The Efficacy of an Antiseptic and Microbial Anti-Adhesive Ear Cleanser in Dogs with Otitis Externa*

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A new antimicrobial ear cleanser was evaluated for the treatment of bacterial and yeast ear infections in dogs. Forty-five dogs with erythemato-ceruminous or purulent otitis externa were randomly allocated to two treatment groups: reference ear cleanser (Epiotic, Virbac) or test ear cleanser (Epiotic Advanced, Virbac). Ear cleansing was performed twice daily for 2 weeks, and no other treatment was allowed. By week 2, clinical (exudate quantity, erythema, stenosis, excoriation, and odor) and discomfort (pain, ear scratching, and head shaking) scores were significantly decreased ($P < .0001$ for all) and no microbial overgrowth could be detected in 25 (64.1%) and 32 (68.1%) ears treated with Epiotic and Epiotic Advanced, respectively. The new pH-balanced, propylene glycol–free test ear cleanser, which incorporates microbial adhesin-blocking carbohydrates, proved as effective as the reference acidic formula.
INTRODUCTION

Otitis externa is one of the most common conditions diagnosed by small animal veterinarians, representing as many as 10% to 20% of canine patients. Recurrence is frequent and is associated with progressive thickening of the ear canal walls, stenosis, impaired drainage of secretions and keratin debris, and colonization by pathogenic microorganisms, which produce further inflammation. Tissue proliferation and treatment failure may be a source of frustration for the veterinarian and dissatisfaction for the client.

Thorough cleaning of the ear canals is often a rewarding first-step procedure and is extremely important for the effective management of otitis externa. Accumulated cerumen, debris, and exudate are irritating, produce a favorable environment for microorganisms to proliferate, prevent medications from contacting aural epithelium, and may inactivate some antibiotics.

Various veterinary ear-cleansing solutions are used routinely in practice, but few published studies quantify the clinical and antimicrobial benefits in vivo associated with the use of the different formulations. The exclusive application of an ear solution (Epiotic, Virbac) containing lactic acid (2.5%), salicylic acid (0.1%) in free and encapsulated forms (spherulites) with chitosanide, and parachlorometaxylenol (PCMX; 0.1%) in a sodium docusate and propylene glycol excipient twice daily for 7 days significantly decreased bacterial and yeast counts in dogs with chronically greasy, mildly erythematous infected ears. The same cleanser formula proved effective over a 2-week period to provide clinical improvement and microbial cure, as assessed by bacterial culture and yeast cytology, in 67.7% of infected ears from dogs with infectious otitis externa.

The aim of this study was to evaluate the in vivo efficacy of a new pH-balanced, propylene glycol–free formulation of the ear cleanser (Epiotic Advanced, Virbac) against infectious otitis externa in dogs. The new formula contains free salicylic acid (0.1%), PCMX (0.1%), EDTA (0.5%), and specific monosaccharides in a sodium docusate and nonionic surfactant excipient. This new formula (“test ear cleanser” [Epiotic Advanced]) was designed for optimal tolerance, even in the most sensitive ears. The evaluation was performed under the conditions of a randomized blind comparative field trial against the reference acidic formula (“reference ear cleanser” [Epiotic]) that has been proven to be effective.

MATERIALS AND METHODS

Study Sites

The study was conducted as a randomized multicenter field trial at nine veterinary centers in the United Kingdom, France, and Belgium. All investigators were qualified in veterinary dermatology (i.e., all are postgraduate certificate holders and three are diplomates of the European College of Veterinary Dermatology). The sites included seven privately owned veterinary clinics and two veterinary school hospitals (Lyon and Toulouse, France).

Animals

Owner written consent was obtained before including a dog in the study. Forty-nine dogs were selected. Inclusion criteria were clinical signs of erythematous-ceruminous (erythema and moist, brown, waxy discharge) or purulent (creamy to yellow exudate) otitis externa in one or both ears and yeast and/or bacterial organisms detected on cytology of ear swabs. Dogs with parasitic otitis, otic foreign body, end-stage proliferative ear disease, occlusive masses in the ear canal, ruptured tympanic membrane, autoimmune skin disease, or poor general health were not included in the trial. None of the study animals received any systemic or topical anti-
fungal, antibacterial, or antiinflammatory agents in the week before study initiation. None of the study animals received any long-acting corticosteroids before the study. At the time of inclusion in the trial, two dogs were receiving immunotherapy and two were being fed hypoallergenic diets for long-term management of allergic dermatitis. Another dog was receiving daily benazepril for chronic heart failure.

Treatments
The dogs were allocated to one of two treatment groups according to a preestablished randomization list. In 23 dogs, ear cleaning was performed with the reference ear cleanser (Epiotic) containing lactic acid, salicylic acid, PCMX, sodium docusate, and propylene glycol. In the other 26 dogs, ears were cleaned with the new formulation (test ear cleanser; Epiotc Advanced) containing salicylic acid, PCMX, EDTA, sodium docusate, the monosaccharides D-galactose, D-mannose and L-rhamnose, and nonionic surfactant excipients. The products were provided to investigators in identical bottles identified only by code numbers. The owners were instructed by veterinarians to treat the affected ears twice daily for 2 weeks by completely filling the ear canal with the solution and massaging the ear for 1 minute. No antibiotic, antifungal, or glucocorticoid treatments were allowed during the study period. No placebo group was included for ethical reasons.

Evaluation
Complete physical and otoscopic examinations of the ears were performed at baseline (day 0) and subsequent follow-up visits 1 and 2 weeks after initiation of treatment. A 12-hour delay was required between the last treatment and the examination. The clinical condition of the ear canal and pinna was assessed by the veterinarian for five signs: erythema, swelling/stenosis, excoriation, exudation, and odor. Signs of discomfort were evaluated by the investigator based on three parameters: pain, ear scratching, and head shaking. Dog discomfort was rated after interrogation of the owner and according to observations in the consultation room. Pain was estimated based on the animal’s reaction to palpation of the ear canal. Each parameter was graded on a four-point scale according to severity (0 = none; 1 = mild; 2 = moderate; 3 = severe). Two composite indices, the otitis clinical index and dog discomfort index, were obtained by adding the respective component scores at each examination.

Subjective parameters reflecting the owner’s perception of the practical aspects of the cleanser (cleansing power, solution odor, and avoidance reaction from the dog at administration) were scored on a four-point scale according to satisfaction (poor, fair, good, very good). At the end of the study, dog owners were asked to judge the level of ear improvement and the treatment efficacy as very good, good, fair, or poor.

Samples for bacterial culture were collected from the horizontal ear canal with sterile cotton-tipped swabs (Culturette, Oxoid, Basingstoke, UK) on day 0. Properly identified ear swabs were sent in Amies transport medium to a centralized reference veterinary diagnostic laboratory (Vébiotel, Veterinary Analyses, Mi-
microbiology Unit, Arcueil, France). Swab samples were plated on nonselective medium and incubated in both microaerophilic and aerobic atmospheres at 35°C for 18 to 24 hours. The bacterial strains were identified by standard identification tests and biochemical testing (API kits, Biomerieux, Marcy-l’Etoile, France). The antimicrobial sensitivity patterns of Staphylococcus intermedius and Pseudomonas aeruginosa strains were determined by the agar disk diffusion method according to the standards of the French Society of Microbiology.

Samples were also collected from the ear canals with cotton-tipped swabs on days 0, 7, and 14 for cytologic examination. Each swab was rolled onto a clean microscope slide and stained with Diff-Quik (Baxter Healthcare, Dade Division, Miami, FL) after heat-fixing. The slide was scanned at low magnification (×40–100) to select a representative area. Yeast, coccoid, and rod-shaped organisms were counted from 10 consecutive microscope fields at higher magnification (×1,000, oil immersion). The mean number of yeast or bacterial organisms/field was calculated. If the mean number of yeast or coccoid organisms/oil-immersion field was four or more, or if rod-shaped organisms could be identified in oil-immersion fields, microbial overgrowth was diagnosed.

Any adverse event occurring during the trial, whether product related or not, was to be reported with a clear description of the clinical signs and outcome.

Statistical Analysis

Animal characteristics were compared at baseline to check group comparability before treatment. Qualitative parameters (breed category, sex, type of otitis, history of previous episodes, otitis extension) were compared on day 0 between groups using the chi-squared test. Quantitative parameters (weight, age, clinical indices, and microbial counts) were compared at baseline using the Mann-Whitney U test. The Wilcoxon signed rank test was used to test for difference in clinical indices and microbial counts between right and left ears. Since no independence was found, only the larger value from the two ears was considered for each dog in statistical tests. Within-group comparison of the clinical indices and microbial counts over the study period was performed using a Friedman analysis of variance (ANOVA) followed, if significant, by the Wilcoxon signed rank test for individual comparisons between time points. Between-group comparison of the reduction of clinical and microbial parameters was performed using the Student’s t-test (or the Mann-Whitney U test for nonparametric values). \( P < 0.05 \) was considered statistically significant.

RESULTS

Study Population and Animal Characteristics at Baseline

Two dogs were lost to follow-up after day 0, and microbial counts were not available at endpoint for two other animals enrolled in the study. These four dogs with incomplete datasets were not considered in the analysis of treatment efficacy. One dog in the reference group received a concomitant topical treatment containing prednisolone, polymyxin B, and miconazole on day 11. The clinical and microbial parameters recorded on day 7 were imputed on day 14 before inclusion in the statistical analysis (last observation carried forward). Thus, a total of 45 dogs completed the trial and were included in the statistical analysis.

Many breeds were represented in the study. Labrador retrievers, golden retrievers, poodles, boxers, rottweilers, wirehaired pointing griffons, fox terriers, cavalier King Charles spaniels, bulldogs, and American Staffordshire terriers represented 26 individuals. Four crossbred dogs and single representatives of the following breeds were also examined: Bernese
mountain dog, cocker spaniel, German wire-haired pointer, German shepherd, Jack Russell terrier, Belgian Malinois, Newfoundland, Petit Bleu de Gascogne, porcelaine, ratter, shar-pei, shih tzu, West Highland white terrier, Welsh springer spaniel, and Yorkshire terrier.

Dogs ranged in size from 3.3 to 53 kg (median, 20 kg) and in age from 1 to 14 years (median, 4.5 years). The sex ratio was balanced: 22 females and 23 males.

Hypersensitivity skin disorders (atopic dermatitis, food allergy) were diagnosed as the most frequent underlying cause of otitis externa (22 dogs). Other occasional explanatory factors included ear conformation anomaly (four dogs), hypothyroidism (one dog), and improper grooming (one dog). No particular cause could be determined in 17 other dogs. Twenty-nine dogs (64.4%) had presented with two to 20 previous episodes of otitis externa (median, three episodes) over a period of 6 months to 5 years (median, 2 years) before being included in the study. First occurrence of otitis externa was reported for the remaining 16 dogs (35.6%).

### TABLE 1. Number (%) of Dogs Presenting with Various Signs of Otitis Externa at Baseline

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Epiotic (n = 21)</th>
<th>Epiotic Advanced (n = 24)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of otitis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Erythematoceruminous</td>
<td>18 (85.7%)</td>
<td>19 (79.2%)</td>
</tr>
<tr>
<td>Purulent</td>
<td>3 (14.3%)</td>
<td>5 (20.8%)</td>
</tr>
<tr>
<td>History</td>
<td></td>
<td></td>
</tr>
<tr>
<td>First occurrence</td>
<td>9 (42.9%)</td>
<td>7 (29.2%)</td>
</tr>
<tr>
<td>Relapse</td>
<td>12 (57.1%)</td>
<td>17 (70.8%)</td>
</tr>
<tr>
<td>Extension</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unilateral</td>
<td>3 (14.3%)</td>
<td>1 (4.2%)</td>
</tr>
<tr>
<td>Bilateral</td>
<td>18 (85.7%)</td>
<td>23 (95.8%)</td>
</tr>
<tr>
<td>Total</td>
<td>21 (100%)</td>
<td>24 (100%)</td>
</tr>
<tr>
<td>Increased aural exudate</td>
<td>21 (100%)</td>
<td>24 (100%)</td>
</tr>
<tr>
<td>Erythema of the pinna and ear canal</td>
<td>20 (95.2%)</td>
<td>23 (95.8%)</td>
</tr>
<tr>
<td>Swelling/stenosis of the ear canal walls</td>
<td>14 (66.7%)</td>
<td>18 (75%)</td>
</tr>
<tr>
<td>Ulceration/erosion of the ear canal lining</td>
<td>3 (14.3%)</td>
<td>7 (29.2%)</td>
</tr>
<tr>
<td>Malodor</td>
<td>18 (85.7%)</td>
<td>23 (95.8%)</td>
</tr>
<tr>
<td>Pain</td>
<td>16 (76.2%)</td>
<td>19 (79.2%)</td>
</tr>
<tr>
<td>Head shaking</td>
<td>20 (95.2%)</td>
<td>24 (100%)</td>
</tr>
<tr>
<td>≥4 Malassezia organisms/hpf in smear cytology</td>
<td>14 (66.7%)</td>
<td>18 (75%)</td>
</tr>
<tr>
<td>≥4 Coccoid organisms/hpf in smear cytology</td>
<td>15 (71.4%)</td>
<td>15 (62.5%)</td>
</tr>
<tr>
<td>Rod-shaped organism/hpf in smear cytology</td>
<td>11 (52.4%)</td>
<td>11 (45.8%)</td>
</tr>
</tbody>
</table>

hpf = high power microscopic field (×1000, oil immersion).
Both ears were infected in 91.1% of the dogs. A purulent discharge was recorded in eight dogs (17.8%), and erythematoceruminous otitis was diagnosed in the other 37 dogs (82.2%). Many ear canals showed an increased quantity of aural exudate and evidence of erythema, malodor, pain, and pruritus, and a majority of dogs (71.1%) presented with swelling of the ear canal walls. Erosion of the auditory canal lining was a less frequent finding (nine dogs) and was mainly recorded in conjunction with purulent otitis externa.

Pandurata Malassezia yeast overgrowth was detected at cytology in 23 (26.7%) ears. In 28 (32.6%) samples, a mixed yeast–bacterial overgrowth could be demonstrated; bacterial proliferation alone was detected in another 20 (23.3%) smears. Only in 15 (17.4%) ear samples was the number of microorganisms below overgrowth criteria. No significant difference could be detected on day 0 between the groups for any of the demographic, clinical, and microbial variables (Table 1).

Bacterial species isolated from ears mainly belonged to the genera *Staphylococcus* (43% of samples), *Bacillus* (19.8%), *Escherichia* (9.3%), *Pseudomonas* (7%), *Streptococcus* (5.8%), *Corynebacterium* (4.7%), and *Enterococcus* (3.5%). The sensitivity of *Staphylococcus intermedius* isolates (25 strains) to antibiotics in vitro was generally high—amoxicillin–clavulanic acid (100%), enrofloxacin (100%), marbofloxacin (100%), gentamicin (96%), and fusidic acid (88%)—except for polymyxin B (8%). By contrast, *P. aeruginosa* isolates (five strains) showed sensitivity to marbofloxacin (100%), gentamicin (96%), and fusidic acid (88%)—except for polymyxin B (8%). By contrast, *P. aeruginosa* isolates (five strains) showed sensitivity to marbofloxacin (100%), gentamicin (96%), and fusidic acid (88%)—except for polymyxin B (8%). By contrast, *P. aeruginosa* isolates (five strains) showed sensitivity to marbofloxacin (100%), gentamicin (96%), and fusidic acid (88%)—except for polymyxin B (8%).

### Clinical Signs
The otitis clinical index and the dog discomfort index decreased significantly in both treatment groups from baseline to day 7 and again from day 7 to day 14. No significant difference could be detected for score reduction between the groups (Table 2). By week 2, the composite clinical index was reduced by 50% or more in 16 (76.2%) and 20 (83.3%) dogs treated with the reference ear cleanser and the

<table>
<thead>
<tr>
<th>Index</th>
<th>Group</th>
<th>Baseline</th>
<th>Week 1</th>
<th>Week 2</th>
<th>% Reduction by Week 1</th>
<th>% Reduction by Week 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical</td>
<td>Epiotic <em>(n = 21)</em></td>
<td>6 (5, 10)*</td>
<td>4 (2, 5)*</td>
<td>2 (1, 4)*</td>
<td>40 (29, 71)</td>
<td>70 (50, 83)</td>
</tr>
<tr>
<td></td>
<td>Epiotic Advanced <em>(n = 24)</em></td>
<td>7.5 (7, 9)*</td>
<td>4 (2, 4)*</td>
<td>2 (1, 3)*</td>
<td>48 (38, 71)</td>
<td>73 (56, 77)</td>
</tr>
<tr>
<td>Discomfort</td>
<td>Epiotic <em>(n = 21)</em></td>
<td>4 (4, 6)*</td>
<td>2.5 (2, 4)*</td>
<td>1 (0, 1)*</td>
<td>42 (14, 50)</td>
<td>83 (57, 100)</td>
</tr>
<tr>
<td></td>
<td>Epiotic Advanced <em>(n = 24)</em></td>
<td>5 (4, 6)*</td>
<td>3 (2, 4)*</td>
<td>1 (0, 2)*</td>
<td>43 (20, 54)</td>
<td>83 (67, 100)</td>
</tr>
</tbody>
</table>

*The clinical index was calculated from the addition of five otic parameters: exudate quantity, erythema, swelling/stenosis, excoriation, and odor. The discomfort index was calculated from the addition of three parameters: pain, ear scratching, and head shaking. Each parameter was scored on a scale from 0 to 3 (0 = none; 1 = mild; 2 = moderate; and 3 = severe).*

b,c,dWithin a row, values with different superscript letters differ significantly (*P* < .002 between baseline and week 1; *P* < .004 between week 1 and week 2; and *P* < .0001 between baseline and week 2).
test ear cleanser, respectively. Absent to mild signs of swelling, excoriation of the ear canal wall, or odor were recorded for more than 90% of ears in both groups by the end of the study period. Mild to moderate erythema was still present in only five (12.8%) and seven (14.9%) ears in the reference ear cleanser and the test ear cleanser groups, respectively, at the end of the treatment. Despite a more than 50% reduction of the mean quantity of exudate over the study period in more than two-thirds of ears in both groups, 31 (79.5%) and 34 (72.3%) ears still exhibited mild to moderate exudate after 2 weeks of treatment with the test and reference cleansers, respectively. For more than 90% of dogs in each group, pain and ear scratching were resolved or only of mild degree by week 2. Moderate head shaking was still recorded on day 14 for three (14.3%) dogs treated with the reference ear cleanser and two (4.2%) dogs treated with the test ear cleanser.

**Microbial Counts**

Dramatic reductions in yeast, coccoid, and rod-shaped organism counts were demonstrated in smears over the study period in both groups (Figures 1 and 2). By week 2, the mean

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**Figure 1.** Box-and-whiskers plots of the mean number of (A) Malassezia, (B) cocc, and (C) rods counted from 10 contiguous high-power microscopic fields (hpf; ×1,000, oil immersion) in smears from the infected ears of 21 dogs treated with the reference ear cleanser (Epiotic) twice daily for 2 weeks. The top and bottom of the box represent the 25th and 75th percentiles. A line is drawn through the box at the median (50th percentile). Extreme values are represented by points. Significant reductions of microbial counts were recorded between baseline and week 1 (A, P < .0002; B, P < .002; C, P < .05) and between baseline and week 2 (A, P < .0005; B, P < .0006; C, P < .005).
number of *Malassezia* yeasts/microscopic oil-immersion field (×1,000) was determined as 4.5 or fewer in 16 (76.2%) dogs treated with the reference ear cleanser and 1 or fewer in 19 (79.2%) dogs treated with the test ear cleanser. The mean numbers of coccoid bacteria/oil-immersion field were 6.5 or fewer in 16 (76.2%) dogs treated with the reference ear cleanser and 3.5 or fewer in 18 (75%) dogs treated with the test ear cleanser. Rod organisms in oil-immersion fields were still detected in only four dogs in both groups. The mean reductions of yeast, coccoid, and rod populations after 2-week treatment with the reference ear cleanser were 65.4%, 47.5%, and 79.2%, respectively. Corresponding microbial reductions were 78.9%, 59.6%, and 78.3% with the test ear cleanser. No statistical difference could be detected between treatments for microbial count reduction of either pathogen at end point (*P* > .2).

**Response to Treatment**

An excellent clinical index response (≥70% reduction) was recorded in 21 of 39 (53.8%) and 29 of 47 (61.7%) individual ears, respectively, with the reference ear cleanser and the test ear cleanser used alone for 2 weeks to manage otitis externa. Perceptible improvement
(≥40% clinical index reduction) was detected for 30 of 39 (76.3%) and 41 of 47 (87.2%) ears in the same respective treatment groups. Absence of microbial overgrowth on day 14, as determined by cytology, was recorded in 25 of 39 (64.1%) and 32 of 47 (68.1%) ears, respectively, in the reference and test cleanser groups. The success of the ear cleanser therapy seemed little influenced by the type of exudate (erythematoceruminous versus purulent) detected initially in ears (Table 3).

According to available investigators' blind assessment, 14 of 20 (70%) and 19 of 22 (86.4%) dogs presented a “good” to “very good” response to treatment with the reference and the test ear cleansers, respectively. No significant difference was detected between the groups for the overall opinion of the investigator in terms of treatment efficacy (P = .4681).

Owners rated 18 of 21 (85.7%) dogs treated with reference ear cleanser as “improved,” whereas a positive outcome opinion was noted for all dogs (24 of 24) assigned to the test ear cleanser. The cleansing properties of the products were rated as “good” to “very good” in 14 of 21 (66.7%) and 18 of 24 (75%) dogs, respectively, with the reference and test cleansers. The odor of both solutions was rated as acceptable or pleasant by all owners but one. A moderate to marked avoidance reaction by the dog when the cleanser was administered into the ear was recorded in eight of 21 (38.1%) and nine of 24 (37.5%) dogs in the reference and the test ear cleanser groups, respectively. When it occurred, this reaction was attributed to an ear clearance reaction or animal irritability. It did not prevent proper compliance with the prescribed regimen. No significant difference was detected between the groups in terms of owner opinion of each of the practical aspects of the cleansers (P > .2).

No adverse event was recorded in either treatment group over the study period.

**DISCUSSION**

In this study, both antimicrobial ear cleansers used alone twice daily for 2 weeks greatly improved clinical signs and reduced bacterial and yeast overgrowth in a majority of dogs with infectious otitis externa.

The cleansers decreased signs of inflammation in ears, as evidenced by marked reduction of erythema and resolution of swelling and exudation in ear canals; furthermore, suppression of pain, ear scratching, and head shaking was noted in most dogs. Persistence of small quantities of exudate in ear canals at the end of the treatment period may reflect product fluidity and remaining exaggerated glandular activity. This trial, therefore, confirms that thor-
ough regular ear cleaning is an important therapeutic component in the management of otitis externa in dogs. This effect is thought to be exerted in part by the removal of wax, bacterial toxins, degenerating cellular debris, and free fatty acid, all of which can act as a focus for infection and stimulate further inflammation.7

The cleansers also produced a marked reduction of yeast and coccoid or rod bacterial populations within 1 week, as evidenced by cytologic findings. Potent in vivo antimicrobial activity of the reference ear cleanser administered twice daily for 7 days had previously been reported in basset hounds with erythemato-ceruminous otitis externa.5 Organisms most frequently identified in smears (Malassezia yeasts) and bacterial culture (staphylococci, streptococci, and Pseudomonas spp) in this study corresponded to the most common pathogens recognized in canine otitis externa.8–11 Yeast and/or bacterial overgrowth represent important perpetuating factors that greatly exacerbate otitis.5 There is some debate, however, about the number of organisms/microscopic field that would be considered indicative of infection. The proposed criterion for the cytologic diagnosis of Malassezia or coccoid overgrowth in this study (>4 organisms/oil-immersion field, ×1,000 magnification) is in agreement with earlier cytologic reports12 and recent clinical studies of antimicrobial preparations for the treatment of canine otitis.6 Pseudomonas bacteria are not routinely isolated from healthy ears,12 and, thus, the presence of any rod organism in oil-immersion fields (×1,000 magnification) was set for the diagnosis of infection. Based on these combined cytologic criteria, no microbial overgrowth could be detected in approximately two-thirds of the ears by week 2 of treatment with both ear cleansers. The results are in close agreement with a previous clinical study on Epiotic, which reported microbial cure (based on cytology and bacterial culture) in 67.7% of infected ears within 2 weeks.6 In the present trial, resolution of microbial overgrowth was similar in erythemato-ceruminous and purulent cases of otitis externa, reflecting consistent efficacy of the cleansing solutions across different types of exudate and species of pathogens in the ear canal.

The reduction in the populations of yeast and bacteria would have contributed to achievement of significant clinical improvement by reducing induced tissue damage and inflammation.

The majority of dogs in this study presented with relapsing otitis externa and associated allergy at inclusion. This suggests that the condition should not be viewed as a simple infection but rather as a complex disease process with an underlying cause.13 In many cases, the ear problem is managed rather than cured and the objective of therapy is to control inflammation and infection while making the dog comfortable. In this respect, both test and reference ear cleansers proved to be valuable topical agents as assessed by the positive opinion of both investigators and owners in terms of treatment outcome in 70% and 86% of dogs, respectively. It should be noted, however, that chronic cases with severe tissue proliferation were not included in the study because complete stenosis would have hampered examination and cleaning of the ear canal. Similarly, the number of dogs with purulent otitis was quite low because of the lower frequency of such cases in veterinary practices and possibly because investigators were reluctant to include such dogs when the only authorized treatment was an ear cleanser.

The antimicrobial action of the reference product is thought to involve the low pH created by lactic and salicylic acid as well as the antibacterial and antifungal activity of propylene glycol and PCMX.5,6,14,15 Penetration of these agents may be facilitated by sodium docusate, an effective wax and debris emulsifier.16 The test ear cleanser is a neutral, pH-balanced solution
lial tissues could be inhibited by various exogenous monosaccharides in vitro, including D-mannose.25–27 A topical preparation of D-galactose, D-mannose, and N-acetylneuraminic acid was found to be as effective as a reference gentamicin sulfate preparation in vivo for treating acute P. aeruginosa otitis externa in human patients under the conditions of a double-blind prospective clinical trial.28 Occupation of lectins on the bacterial surface by exogenous sugars is thought to prevent bacterial adherence.26,29 Similarly, mannosyl-bearing carbohydrate residues on canine epithelial cells were found to serve as ligands for adhesins expressed by the yeast Malassezia pachydermatis.30

In the present study, it is unknown to what extent the specific sugars incorporated in the new formula have contributed to the overall antimicrobial efficacy of the solution. However, the use of specific sugars to competitively displace pathogenic microorganisms from their attachment sites may provide an interesting adjunctive benefit to antiseptic activity, representing a new promising “antiadhesive” approach to combat ear infections, particularly when the causative agent is an antibiotic-resistant strain of bacteria.27

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