

Full Length Research Paper

Benefits of animal intervention strategies in the control of neglected zoonotic diseases in Nigeria

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Nigeria among many other developing countries of Africa, Asia and Latin America still suffers the impact of neglected zoonotic diseases (NZDs) such as rabies, brucellosis, cysticercosis, echinococcosis and other geo-helminths which have been successfully eradicated in industrialized countries. These diseases cause economic bankruptcy among over 70% of Nigerians who live in the rural areas and whose livelihood is dependent on mini-livestock production. In the current review, the employment of animal intervention strategies to control these NZDs through animal vaccination, strategic de-worming, enactment and re-enforcement of legislations and policies on NZDs control, efficient veterinary meat inspection, public education and depopulation as a last option are discussed. The benefits of animal intervention strategies are affordability, safety to animals and the general public as well as improvement of national economy.

Key words: Benefits, animal intervention strategies, control, neglected zoonotic diseases, risk factors, Nigeria.

INTRODUCTION

NZDs remain a major problem in resource-limited countries of Africa, Asia and Latin America, despite their eradication in industrialized countries. However, global disease control focus has been on the millennium development goal 6; which is to combat non-zoonotic tuberculosis, HIV and AIDS as well as malaria. It has resulted in over emphasis on these three diseases and the abandoning of majority of zoonotic diseases affecting the poor populations of low income countries especially in the area of policy making towards disease control (Molyneux, 2008).

Neglected zoonoses exert dual effects either through direct causation of illnesses in man and animals or

indirectly through economic losses caused to poor rural people whose livelihood is dependent on livestock production. Majority of the Nigerian rural populations depend on incomes generated from livestock production to meet emergency expenditures such as food, school fees and medical bills (Welburn et al., 2015). Intervention by way of controlling these diseases will ensure triple benefits by improving the health of livestock, livelihoods and protection of human health (World Health Organization, 2007, 2010).

The role of animals in the control of zoonoses can never be over emphasized considering the significant role of domestic and wild animals in maintaining, amplifying

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and transmission of zoonotic pathogens in nature (WHO, 2010). At least 61% of all emergent human pathogens reported during the last two decades are said to be zoonotic, with majority (71.8%) being from animals and their products (Jones et al., 2008) whereas only 3% are utilizing humans as primary reservoirs (Shaffer, 2008). The mechanisms of zoonoses transmission may be direct as in the cases of rabies, anthrax and trichinosis or indirect via vectors (human African trypanosomiasis, leishmaniasis, onchocerciasis), through foods of animal origin (cysticercosis, echinococcosis, brucellosis) and via water as in the cases of salmonellosis and campylobacteriosis (WHO, 2010).

It is evident that current strategies for the control of NZDs in Nigeria which include the use of injectable vaccinations, treatment of infected animals, VMI, and legislations have yielded poor results probably due to inadequacy of vaccine production, unwillingness of animal owners to seek veterinary care, un-standardized VMI and un-enforced legislations. Documented reports shows that NZDs including brucellosis (Bertu et al., 2010; Gusi et al., 2010; Aworh et al., 2013), rabies (Abubakar and Bakari, 2012; Karshima et al., 2013a; Eke et al., 2015), *Taenia solium* cysticercosis (Biu and Ijudai, 2012; Karshima et al., 2013b), echinococcosis (Saulawa et al., 2011; Adediran et al., 2014) and zoonotic tuberculosis (Raufu and Ameh, 2010; Nwanta et al., 2011; Ejeh et al., 2014) have remained endemic in Nigeria for decades despite efforts towards their control. For instance, studies among humans in Nigeria have revealed 100% case fatality due to rabies (Eke et al., 2015), prevalence rates ranging between 24.1 and 55.0% for brucellosis (Alausa and Awoseyi, 1976; Cadmus et al., 2006; Aworh et al., 2013) as well as 0.6 and 9.6% for cysticercosis (Dada, 1980; Weka et al., 2013). This review has attempted to outline the strategies and benefits of animal intervention in the control of NZDs in Nigeria and presents these strategies as a way forward towards the control of NZDs in Nigeria.

Risk factors associated with the spread of neglected zoonoses in Nigeria

Understanding the risk factors associated with the spread of neglected zoonoses in Nigeria is essential for their control; because reducing these risk factors will definitely retard transmission of zoonotic diseases. The consumption of unpasteurized milk, undercooked or raw meat and blood of animals increase the risk of neglected zoonoses transmission. For instance Onoja et al. (2010) reported increased risk of milk-borne NZDs like zoonotic tuberculosis and brucellosis among nomads due to their habit of taking raw milk directly from the udder of cows. Similarly, the consumption of raw or undercooked meat increases the risk of meat-borne NZDs like cysticercosis

which is incriminated in African epilepsy (Diop et al., 2003) as well as echinococcosis, brucellosis and zoonotic tuberculosis. Moreover, it is advised that the habit of consuming blood of animals slaughtered in abattoirs in some parts of Nigeria must be discouraged as this practice may transmit zoonotic pathogens to the consumers.

Lack of vaccination or un-vaccinated livestock and pets against vaccinal NZDs are additional risk factor for the existence of these diseases among humans and animals. For example, low rabies vaccination coverage were reported in Africa (Jibat et al., 2015) and different parts of Nigeria including Zaria (Dzikwi et al., 2011), Lagos (Hambolu et al., 2014) and Aba (Otolorin et al., 2014), suggesting high risk of rabies transmission in the country. The consumption of "bush meat" which refers to meat from wild animals is another risk factor associated with the transmission of NZDs especially those originating from wild animal reservoirs (Alexander et al., 2012). In Nigeria, all food animals intended for human consumption are expected to be slaughtered in the abattoir where they are subjected to veterinary meat inspection and are certified safe before forwarding for human consumption. However, meats from wild animals are not subjected to inspection by the veterinarian and so pose the risk of transmission of NZDs like cysticercosis, echinococcosis, brucellosis and zoonotic tuberculosis to man.

The trade of live wildlife species is beneficial to the economy of many nations; however, it poses public health risk of emergence and maintenance of NZDs (Karshima, 2013). For instance, non-human primates reported as reservoirs of ebola virus in West Africa (Leroy et al., 2004; Bermejo et al., 2006) are domesticated in Nigeria as companion animals thereby increasing the risk of transmission of zoonotic diseases between wildlife and man. People living with immuno-suppressed conditions such as AIDS and cancer among the healthy individuals have increased susceptibility to disease conditions including neglected zoonoses. For instance, the risk of zoonoses transmission will be higher among the 5.4 million Nigerians living with HIV and AIDS (World Bank, 2013) and the 100,000 people reported to suffer from cancer yearly (Ferlay et al., 2010).

Veterinary inspection of food animals and carcasses in abattoirs is aimed at providing wholesome meat for human consumption (Karshima, 2012). However, the debilitating state of Nigerian abattoirs at present and the negligence of duty by some professionals who are supposed to inspect meat after slaughter and certify it safe for human consumption make this a mirage and so the consumption of un-hygienically processed and uninspected meat has become the order of the day thereby exposing consumers to the risk of meat-borne neglected zoonoses like zoonotic tuberculosis, cysticercosis, echinococcosis and brucellosis.

Attitudes of professionals towards the control of

zoonosis in Nigeria also pose risk of transmission of NZDs among humans and animals. Of particular concern is the low level of collaboration among the veterinary, medical and environmental professionals in the country (Karshima, 2012), despite the global loud cry on the need to embrace the one health concept. Veterinarians assigned the responsibility of conducting meat inspection in the abattoirs must ensure timely resumption at the abattoir and efficient meat inspection. Veterinary professionals must also imbibe the habit of using protective wears during practice to avoid introducing NZDs of animal origin to the human populace.

Animal intervention strategies applicable in Nigeria

Vaccination against vaccinable NZDs

Prevention is said to be cheaper and safer than cure. Vaccination of animals against vaccinable NZDs will go a long way in the control of these diseases among animals and humans. The use of anti-rabies vaccine for dogs, *Brucella* S19 and anthrax spores vaccine produced by National Veterinary Research Institution (NVRI), Vom against these zoonotic diseases is highly recommended for their control in Nigeria. Vaccinating over 70% of animal population against these zoonoses will ensure herd immunity and subsequent protection of the animal population and humans from these NZDs. Free vaccination campaigns which has been neglected, should be encouraged by the government and stakeholders in the veterinary and health sectors to overcome the challenge of low vaccination coverage reported in several parts of the country (Dzikwi et al., 2011; Hambolu et al., 2014; Otolorin et al., 2014). Vaccine failure arising from poor storage, wrong route of administration and incorrect reconstitution among other factors should also be addressed for adequate vaccination result.

Though this may require enormous efforts, curtailing the transmission of NZDs between wildlife, domestic animals and man through the vaccination of wildlife species will help in breaking the cycle of transmission originating from wildlife. The production of water soluble vaccine for NZDs and their administration in artificial dams at strategic places where wildlife visit to drink water was suggested (Karshima, 2013). The water soluble alternative vaccines suggested for the control of NZDs among livestock and wildlife reservoirs in Nigeria include: anti-rabies and hepatitis D and E in canids and felids as well as anthrax spores, *Brucella* S19 and foot and mouth disease vaccines in domestic and wild ruminants. Legislations governing the use of vaccines in animals by veterinarians who are mandated to provide these services should be enforced to prevent abuses from non veterinary professionals. The National Veterinary Research Institute which is responsible for the production of animal vaccines must also increase their capacity to

meet up with their demand.

Routine screening of companion animals against zoonotic helminths

Veterinarians are thought to be on the “front line” of prevention of pet-associated zoonotic helminth infections (Smith et al., 2009). The WHO recommended that puppies and kittens should be de-wormed at the age of 2 weeks to eliminate larvae acquired through trans-mammary and trans-placental transmission (Stull et al., 2007). People living with immuno-compromised conditions have higher risk of acquiring zoonoses from companion animals. Therefore, they should always present their pets to Veterinarians for strategic de-worming. Kahn, (2007) recommended that animals that can bite or scratch should not be considered as pets for this group of people. The contamination of environment, food, vegetables and water by animal excreta which is usually the source of human infection with taeniasis/cysticercosis, echinococcosis and soil-transmitted helminths can be controlled through the regulation of indiscriminate keeping of animals.

Efficient veterinary meat inspection in the abattoirs

The benefits of efficient veterinary meat inspection (VMI) are improvement of human health (Biffa et al., 2010), animal disease control through disease trace back mechanism and improved environmental health (Nwanta et al., 2008). VMI is believed to protect the 10% of the human population that may be affected by meat-borne zoonotic diseases yearly (Schlundt et al., 2004). To be able to achieve this, stakeholder responsible for abattoir management must ensure the renovation and equipping of Nigerian abattoirs as well as sponsor legislations and policies to support meat inspection. Veterinarians must also stand up to their responsibilities by timely reporting to the abattoir for meat inspection and adequate judgement. In addition to the training on VMI offered in veterinary schools, refresher courses are highly recommended for Meat Inspectors for optimal performance.

Regulation of importation of domestic, wild animals and their products

Regulating the importation of domesticated animals, wildlife species and their products will play vital roles in the control of NZDs in Nigeria. For instance, the Animal Disease Control Act of 24th February, 1988 clearly prohibits the importation of animals, hatching eggs, poultry and animal products into Nigeria from any country by land, sea or air without permission. Strict observance of the provision of this act will go a long way to control the

spread of NZDs from imported animals and their products. It is also pertinent to subject imported and trade animals to inspection at designated quarantine sections and control posts. Veterinarians should also be backed-up to conduct surveillance of suspected premises believed to harbour diseased animals as required by the law. It is also advised that communities rearing livestock should report increased frequencies of illnesses and deaths in animals to Veterinarians. To enforce this act, contraveners should be penalized as stipulated by law, and the fines recommended by this act should be reviewed upward to meet the contemporary reality in Nigeria.

Public education

Neglected endemic zoonoses are usually transmitted via the consumption of raw, undercooked, unpasteurised milk or close contact with animals (Ash et al., 2015). For instance, cysticercosis, echinococcosis, brucellosis, zoonotic tuberculosis can all be transmitted via the consumption of undercooked meat, however, in addition to this, brucellosis and zoonotic tuberculosis can also be transmitted through the consumption of unpasteurised milk and close contact with infected animals. It is therefore necessary to educate the general public about the routes of transmission of these endemic zoonoses so as to protect themselves from their menace. Poor hygiene and sanitation influence the transmission of these diseases and so the public must also be educated on the health risks of unhygienic practices like indiscriminate disposal of human and animal excreta.

Depopulation of animals

Though this is not a humane method of disease control, it is a last option especially when deadly zoonotic pathogens like anthrax and rabies are already circulating in animal reservoirs. Depopulation decreases the number of diseased animals in circulation and thus reduces public health risk. Depopulation was employed in Nigeria during 2006 when outbreak of highly pathogenic avian influenza took place. To achieve commendable success in depopulation; the government must also be committed to the compensation component of this disease control strategy. Carcass disposal is a very important component of depopulation and methods such as composting, burial, incineration, rendering and landfilling are recommended.

Benefits of animal intervention in the control of neglected zoonotic diseases in Nigeria

NZDs control through animal intervention is beneficial to

the animal itself, man and national economy. These benefits can be broadly summarized into three segments as follows:

Improvement of animal health

Neglected zoonotic pathogens like *Mycobacterium bovis*, *Cysticercus cellulosae* of *Taenia solium*, *Brucella abortus*, *Brucella melitensis*, *hydatid cyst* of *Echinococcus* cause different levels of morbidity and mortality in animals. These pathogens and their associated diseases if adequately curtailed through the use of vaccination, routine screening, strategic de-worming as well as enactment and enforcement of zoonoses control laws and policies will go a long way in improving animal health. Efficient veterinary meat inspection at the abattoirs will also help in eliminating NZDs from their primary sources through the trace back mechanism.

Promotion of human health

Substantive evidence shows that at least 61% of all human pathogens that emerged during the last 2 decades are zoonotic, and over 71% of these pathogens were from animals and their products (Jones et al., 2008). This suggests that humans would have been protected if these zoonotic diseases could have been identified in animals through surveillance and by curtailing transmission to humans. For instance, several workers reported brucellosis among herdsmen, butchers and meat sellers with prevalence rates ranging between 11.0 and 55.0% (Alausa and Awoseyi, 1976; Aworh et al., 2013; Adamu et al., 2015) despite the fact that this zoonosis can be prevented in animals through the use of *Bruella* S19 vaccine which is produced by NVRI, Vom, Nigeria and readily available for farmers. Human rabies cases have also been reported in Nigeria for more than 4 decades (Kemp et al., 1972; Ogunkoya et al., 1990; Abubakar and Bakari, 2012; Eke et al., 2015) despite the availability of anti-rabies vaccines for dogs which are the major source of human rabies in Nigeria. Transmission of NZDs in Nigeria can be curtailed through efficient zoonoses surveillance, vaccination of animals against neglected zoonoses like rabies, brucellosis and anthrax, veterinary inspection of meat and the regulation of importation of animals and their products. By this, animal sources of human zoonotic infections will be controlled and transmission to humans can be curtailed.

Improvement of national economy

Economic losses due to neglected zoonoses are numerous and may include; losses due to treatment of

sick animals, death of animals which are usually sources of income for rural population of Nigeria, hospitalization of ill people as a result of neglected zoonoses, misdiagnosis as well as prolonged and combined antimicrobial therapies required for neglected zoonosis like brucellosis (Seimenis et al., 2006; Dean et al., 2012; McDermott et al., 2013). Losses can also be due to condemnation of carcasses as a result of neglected zoonoses like zoonotic tuberculosis, cysticercosis, hydatidosis among many others. For example economic losses due to bovine brucellosis in Nigeria alone were estimated at 575,608 USD per year (Ajogi et al., 1998). Employing animal intervention in the control of these neglected zoonoses will improve the economy of livestock producers and in turn add to the gross domestic product of the nation through cost-savings. It was also observed that it is 50 times cheaper to employ animal intervention in the control of rabies in Nigeria through the vaccination of dogs using NVRI anti-rabies vaccine for dogs than administration of both pre and post-exposure Anti-Rabies Vaccine in humans (Karshima, 2012).

Conclusion

NZDs are still major problems in Nigeria causing morbidity and mortality among humans and animals. These controls will relieve burdens on human and animal health as well as reduce poverty levels especially among the rural population. The use of animal intervention strategies in the control of NZDs like rabies, brucellosis, zoonotic tuberculosis, cysticercosis, anthrax, echinococcosis among many others is cost-effective. It is therefore recommended that the veterinary, health, environmental sectors as well as policy makers, should embrace the animal intervention strategies which are affordable, safe, cost-saving and beneficial to humans, animals and the environment.

Conflict of Interests

The author has not declared any conflict of interests.

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