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Commercialisation of Alternative Livestock Feeds Could Save Fish Stocks in Lake Victoria

SIYA AGGREY^{*}, DONALD R. KUGONZA^{*}, VINCENT MUWANIKA^{*}

^{*}College of Agricultural and Environmental Sciences, Makerere University, P.O. Box 7062, Kampala, Uganda

Corresponding author's email address: siyaggrey@gmail.com

Abstract

Increasing livestock production in East Africa requires increased use of fish meal as a source of protein, some of which comes from the Silver Cyprinid (*Rastrineobola argentea*) in Lake Victoria, which could result in its over-exploitation and affect the survival of other organisms in the lake. The crude protein content of cockroaches (38-76% CP depending on the age) and of other insects is similar to that of fish meal (61.24% CP) and could be a substitute for it, if these insects can be domesticated and used as animal feeds. Non-conventional feeds such as cockroaches, houseflies, termites, earthworms and carabid beetles are used on a small scale by farmers in Uganda who would be willing to use them more if they could be produced on a large scale. There is therefore a need to promote large scale insect breeding so that these alternative protein sources can be integrated into farming systems.

Keywords: Alternative protein sources, Fishmeal, Insects, Poultry

Introduction

The world's human population is predicted to reach 9.7 billion (34% higher than today) by 2050 (United Nations, 2013) and this growth will mainly be in developing countries) such as those around Lake Victoria. By this time, about 70% of the population will be urban compared to 49% today (FAO, 2009; Angel *et al.*, 2011). This increase in human population calls for an increase in food production and it is estimated that it will have to increase by 70% to feed the population in 2050 (FAO, 2009). This increase in food production will consequently have impacts on water bodies like L. Victoria since agriculture is a major source of pollutants and sedimentation in lakes (Moss, 2008; Donohue and Garcia Molinos, 2009).

Livestock production has evolved in response to the demand for animal products, which will double by 2050 causing, amongst other things, a significant increase in anthropogenic greenhouse gases (Herrero *et al.*, 2009; Thornton, 2010). There will also be an increased demand for fish meal (Torstensen *et al.*, 2008) that has and will continue to cause unsustainable pressure on fish resources (Asche *et al.*, 2013). Around Lake Victoria the small cyprinid fish

Rastrineobola argentea is mostly used for livestock feed, especially chicken production (Sharpe *et al.*, 2012). In some parts of Africa, the demand for fish meal for both human diets and livestock feeds has affected the price of stock feeds (Ayantunde *et al.*, 2014).

The continued increase in the human population calls for commercialization of alternative unconventional protein-rich feeds for livestock, including these feeds with fish meal (Burr *et al.*, 2012). Some of these potential livestock feeds are eaten in the wild; for example, free range chicken feed on various insects and earthworms (Józefiak *et al.*, 2016) but these alternative sources have not been adopted because the technologies of production have not been developed (EFSA Scientific Committee, 2015).

The consequences of climate change, such as severe flooding, are likely to increase the siltation of rivers and lakes (Xu *et al.*, 2005) and could affect fisheries productivity in freshwater bodies including Lake Victoria (Bates *et al.*, 2008). Insects, such as cockroaches have proved to be resistant to the harsh climatic conditions likely to be imposed by climate

change since they are able to survive at extreme temperatures with limited food and water and can survive on food wastes (Brenner, 2002).

Rapid urbanization is currently reducing the availability of land for agriculture (Tiffen, 2003). Consequently, marginal lands and wetlands are increasingly being converted for agriculture; and the loss of wetlands around Lake Victoria could adversely affect fisheries productivity (Thenya *et al.*, 2006). Insect farming such as the rearing of cockroaches (e.g. *Blaptica dubia*), for instance, requires a smaller land acreage for its production and has been found to emit fewer greenhouse gases than livestock (Oonincx *et al.*, 2010).

Methods

The Kawempe division of Kampala was selected for this investigation since it has many modern poultry farms (Benson and Mugarura, 2013) and is in the Lake Victoria basin. A total of 60 poultry farmers were interviewed to assess their attitudes towards the use of cockroaches as a substitute for fish meal. Consent from the respondents was sought before interview with each respondent having signed a prior consent form (Van Deventer, 2009). These key informant guides also took into consideration what farmers currently use as substitutes for fish meal and the challenges in poultry farming.

The literature was reviewed to determine the feed ingredients in fish meal relative to insect protein sources, which included crickets, cockroaches, carabid beetles and houseflies. The nutrient concentration of the different feed sources was determined in relation to fishmeal mainly used by the farmers. The crude nutrient content for each of the feed sources was evaluated in relation to the nutrient requirements of poultry.

Results and Discussion

Most (75%) poultry farmers were willing to use cockroaches as a substitute for fishmeal and alternative protein sources used by the farmers included carabid beetles, earthworms and houseflies. More than two thirds (69%) of the poultry farmers improvise alternative feeds by methods such as piling up chicken droppings so that carabid beetles, housefly maggots and other insects can grow in them and then be eaten by the chickens. This is not seen as a substitute for fish meal and the farmers complained about the lack of technologies to produce these

alternative feeds in sufficient quantities to sustain poultry farming.

The crude protein concentration of carabid beetles, cockroaches and houseflies was 77%, 62% and 79% respectively (Finke, 2013) compared to 61% crude protein in fish meal (Quartararo *et al.*, 1998; Soares *et al.*, 2015). Soybean (plant protein source) was also evaluated and compared with the crude protein concentration in fishmeal. Soybean averaged at 63.07% crude protein, CP (Soares *et al.*, 2015) which is fairly equivalent to that of fish meal. The small differences between the crude protein concentration in fish meal and other protein sources suggest that these alternative sources could replace fishmeal. If these sources could be produced on a large-scale substitution might reduce pressure on fish stocks, while increasing the quantity of fish available for human consumption.

However, in order to tap into this potential, there is need to train farmers on the use and production of these alternative feeds. Policies to encourage the use of alternative feeds for poultry need to be instituted and the development of technologies for large-scale production developed. There is also a need for research on ways of ensuring safety in the production of these alternative feeds.

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