

Levels of aflatoxins in the Kenyan dairy value chain: How can we assess the economic impact?

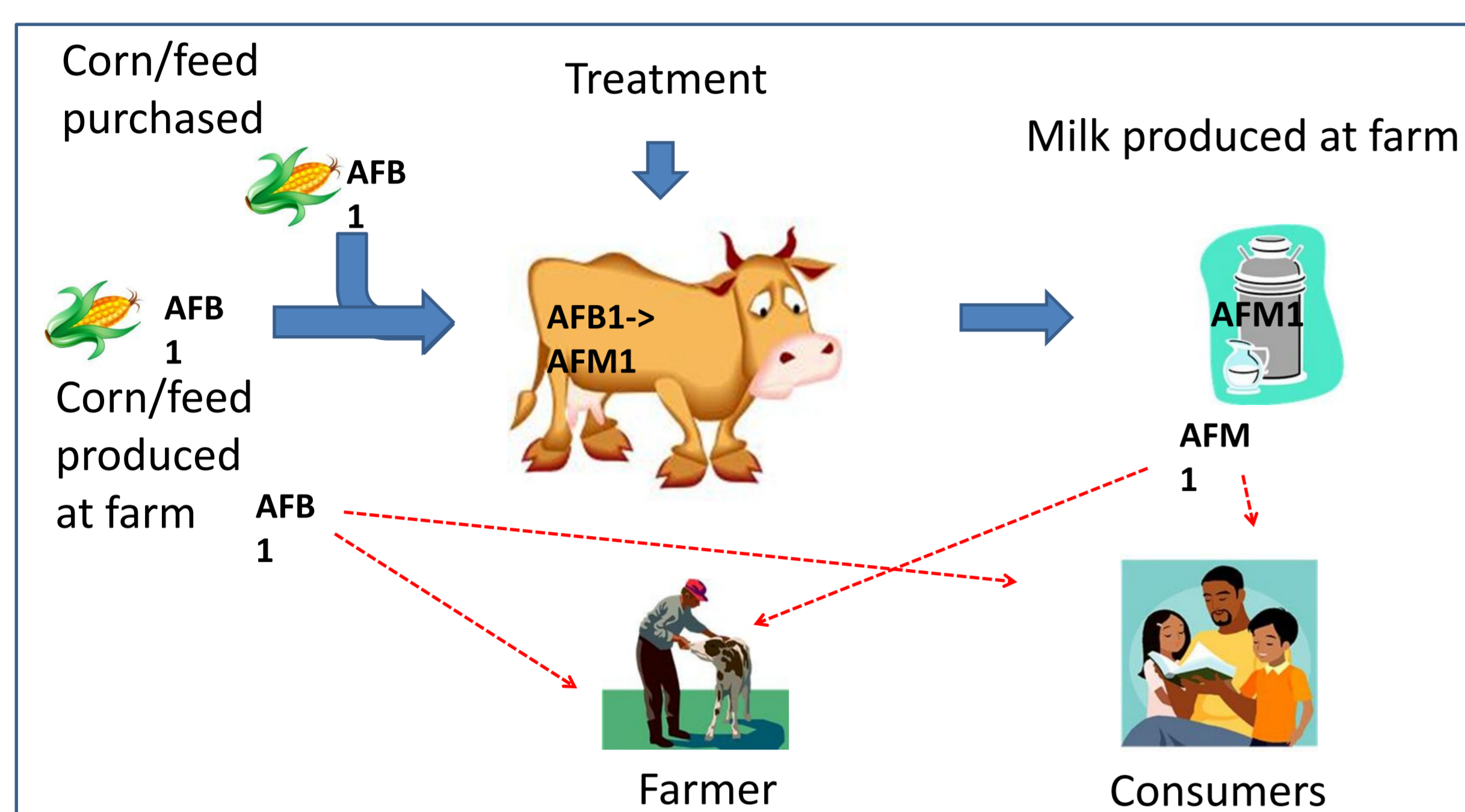
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Introduction

Kenya's dairy industry plays an important economic role in the life of farmers, milk processors, milk traders, feed manufacturers and traders. This industry contributes up to 14% of the agricultural GDP and 3.5% of the total GDP. Studies have shown that dairy chain development could be hampered by mycotoxins and Kenyan dairy sector is not an exception. Aflatoxin contamination has negative effects on human health and incurs economic losses to the dairy sector.

Materials and Methods

A systematic literature review was done using Cab-direct, Pubmed, AJOL, and Google scholar, with the following key word combinations: mycotoxins, maize, feeds, , milk, economics, Kenya. Abstracts were screened online and the relevant papers retrieved.



The natural occurring aflatoxins are AFB1, AFB2, AFG1, AFG2, with AFB1 the most abundant, toxic and carcinogenic. AFM1 and AFM2, the hydroxilated products of AFB1 and AFB2 respectively, are found in milk and milk products. AFM1 is hepatotoxic and carcinogenic. Aflatoxins cause hepatocellular carcinoma in humans and are also associated with stunting in children. Chronic aflatoxin poisoning in dairy cattle causes a reduction in milk yield, decreases feed efficiency, and reduces reproduction efficiency. Acute aflatoxin poisoning due to consumption of contaminated food and feed causes deaths in man and dairy cattle.

Figure 1. Aflatoxin contamination pathway - source: authors

Results

Most of the publications on the levels of aflatoxins in Kenyan dairy value chain are on maize, followed by animal feed, peanuts, milk and wheat.

The levels of aflatoxins in maize in most studies were well above the Kenyan upper limit of 10 ppb in food/feed (up to 116666 ppb).

The highest level in dairy feeds was 1123 ppb compared to 2687 ppb in peanuts. Milk had AFM1 levels up to 0.78 ppb which is above the FAO/WHO upper limit of 0.05 ppb.

The levels of aflatoxins in maize were 0-4593 ppb (Nairobi county), 0-58000 ppb (Kitui, Machakos, Makueni, Embu and Kiambu counties), 0-426 ppb (Taita, Kwale, Tana river, Nakuru, Laikipia, and Kilifi counties), 14-17 ppb (Bungoma county) and 0-116666 ppb (Nandi county). The dairy feed aflatoxin concentrations were 0-4593 ppb (Nairobi, Machakos, Nyeri, Uasin gishu, and Nakuru counties). In two counties of Busia and Homabay the aflatoxin levels in peanuts were in the range of zero to 7525 ppb.

Economic costs is the sum of direct market costs and human health costs.

Direct market costs correspond to the costs incurred by all the stakeholders among the dairy value chain who are affected by aflatoxins. This is especially the case of feed producers, and milk producers.

Human health costs could be assessed through questionnaire directed to sampled consumers and using the following equation (Rico-Sole, 2012):

$$Aflatoxin\ health\ costs_i = H \cdot E \sum_{i=1}^n x_i \cdot w_i \cdot z_i$$

H: number of exposed habitants

E: health expenditure per capita

i: risk factor

x_i : fraction in DALY's implication in this population of risk factor i

w_i : estimated fraction of implication of aflatoxin in risk factor i

z_i : estimated fraction of implication of milk consumption in aflatoxin in risk factor i

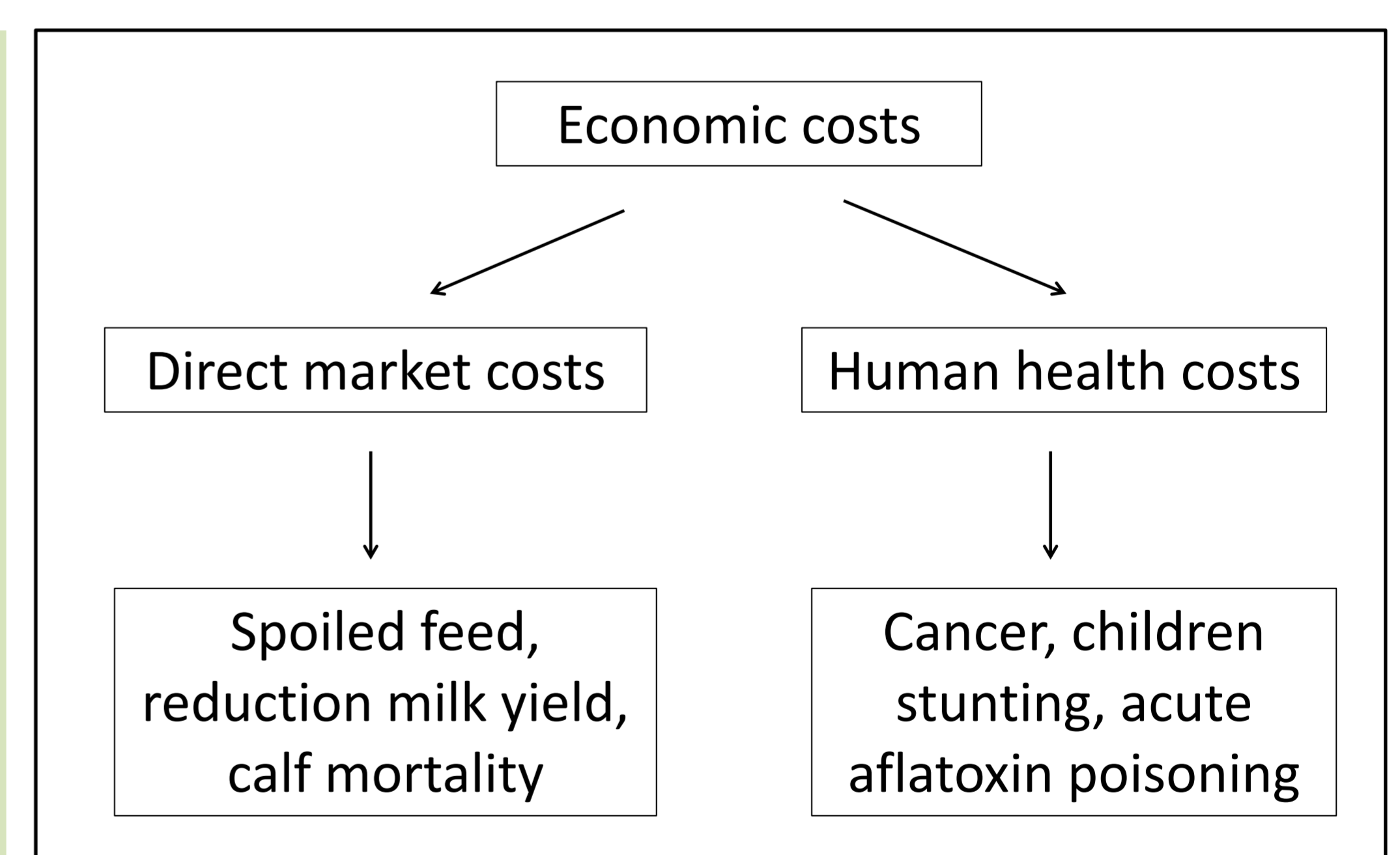


Figure 2. Economic costs of aflatoxins

source: authors from Khlangwiset and Wu (2010)

Key messages

- The high aflatoxin level in maize in Kenya is a potential risk to acute aflatoxicosis and hepatocellular carcinoma in humans
- Economic costs of aflatoxins should include both direct markets costs and human health costs
- A study of the aflatoxin contamination levels a long the Kenyan dairy value chain can identify the critical control points to implement mitigation strategies.
- Mitigation strategies should be implemented on the basis of cost-effectiveness analysis and on stakeholders compliance