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RESEARCH ARTICLE

INTEGRATION BETWEEN PARASITE INFECTION RESEARCH AND BIOLOGICAL TEACHING FOR SECONDARY SCHOOL STUDENTS IN HANOI, VIETNAM

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ABSTRACT

Hanoi zoo is a place to display animal species serving the people and foreigners to visit, play and entertain. At the same time, the zoo is also a place for scientific research into animals, contributing to the preservation and education of the preservation of the natural environment. The zoo has been constantly upgraded and renovated to meet the needs of entertainment, education for people both of the capital and the country. With the number of millions of visitors every year, it is said that the park is attractive and effective. The purpose of this study was to investigate the parasite infection in the monkeys at Hanoi zoo and integrate these results for biological teaching in secondary school students in Hanoi. 48 fresh fecal samples were collected from six primate species and examined using Willis method, as a standard parasitological technique. There were 28 samples infected with parasites, accounting for 58.3%. The prevalence of parasitic infections in adult females (67.9%) was higher than that of adult males (44.4%). Results showed that there were three genera of parasites such as Trichuris, Strongyloides and Entamoeba. The hookworm was found only in *Macaca fascicularis* and mild infection. Six study species were infected by Entamoeba protozoa. It could be concluded that, there was gastrointestinal parasite infection among six species of Cercopithecidae family examined in Hanoi zoo. With the research results obtained, we integrated into biological teaching for some secondary school students in Hanoi to raise awareness of environmental protection at Hanoi zoo as recommended some solutions for visitors.

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INTRODUCTION

The occurrence of parasitic diseases is extremely common and thus represents a world-wide health problem. Such diseases are responsible for high death rates [Rey, 2008; Neves et al., 2011]. The appearance of diseases caused by enteroparasites (intestinal parasites), such as worms and protozoa, herein called enteroparasitoses, is related to poor hygienic-sanitary conditions and is frequent in Vietnam, as well as in other countries that present similar hygienic-sanitary conditions. Enteroparasitoses are grave public health problems that still persist in developing countries. The problem concerning intestinal parasitoses in Vietnam is graver than it might look, since there is a lack of deep sanitary education policies. The eradication of such parasites requires that socioeconomic conditions are improved, both in basic sanitation as well as in sanitary education, besides changing certain cultural habits. Such conditions are more evident in situations of poverty, social imbalance, lack of basic sanitation and inadequate sanitary education.

In order to minimize this situation, formal education, through Parasitology lessons, must promote a learning process that engage students in the technical and scientific aspects of parasitic diseases, as well as stimulating philosophical thinking that is responsible for promoting change in social and environmental structures [Neves, 2006]. This means that teaching practices should focus on contextualized, problem-based approaches when discussing health problems caused by parasites. In the context of learning Parasitology, it is of paramount importance to develop the knowledge of Epidemiology, so that learners can understand the relationships between parasites, hosts and the environment or circumstances in which both occur. However, according to [Oda, 2011], the contexts in which the pedagogical formation of Biological Sciences Teachers occur, with respect to the study of Parasitology, have shown that there is no consensus about their precision and utility for Education and Disease Prevention. When teaching secondary school students, one must emphasize preventative sanitary education, which entails guidance with respect to hygiene, health and environmental care. Concerning Epidemiology notions, these professionals need to: identify the

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audiology or cause of the disease; know the natural history and disease prognosis; assess the health of the population and the extension of disease (or death) in the population; and assess prophylactic interventions and existing health programs, so that they can carry out high quality preventative education. In this light, it is important that the teacher understands the parasites' transmission mechanisms as well as their biological cycles due to their preference to infest intermediate hosts or various final host species. This biological singularity ensures the maintenance and dispersion of parasites. The parasite's action over the host causes a balance in their relationship, which stems from some basic factors, such as: parasite species; host's age and nutritional status; sanitary conditions and immune response level of the host. From an ecological point of view, the relationship between parasite and host is responsible for the life balance of both (Neves et al., 2011; Rey, 1991).

The understanding of such mechanism demands visual information that can only be obtained through lab resources [Krasilchik, 2004]. Moreover, lab lessons cannot be replaced by other practices, since they enable students to observe the functional mechanisms that allow organisms to survive, such as the ones studied directly by Parasitology (e.g. of worms such as nematelmints) as well as parasite protozoa. Hence, the goal of this work is to offer conditions for teaching secondary school students to learn Parasitology meaningfully, considering both the theoretical and practical aspects. The focus of the intervention was the morphology and biology of the main parasites (nematelmints and protozoa) emphasizing the relationship between parasite and host [cited in Mendonça et al., 2016]. The understanding of the content to be shared and its meaning in different contexts is a basic condition for the teacher to develop the theme in basic schools. It has also emphasized the students understanding about the contents taught and has allowed us to know students' skills related to attitudes and procedures. Thus, we consider that the teaching units, planned in accordance to the aforementioned goals have made learning potentially meaningful to students. Environmental education is integrated into many school subjects secondary school in Vietnam, including biology in general and seventh grade biology in particular. Because the contents in this subject that has capable referring to environmental education. However, when developing lesson plans, teachers should consider research and select appropriate environmental education content to take the content of lectures as mainstreaming or contacting. For the secondary school, students can study for a problem on the local environment under the teacher's guide. The selection of the research problem should fit for the strength of the student and suitability with the existing conditions of the school and of the local. Learning project will create excitement, and work-skills, problem-solving methods and limit the passive learning of students. The method of environmental education in order to create for learners to actively participate in the learning process, creating opportunities for students to discover the environmental problems and find the solutions of problems under teachers' organization and guidance. Environmental education is an interdisciplinary education field, so it will use a variety of teaching methods, focusing on the typical methods of the subject that have the peculiarity. The usual methods are sightseeing, census, survey, fieldwork, in laboratory and methods of exploitation of actual experience to education. Hanoi Zoo is a place to display animal species serving the people and foreigners to visit, play and entertain.

At the same time, the zoo is also a place for scientific research into animals, contributing to the preservation and education of the preservation of the natural environment. With the number of millions of visitors every year, it is said that the park is attractive and effective. In here, there is no report on the status of parasite infection of primate in general, the Cercopithecidae family in particular. We investigated the parasite infection in the monkeys at the Hanoi zoo through stool samples as a scientific basis to prevent parasitic diseases caused by primates and especially, for visitors here. In 7th grade biology that has lessons on protozoa and nematodes so we integrated the research results obtained into biological teaching for some secondary school students in Hanoi to raise awareness of environmental protection at Hanoi zoo as recommended some solutions for visitors.

MATERIALS AND METHODS

We used the methods as sightseeing, survey; analyze nematelmints and protozoa in laboratory of Cercopithecidae family in Institute of Ecology and Biological Resources, Vietnam Academy of Science and Technology and the integrated teaching method for some secondary school students in Hanoi.

The analyze method parasites in laboratory of Cercopithecidae family.

Sampling: 48 fresh faeces (10-12g) were collected from 55 individuals of six species from September to November, 2017 [Gillespie et al., 2008]. Fecal samples were taken from 8h to 9h or from 13h to 14h from individuals in the barn when they excreted. Samples were labeled with each species, sex, age, date of collection and taken immediately to lab of Department of Parasitology in Institute of Ecology and Biological Resources, Vietnam Academy of Science and Technology to analysis by Willis method. Samples were observed under microscope (10X and 40X). Classification parasites following to the method in [Cheesbrough, 2005; F.A.O, 2010].

The prevalence of parasitic infections in this study was characterized by the following: Prevalence (TLN): $TLN\% = (Number\ of\ parasites\ tested / total\ number\ of\ samples\ tested) \times 100$

Data processing by software Excel 2010: The integrated teaching method

Questioning and using visual media method: We used a number of methods such as questioning, using visual media such as pictures, videos, films. These using inspired and deeply for students.

Collaborative teaching methods in small groups: The class was divided into small groups; group activities (each group has 6-8 students) were maintained and depending on the activity. The groups were assigned the same tasks or different tasks.

RESULTS

Parasite infection in Cercopithecidae family in Hanoi zoo: Out of the total number of six species of Cercopithecidae family in Hanoi zoo, all of them were found to be positive for parasitic infestation (Table 1).

In 48 samples collected in Hanoi zoo, 28 samples were infected parasites such as Entamoeba protozoa, Strongyloides, Trichuris and hookworm.

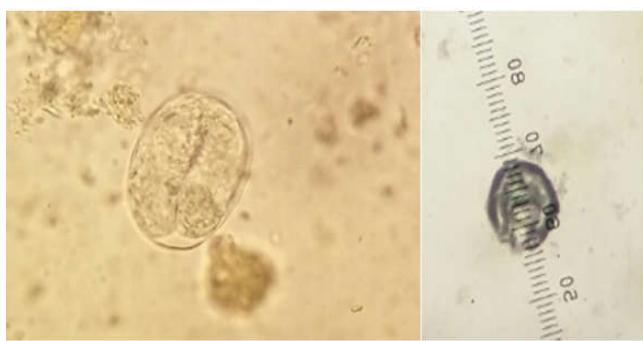


Figure 1. Strongyloides eggs (*Strongyloides spp.*)



Figure 2. Entamoeba



Figure 3. Trichuris eggs (*Trichuris spp.*)

Table 1. Parasitic infection in feces following age and sex of Cercopithecidae family in Hanoi Zoo

Age	Sex	Number examined	Number positive	% Positive
Young	Undetermined	2	1	50.0%
	Sub-total	2	1	50.0%
Adult	Male	18	8	44.4%
	Female	28	19	67.9%
	Sub-total	46	27	58.7%
Total		48	28	58.3%

It can be seen that the rate is quite high, accounting for 58.3%. There was a high infestation rate in adult female with 67.9% while adult male with 44.4% (Table 1). During the sample analysis, photos of Entamoeba, Strongyloides and Trichuris were recorded to serve teaching. Results showed that there were three genera of parasites such as Trichuris, Strongyloides and Entamoeba. The hookworm was found only in *Macaca fascicularis* and mild infection. Six study species were infected by Entamoeba protozoa. It could be concluded that, there was gastrointestinal parasite infection among six species of Cercopithecidae family examined in Hanoi zoo.

The integrated teaching method

Questioning and using visual media method: We introduced the theme by posing the following focus question: "What do you know about Parasitology?". The importance of the focus question has been discussed in detail. Open focus questions, like the one proposed to the students, stimulates the formation of more dynamic propositions by offering more explanation possibilities. By proposing open focus questions, we stimulate students to expose their previous ideas about the parasitology theme and we estimate their potential with regards to the previous knowledge so that we can teach them accordingly. When analyzing their answers, we detected that 50% of the students had relevant subsumes for the development of the theme. This result revealed conditions for the progressive meaningful learning of the parasitology theme based on the previous knowledge of students. To value previous knowledge when one aims at meaningful learning, entails adapting the planned content to the structure of previous knowledge of the student, even though such knowledge can either promote or hinder learning. After that, we pointed out the importance of the concepts of health and disease, emphasizing aspects related to disease causes in humans – within the context of parasitology. To enrich the debate, we have used texts, group discussions, papers and handouts. Beside, we also used pictures of Trichuris, Strongyloides and Entamoeba while analyzing in laboratory to help students' better understanding in the fact. These using were very useful tools for teaching environmental education. The use of visual media inspires and deeply for students.

Collaborative teaching methods in small groups: The class was divided into 4 groups; group activities (each group has 8 students) were maintained and depending on the activity. The groups were assigned the same tasks or different tasks. The main concept has a cross relationship with the term "equilibrium", which may exist between host and parasite. Group 1: They also added examples to the relationship, which indicates progressive differentiation and integrative reconciliation, when they indicate in which parts parasite-caused diseases attack human beings. They have also recorded the structures attacked by diseases as well as the actions suffered by them. Such indication resulted in valid propositions, such as "the parasite transmits diseases"; "diseases attack cells, tissues and organs"; "the host can suffer traumatic and irritating actions". However, when discussing the actions suffered by the host, they only talked about what was already in the lesson.

Group 2: They started their presentation with the general concept "host-parasite" and explained the concepts below the main concepts. It was only afterwards that they proceeded to

explain the causes of the pathogenic action caused by the parasite. For each case, they gave examples and discussed the consequences of the harmful agent for human beings. The propositions indicate adequate, valid relationships in the context of the study.

When sharing the meanings, they assigned to the conceptual relationship, Group 3 showed evidence of progressive differentiation and of integrative reconciliation, processes that characterize meaningful learning. Such connections indicate reasoning, creative ability and theme understanding. However, during their explanation, Group 3 established several cross-relationships, relating, for example, "cellular" alterations to the nutritional status of the host; the concepts "causative agent", "worm" and organism infected by parasite and the sanitary conditions involved in prophylactic measures. Group 4 started the presentation by discussing the general concept "parasites". They moved next to the "pathological action" caused by parasites. They explained each action, giving examples and putting the names of each agent causing each action in the map. They then moved on to explain the occurrence periods of infections caused by parasites, giving oral examples of each of them. Finally, they presented the damage that parasites cause, specifying the body parts where such damage occurs. The propositions built are compliant with the contents taught, and thus were considered to be correct. This entails progressive differentiation and integrative reconciliation, during acquisition, negotiation and sharing of meaning, which widen the cognitive spaces for the consolidation process. The occurrence of some non-cross relationships, but that counted with valid interaction between the concept "parasite" and the causes and places where they happen, demonstrates the group's ability to differentiate these concepts. Some examples were recorded in the slides and others were cited during the group's presentation.

DISCUSSION

From our point of view, we have achieved our goal, since the implementation of the teaching strategy provided conditions for secondary school students to learn Parasitology contents meaningfully as evidenced in 7th grade. However, on the whole, preparation / presentation of the statement by the groups evidenced that the scientific concepts of the theme, have been expanded, differentiated, reconciled and shared within the dynamics of the classroom. Moreover, the dynamics of elaboration and integration between lab resources and the integrated teaching method allowed us to identify more easily procedural skills related to observing, recording, building schemes and explaining the learned conceptual concepts. Attitudes regarding the importance of acquired knowledge, from the point of view students, as well from students of primary school, secondary school and the society in general, were evidenced by the groups during discussions about the parasite-host. This was also the case with the respect and consideration of different opinions and criticism about their presentations.

For example, they like learning better methods for new learning, both in the health area with in various segments presented in other disciplines, with a better understanding of the subject matter in case the diseases transmitted by contaminated water and food should review the basic education part from childhood to adulthood of people to at least reduce the large incidences of diseases. In this light, we argue that teaching strategies, organized in teaching units, can promote potentially meaningful teaching. The use of research results in lab lessons integrated teaching stimulated the interaction between students, made knowledge more complete, adding relevance to previous knowledge through the offering of new information, thus adding value to the teaching learning process of Parasitology. In addition, we also discussed to propose solutions for Hanoi zoo as follows: use of periodic anti-helminths for monkey species; ensure proper nutrition and research on their immune response to parasites in here.

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