used as a control, demonstrated efficacy against all tested bacteria. The results suggest that Neem and propolis extracts, especially at 30%, could be valid options for treating Enterococcus sp. infections in dogs with otitis.

Conclusions

- Treatments for otitis externa in dogs have shown efficacy in improving associated clinical signs. Conventional treatment excels in reducing erythema and hyperkeratosis, while phytotherapy has shown more favorable results in reducing inflammation and pain, according to clinical and statistical evaluations. Cytological analyses support the efficacy of phytotherapy by revealing a notable reduction in the number of cocci compared to conventional treatment.
- Successful treatment of otitis externa in dogs is closely linked to effective control of ear biofilm. By removing or controlling the bacterial film with thorough cleaning, the ear's ability to absorb medication is enhanced regardless of the treatment applied. This highlights the importance of proper cleaning to improve therapeutic outcomes in otitis externa in dogs.

Conflict of interest

The authors declare that there is no conflict of interest in relation to the submitted article.

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