Walking around the African continent: One Health experiences

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Abstract

The One Health approach integrates human, animal, and environmental health to address several social issues, including zoonotic diseases. The concept, introduced to the veterinary domain in Italy by Adriano Mantovani and developed by his students, emphasizes the interconnectedness of species and their shared environment. The paper traces several research projects performed in Africa that illustrate this approach. In Somalia, Italian cooperation in Mogadishu led to studies on helminths in stray cats and chickens, revealing significant zoonotic threats, particularly from Ancylostomatidae species. A 2008 investigation into 1400 land turtles from North Africa uncovered a high prevalence of various *Salmonella* serotypes and *Hyalomma aegypticum* ticks, underscoring the risks of exotic pets. Research in Sahrawi refugee camps revealrd ultrasonography evidence of echinococcosis in humans and parasitological findings in animals, while a seropositivity rate of 32% for toxoplasmosis, necessitating further study despite limited funding. A study on wild ruminants in South African game preserves linked poor body condition scores to high parasite loads, emphasizing the need for effective management practices to conserve biodiversity and prevent zoonotic diseases. For the first time, *Echinococcus equinus* was reported in a white rhinoceros in Kruger National Park, expanding knowledge on wildlife parasitology. At Songea slaughterhouse in Tanzania, a high prevalence of fasciolosis in cattle was linked to water sources, revealing significant economic and zoonotic impacts, furthermore, the laboratory analyses allowed to exclude some important zoonotic diseases in the slaughtered animals. A study in Limpopo National Park, Mozambique, identified *Echinococcus ortleppi* in cattle, highlighting the challenges of disease monitoring in rural areas. The paper underscores the value of integrating local knowledge and international cooperation in advancing the One Health agenda and addressing neglected zoonotic diseases in Africa.

Keywords

Africa, Zoonoses, One Health, Parasitic Diseases, Neglected Diseases.

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One Health, to which this new journal is dedicated, should convey a new approach to zoonotic diseases. Doubt becomes mandatory as *Homo Sapiens* has since its origins noticed similarities between his peers and animals and has studied and interpreted them up to the Middle Age when a fracture appeared on the theological level. Later on this mutual path has taken shape and it has evolved until nowadays with undeniable similarities at the level of anatomo-physiology, diagnostics, therapy and prophylaxis.

The fact that animals and mankind live in the same environment has led us to also take into account the environmental wellbeing in a harmonic setting involving humans, animals and the environment that has to be preserved.

In modern times, in our country, the *One Health* concept has been introduced in the veterinary domain by Adriano Mantovani in Bologna and it has been developed by his students of which I am honoured to be part (G. Poglayen). This is what led us to interpret most of our parasitological experiences within this very practical approach which can also be described as philosophical [1]. Our Africa (according to the order of publication) begins through a third party in Mogadishu. Through the protectorate on Somalia which was achieved after the second world war, Italy has undertaken many cooperation activities among which the Faculty of Veterinary Medicine whose aim was to involve local professors and instruct prospective graduates on the management of the remarkable zootechnical heritage. Since 1974 the Faculty, headed by the University of Pisa, has seen the involvement of many professors from different Italian Faculties and it has regularly published the results of research conducted in Somalia on a Scientific Bulletin of the Zootechnics and Veterinary Medicine Faculty published in Turin.

With the fall of the Republic of Somalia and the outburst of the civil war everything has been lost and many Somali colleagues were forced to exile. Some of them went to Canada, many in the United Kingdom, where they were granted a fixed state subsidy, and others in Italy, favoured by a language familiar to them but with little to no protection from the economic point of view (meagre scolarships, short term contracts...). Among the latter the head of the Faculty in Mogadishu, Professor Osman Issa Gadale, landed in Bologna and attended the laboratory of Parasitic Diseases where we were able to involve him on research that allowed him to renew the scholarship and to obtain the PhD. Thanks to his contacts with the home country we were able to examine the digestive tract of 50 stray cats (*Felis catus*) captured and eutanasized in Mogadishc. All the animals resulted positive for helminths: *Toxocara cati* (28%), *Ancylostoma braziliense* (78%), *A. tubaeforme* (2%), *Dipylidium caninum* (34%), *Diplopylidium noelleri* (4%), *Joyeuxiella pasqualei* (62%), *Taenia taeniaeformis* (4%), *Taenia* sp (6%) and *Moniliformis* sp (2%). None of these parasites was previously reported in Soamali cats. The approach allowed to study also the parasite distribution inside the hosts to define each role. However, the most important result was the high number of Ancylostomatidae species with a zoonotic role (creeping eruption) in the urban environment during a civil war [2]. The results was also reported on the official journal of the Italian

Parasitology Society, Parassitologia [3].

The undisputed influence and prestige that prof. Osman had still in his homeland allowed us to realize another experience. This time we studied chicken helminths, considering this animal a resource of protein food, very common and easy to obtain. An epidemiological survey was carried out on helminths in the digestive tract of chickens (*Gallus gallus domesticus*) in Somalia [4]. One hundred and forty chickens of a local breed and originating from two different types of rearing system (environment) were used: 125 had been free-range chickens taken to a slaugtherhouse in Mogadishu and 15 were obtained from an intensive-rearing farm. Of the 140 chickens examined 110 were infected (79%). 104 were from free-range flocks and 6 from the intensive-rearing farm. Therefore, 83 % of the animals of the first group and 40% of the second were infected. Differences in prevalence of endoparasites in both environments were statistically significant (P< 0.01). The identified parasite species were: *Ascaridia galli, Subulura suctoria, Raillietina (Raillietina) tetragona, Raillietina (Raillietina) echinobothrida, Raillietina (Skriabjnia) cesticillus, Raillietina (Paroniella) sp, Raillietina (Raillietina) sp, Raillietina* sp, *Cotugna* sp and *Mediorhyncus gallinarum*. The parasites presented various associations. No zoonotic helmints were found but the damage from parasites can itself be considered in modern terms a real zoonosis, particularly in Africa. In fact, according to Mantovani (2013) [5] the term zoonosis should be understood as "any detriment to the health and/or quality of human life deriving from relationships with (other) vertebrate or edible or toxic invertebrate animals". From this perspective, even the death, insufficient growth of a chicken or a reduction in the number of eggs can be considered a zoonosis.

It is not always necessary to travel to african continent to encounter disease agents to be introduced into our country. This is the case of a seizure of 1400 land turtles (*Testudo graeca*) from North Africa carried out in Palermo by the CITES forestry police unit in 2008. The health status of the reptiles was conducted through clinical examination, cloacal swab and search for any ectoparasites (ticks). The results of the consequent investigation are absolutely worrying and show the presence of 20 different salmonella serotypes in 62% of the subjects, of which over a quarter belong to "exotic" serotypes. Even the only tick species isolated in 37% of turtles *Hyalomma aegypticum* is of considerable importance for human health as it is capable of carrying for instances the Crimean-Congo Haemorrhagic virus [6]. It does not seem superfluous to underline the terrible fashion of choosing exotic animals as pets, which are a harbinger of health and environmental risks.

The Sahrawis are a nomadic people driven from their territories by Morocco with the support of Spain. Since 1979 they have lived relegated to 5 refugee camps in the Algerian desert, depending on international support and on the help of NGOs. With a continuous hemorrhage of young people emigrating to Spain we can say that we are driving the proud nomadic people to extinction. The NGO Africa 70 had the merit of successfully reorganizing the veterinary healthcare service from slaughter control to animal care by recovering veterinarians (who graduated in Cuba and subsequently abandoned in the camps)

and training a generation of young support technicians. The sending of Italian colleagues allowed the study and implementation of specific research subsequently published which demonstrates not only help material. Regarding Echinococcosis the presence of cystic lesions was demonstrated by ultrasonograpuy in adult people (22 out of 263) but not serologically confirmed. Out of 37 childrens, one resulted positive [7].

Taking into consideration that this ethnic group occupies a restricted area of the desert in cohabitation with different domestic animals (dogs, cats, sheep, goats, camels) another serological research was performed on echinococcosis and toxoplasmosis. No echinococcosis was revealed in humans but adult worms were found in dogs and cysts in camels (Poglayen, personal communication). Concerning *Toxoplasma*, a positivity rate (IgG) of 32% was recorded with an higher level in female in the age class 5-10 years. This data would be worthy of further study but the scarcity of funding has drastically reduced activities. Even the 12.5 % of recent infections (IgM) would have deserved further investigation [8].

In recent past, Veterinary Medicine has focused its interest on involving wild animals non only as single head fenced in captivity and therefore clinically similar to domestic one, but also as free-living populations. All these are meant to protect biodiversity and curtail the possible spread of pathogens and zoonotic disease. These preliminary considerations suggest transferring the clinical approach proposed by Bologna [9] and more recently by Cambridge Academy [10] simplifying and adapting them to wild ruminants in game preserves of South Africa. These are wild farms suitable for the conservation, including breeding of species of local wildlife particularly valuable, from economic, touristic or endangered point of view. Their management is quite particular: wild ruminants are fenced on many hectares of land and continuosly exchanged with other preserves. Considering that from this wild farm parasitological information are lacking and also domestic ruminants are raised close the wild ones, we suggested transferring the clinical approach cited adapting them to wild ruminants by a visual system for scoring body condition (telediagnosis). Body Condition Score (BCS) is an index of an animal's health [11]. An increase or decrease in Body Conditions could mean a change in quality of management or environment in which an animal lives. The wildlife BCS should be linked to the presence of gastrointestinal parasites that should be recognized, counted and statistically evaluated. Another purpose to study the parasitism of wild ruminants should be to help their management by rangers. Our survey was done in 6 preserves in the Eastern region of Garden Route, Republic of South Africa during February 2016. Overall, we had the opportunity to work with 103 animals belonging to 15 different ruminant species. To evaluate the BCS the animals were identified through an optical instrument (field glass Olympus 10X50) at dropping time and subsequently photographed. Fecal samples were collected from each animal, parasitological exams were performed and the results statistically evaluated. The 83.5% of samples resulted positive for gastrointestinal strongyles (GIS) and 21.85% were also positive for coccidia. Scarce BCS values resulted linked to the higher parasite presence, same animals

should be treated avoiding its loss. The present paper is full part of the limited experiences of telediagnosis in a conservation perspective. The preserves owners were enthusiastic about our work and the management advice that emerged from it. For our part we can affirm that only with their collaboration we have been able to obtain transferable results even in situations of complete freedom of the animals as happens in national parks [12].

The great helpful and collaboration on the part of the managers, colleagues and rangers of the Krugher National Park have offered us the opportunity to report, for the first time in the world, *E. equinus* in the white rhinoceros (*Ceratotherium simum simum*). The animal was killed by poachers, but rangers and vets arrived shortly after the lions that had spared the thoracic cavity were was possible to find four cysts in the lungs. The cysts were fertile with many protoscolices inside and subjected to PCR allowing to define the strain *E. equinus*, the same genotype present in zebras of the area. This strain is not tansmissible to man and the local definitive carnivorous host is unknown and we are searching for it [13].

The activity of Vet for Africa NGO, supported by the Bologna University in Tanzania allowed us to collect disease information at Songea slaughtherhouse (South Tanzania). With the collaboration of official veterinarians, we wanted to investigate further the parasite presence with particular attention to zoonotic ones deepening inspective diagnosis by means of parasitological and histological investigations on tissue samples. Overall the slaughter data of 614 animals were reported. In most cases slaugthered cattle belonged to local breeds and came from Mbeya region. Fasciolosis (diagnosed in 44.6 % of animals) was the most frequent condition, followed by respiratory diseases (24.4%), aortic onchocerciasis (6.5%), hydatidosis (5.5%) and bovine cysticercosis. Laboratory analysis identified *Fasciola gigantica* as the species involved in hepatic distomatosis in this area; In an attempt to identify the cause of this high prevalence, we found that all the cattle were taken to local rivers to drink every morning and evening, where they inevitably came into contact with the intermediate host snail.. Cases macroscopically ascribed to cysticercosis turned out to be a muscular form of onchocerchiasis (by *Onchocerca dukey*), a neglected and unrecognised parasitic disease in Tanzania, questioning the real frequence of a zoonosis that causes primarily major economic losses. Pulmonary cysts, referred as hydatidosis at visual inspection, were histologically identified ad haemal nodes, lymphoid organs common in ruminants, but described in cattle lungs for the first time in the present research. Slaugtherhouse demonstated to be an important epidemiological observatory, especially for neglected parasitoses. The possibility of having basic laboratory diagnostic as an aid to visual inspection can ensure greater efficiency of veterinary service in the control of important livestock disease and zoonoses in the frame of a One Health perspective [14].

Cystic echinococcosis (CE) is included in WHO (World Health Organization) list of the most frequent Neglected Zoonotic Diseases (NZDs) and is a major problem in rural areas where hygienic measures are poor. Prevalence of the disease in humans is often underestimated given the challenges in carrying out studies in resource-poor communities

in remote and isolated geographic areas. A prevalence and genotyping study was conducted in the Limpopo National Park (LNP), Gaza province (Mozambique), to evaluate the effects of this parasitic disease on liverstock production, wildlife health and possible public health risk in this human-wildlife interface conservation area. A total of 204 cattle were inspected in the Massingir slaughterouse which is the focal point for all animals reared in the LNP and its buffer zone. Inspection detected 25 animals with cystic-like lesions in various organs, of which 22 were microscopically confirmed as *Echinococcus granulosus* s.l., representing a prevalence of 10.8%. Subsequent molecular analysis confirmed that the samples belonged to strain G5, now reclassified as *E. ortleppi*, one of the known zoonotic *Echinococcus* species. Due to the poor attention observed by local technicians during inspection procedures on the occasion of the visit of the European Cooperation Inspectors we prepared a poster on the veterinarian importance during animal inspection to be displayed in the slaughterhouses and schools in the area (Figure 1) [15].

At the end of this brief review of our activity on the African continent we would like to highlight that a modest knowledge gap was also completed also with the support of local colleagues and above all it was possible to scientifically demonstrate the cooperation's activity, which is quite rare.

Figure 1. Poster prepared to illustrate the main livestock diseases that can be found at slaughter in the context of the research activity conducted in Mozambique.

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