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EFFECTS OF HUMAN-PET INTERACTION; ZOOZOSIS

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Abstract

Pets are the wellspring of bliss for human; likewise, they affect their wellbeing. Nevertheless, there are some antagonistic parts of having pets as individuals having close contact with pets can be influenced by a few zoonotic illnesses such as Dermatophytosis, Toxoplasmosis, Rabies, Plague and Sarcoptes and others. Parasite, bacteria, fungi, and virus that reside in the household pets cause these ailments. The ailment can be transmitted by means of skin contact, bites (rabies), handling pet, eating infected animal (Bacillus anthracis), drinking contaminated water or indirectly through-contaminated food, insect vectors (cat scratch fever). These zoonotic diseases are extremely harmful for people that also cause death. Zoonotic infections are common. World is endeavoring to control the zoonotic infections. Anti-microbials are accessible in most of countries. The zoonotic diseases can be controlled by taking several preventive measures, such as maintaining, a strategic distance from contact with pets, enhanced sanitation, hand washing after playing with pet, dispose of the fomites, avoid sharing bed with the pet, use gloves and mask while handling the live or dead dogs and cats that are vulnerable to infection. Lack of care is an important factor for the irresistible ailments. Public awareness programs assume to play critical job in taking care of pets and reduce the risk of the zoonotic malady. The main objective of this review article is to aware the people from such harmful diseases that are very dangerous for their health. After reading this article people will be able to prevent these harmful diseases by adapting the precautionary measures.

Keywords: Immunocompromised, Mortality, Pets, Prevalence, Symptoms, Transmission, Zoonosis

INTRODUCTION

The ailment, which is caused by the interaction of humans and animals, is called Zoonosis. People have uncommon friendship with their pets; the regular pets are puppies and felines. Some little creatures are kept as 'children's pet' and owner keeps them as family members (1). Pet contributes to development of emotional, social, and physical development of youngster and owner's happiness and health (2). Pets share their common home environment and have beneficial and as well harmful effect on human health (1).

In United State, two third families have pets. A canine can cost \$8,000 and feline can cost \$10,000 in their lifetime. Individuals acquire pet to their home because of their forlornness, love for the nature and generosity towards animal. A study reveals that out of 92 heart attack victims, 28% survived who were pet owners. This demonstrates the constructive outcome of the pet-owner companionship (3). Pet owners have lesser pressure and pulse issues; they have higher confidence, positive state of mind, more aspiration and lower level of loneliness (4). Pet owners have lesser doctor visits for hypertension and cholesterol issues (2).

In the United States, the rate of mortality from the pet is 100 times more than the venomous snake. Each year, 85000 Americans get into emergency rooms because of their dogs. Individuals that interact with the pets get different maladies like scratch fever, rabies, sarcoptes, capnocytophaga canimorsus, salmonellosis and late-night commotions of pets cause real clashes between the neighbors (3).

Health danger from household pets is normal because of pet bite and sensitivity. Parasitic, viral, bacterial, and contagious diseases are transmittable from animal to human. Infectious agents in pet are typically caused by various bacteria, viruses, and parasites, whereas fungi are of negligible importance (5) due to behavioral characteristics and impaired immune system of fungi, similarly infections from the animals are higher for the people who deal with animals like veterinarians (6).



The microorganisms can enter in people by direct skin contact, bites, through fomites and eating sullied food and drinking defiled water etc. (5).

TOXOCARIASIS

Toxocariasis is a disease which is transmitted by parasites through roundworm in dogs (*Toxocara canis*) and cats (*Toxocara cati*). This disease is enzootic in every part of United States and harmful for children causing damage to liver, lungs, central nervous system and especially to the eyes. Two main types of *Toxocara* exist: one is *Visceral Toxocara* that is specific for the visceral organs and affect liver, lungs, and central nervous system; the other type is *Ocular Toxocara* that cause infectious diseases in the eyes and usually damage retina of eyes (7).

In USA, the prevalence of *T.canis* is 30% (8). Toxocarais transmitted through the feces of dog and cat. Humans can also be affected by *Toxocara* parasite by eating meat that is not properly cooked and have *Toxocara larva*. As human cannot excrete eggs so humans are not able to transmit this disease (7). Toxocariasis also caused by eating soil called geophagia and nail biting called onychophagia and neglecting hand washing after direct handling pet. Eggs of *T.canis* found on the hair of 25% dogs (9). Clay soils are important factor for the viability of larva providing protective environment (7).

Fecal sample from (n=200) dogs was collected from 100 street dogs and 100 pets, in which 50% were below the age of 6 month (pups) and 50% were adults. Researchers collect blood samples from all dogs and analyze the result. Study revealed 49% prevalence of *Toxocara* found in street dogs, 60% in pets and 38% in pups (10).

TOXOPLASMOSIS

In 1908, Nicolle and Manceaux found *Toxoplasma gondii* in rat (*Ctenodactylus gundi*) (11). *T. gondii* parasite infects mostly warm-blooded animals and birds. It causes encephalomyelitis in the fetus, which causes 10% pre-birth disease result in abortion (12). Oocysts shed in the feces just by the feline family while the intermediate host can give shelter to the cyst tissue in their body. Infected cat shows the symptoms like fever, ocular inflammation, anorexia, lethargy, abdominal discomfort, and neurological abnormalities (13). During pregnancy it cause prompt premature birth or visual and neurological malady in the baby which leads to death (13,14).

The transmission of *T. gondii* is by cat mainly, rarely by dogs. Cat transmits parasite to human by oral-fecal route and shed oocytes in their feces. Oocytes are non-infectious; however, after spore formation it becomes infectious in 1-3 days. People are exposed to the parasite of toxoplasmosis by feces, undercooked meat of contaminated animal (15).

T. gondii is existing everywhere in the world. There are two phases of asexual reproduction of *T. gondii* found in intermediate host. Tachyzoites replicates in the principal stage and bradyzoites in second stage. Tachyzoites multiply rapidly forming tissue cyst by the process called endodyogeny, in the tissue cyst bradyzoites multiply with the same process, but slowly. The tissue cyst found in the neural and muscular tissue, partly on the visceral organs. At the terminal life stage tissue cyst become infectious. Tachyzoites, bradyzoites and sporozoites are the three infectious stages of life cycle of *T. gondii* and all three-effect intermediate host as well as definitive host. The transmission of *T. gondii* is by three main routes (A) Horizontally from the environment a person ingests the oocysts (B), Horizontally by eating raw or undercooked meat which contain tissue cyst (C) Vertically transmission of Tachyzoites is done from mother to fetus (12).

SARCOPTIC MANGE

In a study, 10 orders, 27 families and 104 types of Sarcoptic mange have been identified (16). Sarcoptic Mange lives on the surface of the host and cause skin disease (17).

Due to the secondary sepsis the mortality rate was 50% in northern Australia in five years was reported. In a survey of Capital of Senegal (Dakar) out of (n=114) cases in two years, just a single demise was accounted for in which 97% cases were experiencing glomerulonephritis (18). First, it was believed to be

fungus, so the influenced individual is alluded to microbiology lab, but no fungal elements were found and *Sarcoptes scabiei* was recognized by its morphology. In dogs, the areas which do not have hair are usually get affected by this parasite *Sarcoptes scabiei* like chest, abdomen, neck, confront, ears, elbow, and the hocks. The parasite can be transmitting directly from animal to animal or animal to humans or indirectly by some carrier like mites. Young and poorly nourished animals are more susceptible to this disease. It results in the popular lesion formation which is extremely itchy and leads to scab formation, oozing and scaling. The areas which are exposed to mites are affected causing formation of lesions in humans, the interdigital webs and genitalia are safe from the infection. Alopecia which is spot baldness occurs and there is a weight reduction because of *Sarcoptes scabiei*. Sometimes it leads to severe morbidity when secondary bacteria attack. The mites do not form long burrows they get into the skin and cause tingling, there brooding period is short and the influenced region may get in contact with the secondary bacteria like *Streptococcus pyogenes* or *Staphylococcus aureus*, which prompts intense difficulties (17). Mites eat cells and tissue liquid. The irritant and allergic effect is due to the excretion and secretion of mites that can be the molted skin, dead mites, or eggshells (16). *S. scabiei* belongs to the phylum 'Arthropoda'. The adult female mite size is 0.3 x 0.4mm and male are 0.25 x 0.2mm in size with roughly circular body (17).

ECHINOCOCCOSIS

Echinococcosis is an infectious zoonotic ailment. Worldwide there might be more than one million citizens living with cystic hydrated illness and alveolar echinococcosis at once. If it stays untreated, they may cause clinical extreme disorders in individuals that are perilous forever. After the operation of cystic echinococcosis for surgical patients, the average death rate is 2.2% and after medical treatment about 6.5% cases fail and they require a long time for recovery. In 2015, According to Foodborne Disease Burden Epidemiology Reference Group globally 19300 deaths happen because of echinococcosis every year (19)

Human echinococcosis is a parasitic zoonotic contamination that is cause by parasite, or, in other words tapeworm (cestodes) that has a place with family Echinococcus. There are six types of echinococcosis yet four are health concern:

- Cystic Echinococcosis: it is additionally called hydatid illness or hydatidosis which is caused by parasite *Echinococcus granulosus*
- Alveolar echinococcosis: it is cause by a parasite called *E. multilocularis*.
- Polycystic echinococcosis: it is caused by *E. vogeli* and *E. oligarthrus*.

Dog is a definitive host of *Echinococcus granulosus* that live in the intestine as well as herbivores are intermediate hosts for the tissue give rise to metacestode stage. Metacestode is spherical, fluid-filled, unilocular cysts that contain an inner cell germinal layer that is supported by a characteristic acellular, acidophilic-staining, laminated membrane of variable thickness. Granulomatous layer of host surrounds each cyst. They produce multiple protoscolices with the help of asexual division after the brood capsule that is small vesicle bud internally from the germinal layer. In humans, the hydatid cysts grow slowly, attain the volume of several liters, and consist of many thousands of protoscolices. With time, it is converted into young echinococcosis cyst (20).

People can be affected by the inadvertent ingestion of egg that originates from the feces of dog infected with Echinococcus. Children also become infected while playing with the infected dog because the eggs are present in hair around the infected dog's anus, paw, and muzzle. In intermediate host after the ingestion of egg, the larva develops into cyst. These cysts commonly develop in lungs, brain and liver which cause the serious effect to the health of the infected people (2).

E. granulosus found on all continents. It has high pervasiveness in Mediterranean nations, China, Russia, north and east Africa, Australia, and South America. Clear evidence is present for the emergence and re-emergence of human cystic echinococcosis in the parts of central Asia, China, Eastern Europe, and Israel (21).

BACTERIAL INFECTIONS

PLAGUE



Plague is harmful infectious zoonotic disease and if it remains untreated, then it causes high fatality rates of 50-60%. Plague has high mortality, and it is responsible for widespread epidemics (22). Up to the present time, worldwide three major plagues have been recorded: in 6th Century Justinian plague, in 14th Century the Black Death occur due to which about 25 million people died and in 20th Century this epidemic begins in the 1880s and proceed until the 1950s. Now plague is categorized in re-emerging disease by World Health Organization (WHO) because of its increase in number and spread globally. In 1898-1908, more than 6 million people died in India. In 1980-1997, there were 19349 total cases of Plague in Africa in which 1781 deaths occurred, and fatality pace was 9.2%. In United States, in the period of 1980 to 1997 there were 3137 cases of Plague from which 194 deaths occur and the fatality rate was 6.2%. In the period of 1954–1997, the mortality rate due to the Plague was high in many countries (22).

In 28 years for the first time in India several cases of plague in September 1994 were reported. Out of 300 cases of pneumonic plague 36 deaths has occurred that were reported in Surat city on September 24th (23). Plague is endemic in the western USA and areas of Africa, Asia, and South America. In the USA less than 20% cases of plague are reported annually. Cats are responsible for 7.7% cases of plague in USA (24).

Plague is a zoonotic infection that is caused *Yersinia pestis* that is non-motile, Gram-negative, and non-spore-forming coccobacillus bacteria. In endemic areas, cats and dogs are potential source of human infection. In dogs, plague is not a harsh disease; dogs only suffer from fever and lethargy and do not transmit plague to humans directly. Transmission of *Y. pestis* to humans caused by rodent flea that live on dogs. Risk factor for infection is increased due to the sleeping of dogs on the same bed as a member of household (25).

As compared to dogs, cats are highly vulnerable to plague and human's infection is caused by direct transmission of organism. Cats maintain *Y. pestis* in throat for at least 10 days by eating infected rodents before infected subcutaneously. Large pustules with a tendency to burst is developed on cats these pustules releasing pus that contain large number of living bacilli (25). Transmission of infection in human can occur through exposure to tissue, respiratory droplets, or secretion of infected animals (24).

In human three clinical forms of plague are recognized: bubonic, pneumonic and septicemia. In the United States, bubonic form is the most common. The septicemia and pneumonic form are secondary to the bubonic form. Bubonic plague is caused by the bite of infected flea or by an open skin lesion. Due to the infection in human painful swollen inflamed lymph node is called bubo (23).

For the detection and characterization of *Y. pestis*, multiplex-PCR has been developed. ELISA and passive hemagglutination assay can be used. After the exposure to plague antimicrobial therapy should start immediately (23).

SALMONELLOSIS

Salmonellosis is an acute gastrointestinal sickness. Globally 155000 deaths happen every year (26). For the first time *Salmonella's* Bacteria found in feces of infant is *Salmonella* Virchow (27). In dogs and cat salmonellosis occur without showing symptoms. In young and weak animal's salmonellosis is common and may cause clinical syndromes like enterocolitis, septicemia, and abortions (rare). Eye disorder "Conjunctivitis" often found in cats. The uteri of the bitches get infected and result in abortions, stillbirths, or weak offspring. The rate of excretion of salmonella in feces of asymptomatic cats and dogs is 0 to 14% and 0 to 43% respectively. There are two ways for the bacteria to get into the body direct and indirect through the oral fecal route. The pets are allowed to wander on the streets and kill, hunt, and eat other species. The food of dog and cat are full of salmonella. On the survey of judging offal and raw meat quality the *S. typhimurium* was found. Offal contains 24 different salmonella serotypes, among 408 samples 56.6% and in (n=112) samples of commercial raw meat 44.4% salmonella bacteria present. The bacteria get into the body of other animals and human through oral-fecal route. When the number of salmonellae ingested it can cause infection. The gastrointestinal factors can also affect the establishment of the infection like peristalsis, acidity of the gastric, mucus quality, lysozyme in secretion, gut flora etc. The young animals do not have well established gut flora and weak immune system, so they get salmonella infection more frequently. *Salmonella* are facultative pathogens live in the host's cell means can live in and without oxygen in the cell.

Infection develops in three to five days after the exposure; mostly the animals recover within three to four weeks but the animals which carry salmonella their carrier and excrete state remain for six weeks (28).

Death can also occur due to weakness and dehydration. Pets are usually kept indoors and have close contact with their owners; even pets are allowed to roam in kitchen and bedrooms. The pets contaminate the areas. Pets shed salmonella in their feces, cat litter on their faces, the oral swab has salmonella; the paws of pets become contaminated so when owners come in contact with the pets, they get the salmonella and become infected. The human can acquire infection from cat more frequently than the dogs. Children get more affected because they tend to take everything in mouth (28).

CAPNOCYTOPHAGA CANIMORSUS

Capnocytophaga canimorsus is a commensal bacterium, anaerobic gram-negative rods. They are classified as 'Carbon dioxide loving' get from Greek word capnophilic and canimorsus get from Latin word 'canis means dog'; 'morsus means bite'. The cases of *C. canimorsus* have been reported in the United States, Canada, Europe, Australia, and South Africa. Two hundred cases of *C. canimorsus* had reported worldwide in 1976. The rate mortality due to *C. canimorsus* is 30%; patients also face gangrene, myocardial infarction, and renal failure. The mortality rate is 5% and 25% due meningitis and endocarditis, respectively. The infection of *C. canimorsus* occurs by dog and cat bites, scratches, and close contact. The growth of the organism is slow, and they live in the oral cavity of the animals. When dog bite *C. canimorsus* takes five days to incubate. The patients who visit hospital in early hours after the bite have minor symptoms local lesions, but after that patient may suffer infectious later stage which show cellulitis, pain at the place of injury, Purulent drainage, lymphangitis, and lymphadenopathy. Immunocompromised patients face severe infection they become infected with sepsis, meningitis, osteomyelitis, peritonitis, endocarditis, pneumonia, purulent arthritis, DIC and fulminant purpura that is bleeding in tissues, these disorders also examined in the healthy person after the dog bite. The pet owners, veterinarians and animal keepers are under more risk of getting infection (29).

PASTEURELLOSIS

Pasteurella multocida is a bacterium, which causes one of the zoonotic infections that is called Pasteurellosis. It is a gram-negative coccobacillus, facultative anaerobic, pleomorphic, and non-spore forming commensal bacterium that live in the part of oral cavities of cat and dogs (30).

In 2013 Pasteurellosis were reported by 10 countries that include: Burkina Faso, Ethiopia, Guinea Conakry, Mali, Niger, Senegal, Somalia, South Sudan, Sudan, and Zambia in which total outbreak is 1211, from which 14,122 cases and 2530 deaths. In 18 countries 1257 outbreaks, 23,219 cases and 4845 deaths were reported in 2012. The highest number of outbreaks was recorded in Ethiopia (31).

This bacterium is part of oral cavity of 70% to 90% of cats and 50% to 66% of dogs. 50% to 80% of wound infection that caused by cat bite and 5% infection due to dog bite contains *P. multocida* (32). The symptoms of Pasteurellosis in cats are sub-cutaneous abscesses, Pyothorax, respiratory tract infection, spinal empyema, and meningitis encephalomyelitis. In humans' transmission is through close contact, bite, wounds, and licks of the infected animal (30). According to a survey of literature, 20-30 human deaths are occurring due to Pasteurellosis annually in worldwide in the past 30 years (33).

VIRAL INFECTIONS

RABIES

Destructive malady, which is called rabies, is caused by infection which has a place with Lyssavirus, and family *Rhabdoviridae*. This virus affects the central nervous system and then enters in saliva of infected animal and spread to human by bite or scratches on skin. Prodromal, furious, and dumb are the three stages which is seen in human having rabies. Neuropathic pain may be occurring due to virus replication at the site of bite or wound. In some cases, sudden death may occur without showing any symptoms (34).

Many countries in Asia suffered from rabies (34). Rabies is a neglected zoonotic disease that causes an estimated 59,000 deaths per year (35). Within 15 minutes one Asian dies, where 15% under the age of 15 years. Dogs cause rabies in more than 3 billion people in developing countries. According to WHO, in 2004 high death rate has been seen in India, every year 15 million people become victims of rabies. Highest death rate due to rabies has been found in Nepal throughout the world. Rabies is also an alarming situation in Pakistan. In Karachi the doctors treated the 25-30 new cases of dog's bite in every year in civil hospital that is the one of biggest public hospital in Karachi. Rabies is also present in Pakistan. Sindh, Punjab, Khyber Pakhtunkhwa, Pishin in Balochistan, Naseer Abad and Jaffar Abad are those areas in Pakistan having the status of high-risk area. Rabies cause 24,000 deaths occur per year in Africa. Rural areas have high death rate as compared to urban areas. South African Countries are also a high-risk area for this deadly disease. These countries include Namibia, Mozambique, Zimbabwe, and Angola. This infectious disease is also present in Europe, but due to animal vaccination many European countries are free from rabies. Dog's bite can cause 99% human deaths (34).

FUNGUS INFECTION

DERMATOPHYTOSIS

The zoonotic disease which causes the skin infection is called dermatophytosis (36) which is a fungal disease spread by a fungus called dermatophytes (37). Dermatophytosis is commonly known as ringworm (38).

Dermatophyte infections are normal, and their pervasiveness contrasts as indicated by atmosphere and many hazard factors including animal contact. In a few areas, over 60% children affected with tinea capitis and in a few sections of Europe over half of the population is infected with tinea pedis. In kids, dermatophytosis is more typical (31).

This most important zoonotic skin infection is present in warm and humid climate and more common in cats than dogs. Dermatophytosis have many species but *Microsporum canis* and Trichophyton mentagrophytes species cause infection in dogs and cats. 90% of cats and 60% of dogs are infected by *M. canis*. 30% of dogs are infected by *T. mentagrophytes*. Feline dermatophytosis is an external fungal infection of skin in cats (39). In majority of human infection is cause by Epidermophyton or Trichophyton species. Dermatophytes are transmitted through direct contact or indirect contact, directly from the animals and indirectly with fomites such as by clothes, utensils, and furniture.

Arthrospore may cause the infection in upper layer of skin when it attaches to the epidermis. Spores grow into hyphae these are supported by enzymes formed by fungal spores. This cause inflammatory reaction, spoil the hair shaft and hair fall out (40). Animals of any sex, age or verity is vulnerable to infection, but infection is common in sick, old, and tiring animals. Animals having longhair are at high risk of infection (36).

Dermatophytosis can be diagnosed by many ways including following procedures. Direct hair examinations are also called Trichogram. Wood's lamp is second method of diagnosis this is an ultraviolet lamp that cause the infected hair to fluoresce apple green in complete darkness. Skin biopsy is also used to diagnose the dermatophytosis. Animals with strong immune system do not need any treatment they recover without that. Dermatophytosis is highly infectious disease for this reason animals in homes with their owners should be treated to prevent from this contagious disease (40).

PREVENTION AND CONTROL

To control diseases preventive measures ought to be taken like stay away from the contact with dogs, enhanced sanitation (21). Take puppies for general checkups and Awareness ought to be given to maintain a strategic distance from Infection (particularly younger animals) show youngsters not to eat soil; showing kids not to eat soil as this will diminish their hazard for ingesting contamination cause by the eggs shed by pets (7). Person should wash his/her hand after interacting with the feces particularly pregnant ladies and HIV patients ought to widely wash their hands, yet individual ought to abstain from interacting with the

feces or residue of pet's feces. Pets' ought to be kept inside, far from hunting and give canned dry food or appropriately cooked food (15). The prevention includes an early identification and a prompt treatment of the animals. Care must be taken while they are being dealt with. Protective clothing, for example, gloves should be worn (17). Animals should keep away from the areas where food prepare, store or served. The dishes of pets should be distinctive; the pets should not allow eating from a similar dish (28). Quick cleaning of the injury ought to be done (29). Deter pets from sleeping on beds and reduce roaming (25). Significant reason for rabies is absence of mindfulness and modern vaccines, if every one of these issues can settle down then avoidance from diseases is conceivable. Awareness assumes to be a critical job to control maladies cause by pets. To prevent zoonotic ailments, it is important to take a little consideration and change the way of life (34).

PREVALENCE OF ZONOTIC DISEASES

- 1990's surveys the seroprevalence of Toxocariasis was checked in various landmasses Asia, Europe, Africa, South America, and North America in which 40,322 example were analyzed and 31.69% disease was discovered (41) and in Pakistan the prevalence of Toxocariasis is 36% (10,42).
- The seroprevalence of toxoplasmosis in all nations is 38.78% and in Pakistan the seroprevalence is 33% of ladies of childbearing age from 1990 to 2000 (12).
- Sarcoptes information was gathered from various nations like Fiji, Guinea, northern Australia, Panama, and Solomon Island in which 14,204 examples were analyzed and their predominance was 45.17% discovered (43). In Pakistan, the rate of scabies is low. 4020 examples were gathered and just 0.99% disease rate was discovered (44).
- In Punjab, Pakistan 39,738 examples of echinococcus were gathered in which 6.67% were tainted (45) and worldwide in production animals the prevalence was 10.5% was found (46).
- The death rate of the Plague is 11.80% every year around the world (22).
- The pervasiveness of Pasteurellosis is 31.73% in Pakistan (47).
- In Pakistan, from 1860 family units blood tests were gathered and the prevalence of Rabies was 19.13% (48).
- The pervasiveness of Dermatophytosis in Pakistan is 26% (49) and overall, its predominance is 27% (50).
- The pervasiveness of Salmonella enteritidis is 43.5% (51).

WORLDWIDE DISTRIBUTION OF ZONOTIC DISEASES

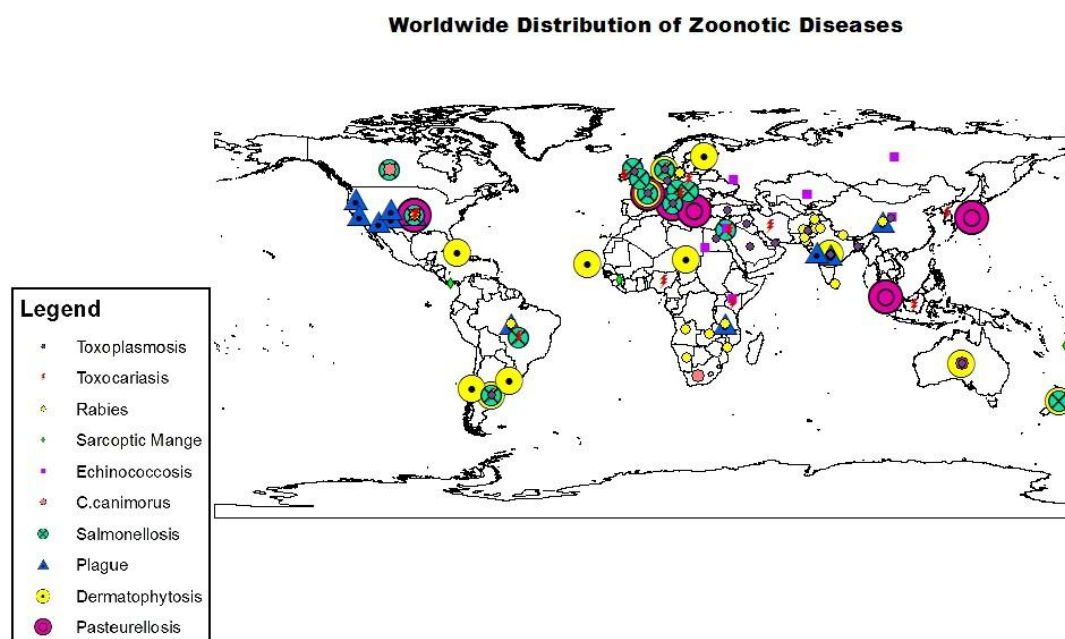


Fig. 1. Presence of Zoonotic diseases in different countries, worldwide (12, 15, 21, 23, 34, 40, 41, 43, 52, 53)

Table I. Pathogen, mode of transmission and symptoms of different zoonotic diseases

| S. No | Disease | Pathogen | Mode of Transmission | Symptoms | Reference |
|-------|----------------------------------|----------|---|--|-----------|
| 1 | Toxocariasis | Parasite | Pet handling, feces, improperly cooked meat | Visceral Toxocariasis: fever, fatigue, anorexia abdominal pain, pulmonary symptoms cough, short breathing Ocular Toxocariasis: Vision loss, eye pain, eye redness | (1) |
| 2 | Toxoplasmosis | Parasite | feces, raw or undercooked meat | Fever, mental confusion, focal neurological signs, lung consolidation, myocarditis, lymphadenopathy | (2, 3) |
| 3 | Sarcoptic Mange | Parasite | Directly or indirectly through mites | Papular Lesion, weight loss, spot baldness | (4) |
| 4 | Echinococcosis | Parasite | Through eggs in feces and in hair of dogs | Cystic echinococcosis: effect the kidney, spleen, peritoneal cavity, and the skin and muscles Alveolar echinococcosis: parasitic lesion in liver, lungs, spleen, or brain is affected, cholestatic jaundice, epigastric pain, weight loss or fatigue and hepatomegaly | (5, 6) |
| 5 | Plague | Bacteria | tissue, respiratory droplets, or secretion of infected animals, | Bubonic: fever, chills, headache, abscess or ulcer and tender bubo. Septicemia: hypotension, intravascular coagulation, shock, and death. Pneumonic: sudden fever, myalgia, headache, and some pulmonary signs | (7) |
| 6 | Salmonellosis | Bacteria | feces, Contaminated water and food, handling pet | severe abdominal pain, nausea, vomiting, profuse and uncontrollable diarrhea, fever (102°F), aching, dehydration | (8) |
| 7 | <i>Capnocytophaga canimorsus</i> | Bacteria | Dog bite, scratches, and close contact | Fever, chills, myalgia, vomiting, diarrhea, abdominal pain, malaise, dyspnea, mental confusion, and headache. | (9, 10) |
| 8 | Pasteurellosis | Bacteria | contact, bite, wounds, and licks of the infected animal | Cellulites, osteomyelitis, swelling, endocarditis, lymphadenopath, abscess formation and meningitis | (11) |
| 9 | Rabies | Virus | Dog bite | Pruritus, nervous-system dysfunction, fluctuating consciousness, hydrophobia, Opisthotonos, hemiparesis, paraparesis and autonomic hyperactivity. | (12, 13) |
| 10 | Dermatophytosis | Fungi | Skin Contact | Tinea capitis: Infection of eyebrows, scalp, eyelashes, kerion lesions, scaling lesions and alopecia Tinea cruris: Infection of pubic area, groin and pruritic erythematous | (14) |

CONCLUSION

A pet is an animal kept primarily for person's company for the sake of pleasure. Two of the most common pets are cats and dogs. Pet's owners keep them as family members because they have positive effects on their health and happiness. Apart from these beneficial effects, there are some harmful aspects of having pets. People can get various diseases that have close contact with pets caused by bacteria, parasite, fungi, and virus that are present in the domestic pets. These microorganisms can enter in humans by direct skin contact, bites, through fomites and eating contaminated food and drinking contaminated water. Many countries have the status of high-risk zoonotic area but most of the countries around the globe trying to control the zoonotic diseases. Dogs and cats should be vaccinated. The high risk of zoonotic disease can overcome by taking preventive measures. The lack of education and awareness is the major cause of the infectious diseases due to animals. Public awareness programs play important role to educate people and

reduce the risk of the zoonotic disease. In public awareness program, people should be aware from the mode of transmission, spreading, symptoms, treatment, control and preventing measures of these diseases. There is a need to take little care and change lifestyle to avoid these kinds of infectious diseases.

References:

1. Chitty J, Hendricks A. Zoonotic skin disease in small animals. In practice. 2007;29(2):92-7.
2. Robertson ID, Thompson RC. Enteric parasitic zoonoses of domesticated dogs and cats. *Microbes and Infection*. 2002;4(8):867-73.
3. Herzog H. The impact of pets on human health and psychological well-being: fact, fiction, or hypothesis? *Current directions in psychological science*. 2011;20(4):236-9.
4. El-Alayli A, Lystad AL, Webb SR, Hollingsworth SL, Ciolli JL. Reigning cats and dogs: A pet-enhancement bias and its link to pet attachment, pet-self similarity, self-enhancement, and well-being. *Basic and Applied Social Psychology*. 2006;28(2):131-43.
5. Kruse H, Kirkemo AM, Handeland K. Wildlife as source of zoonotic infections. *Emerging infectious diseases*. 2004;10(12):2067.
6. Robertson ID, Irwin PJ, Lymbery AJ, Thompson RC. The role of companion animals in the emergence of parasitic zoonoses. *International journal for parasitology*. 2000;30(12-13):1369-77.
7. Woodhall DM, Fiore AE. Toxocariasis: a review for pediatricians. *Journal of the Pediatric Infectious Diseases Society*. 2014;3(2):154-9.
8. Thompson DE, Bundy DA, Cooper ES, Schantz PM. Epidemiological characteristics of *Toxocara canis* zoonotic infection of children in a Caribbean community. *Bulletin of the World Health Organization*. 1986;64(2):283.
9. Borecka A, Klapac T. Epidemiology of human toxocariasis in Poland—A review of cases 1978–2009. *Annals of Agricultural and Environmental Medicine*. 2015;22(1).
10. Chattha MA, Aslam A, Rehman ZU, Khan JA, Avais M. Prevalence of *Toxocara canis* infection in dogs and its effects on various blood parameters in Lahore (Pakistan). *J. Anim. Plant Sci*. 2009;19(2):71-3.
11. Webster JP. Review of "toxoplasmosis of animals and humans" by JP Dubey. *Parasites & Vectors*. 2010; 3:112.
12. Tenter AM, Heckeroth AR, Weiss LM. *Toxoplasma gondii*: from animals to humans. *International journal for parasitology*. 2000;30(12-13):1217-58.
13. Elmore SA, Jones JL, Conrad PA, Patton S, Lindsay DS,
14. JP. *Toxoplasma gondii*: epidemiology, feline clinical aspects, and prevention. *Trends in parasitology*. 2010;26(4):190-6.
15. Tasawar Z, Aziz F, Lashari MH, Shafi S, Ahmad M, Lal V, Hayat CS. Seroprevalence of Human toxoplasmosis in southern Punjab, Pakistan. *Pak J Life Soc Sci*. 2012;10(1):48-52.
16. Plaut M, Zimmerman EM, Goldstein RA. Health hazards to humans associated with domesticated pets. *Annual review of public health*. 1996;17(1):221-45.
17. Pence DB, Ueckermann E. Sarcoptic mange in wildlife. *Revue scientifique et technique (International Office of Epizootics)*. 2002;21(2):385-98.
18. Bandi KM, Saikumar C. Sarcoptic mange: a zoonotic ectoparasitic skin disease. *Journal of Clinical and Diagnostic Research: JCDR*. 2013;7(1):156.
19. Leone PA. Scabies and pediculosis pubis: an update of treatment regimens and general review. *Clinical Infectious Diseases*. 2007;44: S153-9.
20. World Health Organization WHO. Echinococcosis. 2018.
21. Moro P, Schantz PM. Echinococcosis: a review. *International journal of Infectious diseases*. 2009;13(2):125-33.
22. McManus DP, Zhang W, Li J, Bartley PB. Echinococcosis. *The lancet*. 2003;362(9392):1295-304.
23. World Health Organization WHO. Report on Global Surveillance of Epidemic-prone Infectious Diseases. 2000.
24. Higgins R. Emerging or re-emerging bacterial zoonotic diseases: bartonellosis, leptospirosis, Lyme borreliosis, plague. *Revue Scientifique et Technique-Office International des Epizooties*. 2004;23(2):569-82.
25. McElroy KM, Blagburn BL, Breitschwerdt EB, Mead PS, McQuiston JH. Flea-associated zoonotic diseases of cats in the USA: bartonellosis, flea-borne rickettsioses, and plague. *Trends in parasitology*. 2010;26(4):197-204.
26. Oyston PC, Williamson D. Plague: infections of companion animals and opportunities for intervention. *Animals*. 2011;1(2):242-55.

27. Majowicz SE, Musto J, Scallan E, Angulo FJ, Kirk M, O'Brien SJ, Jones TF, Fazil A, Hoekstra RM, International Collaboration on Enteric Disease "Burden of Illness" Studies. The global burden of nontyphoidal *Salmonella* gastroenteritis. *Clinical infectious diseases*. 2010;50(6):882-9.
28. Sato Y, Mori T, Koyama T, Nagase H. *Salmonella* Virchow infection in an infant transmitted by household dogs. *Journal of Veterinary Medical Science*. 2000;62(7):767-9.
29. Carter ME, Quinn PJ. *Salmonella* infections in dogs and cats. *Salmonella in domestic animals*. 2000; 14:231-44.
30. Gaastra W, Lipman LJ. *Capnocytophaga canimorsus*. *Veterinary microbiology*. 2010 Jan 27;140(3-4):339-46.
31. Lloret A, Egberink H, Addie D, Belák S, Boucraut-Baralon C, Frymus T, Gruffydd-Jones T, Hartmann K, Hosie MJ, Lutz H, Marsilio F. *Pasteurella multocida* infection in cats: ABCD guidelines on prevention and management. *Journal of Feline Medicine and Surgery*. 2013;15(7):570-2.
32. Griego RD, Rosen T, Orenge IF, Wolf JE. Dog, cat, and human bites: a review. *Journal of the American Academy of Dermatology*. 1995;33(6):1019-29.
33. World Health Organization. WHO report on global surveillance of epidemic-prone infectious diseases? World Health Organization; 2000.
34. Wilson BA, Ho M. *Pasteurella multocida*: from zoonosis to cellular microbiology. *Clinical microbiology reviews*. 2013;26(3):631-55.
35. Khan S. Rabies molecular virology, diagnosis, prevention and treatment. 2015;13.
36. O'Brien KL, Nolan T. The WHO position on rabies immunization—2018 updates. *Vaccine*. 2019;37: A85.
37. Moriello KA. Treatment of dermatophytosis in dogs and cats: review of published studies. *Veterinary dermatology*. 2004;15(2):99-107.
38. Gnat S, Łagowski D, Nowakiewicz A. Major challenges and perspectives in the diagnostics and treatment of dermatophyte infections. *Journal of applied microbiology*. 2020;129(2):212-32.
39. Paryuni AD, Indarjulianto S, Widyarini S. Dermatophytosis in companion animals: A review. *Veterinary World*. 2020;13(6):1174.
40. Moriello KA. Dermatophytosis. In *Feline Dermatology 2020*; 265-296. Springer, Cham.
41. Silver H. Dermatophytosis in cats and dogs. *The Veterinary Nurse*. 2011;2(6):310-6.
42. Rubinsky-Elefant G, Hirata CE, Yamamoto JH, Ferreira MU. Human toxocariasis: diagnosis, worldwide seroprevalences and clinical expression of the systemic and ocular forms. *Annals of Tropical Medicine & Parasitology*. 2010;104(1):3-23.
43. Maqbool A, Raza SH, Hayat CS, Shafiq M. Prevalence and chemotherapy of toxocariasis in the dog in Faisalabad (Punjab), Pakistan. *Veterinarski Arhiv*. 1998;68(4):121-5.
44. Romani L, Steer AC, Whitfeld MJ, Kaldor JM. Prevalence of scabies and impetigo worldwide: a systematic review. *The Lancet infectious diseases*. 2015;15(8):960-7.
45. Iqbal A, Siddique F, Mahmood MS, Shamim A, Zafar T, Rasheed I, Saleem I, Ahmad W. Prevalence and impacts of ectoparasitic fauna infesting goats (*Capra hircus*) of district Toba Tek Singh, Punjab, Pakistan. 2014;92.
46. Latif AA, Tanveer A, Maqbool A, Siddiqi N, Kyaw-Tanner M, Traub RJ. Morphological and molecular characterisation of *Echinococcus granulosus* in livestock and humans in Punjab, Pakistan. *Veterinary parasitology*. 2010;170(1-2):44-9.
47. Cardona GA, Carmena D. A review of the global prevalence, molecular epidemiology and economics of cystic echinococcosis in production animals. *Veterinary parasitology*. 2013;192(1-3):10-32.
48. Farooq U, Hussain M, Irshad H, Badar N, Munir R, Ali Q. Status of haemorrhagic septicaemia based on epidemiology in Pakistan. *Pakistan Veterinary Journal*. 2007;27(2):67.
49. Shah SI, Beg MA, Nadeem MS, Fiaz M, Kayani AR, Rashid N, Irfan M. Occurrence of rabies and dog bite in Rawalpindi district, Pakistan. *Annals of PIMS ISSN*. 2016; 1815:2287.
50. Aman S, Haroon TS, Hussain I, Bokhari MA, Khurshid K. *Tinea unguium* in Lahore, Pakistan. *Medical mycology*. 2001;39(2):177-80.
51. Acha PN, Szyfres B. Zoonosis y enfermedades transmissibles comunes al hombre ya los animales: Volumen III: Parasitosis. Organizacion Panamericana de la Salud; 2003.
52. Hendriksen RS, Vieira AR, Karlsmose S, Lo Fo Wong DM, Jensen AB, Wegener HC, Aarestrup FM. Global monitoring of *Salmonella* serovar distribution from the World Health Organization Global Foodborne Infections Network Country Data Bank: results of quality assured laboratories from 2001 to 2007. *Foodborne pathogens and disease*. 2011;8(8):887-900.
53. Rodrigue DC, Tauxe RV, Rowe B. International increase in *Salmonella enteritidis*: a new pandemic? *Epidemiology & Infection*. 1990;105(1):21-7.