Performance of the Vetscan Imagyst® AI Faecal Application v2.0

2023 ACVIM ABSTRACT - PRESENTED JUNE 2023

Field Evaluation of Vetscan Imagyst® Artificial Intelligence (AI) Faecal Canine and Feline Parasite Detection[1]

Authors

- Yoko Nagamori, Zoetis Inc, DVM, MS, DACVM (Parasitology)
- Cory Penn, Zoetis Inc, DVM
- Anonda Haskin, Zoetis Inc, DVM

Background

The Vetscan Imagyst AI Faecal application utilises a deep-learning artificial intelligence (AI) algorithm to detect parasite ova, cysts, and oocysts in canine and feline faeces. Deep-learning AI algorithms evolve by learning from additional data sets provided by medical experts. Regular evaluation of algorithm performance and usability are essential to ensure the high quality on-market device.

Hypothesis/Objectives

The Vetscan Imagyst AI Faecal algorithm (v2.0) will correctly identify the diagnostic stages of *Ancylostoma, Cystoisospora, Giardia, Toxocara,* and *Trichuris* in faecal samples of naturally infected dogs and cats previously scanned and manually evaluated by diagnostic parasitology experts from multiple geographies across the U.S.

Animals

853 faecal samples from a mix of client-owned animals undergoing routine faecal examinations (502 canine, 203 feline, and 148 *Giardia* (dog and cat)).

Methods

In previous studies, the 853 faecal samples were processed, manually read by diagnostic parasitology experts, and digitally stored for future evaluation. In this study, those digitally scanned images were analysed using the Vetscan Imagyst AI Faecal algorithm (v.8293) and compared against the original diagnostic parasitology expert manual reads.

Results

Combined diagnostic sensitivity and specificity for canine and feline samples for *Ancylostoma, Toxocara, Cystoisospora,* and *Giardia* ranged from 90.7 - 95.5% and 96.0 - 98.8%, respectively. Sensitivity and specificity for canine Trichuris was 93.1% and 99.7%, respectively (Table 1).

Conclusions and Clinical Importance

The results of the Vetscan Imagyst AI Faecal algorithm tested in this study were comparable to those of diagnostic parasitology experts.

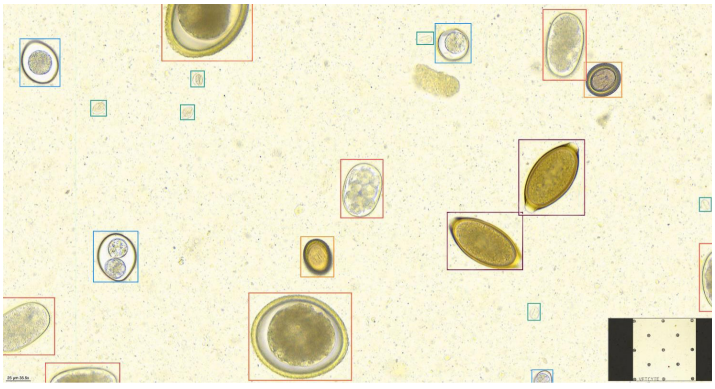
Performance of the Vetscan Imagyst® AI Faecal Application v2.0

Vetscan Imagyst AI Faecal Application (v2.0) Performance in Dogs and Cats

Table 1.
Diagnostic Sensitivity and Specificity of The Vetscan Imagyst AI Faecal Algorithm in Comparison to the Results Reported by Experts.

Parasite	Sensitivity (95% CI)	Specificity (95% CI)
***Ancylostoma* spp. (Hookworm)**	90.7%[1,3] (86.4 – 94.0%)	97.5%[1,3] (95.8 – 98.6%)
***Toxocara* spp. (Roundworm)**	95.5%[1,3] (91.7 – 97.8%)	98.3%[1,3] (96.9 – 99.2%)
Trichuris vulpis* **(Whipworm)**	93.1%[1,3] (87.8 – 96.5%)	99.7%[1,3] (98.7 – 100.0%)
Taeniidae	100%[2] (78.3 – 100%)	97.8%[2] (93.1 – 99.5%)
***Cystoisospora* spp. (Coccidia)**	94.9%[1,3] (90.6 – 97.6%)	96.0%[1,3] (94.1 – 97.4%)
Giardia	92.1%[1,3] (83.5 – 96.9%)	98.8%[1,3] (94.6 – 99.9%)

*Dog samples only



Example of a scanned image of a faecal slide by the Vetscan Imagyst AI Faecal Application.

References

1. Nagamori Y, Haskin A, Penn, C. Abstract ID15: Field Evaluation of Vetscan Imagyst Artificial Intelligence (AI) Fecal Canine and Feline Parasite Detection (2024), 2023 ACVIM Forum Research Abstract Program. *J Vet Intern Med*, 38: 705. *https://doi.org/10.1111/jvim.16913.*
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3. Nagamori Y, Scimeca R, Hall-Sedlak R, et al. Multicenter evaluation of the Vetscan Imagyst system using Ocus 40 and EasyScan One scanners to detect gastrointestinal parasites in feces of dogs and cats. *J Vet Diagn Invest*. 2024 Jan;36(1):32-40. *https://journals.sagepub.com/doi/10.1177/1040638723121618 5?url_ver=Z39.88-2003&rfr_id=ori:rid:crossref.org&rfr_dat=cr_pub%20%200pubmed.*

Performance of the Vetscan Imagyst® AI Blood Application v1.0

2024 ACVIM ABSTRACT (EXCERPT) - PRESENTED JUNE 2024

Diagnostic Assessment of Point-of-Care Scanning System Integrated with Deep-Learning Algorithms for Canine/Feline Blood Film Evaluation[1]

Authors

- Eric Morissette, Zoetis Inc, BSc, DVM, Diplomate ACVP (Clinical)
- Cory Penn, Zoetis Inc, DVM

Background

Comprehensive haematological assessments in canines and felines involve both quantitative (cell counts) and qualitative (blood smear) analyses. Analysing blood smears poses challenges due to technique variations, training disparities, workflow complexities, and time constraints impeding routine blood smear reviews.

Objectives

Assess the performance of the Vetscan Imagyst (VS-I) Blood Smear application, an artificial intelligence algorithm designed for haematological analysis and compare it to ACVP-board-certified clinical pathologists (CPs). Objectives included: determination of accuracy of monolayer detection, WBC estimate, WBC differential, polychromatophil count, and platelet estimate.

Method

Blood smears (119 total, 59 dogs, 60 cats) were retrospectively collected from Zoetis Reference Laboratories. The Grundium Ocus® 40 was used to scan all slides. A randomised 2 out of 4 CPs and the VS-I blood smear algorithm evaluated the samples. The agreement between VS-I and the CPs was assessed.

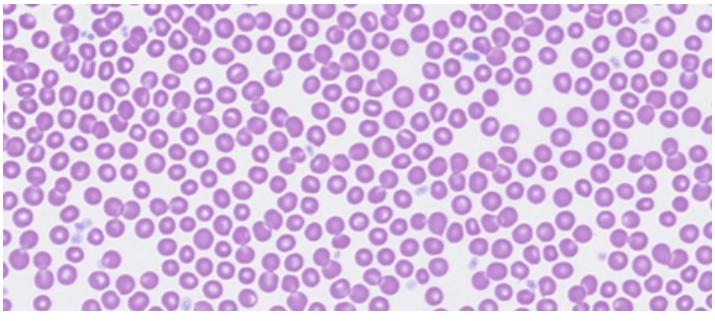
Results

The percentage of samples where VS-I was within 99% prediction interval with the CPs for each white blood cell class differential ranged from 93.2% – 100% for dogs and 88.3% – 100% for cats (Table 1).

The number of samples where VS-I was within 95% prediction interval with the CPs for each cell class estimated number ranged from 88.1% – 94.2% for dogs and 83.3% – 95.0% for cats. (Table 2).

Conclusion/Significance

The VS-I Blood Smear application demonstrated results comparable to ACVP-board-certified clinical pathologists' haematological assessments, providing a solution for efficient and consistent haematological analysis, providing in-house blood smear haematology in veterinary medicine for enhanced care.



Blood smear whole slide image (WSI) from the Vetscan Imagyst

Performance of the Vetscan Imagyst® AI Blood Application v1.0

Image 1.

Example of canine lymphocytes prediction interval. Each clinical pathologist result is represented with a blue dot on the graph. A 99% prediction interval was calculated and depicted with the black lines. The Vetscan Imagyst results are depicted with an orange dot and line.

57 of 59 (96.61%) Vetscan Imagyst® AI Results within the 99% Prediction Interval[2]

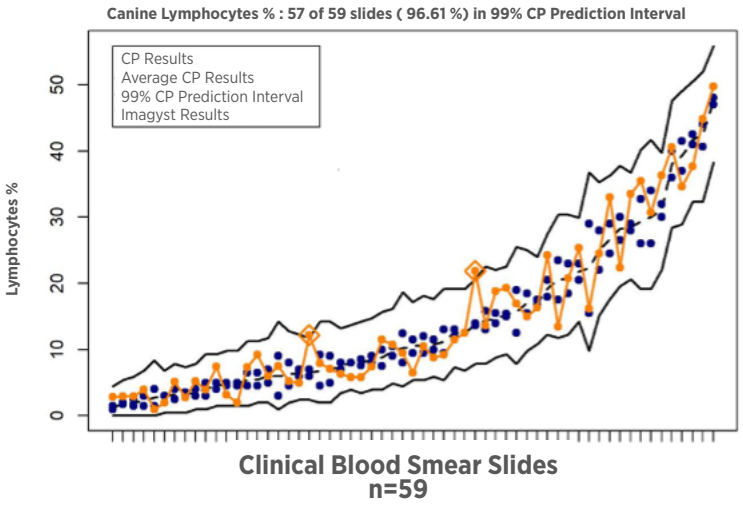


Table 1.

Vetscan Imagyst Blood Smear Application Performance for Samples within 99% Prediction Interval with ACVP-Certified Pathologists for each cell class differential number for Canine and Feline samples[2]

	White Blood Cell Differential %	Percentage of Slides Within 99% Prediction Interval
	Neutrophil %	93.22% (55/59)
	Lymphocyte %	96.61% (57/59)
	Monocyte %	96.61% (57/59)
	Eosinophil %	100% (59/59)
	Basophil %	100% (59/59)
	Neutrophil %	88.33% (53/60)
	Lymphocyte %	91.67% (55/60)
	Monocyte %	95.00% (57/60)
	Eosinophil %	98.33% (59/60)
	Basophil %	100% (60/60)

Table 2.

Vetscan Imagyst Blood Smear Application Performance for Samples within 95% Prediction Interval with ACVP-Certified Pathologists for each cell class estimated number for Canine and Feline samples[2]

	Cell Counting	Percentage of Slides Within 95% Prediction Interval
	Est. Total WBC Count	94.92% (55/59)
	Est. Platelet Count	93.22% (55/59)
	Polychromatophil %	88.14% (52/59)
	Est. Total WBC Count	90.00% (54/60)
	Est. Platelet Count %	83.33% (50/59)
	Polychromatophil %	95% (57/60)

References

1. Morissette E and Penn C. 2024. Diagnostic assessment of point-of-care scanning system integrated with deep-learning algorithms for canine/feline blood film evaluation. ACVIM Forum Research Abstract Program.
2. Zoetis Data on File. Study Report No. D870R-US-21-045 (TI-07254).

Performance of the Vetscan Imagyst® AI Dermatology Application v2.0

ABSTRACT

Deep-Learning Artificial Intelligence (AI) Based Approach for Efficient Evaluation of Canine/Feline Dermatological Cytology Samples[1]

Authors

- Kristin Owens, Zoetis Inc, DVM, Diplomate ACVP (Clinical)
- Eric Morissette, Zoetis Inc, BSc, DVM, Diplomate ACVP (Clinical)
- Mary Lewis, Zoetis Inc, MS, DVM, Diplomate ACVP (Clinical)
- Cory Penn, Zoetis Inc, DVM

Background

Dermatology is a top reason for veterinary visits for dogs/cats, and diagnostic testing is a vital part of case management. A digital tool for rapid, consistent evaluation of dermatological cytology samples has historically been lacking.

Hypothesis/Objectives

The Vetscan Imagyst (VS-I) AI Dermatology Application utilising an evolved algorithm (v2.0) will accurately identify inflammatory leukocytes, bacteria, and yeast on digital slides in agreement with ACVP-boarded (ACVP) clinical pathologists (CPs).

Animals

No animals were utilised in this study. Slide specimens from general practice veterinarians and boarded veterinary dermatologists represented a mix of client-owned canine and feline samples.

Methods

Slides (ear swabs, skin swabs, skin impressions; n=218) were prepared in-clinic, quick Romanowsky stained, coverslipped, and scanned by Grundium Ocus 40. Three ACVP CPs independently scored slides as positive or negative for presence or absence of object classes: inflammatory leukocytes (neutrophils, macrophages, lymphocytes, eosinophils), bacteria (cocci, rods), and yeast (*Malassezia* spp.). VS-I AI Dermatology application analysed these same 218 slides for presence/absence of each object class.

Results

The VS-I AI Dermatology v2.0 algorithm reliably identified bacteria (cocci and rods), yeast, and inflammatory leukocytes. Sensitivity for object classes ranged from 83% - 96%; specificity ranged from 76% - 95% (Table 1).

Conclusions and Clinical Importance

Performance of the VS-I AI Dermatology v2.0 algorithm was comparable to expert ACVP CPs in identification of object classes in dermatological cytology samples. In-house utilisation of the Vetscan Imagyst AI Dermatology v2.0 application can provide a diagnostic tool for consistently identifying inflammatory cells, bacteria, and yeast.

Performance of the Vetscan Imagyst® AI Dermatology Application v2.0

Algorithm Performance

Table 1.

Sensitivity and specificity of Vetscan Imagyst AI Dermatology v2.0 Algorithm as compared to ACVP-CP Consensus.

	Sensitivity (95% CI)	Specificity (95% CI)
Macrophages	96% (91 – 99%)	84% (76 – 90%)
Eosinophils	93% (83 – 97%)	94% (89 – 97%)
Lymphocytes	86% (79 – 91%)	85% (77 – 91%)
Neutrophils*	95% (90 – 98%)	95% (89 – 98%)
Cocci Bacteria	86% (80 – 92%)	82% (73 – 89%)
Rod Bacteria	83% (72 – 91%)	76% (69 – 82%)
Yeast (Malassezia)**	92% (82 – 97%)	87% (81 – 91%)

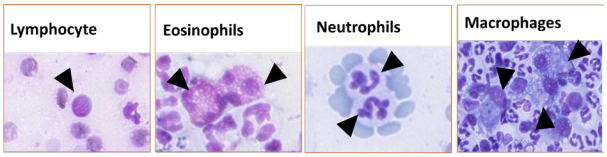
95% Jeffreys Confidence Interval (CI)

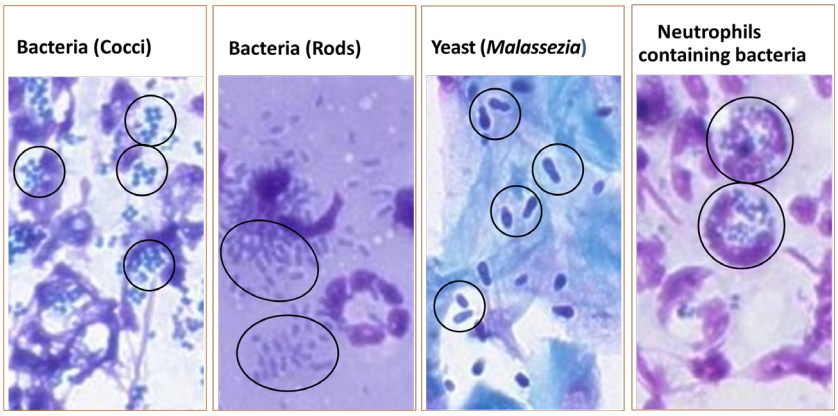
* Normal and degenerate

** Including Malassezia on Keratinocytes

Precision rate for identifying cocci and rod bacteria was 89% with the Vetscan Imagyst AI Dermatology application.

Images of object classes from Grundium Ocus 40 scanner. Inflammatory leukocytes indicated by arrowheads (lymphocytes, eosinophils, macrophages, neutrophils), infectious agents (bacteria (cocci, rods), and yeast (Malassezia spp.)) and neutrophils containing bacteria, indicated by open circles.





References

1. Zoetis Data on File. Study Report No. DHX6Z-US-23-222 (TI-10137).

Performance of the Vetscan Imagyst® AI Equine Faecal Egg Count (FEC) Application v1.0

2023 AAVP ABSTRACT - PRESENTED JUNE 2023

2023 AAEP ABSTRACT - PRESENTED NOVEMBER 2023

Validation of Vetscan Imagyst®, A Diagnostic Test Utilising an Artificial Intelligence Deep-Learning Algorithm, for Detecting Strongyles and *Parascaris* spp. in Equine Faecal Samples[1,2,3]

Authors

- SaraBeth Boggan
- Ashley Steuer, DVM, PhD
- Jason Fritzler, PhD
- Ian Daniel
- Bobby Cowles, DVM, MS, MBA
- Cory Penn, DVM
- Dan Lin, PhD

Background

Faecal egg counts are an important diagnostic tool in equine parasite management; however, many current methods can be inaccurate and imprecise, and vary widely depending on the analyst's skill and experience. The Vetscan Imagyst® is a multi-use platform that includes a novel faecal parasite detection application that uploads the scanned image to the cloud where proprietary software analyses captured images for diagnostic recognition by a deep-learning, object-detection AI algorithm.

Objectives

The objectives of the study were: 1) To assess the performance of the Vetscan Imagyst equine sample preparation method as compared to a Mini-FLOTAC test, 2) To assess accuracy of how the Vetscan Imagyst algorithm classifies and enumerates equine Strongyles and *Parascaris* spp. ova in faeces of naturally infected equids as compared to a parasitologist.

Methods

For the study, a total of 54 equine faecal samples, including foal and adult samples, were processed in triplicate with Sheather's Sugar Solution (SG - 1.26), which allowed for precision to be evaluated as well.

Results

The recovery sensitivity for the sample prep portion of the study was 98.3% and 99.9% for *Parascaris* spp. and Strongyles. The diagnostic sensitivity and specificity for the algorithm evaluation ranged between 99% and 99.9% - 100%, respectively for the 2 targeted parasites.

Conclusions and Clinical Importance

Accuracy results from the study indicated that Vetscan Imagyst consistently provided diagnostic accuracy comparable to manual evaluations by diagnostic parasitology experts. As an automated method driven by a deep learning AI algorithm, Vetscan Imagyst has the potential to avoid variations in analysts, thus providing more consistent results in a timely manner.

Performance of the Vetscan Imagyst® AI Equine Faecal Egg Count (FEC) Application v1.0

The Diagnostic Sensitivity and Specificity Comparison of Vetscan Imagyst and a Diagnostic Parasitology Expert Was Greater than 99%[1]

Table 1.
Diagnostic sensitivity and specificity of the Vetscan Imagyst AI Equine FEC analysis compared with the results reported by experts.

Parasite Ova	Sensitivity	Specificity
Strongyle	100% (100 – 100%)	99.9% (99.9 – 100%)
***Parascaris* spp.**	99.9% (99.9 – 100%)	99.9% (99.9 – 100%)

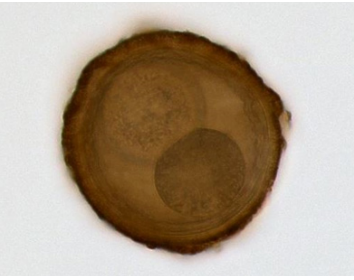
95% Jeffreys Confidence Interval

Substantial Agreement Between Vetscan Imagyst and Diagnostic Parasitology Experts[1]

In addition to the qualitative evaluation of the Vetscan Imagyst algorithm, a quantitative clinical correlation was assessed between the Vetscan Imagyst algorithm, and the expert read of the slides. A Lin's correlation coefficient was calculated to quantify the agreement/concordance between the Vetscan Imagyst Algorithm results for each parasite in each flotation solution and the gold standard evaluation of the slide by diagnostic parasitology experts.

Agreement as calculated by a Lin's concordance correlation coefficient:

- **Strongyle: 0.978**
- ***Parascaris* spp.: 0.944**



Equine *Parascaris* egg. Image collected from Vetscan Imagyst.

Equine Strongyle egg. Image collected from Vetscan Imagyst.

References

1. Zoetis Data on File. Study Report No. DHX6Z-US-22-131 (TI-08834).
2. Boggan SB, Steuer A, Fritzler J, et al. "Validation of Vetscan Imagyst™, a diagnostic test utilizing an artificial intelligence deep-learning algorithm, for detecting strongyles and Parascaris spp. in equine fecal samples". In: 68th Annual Meeting of American Association of Veterinary Parasitologists; 2023 June 10 – 13; Lexington, KY.
3. Penn C. "Validation of a diagnostic test utilizing an artificial intelligence deep-learning algorithm, for detecting strongyles and Parascaris spp. in equine fecal samples" In: 69th American Association of Equine Practitioners Annual Convention; 2023 Nov 29 – Dec 5; San Diego, CA.

Performance of Vetscan Imagyst® AI Urine Sediment Application v1.0

2024 ACVIM ABSTRACT - PRESENTED JUNE 2024

Comparison of Urine Sample Preparation Methods in Recovering Urine Sediment Elements from Canine/Feline Samples

Authors

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- Eric Morissette, Zoetis Inc BSc, DVM, Diplomate ACVP (Clinical)
- Kristin Owens, Zoetis Inc, DVM, Diplomate ACVP (Clinical)
- Cory Penn, Zoetis Inc, DVM

Background

In-clinic analysis of warm, fresh urine provides rapid results of urine sediment findings. A simple, standardised preparation method would aid in performing urine sediments in-clinic.

Hypothesis/Objectives:

The Vetscan Imagyst preparation method (VSI-prep) will recover similar numbers of red blood cells, white blood cells, struvite crystals, calcium oxalate dihydrate crystals, squamous epithelial cells, other epithelial cells, hyaline casts, non-hyaline casts and rod and cocci bacteria as determined by manual microscopic examination by ACVP-boarded clinical pathologists (ACVP-CPs) as compared to standard reference lab preparation method (SRL-prep).

Animals

No animals were used in this study. Urine samples included a mix of client-owned dogs and cats undergoing urinalysis for any reason submitted to Zoetis Reference Laboratories. Some samples were artificially created by spiking donor urine with necessary elements (e.g., RBC from whole blood). A total of 213 paired urine samples consisting of 116 canine (54.5%) and 97 feline (45.5%) were evaluated.

Methods

Two 1mL aliquots were made from each urine sample, processed via VSI-prep or SRL-prep, and blindly evaluated via manual microscopy by the same 2 ACVP-CPs. SRL-prep served as the gold standard for comparison. ACVP-CPs recorded results for urine elements as an average of 10, 40X fields. Species were combined for analysis.

Results

Aggregate % agreement of samples in which formed element isolation with the VSI sample prep was greater than or equal to SRL sample prep ranged between 91.7 -99.5% (Table 1).

Conclusions and Clinical Importance

VSI-prep recovered similar numbers of urine sediment elements in canine and feline urine sediment samples as SRL-prep.

	Red Blood Cells	White Blood Cells	Calcium Oxalate Crystals	Struvite Crystals	Cocci Bacteria	Rod Bacteria
% samples In which formed element Isolation with VSI sample prep was ≥ to SRL sample prep	91.7%	91.9%	95.0%	92.3%	91.9%	92.4%

	Squamous Epithelial Cells	Other Epithelial Cells	Hyaline Casts	Non-Hyaline Casts
% samples In which formed element Isolation with VSI sample prep was ≥ to SRL sample prep	97.9%	98.6%	99.5%	98.8%

Performance of Vetscan Imagyst® AI Urine Sediment Application v1.0

2024 ACVIM ABSTRACT - PRESENTED JUNE 2024

Deep-Learning Artificial Intelligence (AI) for Rapid and Reliable Evaluation of Canine/Feline Urine Sediment Samples[2,3]

Authors

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- Anonda Haskin, Zoetis Inc, DVM
- Eric Morissette, Zoetis Inc, BSc, DVM, Diplomate ACVP (Clinical)
- Kristin Owens, Zoetis Inc, DVM, Diplomate ACVP (Clinical)
- Cory Penn, Zoetis Inc, DVM

Background

Urine sediment examination is vital to a complete urinalysis. A deep learning AI tool for in-clinic, rapid, and consistent evaluation of urine sediment samples is currently lacking.

Hypothesis/Objectives:

Vetscan Imagyst (VSI) AI Urine Sediment will accurately identify red blood cells, white blood cells, struvite crystals, calcium oxalate dihydrate crystals, and rod and cocci bacteria in agreement with digital review by ACVP-boarded clinical pathologists (ACVP-CPs).

Animals

No animals were used in this study. Urine samples included a mix of client-owned dogs and cats undergoing urinalysis for any reason submitted to Zoetis Reference Laboratories. Some samples were artificially created by spiking donor urine with necessary elements (e.g., RBC from whole blood). A total of 175 urine samples consisting of 98 canine (56%) and 77 feline (44%) were evaluated.

Methods

Samples were prepped via the VSI prep method, scanned, and evaluated digitally by 2 randomised, blinded ACVP-CPs who recorded results for urine elements as an average of 10, 40X fields. Algorithm performance was calculated as compared to ACVP-CP consensus, which served as gold standard.

Results

The VSI AI Urine Sediment algorithm reliably identified urine sediment elements. Sensitivity and specificity for urine sediment object classes ranged from 73 - 98% and 76 - 99%, respectively (Table 1). Combined bacteria identification had a positive predictive value of 91%.

Conclusions and Clinical Importance

VSI AI Urine Sediment algorithm tested in this study was comparable to those of ACVP-CPs in the identification of elements in urine sediment. In-clinic utilisation of VSI AI Urine Sediment can provide a diagnostic tool for urine sediment evaluation.

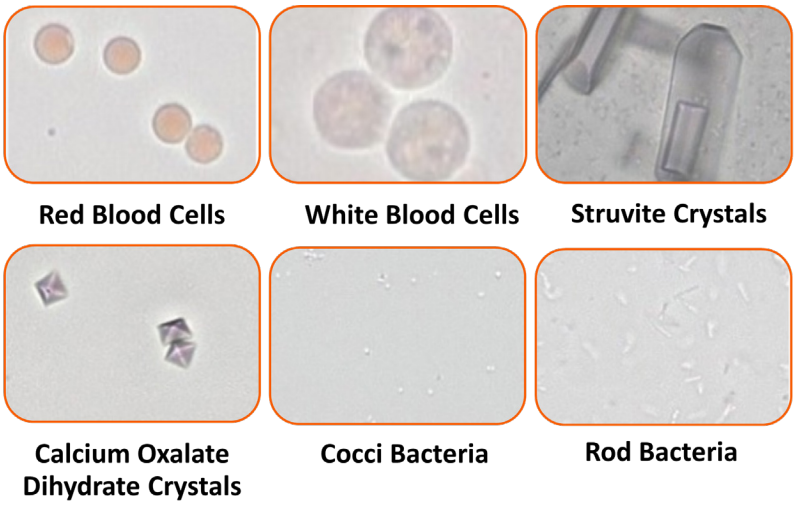
Performance of Vetscan Imagyst® AI Urine Sediment Application v1.0

Algorithm Performance

Table 1.

Sensitivity and specificity of Vetscan Imagyst AI Urine Sediment Algorithm (v1.0) as compared to ACVP-CP Consensus.

Urine Sediment Element	Sensitivity (95% Confidence Interval)	Specificity (95% Confidence Interval)
RBC	95% (89 – 99%)	86% (75 – 93%)
WBC	85% (72 – 93%)	96% (90 – 99%)
Struvite Crystals	91% (80 – 97%)	91% (83 – 96%)
Calcium Oxalate Dihydrate Crystals	98% (88 – 100%)	99% (95 – 100%)
Rod Bacteria	97% (90 – 100%)	76% (64 – 85%)
Cocci Bacteria	73% (58 – 85%)	84% (73 – 92%)



Objects Detected: Red blood cells, White blood cells, Struvite crystals, Calcium oxalate dihydrate crystals, and rod-shaped and cocci bacteria (left to right). 40x

References

1. Haskin A, Lewis M, Morissette E, Owens K, Penn C. 2024. Comparison of Urine Sample Preparation Methods in Recovering Urine Sediment Elements from Canine/Feline Samples. ACVIM Forum Research Abstract Program.
2. Zoetis Study Report No. DHXMZ-US-23-218.
3. Haskin A, Lewis M, Morissette E, Owens K, Penn C. 2024. Deep-Learning Artificial Intelligence (AI) for Rapid and Reliable Evaluation of Canine/Feline

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