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Review Article- Parasites: Introduction, Classification, Lifecycle and Relationship with their Hosts

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ABSTRACT

Parasites are microorganism that need host to continue its lifecycle, some of them need direct life cycle while others needs indirect lifecycle. In this review article the researcher focus on things that related to types of parasites, as well as their lifecycles, and the type of the hosts, and how parasites affect the host and their relationship. The review comes over a wide range of years up to 2020, and the last published researches that are related to the topic of this review. The review discusses briefly the classification of the parasites and classified them into three main classes (groups), which are, Helminthes, Protozoa, and Arthropods. Eventually, the researchers came to a certain conclusions such as parasites are living species that needs host to continue its life cycle, there are many types of hosts depend upon the needs of parasites, there are more than eight million of parasites and their weight ranged from 25 microgram up to 70 grams.

Keywords- Parasites, lifecycle, classification, host**.**

I. INTRODUCTION

In general, parasitology is one of microbiology branches that study the details of a microorganism named parasite[1-5], this study will include and concentrate on different things such as life-cycle, morphology, taxonomy, morphology, as well as the category of the host, and how parasite affect and infect it, and the association between them. This indicates that the parasites can lives either upon or in host, by which it derives and obtain directly all its needs to continue living such as nutrients, which, on long-term cause damage and destruct the host[6-9].

The host can be animal, plant, and human being, and studying parasite and host is very important for microbiologists to understand different branches in biology, and the data that usually obtained from the scientists is directed to find solution for the current and future problems. The importance of parasites lies in the fact that they constitute more than 50 percent of the life of biological organisms[10-16].

Parasites have been classified into 3 major groups:

- Helminthes.
- Protozoa.
- Arthropods.

On the other hand it can be classified according to their location (host that parasites located in), for instance; Endoparasites (parasites lives inside the host), Ectoparasites (parasites lives on the skin of the host). This will increase the variety of the types of parasites and make it very wide and have a lot of subscriptions and their relationship with the environment and where they live (host), such as epidemiology, entomology, entomology, and more[17-22].

Recently, the diagnostic field of medical and clinical parasitology has been developed and faces a major changes, such as, new recognition of new lines of parasites, establish a new pathogens, new techniques, new and alternate tests for diagnosis, and establish new coding, in addition to increasing in research work by the biologists and microbiologist in particular to increase the information, knowledge, and understanding about the infections the caused by parasites in the whole world[23-29].

In this review the researchers will focus on the medical, clinical, and diagnostic side in parasitology.

Helminthes

Helminthes are a certain type of parasites lives in intestine and bowel, it is larvae and worms that live and feed on the host, it affects the host and causes a lot of troubles including problem in absorption to the nutrients, which ultimately affect the host and cause weakness that ends with diseases[29-33].

Helminthes can be classified to the following groups:

- Roundworms.
- Flatworms or flakes.
- Monogenans.
- Tapeworms.

All the types have the same morphology and considered as an organism that consist of multi-cells (multicellular) which can be seen in bad hygiene and sanitation and appearnormally (without microscope)[33-34].

Protozoa

Protozoa is a microscopic single cellular free living organism, and its cell has nucleus in the center and an outer membrane, and that's why it is also called (Eukaryotes). Protozoa are not like fungi, it is not filaments and usually restricted in wet and moist environment, and it can swim and move in water, and it is divided and duplicate and reproduced widely[35-38].

Malaria is considered as one of the most common examples to protozoa due it is identified all over the world. It hit children and adults as well, mosquitoes spread it through the blood of the host, and its lifecycle is usually carried out in the digestive system and may cause death. Protozoa can live also in oceans, freshwater, while other classes can live in animals and plant. However some classes can live in dry and hot environments[39-41]. Protozoa can reproduce in different means such as budding, fission

Arthropods

This class of parasites includes a lot of organisms such as arachnids (like scorpions, spiders, mites, ticks), and insects (like bugs, beetles, bees, ants, mosquitoes, butterflies), and crustaceans (like shrimp, crabs, crayfish, lobsters). Mainly, the arthropods can be classified into two classes[42-43]:

- Arachnids, (that have eight legs).
- Insects, (that have six legs).

In 2013, Hegna and his coworkers mentioned that a German scientist name Karl (Carl) Theodor Ernst von Siebold is the first one who succeeds to classify the arthropods into different types, and that was in 1848[16]. The species that lies under arthropods are around eight millions species, and it is very difficult to determine the number of species due to its huge number. For instance, in 1994, scientist names Thompson count around 350 thousands of arthropods were found in Costa Rica and their weight vary from up to 70 grams to less than 25 micrograms[17, 20].

Diagnosis of parasites and parasitology

Parasites considered as a type of microorganisms, so the diagnosis of these species does not vary from other microbiological species and according to the guidelines and protocols issued by well know organizations[25-28].

The science that care about the diseases to human beings and animals, which is caused by parasites is Parasitology, the development that achieved in biotechnology and the instrumentation enable the scientists to develop the vaccines, measurement control, and the drugs. On the other hand, and because the relationship between the host and the parasite is not completely understood, in addition to the effect of environment which usually changed upon the area, these factors make things very complex for the researchers in their studies[19, 36, 43].

The life cycle of parasites diverse and vary from very complex to simple.

The simple cycle of life, direct lifecycle(Monoxenous)

In this type of lifecycle, the parasite spread from one host to another directly, with no modification, development or adaptation, but it needs only one (single) host to complete its lifecycle. This lifecycle comprise an elevation in the rate of reproduction, and also include stages that considered as quite inactive such as, eggs, and cysts by which the parasites have to challenge the factors of environment such as temperature, radiation (UV light), and desiccation. In this lifecycle the parasites use only one host to spend their lives in it, but their progeny will be passed on to another host. It is important to mention that direct lifecycle of parasites doesn't have intermediate stage which increase the necessity to leave the host. In this stage the parasites must have the ability to stay alive and resist the exterior environment that exists around the host until it finds a new host and located in it. Best examples for simple, direct lifecycle are *Cryptosporidium*, *Trypanosomatids, and Nematodes*, and because the parasite complete its lifecycle in one host, and depending on the type of parasite and the host, it could be very painful, harmful and can cause damages to the organism and to the whole host, but at the same time it could be useful to the host[7, 9, 18].

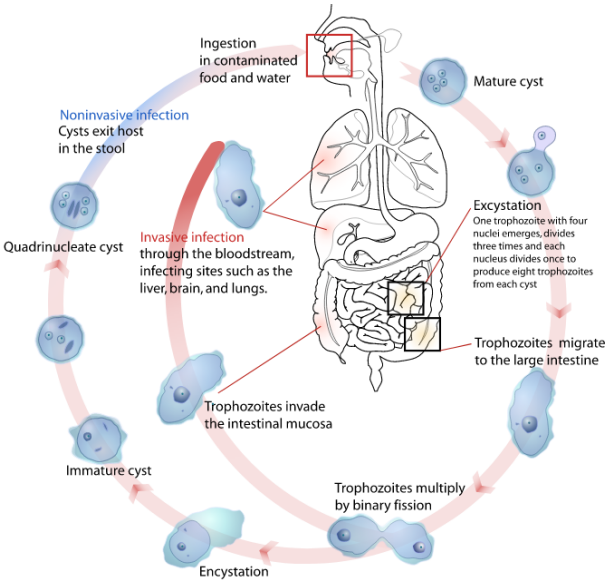


Figure 1: Simple lifecycle of parasites[14]

The non-simple cycle of life, indirect lifecycle (Heteroxenous)

In this type of lifecycle, parasites go through 2 stages in the host, first stage called intermediate stage by which the parasites developed thyself many times (multi development steps) to be able to transmitted from current host to the ultimate (final) host and transmit the diseases in vector form as well, while the second stage called definitive (ultimate) stage by which the parasites adults needs a certain phase named reproduction phase. Mosquito is a perfect example which passes its young parasites first through the blood stream until it reached the final location in the host, also *Leishmania*, and *Plasmodium* are examples for indirect lifecycle wich required more than one host to complete its lifecycle[15-16].

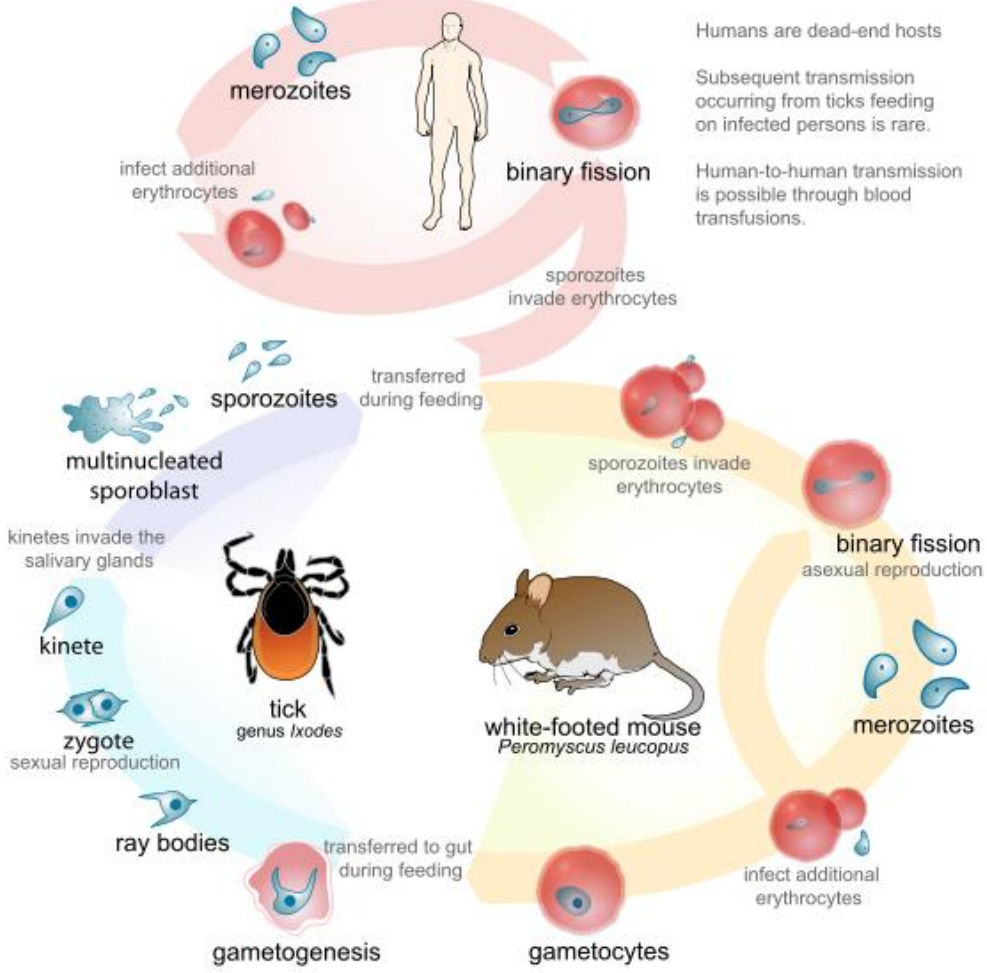


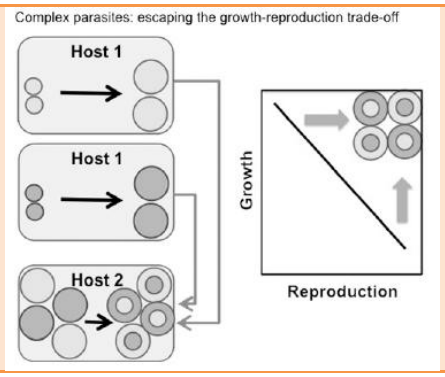
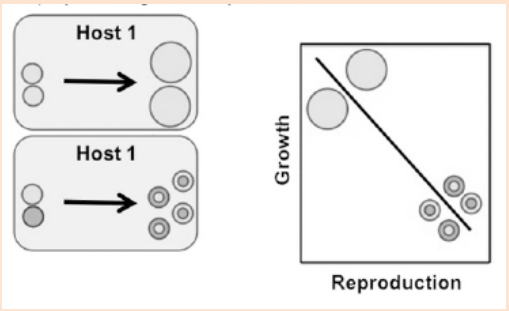
Figure 2: Indirect lifecycle of parasite[15]

By making a comparison between indirect and direct lifecycle of parasites, it was found few similarity points such as reproduction process occurs in both lifecycles, and both of them guaranteed the survival and continue the existence of the parasites[33, 38, 42].

However there are some major differences between direct and indirect lifecycle of parasites, among themare:

Table 1: Major differences between direct and indirect lifecycle in parasites

Characteristic	**Indirect lifecycle**	**Direct lifecycle**
Host number	Multiple	One
Definition	A type of lifecycle in parasites that involves a more than one host to be completed	A type of lifecycle in parasites that involves a single host to be completed

Virulence factor (effect)	Parasites are more harmful to the host	Parasites are harmless to the host
The type of parasite	Parasites are complex	Parasites are simple
Scheme		

II. RELATIONSHIP BETWEEN PARASITE AND HOST

Parasite needs a host to continue and complete its lifecycle, whatever the class or the type of parasite is. As it is known parasite lives in or on other organism or species, the other species by which the parasite gain and get its nutrients and benefits, and may cause pain or harm or even toxicity to, this species or organism is named the host.

Usually, the host of the parasite is larger and bigger than the parasite itself. There are a lot of reason make the parasites stick with the host, not only as a source for nutrient and food, but as a home and a place for location, for instance, hookworms, residence and locate in the tracts of digestive system of humans, or dogs or other mammals animals such as cats. Also the parasites carried out its lifecycle, reproduction, nourishment, and other activities that enable the parasites to live and exist, all these bioactivities are carried out in the host of parasites[5-12].

However, parasites hosts can be classified according to the duration that parasite spends in it like temporary, or permanent, or upon the position, as well as degree of dependence.

Hosts do not welcome parasite, and there is no friendship between them, because the hosts consider and believe that parasites are not welcoming species and they considered it as a strange species and the hosts struggle to, reject, overpower, get rid of them, and kill them through different processes and procedures, the main one, when the body recognize it, is by initiating the immunity system and producing the antibodies, and other defense operations and responses to resist the parasite species and to protect itself, among them are increasing the temperature of the body (fever), production of certain enzymes, diarrhea, and many more[19-24].

On the other hand, parasite did it best to create and establish a safe environment to live in it and to get this, parasite went through and display different and many responses to protect itself from the responses of the host, parasite resist these responses, and between this and that an interaction and relation established between them which enable the parasite to live in it and enforce the host to accept it and start it lifecycle in association with the host and start reproduction as well[33-36].

Usually, the interaction between host and parasite can be classified into two main categories:

1. ***Physiological***: In some cases, parasite are unable to survive in the host and at the same time reproduce in the new and strange environment (host), for example Taenia Solium (a certain type of parasite) that use dog as a host to live in, it can live but cannot and unable to achieve reproduction process, and hence parasite did it best to find a suitable circumstances to develop itself, if there is a way, the environment called friendly (compatible), and if it is not then it si unfriendly environment (incompatible).
2. ***Ecological***: In this case, the parasite is able to live and achieved its lifecycle in the host but it cannot transmit and transfer to another host, this could be because of an ecological difficulties, and that's why the behaviors of the parasites in the labs is different and vary from the nature[40-43].

III. CONCLUSION

- ✓ Parasites are living species that needs host to continue its life cycle.
- ✓ There are many types of hosts depend upon the needs of parasites.
- ✓ Parasites have different size and length that ranged from microorganism up to a large species that can been seen without microscope
- ✓ There are more than eight million of parasites and there weight ranged from 25 microgram up to 70 grams.
- ✓ Mainly, there are two types of lifecycle, direct and indirect.

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