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Detection Of Diseases Including Coronavirus (Covid-19) Using Dogs: A Systematic Study And Review

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Abstract. Animals Possess Abilities Like Camouflage, Regeneration And Diagnostics. A Recent Health Line Survey Says That Some Animals Are Able To Detect Various Diseases In Human Beings. These Animals Use Visual Cues, Smell And Other Aptitudes. Many Researches Have Proved That Dogs Can Detect Certain Types Of Cancers With High Accuracy And They Are Capable Of Sensing Hyperglycemia And Hypoglycemia. This Paper Concentrates On Summarizing The Diseases That Are Detected By Dogs And The Way In Which It Identifies The Coronavirus (COVID – 19). This Research Also Shows The Comparison Of The Researches Of Detecting Various Diseases By Dogs.

1. INTRODUCTION

The Most Dreadful And Wide Spreading Coronavirus (COVID-19) Was First Discovered On December 31st, 2019. It Was First Discovered In The City Of Wuhan, China[1]. The COVID-19 Was Originated From A Virus Named Severe Acute Respiratory Syndrome Coronavirus (SARS-Cov-2). Coronavirus Represents A Family Of Viruses That Results In Cough, Throat Pain, Shortness Of Breath And Fever[2]. Shortness Of Breath Results In Decrease In Oxygen Level Thus Making The Patient Live Only With The Help Of Life Supporting Machines. The Symptoms Of Coronavirus Resemble The Symptoms Of MERS-Cov (Middle East Respiratory Syndrome) And SARS-Cov (Severe Acute Respiratory Syndrome)[3]. The Human Coronavirus Is Classified Into Four Categories Namely Alpha, Beta, Gamma And Delta. The Corona Virus Was First Identified In 1960. Some Of The Corona Virus Starts From Animals And Spreads To Human Beings[4]. The COVID-19 Has Not Been Previously Identified In Humans And It Was Identified Only In 2019. It Originated In China Later It Started To Spread Across Other Countries Of China Followed By Rapid Spread All Over The World[5]. The Current Number Of People Who Suffered And Are Suffering From The COVID-19 Is 6.69 Million And The Number Of Patients Who Recovered Is 5.66 Million[6]. The Mortality Rate Is Also High For COVID-19 Compared To Other Viruses. COVID-19 Has 104 Thousand Death Cases So Far All Over The World. Identifying The COVID-19 Virus At The Initial Stage Helps To Reduce The Spread Of Disease. Early Detection, Isolation From Other People And Immediate Treatment Reduces The Fatal Rate. COVID-19 Spreads From People To People Through Close Contact Via The Droplets Produced By Infected Persons During Cough, Sneeze Or Even Talking[7]. People Sometimes Can Infect When They Touch The Contaminated Surface And Then Touch Their Nose, Mouth Or Eyes. The Virus Penetrates Inside The Human Body Only Through Eyes, Nose And Mouth[8]. Currently The COVID-19 Testing Requires Nasopharyngeal Swabs

Applied By A Skilled Person And A Reverse Transcription Polymerase Chain Reaction Test (RT-PCR) For Identifying The Pathogen. This Method Requires A Skilled Trainer To Perform This Test And It Is Time Consuming. The Test Is Also Cost Prohibitive For Many Of The Developing Countries. Hence There Is A Need To Find An Alternative Method That Is Faster, Highly Reliable, Non-Invasive To Detect Both The Asymptomatic And Pre-Symptomatic Individuals Suffering From COVID-19[9].

Many Researches Have Proved That The Canines Have An Unusual Olfactory Acuity To Identify Persons Suffering From Various Diseases. Researches Proved That Dogs Are Highly Capable Of Detecting Cancer. Particularly The Dogs Are Capable Of Detecting Breast And Lung Cancer[10]. The Dogs Are Also Talented To Detect The Sugar Levels Among The Patients Suffering From Diabetes. Similarly Italian Studies Proved That Fruit Flies Have The Ability To React To The Scents Present In The Cancer Cells. These Bugs Are Capable Of Differentiating Different Types Of Cancer. The Mice Can Also Be Trained To Detect The Avian Flu In The Feces Of Ducks And The Results Obtained Show 90% Accuracy. The Pigeons Are Also Trained To Detect The Malignant Tumours. They Are Capable Of Differentiating The Tumours And Non-Tumours Cells[11][12]. Initially The Accuracy Was Only 50% Percent And It Improved To 85% Accuracy By Aggressively Training And Testing The Samples. In This Paper, Identifying COVID-19 Using Sniffer Dogs Has Been Proposed.

The Dogs Can Detect Pathogen-Specific Odours That Are Made Up Of Specific Patterns Of Volatile Organic Compounds (Vocs). The Viruses Are Not Capable Of Developing Their Own Metabolism Hence Vocs Are Released From Damaged Cells As A Result Of Metabolic Host Process. It Is Easy To Train The Dogs And In This Paper Sniffer Dogs Are Used To Detect COVID-19 In The Real World. The Dogs Are Trained To Differentiate The Infected And Non-Infected People. This Method Of Detecting COVID-19 Using Sniffer Dogs Can Be Employed In Massive Crowd Gathering Such As Airports, Railway Station, Stadiums, Political Rallies, Etc. This Method Can Be Considered As An Additional Method Along With The Clinical Examination Of Nasopharyngeal Swabs.

1 Literature Review

Dogs: Canines Have A High Sense Of Detecting Various Diseases. Researches Proved That Dogs Are Capable Of Detecting Breast Cancer And Lung Cancer With 88% And 99% Accuracy Respectively. Dogs Even Sense Patients Having Hyperglycemia And Hypoglycemia.

Fruit Flies: The Italian Study Proved That Fruit Flies Use Their Antenna To React To The Scents Of Certain Cancer Cells. They Are Also Capable Of Differentiating Different Types Of Cancer.

Mice: There Is A Flu Named Avian Flu In Ducks. American Scientists Proved That The Mice Can Be Trained With 90% Accuracy To Detect The Avian Flu In Ducks.

Pigeons: The Malignant And Non- Malignant Tumours Can Be Differentiated By Training The Pigeons. Pigeons Were Able To Identify The Cancerous Cells With 50% Accuracy With One Day Of Training. However The Accuracy Increased To 85% By Training The Pigeons For 15 Days.

Rats: The Tuberculosis Can Be Detected By Training The Gambian Pouched Rat Or By Training The Giant African Pouched Rat. The Rats Were Able To Detect Tuberculosis With 80% Accuracy.

With Animals Having High Olfactory Detection Of Human Diseases, Researchers Have Started Focusing On Training The Canines To Identify And Detect Diseases. The Dogs Have

Been Assessed As Detectors To Detect Various Types Of Cancer In Recent Studies. The Researchers Have Also Focused On Bacteriuria, Clostridium Difficile, Hypoglycemia, And Tuberculosis. The Only Exceptions To Canine Detectors Were Nematodes And Pouched Rats. The Operationally Feasible Procedures Were Used Only By 9 Out Of 28 Studies Meeting Inclusion Criteria. The Threat To Operational Viability Is Using Only A Fixed Number Of Positive Samples In Each Sample Run. There Is No Sufficient Information From The Reports Obtained To Replicate Or To Evaluate The Validity Of The Findings. Hence Recommendations Have Been Made To Focus On The Type Of Information That Should Be Included When Describing Research In This Area. The Result Of This Systematic Review Suggests That Animals Can Be Used As Detectors In Certain Diagnostic Procedures Along With Additional Research Evaluating Operationally Viable Systems For Olfactory Detection Of Human Diseases Is Necessary.

1 Proposed Work

The Patients With Some Infectious Diseases Can Be Diagnosed With The Help Of Smell And Even Scents And Odours Characterize Some Microbes When Grown In The Laboratory. Animals Have The Ability To Sniff And Animal Olfactory Acuity Is Used For Detecting Various Diseases In People, Weapons, Bombs, Narcotics And Food. The Proposed Work Briefly Summarizes The Study Of Various Canines And Their Sensing Capabilities To Detect Various Diseases.

In This Paper We Have Summarized The Current Knowledge Related To Sniffing Animals That Are Employed In Detecting And Diagnosing The Infectious Diseases.

2 Review And Systematic Study Of Dogs Detecting Various Diseases

The Major Areas Where These Sniffing Animals Can Be Used Are Summarized. The Stool Associated With Toxigenic Clostridioides Difficile Can Be Detected Using Dogs And Can Be Used For Surveillance. Escherichia Coli Is A Bacteria Present In The Urinary Tract Infections And The Dogs Were Trained To Detect E-Coli. The Results Obtained From That Showed High Sensitivity And Moderate Specificity. Training Was Given To African Giant Pouched To Detect Tuberculosis Which Showed Superior Results When Examined Using Microscopy Compared To Culture Or Molecular Methods. Researches Proved That Malaria Could Be Detected By Analyzing Host Skin Odour Or Exhaled Breath And The Research Turned Out To Be A Successful One. In Few Diseases Specific Volatile Organic Compounds (Vocs) Are Produced From Microbes And Those Microbes Can Be Analyzed Using Spectrometry, Metabolomics Or Other Analytical Approaches That Can Be Used To Replace Animal Sniffing.

The Results Obtained From Sniffing Animal Studies Are Productive And The Results Provide Intermediate Diagnostic Solutions For Some Infectious Diseases. The Reason For Not Implementing Widely Using Sniffed Animals Is That The Animals Tend To Lose Their Reproducibility And Cost Of Training Also Seems To Be High. Understanding The Biological Background Of The Animal Ability And To Characterize The Specific Vocs That Animals Are Recognizing Is The Ultimate Goal. The Implementation Of Scent-Based Tests For Major Human Pathogens Can Be Done By Identifying The VOC’s And Improving Odour Sampling Methods And Development Of Point-Of-Care Instruments.

3 Dogs Against Covid-19

The Recent Diagnosis Is Dogs Employed In Detecting The Pandemic Coronavirus COVID-19 Which Is Spread Worldwide. The Study At University Of Helsinki Proved That

The Previously Unknown Odour Signature Of The COVID-19 Disease Caused By The Novel Coronavirus Was Detected By Trained Dogs. A Few Months Later, The Dogs Were Also Able To Differentiate The Urine Samples Of Healthy Humans From People Suffering From Coronavirus Accurately. The Results Were The Same As PCR Tests.

The Finnish Scientists Are Focusing On Using The Trained Dogs For A Large Number Of Patient Samples. At The Same Time Various Research Institutes In France, America, UK And Germany Are Also Focusing The Same. But The Substance That Produces The Characteristic Of COVID-19 In The Urine Odour Is Still Unclear. There Is A Chance Of Urine Odour Getting Changed From Time To Time Since COVID-19 Attacks The Lungs First Later On It Also Damages The Blood Vessels, Heart, Kidney And Other Organs. The COVID-19 Is Associated With Respiratory Diseases And When It Comes To Respiratory Diseases There Is A Change In Body Odour And Hence It Is Easy For Trained Dogs To Detect The Novel Corona Virus. The Researchers Also Have High Hope On This And Are Working On It.

The Dogs Are Trained In Such A Way That They Are Capable Of Detecting Persons Who Possess No Symptoms In An Effective And Fast Manner. Many Researchers Are Working To Find Vaccines For COVID-19 And Along With This Training The Dogs To Detect COVID-19 Goes Parallel.

Although Many Studies Have Proven That Dogs Can Detect Various Diseases, It May Take Some Time For Dogs To Fully Replace The Standard Techniques Of Detection. It Is Still Unknown For The Researchers About The Chemical Compounds The Dogs Use To Identify The Presence Of Disease And This Remains As An Obstacle To Provide An Efficient Training For The Sniffing Dogs. Looking And Analyzing Precisely What The Dogs Are Noticing May Allow The Training To Be Standardized. Few May Believe And Trust The Diagnosis Made By Dogs But Still Many Deny Accepting The Diagnosis Made By Dogs.

The Report From German Researchers States That The Trained Dogs Can Detect COVID-19 In Human Beings With A Success Rate Of 94%. Since Dogs Have Sensing 1000 Times Better Than Humans, Samples Of Eight Dogs Were Taken And They Were Trained For Detecting COVID-19 Using The Saliva Of An Individual. Detecting Coronavirus Using Sniffing Dogs Can Be Employed In Public Places Where There Is A Massive Crowd.

According To The Recent Study From German Researchers Found That Dogs Can Detect Coronavirus In Humans With A Success Rate Of 94%. When This Method Of Detecting Coronavirus Is Employed In Public Places, There Is A Chance To Stop The Spreading Of COVID-19 Further. Once It Is Brought Under Control, Then Early Detection And Treatment May Reduce The Fatal Rate To Great Extent. At Least Now, An Effective And Rapid COVID-19 Detection Method Should Be Employed Throughout The World. The University Veterinary Medicine Hannover Published A Pilot Study In The BMC Infectious Diseases Stated That A Set Of Eight Dogs From Germany's Armed Forces Were Given Training For Seven Days And Were Able To Identify The SARS-COV-2 Virus Present In Humans. The Following Table Shows The Types Of Diseases Identified By Dogs And Percentage Of Accuracy In Identification.

S. No	Type Of Disease Identified	Parameters Taken	% Of Accuracy
1	Malaria	Odour	70
2	Lung Cancer	Blood Sample	88-97
3	Thyroid Cancer	Urine Sample	88
4	Melanoma	Blood Sample	87
5	Breast Cancer	Blood Sample	88-97
6	Parkinsons Disease	Pathogen Smell	85
7	Colon Cancer	Breath Or Stool Samples	95-98
8	Prostate Carcinoma Or Prostate Cancer	Blood Sample	90
9	Epileptic Seizures	Blood Sample	90
10	Low Blood Sugar	Blood Sample	88
11	Heart Attack	Blood Sample	87
12	Coronavirus	Saliva	96

2. CONCLUSION

The Study Clearly Indicates That Dogs Can Be Trained To Detect Various Diseases. It Can Discriminate Against Virus Infected Cells Using Odors. The Results Of The Work Show High Sensitivity Rate And Specificity Rate. The Above Survey Helps In Employing The Sniffer Dogs For Detecting Various Diseases In Real-Time. The Survey Also Demonstrates The Capability Of Dogs To Detect Odors Associated With Viruses. In Addition To The Above, The Dogs Also Offer A Platform For Discovering Advanced Chemical Sensing Machine Technologies. Since Dogs Provide Three Orders Of Magnitude, They Have More Sensory Capacity Compared To Other Current Diagnostic Instruments. Therefore, Dogs Could Be Used To Identify And Detect Peculiar Viruses Like COVID - 19.

3. REFERENCES

[1] Https://Science.Thewire.In/Health/The-Dogs-That-Were-Trained-To-Sniff-Out-The-Coronavirus/
[2] Journal Of Veterinary Behavior , Animal Olfactory Detection Of Human Diseases: Guidelines And Systematic Review, Author Links Open Overlay Paneltimothy L.Edwardsaclare M.Browneabadeeschooncdchristophecoxcalanpolingce
[3] Https://Www.Beckershospitalreview.Com/Quality/5-Animals-Capable-Of-Detecting-Infections-And-Diseases-In-Humans.Html
[4] NARRATIVE REVIEW| VOLUME 26, ISSUE 4, P431-435, APRIL 01, 2020, Sniffing Animals As A Diagnostic Tool In Infectious Diseases, E. Cambau , M. Poljak (2019)
[5] Https://Www.Understandinganimalresearch.Org.Uk/News/Research-Medical-Benefits/The-Science-Of-Sniffs-Disease-Smelling-Dogs/
[6] Https://Www.Timesnownews.Com/Health/Article/Trained-Dogs-Can-Detect-Covid-19-Infection-In-Humans-With-94-Per-Cent-Success-Rate/629345
[7] Https://Newseu.Cgtn.Com/News/2020-09-28/How-Do-Dogs-Detect-COVID-19-And-Which-Dogs-Do-It-Best--U8r9xgugzs/Index.Html
[8] Jendrny, P., Schulz, C., Twele, F. *Et Al.* Scent Dog Identification Of Samples From COVID-19 Patients – A Pilot Study. *BMC Infect Dis* 20, 536 (2020).

[9] Https://Www.Webmd.Com/Colorectal-Cancer/News/20110130/Dogs-Can-Detect-Early-Colorectal-Cancer
[10] Sujatha, K & Shalini Punithavathani, D, 'Optimized Ensemble Decision-Based Multi-Focus Image Fusion Using Binary Genetic Grey-Wolf Optimizer In Camera Sensor Networks", Spinger, DOI: 10.1007/S11042-016-4312-3, Multimedia Tools And Applications
[11] Basha, A.J., Balaji, B.S., Poornima, S. Et Al. Support Vector Machine And Simple Recurrent Network Based Automatic Sleep Stage Classification Of Fuzzy Kernel. J Ambient Intell Human Comput (2020)
[12] **12.** N. Bacanin, T. Bezdan, K. Venkatachalam, And F. Al-Turjman, "Optimized Convolutional Neural Network By Firefly Algorithm For Magnetic Resonance Image Classification Of Glioma Brain Tumor Grade," *Journal Of Real-Time Image Processing*, Pp. 1-14, 2021.