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KENYA DAIRY FARMER PERCEPTION OF MOULDS AND MYCOTOXINS AND IMPLICATIONS FOR EXPOSURE TO AFLATOXINS: A GENDERED ANALYSIS

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ABSTRACT

In the tropics, staples such as maize are often contaminated with mycotoxins, harmful by-products of fungal metabolism. In particular, high exposure to aflatoxins may cause fatal illness in people and animals, while chronic exposure can cause liver cancer in humans and, in domestic animals, growth depression and immune suppression. However, little is known about the potential health risks of milk contaminated with aflatoxins. Moreover, because of different consumption patterns and biology, men, women, boys and girls may experience different levels of risk, while because of gender roles, men and women may have different capacity to mitigate risk; yet, there are few gendered analyses of aflatoxins. This study conducts a qualitative, gendered study on awareness and perceptions of mycotoxins and how these influence risk of dietary exposure to mycotoxins among dairy farmers in Kenya. First, a risk map was developed based on previous occurrence of aflatoxicosis and relevant factors such as farming systems and dairy cattle density. This resulted in three risk categories: high risk with historical outbreaks of human aflatoxicosis, high risk without historical outbreaks and low risk with historical outbreaks. From each category, three districts were randomly selected and from each district, three villages. A focus group discussion (FGD) tool was developed and used for interviews to assess factors related to the potential risk of exposure to mycotoxins in identified risk regions and how perception of risk and risk management differed by gender. In each village, two sex-disaggregated FGDs were conducted, yielding a total of 54 FGDs. This study found that overall risk categories, awareness of mycotoxicosis and carcinogenic effects was generally low, but awareness that eating mouldy food is harmful was high. Women were more cautious than men about feeding spoilt maize to cattle. Preventive measures against fungal contamination were more common post-harvest than pre-harvest. With respect to dairy cow diets and disposal of mouldy foods, women were key decision-makers. Although commercial feeds are expensive and may be contaminated with mycotoxins, farmers regularly fed them to their cattle in low quantities to potentiate milk production. Milk was mainly sold for income generation. The farmer families consumed milk mainly in tea, which was not given to children below school-going age, thus reducing exposure to mycotoxins but also the nutritional benefits of milk. Meat was considered safe even if the cattle had been fed mouldy feeds. This study shows that there is a low understanding of the dangers of mycotoxins in food, and that certain practices among farmers may increase the risk for exposure. Gender analysis reveals that groups having knowledge are not always responsible for risk mitigation.

Key words: farmer, dietary exposure, moulds, mycotoxins, gender, dairy, Kenya, aflatoxins

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INTRODUCTION

In sub-Saharan Africa, climate favours proliferation of fungal species such as *Aspergillus flavus* and *A. parasiticus*. Maize, groundnuts, sorghum, milk and animal feeds are often contaminated with mycotoxins, which are toxic by-products of fungal metabolism [1, 2]. Contamination can occur before harvest and during storage if conditions permit. Mycotoxins are harmful to both human and animal health, and exposure is mainly through consumption of contaminated food and feeds, respectively. Mycotoxin contamination in Africa is currently inevitable in the food production cycle and efforts are mainly geared towards removing contaminated foods and feeds from consumption or minimizing levels present to meet permitted legal limits [3, 4]. In developed countries, stringent regulatory policies control the levels of mycotoxins in food; this is in contrast to the situation in developing countries, where enforcement of existing regulations is virtually non-existent [5]. Aflatoxins are heat-stable chemicals and have been detected in eggs, milk, meat and meat products [6].

Around three-quarters of Kenyans belong to small-scale farming households, who devote most of their land to food crops, with maize dominating for both subsistence and sale [3, 7, 8].This maize may be heavily contaminated with mycotoxins [9]. Kenya has experienced some of the world's most severe outbreaks of mycotoxicosis, with the largest in 2004 resulting in over 300 cases and over 100 deaths [7]. High levels of maize contamination is exacerbated by low dietary diversity; staples are consumed in large quantities estimated at 400–500g of maize daily by adults [9] while the diet of young children is mainly breast milk and maize-based weaning gruel [10]. A study on children in Kisumu County of Kenya found significant correlation between wasting and levels of aflatoxin in the maize flour they were fed on [10]. The study could not establish whether the wasting was a direct effect of aflatoxins or due to insufficient calories. Another study conducted in children in West Africa found a striking association between exposure to aflatoxins and both stunting and being underweight [11, 12]. However, correlation does not necessarily imply causation.

In the Kenya dairy value chain, milk production is mainly from dairy cattle, mostly crosses between dairy and zebu breeds, which produce over 70% of total national milk output[13]. They are mainly fed on natural forage, cultivated fodder and crop by-products such as maize stalks and stover. Commercially available supplements include dairy meal, maize germ, maize bran, cottonseed cake, wheat pollard and wheat bran. The formal and informal dairy sectors create livelihoods for farmers and employees, but most marketed milk in Kenya is sold unprocessed by small-scale vendors or kiosks. Other players include regulators, farm input suppliers, sale and service providers, researchers and dairy farmer organizations [13]. The sale of unprocessed milk raises public health concerns due to health risks from pathogens, toxins and drug residues. Although there is legislation in place to control milk safety (Dairy Industry Act, CAP 336; Public Health Act, CAP 242), it is not strictly enforced. Commercial feeds have been found to be contaminated with aflatoxin B1and milk with aflatoxin M1 [14].When feed is contaminated with aflatoxin B1, some is converted to the M1 form and excreted in milk.

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Gender is a social construct of the roles and status of women and men, and girls and boys within their cultural context [15]. The participation of men and women in agriculture is addressed in gender mainstreaming which aims to achieve equal benefits and gender equality [15]. Gender is central to the division of labour that determines the activities and productivity of individuals in any value chain [16] such as the dairy value chain studied here. Gender analysis has been defined as "a tool to assist in strengthening development planning, implementation, monitoring and evaluation, and to make programs and projects more efficient and relevant" [15]. The application of this tool, therefore, helps bring to the fore the unique contributions of each gender and whatever challenges they may face in their development endeavours that are related to their individual gender as well as those facing the whole community. Consequently, challenges that deter community development can be tackled in diverse ways and equitable solutions reached for better livelihoods. Little is known about the role of gender in the practices that contribute to the risk of dietary exposure to mycotoxins through milk and other staples or how gender roles might contribute to mitigating or augmenting risk. This paper documents the results of a qualitative study conducted in Kenya on farmer perception of risk factors for dietary exposure to mycotoxins in the dairy value chain. The analysis of data was disaggregated by gender.

METHODS

Identification of high-risk and low-risk areas

Mapping aflatoxin risk in the dairy chain in Kenya was carried out using a geographic information systems approach described by Ochungo *et al.* [17]. The procedure spatially locates regions that are at risk by taking into account relevant socio-economic and biophysical factors. The criteria applied were humidity, temperature, rainfall, dairy cattle density, feed resources, farming systems and consumption of maize and milk. Criteria-based mapping using Boolean overlays without weighting was then implemented in the ArcGIS V. 10.3 platform [17, 18]. Areas of convergence for all data layers were overlaid with regions of historical outbreaks to come up with locations of likelihood of risk of mycotoxin exposure within the dairy value chain. The regions were categorized as high risk with historical outbreaks (HR/HO) and without historical outbreaks (HR/NO), and low risk with historical outbreaks (LR/HO). Areas of low risk without historical outbreaks (LR/NO) were omitted.

Selection of villages within risk areas and recruitment of focus groups participants

All the districts in the three risk regions were listed and three districts randomly selected per category and from each district, three villages were randomly sampled. The study was carried out in nine of the 47 districts (currently referred to as counties in the new constitution) in Kenya. The responsible extension workers were contacted to help organize the farmer groups. Two sex-disaggregated focus group discussions (FGDs) were conducted per village except one where no women attended and two male groups formed, giving a total of 54 FGDs. The results of this sampling of study sites are shown in Table 1.

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Collection of data from focus groups

An FGD tool was developed to assess farmer perceptions of health risks associated with spoilt maize and contaminated milk and other staples within the dairy value chain in Kenya. The tool was pre-tested in Githunguri District, Kiambu County. The main topics covered maize and milk handling, general food safety and food hygiene. During the FGDs, questions were asked and responses discussed. If multiple answers were possible, such as a range of preventive measures, all answers were recorded. The round-the-table sitting arrangement adopted helped active participation. During the discussions, the farmers were free to consult each other. Participatory methods (proportional piling) were used to estimate the uses of milk as well as its consumption. Ranking of importance of sources of livelihoods and livestock was performed. Discussions were conducted in Kiswahili language and recording done by making written notes in English.

Data analysis

During data analysis, where appropriate, similar information was collapsed into broader categories. Overlapping responses were treated separately. For example, mention of pesticides or insecticides was considered different responses even though pesticides include insecticides. Researchers classified practices as likely to mitigate exposure or likely to increase exposure, based on their review of the literature and understanding of aflatoxin exposure. All datasets were entered in a Microsoft Excel spreadsheet. Analysis was carried out using a two-sample binomial test to compare male and female group responses. Semi-quantitative analyses were done with the results from the participatory rural appraisals. One cup of milk was estimated to equal 0.3 litres.

Ethical approval

Ethical approval for the study was acquired from the International Livestock Research Institute (ILRI) (approval number ILRI-IREC2013-09).

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RESULTS

The risk categories are shown in Figure 1.

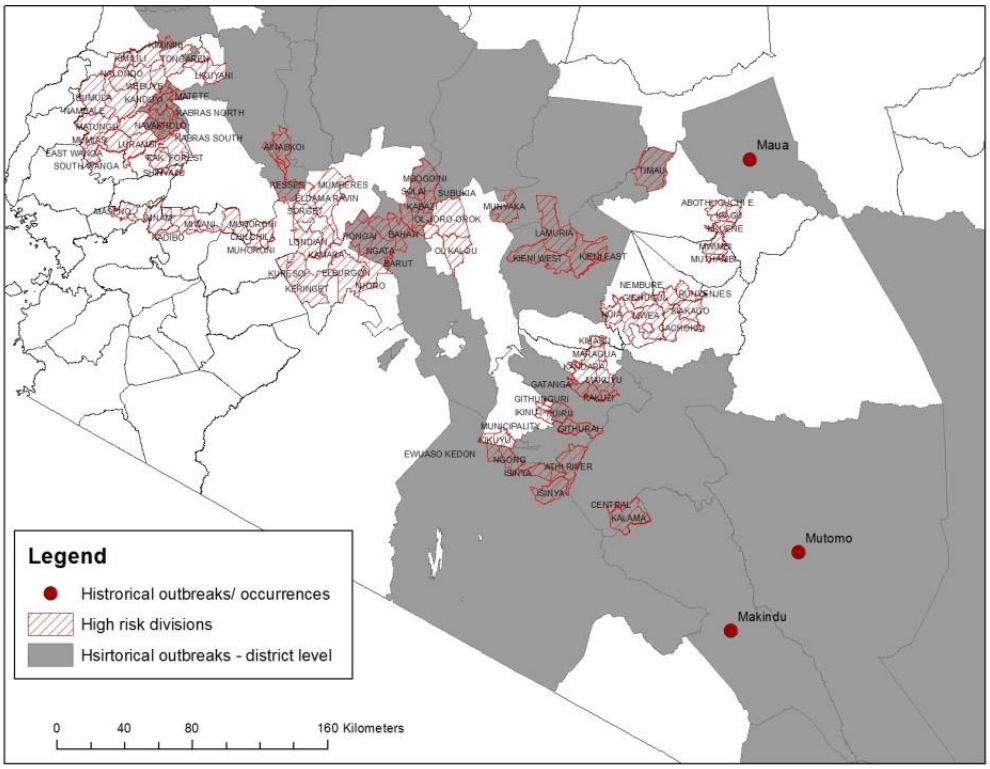

Figure 1: Risk divisions within which the study locations fell

Of the 54 focus groups, 26 were with women and 28 with men, due to one case where no women turned up. A total of 405 people participated, 51% being women and 49% men. From the self-reported age of participants, 54% were aged 20–50 years (64% of women and 45% of men). In all risk categories, women were less educated than men. Over half the population (55%) were educated above primary school. The proportion of women with post-secondary education was 7% compared to 25% of men.

Maize handling

All participants reported that they grew maize for food, sale and feeding to their cattle. Maize was the main staple and the quantities sold were determined by land and family size. From the responses given, the most common cause of spoilage was insects followed by damage by animals (Table 2); however, the perceived cause of spoilage varied by gender and risk category. The main method of identifying spoilt maize was reported as colour change by 76% of focus groups (Table 3) and again, there were differences by gender and risk category.

On the question of who decides what is done with spoilt grain, 73% of women focus groups reported it was the women and 4% to be men. On the other hand, 43% of men focus groups reported it to be women and 18% to be men. More men than women

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reported feeding cattle mouldy maize (64% of men versus 50% of women focus groups). Men and women equally reported that they fed cows with maize instead of commercial feeds because it was cheaper. Notably, men from the LR region did not report this at all compared to 22% of women focus groups in the same region. This is in comparison to 22% and 50% of focus groups from the HR/HO and HR/NO regions, respectively. In contrast, 30% of focus groups, almost equally among men and women, reported that they did not feed maize to cows at all: mainly because they grew just enough for food. Half of those were from the LR region alone. Both men and women were in charge of feeding, depending on the household head.

Milk handling

In all the regions, milk was mainly for sale, consumption at home and feeding calves. Only 7% of focus groups made and sold yoghurt or fermented milk. Milk for consumption at home depended on quantities available and family size. When consumed at home, milk was mainly drunk in tea, which was not given to infants. Infants consumed their milk mainly in porridge, while school-going children consumed it in tea. Estimates of milk consumption varied between focus groups (Table 4), with nursing mothers estimated to drink as much as 3 l daily in Muchungucha (HR/NO) and Gitira (HR/HO), and pregnant women consuming 1.5 l in Gitira. Women and men gave different estimates of how much milk each family member drank. Of the male focus groups, 50% believed that women drank more milk than men, while only 42% of female focus groups believed this. Women said they gave boys and girls the same amount of milk, although five male focus groups believed girls got more milk than boys. They commented that girls spent more time in the kitchen with their mothers and may, therefore, drink more tea while working there.

Approximately 89% of focus groups agreed that what cattle eat can affect the milk. Significantly more women (30% of focus groups) than men (8% of focus groups) ($p=0.05$) reported that some types of feed could increase milk output. Certain feeds were reported to stop milk production by 35% of women focus groups and 12% of men focus groups ($p=0.06$). More women (43% of focus groups) than men (8% of focus groups) ($p=0.01$) reported that certain feeds could cause milk to become watery. Other effects of feed on milk were bad smell, reported by 44% of the focus groups and bad taste reported by 36% of focus groups. More men (44% of focus groups) than women (17% of focus groups) ($p=0.05$) reported that bacteria and moulds could be transferred to milk through feeds. More women (50% of focus groups) than men (25% of focus groups) ($p=0.06$) believed that milk from animals fed mouldy food was safe for human consumption. About 83% of all the focus groups were also aware of hidden dangers in milk, mainly attributed to diseases and medications.

Practices that increase risk of dietary exposure to mycotoxins

There were four practices that this study concluded as most likely to increase the risk of exposure to mycotoxins in animals:

1. All the regions almost equally fed spoilt maize to animals (the main determinant of feeding maize to animals) (50% of women and 64% of men focus groups).

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2. Men and women equally reported they sold spoilt maize as animal feed in 24% of focus groups apportioned as follows: 56% in HR/HO, 11% in HR/NO and 6% in LR/HO regions.
3. All the regions reported that mouldy human food was mainly fed to chickens (77% of women and 57% of men focus groups) and to dogs and pigs (77% of women and 32% of men focus groups).
4. Mouldy cattle feed was not discarded but mixed with a fresh batch (blending down) and fed to the cattle (54% of women and 36% of men focus groups). There was no significant difference between the regions.

Commercial feeds were reported to be vulnerable to getting mouldy and were fed to cattle regularly but in low quantities to increase milk production.

Practices that reduce risk of dietary exposure to mycotoxins in people and animals
Preventive measures against fungal contamination of maize were practised with greater dedication in storage than before harvest. Four practices can be categorized as most likely to reduce the risk of exposure to mycotoxins:

1. Regular cleaning of stores and granaries in preparation for the incoming harvest was more prevalent among women compared to men (p=0.03). This practice was greater by 50% among farmers in HR/HO and LR/HO regions compared to those in the HR/NO region (p=0.03). In the LR/HO region, 35% of women focus groups regularly cleaned their stores compared to only 7% of men focus groups.
2. More women than men reported proper drying of maize as a means to prevent spoilage (p=0.002). In the two HO regions, 31% of women focus groups reported this practice compared to 11% of men focus groups. In the NO region, the practice was reported equally by 14% of men and women focus groups, respectively. Some groups in the LR/HO region re-dried stored maize periodically every three months.
3. More women than men focus groups reported application of fertilizer and manure before harvest to have healthier crops and, therefore, less maize spoilage (p=0.08). Interestingly, in the LR region, no men focus groups reported this practice compared to 23% of women focus groups.
4. More men than women focus groups invested in pesticides for prevention of maize spoilage during storage (p=0.07). The practice was reported almost equally by 80% of focus groups across the three regions. More men than women practised it in the HR region compared to equal representation in the LR region.

Dairy farmer knowledge and practice of meat and milk safety
The main reported measures to enhance the safety of meat and milk were hygienic handling and treating sick animals. However, more men (68% of focus groups) than women (35% of focus groups) (p=0.02) reported hygiene was crucial to enhancing meat safety. On the other hand, more women (54% of focus groups) than men (21% of focus groups) (p=0.01) reported meat inspection as an important measure to enhance meat

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safety. Cattle diseases were reported as a significant challenge to dairy farmers and especially so to women compared to men (p=0.06). It emerged that women took more responsibility in maintaining the milking sheds, storage and general cleanliness while men had higher participation in treating animals. Boiling milk and proper cooking of meat also featured as important hygiene precautions regularly practised. Both men and women agreed that proper cooking and not giving cattle spoilt feeds were ways to enhance meat safety. Equally, they both believed that meat from animals fed mouldy food was safe for human consumption. Women, reported as the main grain handlers, more often than men mentioned colour changes as the main way of identifying moulds.

Women emerged as the main decision-makers with respect to disposal of mouldy foods. All the focus group discussants agreed that women made decisions on what to do with spoilt food because they were responsible for running the kitchen and were also the main handlers of food. Figure 2 presents the responses to the question on who decides what to feed dairy cows. In no region did women report men as sole decision-makers, although they were sometimes included as joint decision-makers.

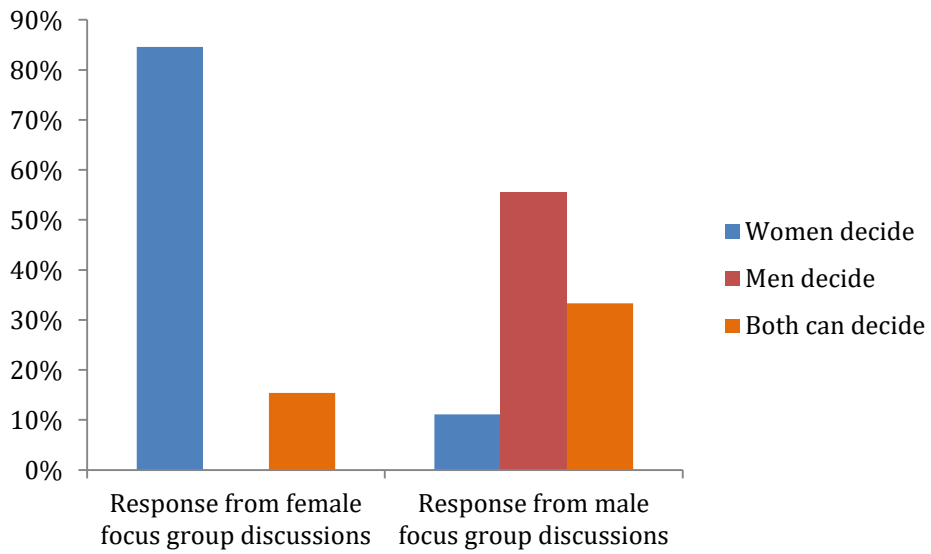

Figure 2: The percentage of female and male focus groups reporting women and men as making decisions over spoilt feed

In total, seven focus groups reported that they would consume mouldy foods. Men and women equally tallied in this aspect but there were slight disparities within the risk regions. In the HR/HO and LR/HO regions, 15% and 17% of focus groups, respectively, reported this risky habit compared to 10% of groups in the HR/NO region. Across the three regions, 31% of focus groups reported hunger and poverty as the main reason they would take this risk (Figure 3). Other explanations for why mouldy food was sometimes eaten included lack of knowledge that it was harmful or a belief that cooking or treating the food would make it safe. In the LR/HO region, a few groups reported that in very severe conditions, people would rather eat contaminated grain than die of hunger.

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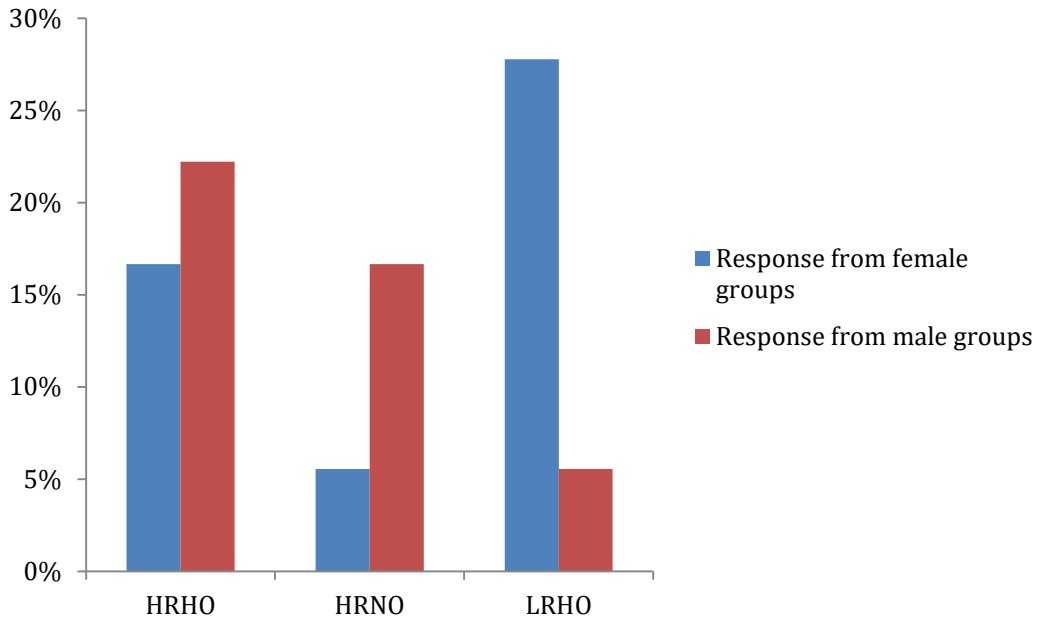

Figure 3: The percentage of focus groups that mentioned poverty as the main reason people cooked mouldy grain, by risk region. HRHO: high risk/historical outbreak, HRNO: high risk/no outbreak, LRHO: low risk/historical outbreak

All groups agreed that moulds could be harmful to human health, and 16 groups (30%) knew they could be fatal (Figure 4). One group of men from a village in the HR/HO region also stated that moulds could cause cancer. Diseases reported to be caused by moulds included stomach ache, heart burn, vomiting, diarrhoea and typhoid. All groups except for 11% stated that moulds could be harmful to animals, and 17% of groups reported it could be fatal. Diseases mentioned were mainly gastrointestinal, including diarrhoea, vomiting, bloating and loss of appetite.

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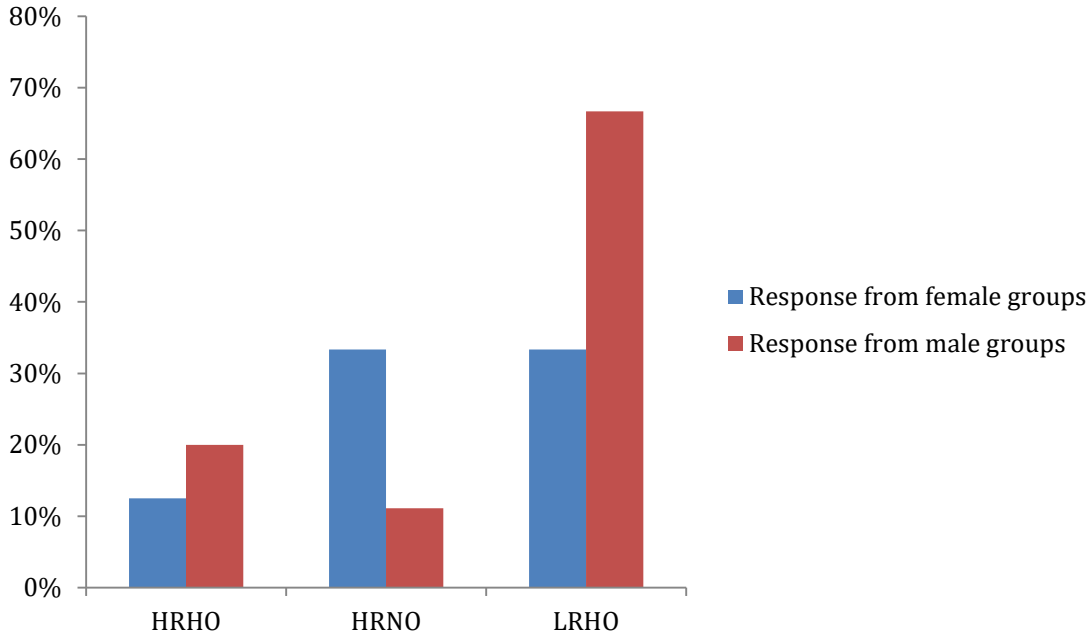

Figure 4: The percentage of focus groups that mentioned that moulds could be fatal, by risk region. HRHO: high risk/historical outbreak, HRNO: high risk/no outbreak, LRHO: low risk/historical outbreak

DISCUSSION

All participants of the study grew maize, mainly for domestic use, for sale (if in surplus) and to obtain cattle feed. This concurs with previous studies [16]. In this study, risk mapping was used to identify study sites and classify them as high-risk and low-risk. This method helps explore variations of risk perceptions and related practices within the study population. Across strata defined by gender [19], risk mapping revealed significant diversity between the risk categories. Participants from the regions with historical outbreaks had better maize handling practices, perhaps the result of past experience with mycotoxin contamination, leading to receiving more information. There was a gender gap in education, with fewer women having attained post-secondary level, which could contribute to low agricultural output [20]. More women than men participants also reported regular cleaning of stores and granaries, which may be part of their role as the main grain handlers [21]. Women also emerged as key decision-makers with respect to how to dispose of mouldy grain, in line with their traditional role as overseers of family food security [22].

Most of the milk was sold and was a major source of income. The children of school-going age consumed on average less than half a litre of milk per day. Cow milk has been shown to be contaminated with aflatoxins [14], as has breast milk [23]. The effect of milk aflatoxins on child growth is still not fully understood, but the role of milk as an important source of nutrition is unquestionable.

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The participating small-scale dairy farmers observed several practices that increased the risk of exposure to mycotoxins to both human and livestock. The presence of moulds on food and feeds did not motivate destruction. The main reason for feeding maize to animals or selling it as animal feed was because maize was spoiled. A recent study found maize products in the market to be highly contaminated [24]. Commercial feeds, often contaminated with mycotoxins [25], were fed to cattle regularly but in low quantities, since they increase milk production, yet are expensive. Most mouldy human food was fed to chickens, reported as the most commonly kept livestock by this study population. Sale of eggs and chicken is an important source of income to these farmers, and although poultry meat and eggs can be contaminated with aflatoxins [26], the levels are not known.

Gender refers to the relationship between women and men and the cultural roles they play in society [15]. The responsibilities each hold, therefore, have reference to gender. Sex-disaggregated focus groups help remove inhibitions that the role of one gender may impose on the other. The differences in how they perform their roles are, therefore, easier to report when in separate groups. The application of gender analysis used the same tool for men and women, which helped capture both similarities as well as unique gender differences in their practices. Women reported themselves as the key decision-makers with respect to dairy cattle diets; however, men similarly reported themselves to be in charge of this important duty. This could be a possible power struggle for control over dairy cattle ensuing from their importance to these communities, with each gender desiring to be the one in control. There is a relationship between income and ability to influence household decision-making [20].

All participants of this study agreed that hygienic handling was the most important method to enhance meat and milk safety. However, the women paid more attention to this role while, on the other hand, men paid more attention to treating sick animals. Women were the main decision-makers with respect to disposal of mouldy foods. All the groups agreed that women made decisions on what to do with spoilt food because they were responsible for running the kitchen and were also the main handlers of food. This is in line with their role as the gender mainly responsible for household food security [21, 22]. Discoloured grain may be at higher risk of being mycotoxin-contaminated although it has recently been shown that apparently “clean” grain can be very high in aflatoxins [27]. However, this study showed that many households would still use mouldy food as human or animal food, and there was limited knowledge that mycotoxins are heat-stable chemicals [6] that cannot be eliminated by cooking. Although there have been previous studies aimed at assessing exposure to aflatoxins [10, 24, 28], a gender analysis of the risk of dietary exposure to mycotoxins has not previously been carried out.

CONCLUSION

This study shows that, among dairy households, there is a low understanding of the dangers of mycotoxins in feed and food, and that certain practices among farmers may increase the risk of exposure while other practices mitigate risk. The relatively high milk consumption among dairy farming families might contribute to health risks from aflatoxins. Gender analysis can enrich nutritional and risk assessments by highlighting disparities that otherwise get overlooked. In addition, this study shows that gender

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analysis and qualitative studies can make important contributions to risk assessment of dietary issues in community-based studies.

The results of this study clearly point to the importance of targeting women in extension work as the main handlers of food. The study also reports on the lack of awareness about aflatoxins and what to do with mouldy grains. In poor households, it may not be sustainable to destroy all mouldy grains; therefore, the least harmful options may need to be chosen. At the moment, there are still knowledge gaps about the impact of aflatoxins on animal productivity, and the harm of feeding mouldy grains to livestock. There is urgent need for more research on alternate uses of spoilt grains and about the best options for destruction.

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Table 1: Study areas and group populations of men and women who participated in the qualitative study on dietary exposure to mycotoxins

Risk category	District	Villages	Men	Women
High-risk with historical outbreak (HR/HO)	Nairobi (Dagoretti)	Kagira	7	12
		Ruthimitu	7	11
		Matini	6	13
	Kajiado (Ngong)	Ngong Township	7	7
		Triangle*	5+5	0
		Emanyatta	5	9
	Nakuru (Rongai)	Ngecha	3	5
		Migaa	4	12
		Gitira	5	7
High-risk with no historical outbreak (HR/NO)	Kiambu (Ruiru)	Riverside	7	4
		Toll	6	6
		Mugutha	7	8
	Murang'a (Kandara)	Kirigithu	7	7
		Kiguoya	5	8
		Mutheru	16	7
	Murang'a (Kiharu)	Muchungucha	7	9
		Nyakihai	6	6
		Kiangage	7	9
Low-risk with historical outbreak (LR/HO)	Meru (Maua)	Kanjoo	12	5
		Kabuitu	9	3
		KieniKiaaruu	8	8
	Baringo (Kabarnet)	Koptorokwo	17	10
		Kitumbei	7	14
		Katipsogon	9	9
	Makueni (Kaiti)	Wathu	3	7
		Ng'ele	4	4
		Mwea	8	6
	Total	405	199	206

*Two male group discussions were conducted as there was no female group available

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Table 2: The main reasons reported to contribute to maize spoilage. The numbers indicate the total number of times each item was mentioned by the groups in total

Reasons why maize spoils	HR/HO		HR/NO		LR/HO		Total (Rank)
	Men	Women	Men	Women	Men	Women	
Weevils/other insects post-harvest	19	11	16	22	27	14	109 (1)
Damage by animals	10	2	7	7	26	12	64 (2)
Improper drying post-harvest	0	10	4	5	2	22	43 (3)
Too much rain during harvest season	7	7	8	4	5	8	39 (4)
Drought/ shortage of rain	7	5	6	4	5	6	33 (5)

HR/HO: high-risk with historical outbreaks; HR/NO: high-risk without historical outbreaks; LR/HO: low-risk with historical outbreaks

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Table 3: The methods by which study participants identify spoilt maize. The numbers are the focus groups that mentioned these items

How farmers identify spoilt maize	HR/HO		HR/NO		LR/HO		Total (Rank)
	Men	Women	Men	Women	Men	Women	
Grain colour changes/observation	8	7	6	3	7	10	41 (1)
See weevils and holes by weevils	9	4	6	6	5	4	34 (2)
Rotting of grain	5	4	1	2	4	2	18 (3)
Smell (bad)	0	3	2	1	1	7	14 (4)
Bitter taste of maize flour or *githeri* (cooked maize and beans mixture)	0	1	4	1	2	2	10 (5)
Mouldy (black soot on ear when forming cob on farm)	1	2	2	2	0	3	10 (5)

HR/HO: high-risk with historical outbreaks; HR/NO: high-risk without historical outbreaks; LR/HO: low-risk with historical outbreaks

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Table 4: Pattern of milk consumption in litres among Kenyan dairy farmer households, given as the mean (and range) of the consumption in litres as estimated by men and women, respectively

	HR/HO		HR/NO		LR/HO	
	Men	Women	Men	Women	Men	Women
Adults males	0.3 (0.2–0.6)	0.4 (0.3–0.6)	0.4 (0.2–0.9)	0.4 (0.2–0.9)	0.3 (0.1–0.6)	0.3 (0.2–0.5)
Adult females	0.4 (0.2–0.9)	0.6 (0.3–1)	0.5 (0.2–0.9)	0.6 (0.3–0.9)	0.3 (0.1–0.6)	0.3 (0.1–0.5)
Boys	0.3 (0.2–0.9)	0.5 (0.3–1)	0.4 (0.2–0.8)	0.5 (0.2–0.9)	0.2 (0.1–0.5)	0.4 (0.1–0.6)
Girls	0.4 (0.15–0.9)	0.5 (0.3–1)	0.4 (0.2–0.8)	0.5 (0.2–0.9)	0.4(0.1–0.9)	0.4 (0.1–0.9)
Expectant women	0.7 (0.3–1.2)	0.9 (0.3-1.5)	0.6 (0.3–0.9)	0.6 (0.3–0.9)	0.5 (0.1–1.2)	0.6 (0.2–1)
Nursing mothers	0.8 (0.3–1.5)	1.5 (0.6-3)	0.8 (0.3–1.2)	1 (0.3–3)	0.7 (0.2–1.5)	0.7 (0.2–2)

HR/HO: high-risk with historical outbreaks; HR/NO: high-risk without historical outbreaks; LR/HO: low-risk with historical outbreaks

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