VOICE FOR CHANGE PARTNERSHIP (V4CP)

# Regulatory Compliance in the Kenyan Dairy Sector

## Awareness and Compliance among Farmers and Vendors

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### INTRODUCTION

The purpose of this research note is to describe relevant policies and standards, and to summarise recent research and literature to gain insight into compliance with dairy standards in Kenya. We highlight key points of the main policies pertaining to the sale of dairy products, and present unpublished findings from three recent studies conducted by the International Livestock Research Institute (ILRI) and partners and the results of a rapid literature review.

In Kenya, the formal milk sector handles milk that is typically chilled and then pasteurised or ultra-heat treated and sold in the modern retail sector, that is, supermarkets or shops where pasteurised milk can be refrigerated. The informal milk sector includes direct sales by farmers to consumers, and milk collected by traders and then sold through kiosks, milk bars, or mobile vendors. In the informal sector, milk may be sold raw or boiled, and it is often difficult for consumers to know whether the milk they buy has been boiled or not. In both the formal and informal sector, milk is increasingly sold from vending machines (milk ATMs), where milk is slightly more expensive than informally marketed raw milk but considerably cheaper than packaged and pasteurized formal sector milk. The informal milk sector is estimated to constitute around 80-85% of the market in Kenya, though this appears to be declining (FAO, 2011).

Figure 1 presents the spatial distribution of chronic malnutrition among children below the age of 5 years in rural Burkina Faso in 2010.

### RELEVANT POLICIES

Rules governing how milk is to be produced, handled and sold in Kenya are set out in KS1552:2016 - Code of hygienic practice for milk and milk products. The code lays out the following requirements, among others:

- Milk should be transported to a collection center within two hours of milking. Milk stored for a longer period should be cooled to $10^0$ C or below.
- Equipment, utensils and instruments which are intended to come into contact with milk shall be made from food grade and approved material and shall be easy to clean and disinfect.
- All milk delivery vehicles shall be conspicuously inscribed with the name and address of the licensed distributor or transporter.
- No direct sale of raw milk to consumers in municipalities shall be allowed; enforcement shall be monitored by the Kenya Dairy Board and the local authority.
- Direct sale of milk by farmers or bulk distribution may be allowed in rural and semi-rural areas subject to conditions of time since milking and distance relative to the point of production; farmers must be registered and licensed.
- Milk for sale should be kept as cool as possible, preferably under refrigeration.

Separate standards have been specified for raw and pasteurized milk by the East African Community and apply to milk sold in Kenya.

In this note we present new results on the awareness of regulations among dairy farmer and traders, on compliance of milk with saleable product laws at the retail level, and of the quality of informally marketed milk stored by households. We also review recent literature on whether milk (both informally and formally marketed) meets the standards shown in Table 1.

## Table 1. EAC/Kenyan standards for pasteurized and raw milk

| | Pasteurized | Raw |
|---|---|---|
| No added water or preservatives | yes | yes |
| Limits established by the Codex Alimentarius Commission: | | |
| Heavy metals | yes | yes |
| Pesticides | yes | * |
| Veterinary drug residues | yes | yes |
| Minimum milk fat % ⁺ | 3.25 | 3.25 |
| Minimum non-fat milk solids % | 8.5 | 8.5 |
| Maximum total plate count (TPC), per mL† | 30,000 | 2,000,00 |
| Maximum coliform plate count, per mL‡ | 10 | 50,000 |
| Escherichia coli per mL | Absent | n/a |
| Mycobacterium tuberculosis, per mL | Absent | n/a |

*Pesticide limits for raw milk are explicitly stated in the East African standard.
⁺ Applies to whole milk; lower for fat-reduced, low-fat, and fat-free milk.
† Raw milk maximum TPC refers to the standard Grade III; the maximum for Grade II is 1,000,000 and for Grade I is 200,000.
‡ Raw milk maximum coliform plate count refers to "good" quality milk; the maximum for "very good" quality milk is 1,000.

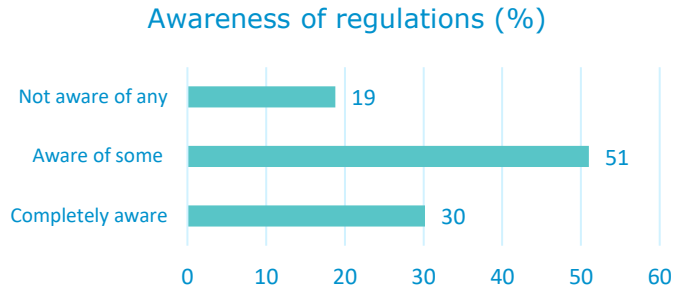
## LOW AWARENESS OF REGULATIONS AMONG DAIRY FARMERS AND VENDORS

A survey of 96 dairy farmers and traders was carried out in July 2018 by ILRI in Nairobi. Interviews were conducted in sub-locations recommended by local government officials (Kasarani, Kamulu, Clay City, Mwiki and Ruai). 78% of participants were the owner of the business, and most had attended or completed secondary school. Businesses included farmers selling directly, farmers who take their milk to either market or sellers, milk ATM traders, individuals receiving milk from a distributor and traditional dairy shops. The milk sold was a mixture of pasteurised, boiled and untreated (raw). The volume of milk handled by participants ranged from 3 to 800 litres daily, with a mean sold milk volume of 79 litres. It proved difficult to clearly distinguish between formal and informal sector operations.

The survey evaluated self-reported awareness of regulations. The type of regulation was not specified for simplicity and to avoid bias. As shown in Figure 1, only 30% of study participants described themselves as fully aware of regulations relating to the sale of milk, 51% said that they we re aware of some regulations, and 19% admitted they were not aware of any.

As some vendors may have been hesitant to admit their lack of awareness of regulations, it is likely that the true level of awareness is even lower than that reported. While awareness of regulations does not imply compliance, compliance is unlikely without awareness, so the fact that 70% of those involved in selling milk admitted to being unaware of at least some regulations is of concern.

**Figure 1. Farmers' and traders self-reported awareness of regulations relating to the sale of milk**




Participants were also asked where they had learned about regulations, or if unaware, where they would go to find out. The Ministry of Agriculture, Livestock and Fisheries (41%), and the Kenya Dairy Board (16%) were most often mentioned as a source of information. During discussions with government officials, it emerged that lack of funding was a constraint to providing information to dairy business operators.

How can this low level of awareness be addressed? There is evidence that training and certifying small-scale milk producers and vendors on food safety practices improves both awareness and practices, and can reduce the prevalence of food safety hazards. A pilot project to train and certify small-scale milk traders and vendors operating outside Nairobi improved hygiene practices and microbiological quality (Omore and Baker, 2011; Blackmore et al., 2015), while a similar project in India improve knowledge and practices among dairy producers and traders (Lindahl et al., 2018).

## 36% OF MILK PRODUCTS NON-COMPLIANT WITH SALEABLE PRODUCTS LAWS

A study conducted in 2013-2014 to investigate the conditions of milk sold in Kenya sampled 291 dairy products across informal and formal market traders in Nairobi County. The study evaluated cost, storage, expiry, appearance and packaging details. Samples were a mixture of pasteurised (24%), UHT (25%) and raw milk (26%), plus yoghurt (13%) and the fermented milk product maziwa lala (12%).

Pasteurised and UHT milk: Samples of pasteurised and UHT milk were purchased from supermarkets and shopping centres. These products were sold in either plastic pouches or tetra packs. It was recommended on the packaging of these products that 48% were to be cooled. Of these, 23% were not kept in a refrigerator or cool storage. 5% of these samples had also exceeded their expiry date from 0 to 74 days. To have even one sample found to be expired is a concern where samples are readily available for human consumption, and to find 7 is of serious concern.

Raw milk: Samples of raw milk were collected from a mixture of dairy shops, milk bars and markets. 92% of these milk samples were found to be stored in plastic containers, and only 8% in aluminium containers. While the legislation lacks clarity, it appears that use of plastic vessels or jerry cans for storage of milk offered for sale contravenes to the Dairy Industry Act (Public Health Act, 2012; Dairy Industry Act, 2012). 80% of these samples were neither refrigerated nor cooled and 1% had an abnormal appearance (clots, flakes, lumps, unusually watery, presence blood, or abnormal colour).

Processed Milk Products: Samples of yoghurt and maziwa lala were collected from a mixture of markets and shopping centres. These samples were sold in plastic bottles, paper and plastic tetra pack containers. 33% of samples that should have been kept cool were neither refrigerated nor cooled and 11% had an abnormal appearance. Where expiry dates were shown, all products were within these.

Overall, 36% of products sampled for this study either were kept at the wrong temperature, were of abnormal appearance, or were beyond the expiry date. Of these products; 57% were raw, 17% pasteurised and 5% UHT milk, 13% were yoghurt and 8% lala.

## CONTAMINATION AT THE HOUSEHOLD LEVEL DESPITE BOILING

A final study was carried out between May and June 2017 and collected data on the treatment and storage of milk by households in Dagoretti, as well as its contamination with bacteria and aflatoxins.

Nearly three quarters of households had purchased their milk on the same day of sampling, and approximately half reported that they had boiled their milk. Milk had been boiled between 3 and 24 hours before it was collected by researchers in 75% of cases. Only 7% of households owned a refrigerator; among these, 50% refrigerated their milk. Raw milk that has not that is not boiled immediately before consumption, and any milk stored at room temperature for an extended period may be unsafe (Alonso et al., in preparation).

15% of the samples that had been boiled after purchase did not meet the East African Community standard (applicable to Kenya) for total bacterial contamination of raw milk, while one third of un-boiled samples failed to meet the standard. This demonstrates that boiling milk reduces the presence of bacteria in milk, but also shows that household risk mitigation practices are not fully effective (Varnell et al., in preparation). Further, 85% of samples had levels of aflatoxin M1 above the EU reference standard.

## RECENT LITERATURE ON COMPLIANCE WITH DAIRY REGULATIONS AND STANDARDS IN KENYA

A literature review was conducted of studies completed or published over the past 10 years, that contained information on compliance with standards (as shown in Table 1) of milk sold at the retail or wholesale level. The complete list of papers, and key findings, are presented in Table 2 on the final page of this note.

Information related to four types of standards was reviewed:

- Compositional standards (the amount of water, fat and non-fat solids in milk). Failure to meet composition standards is usually due to the addition of water to increase profits. It is not a health risk unless the added water is contaminated but does reduce the nutritional quality of milk. A 2017 study in Lamu County found that 25% of milk samples collected from informal milk vendors failed to comply with compositional standards, while a study in Kiambu found that 27% of samples failed to comply.

- Microbiological standards. These set limits on the level of total bacteria, which may be expressed as the total viable count (TVC); total plate count (TPC); total bacterial count (TBC), and also on the level of coliform bacteria. The level of bacterial contamination allowed differs between raw and pasteurised milk: pasteurized milk has undergone heat treatment and is expected to have fewer bacteria. Bacterial counts are not a direct measure of health risk as bacteria may or may not cause disease. However, as enterobacteria and coliform bacteria mostly come from the faeces of animals or people, and because many pathogens are transmitted by faeces, high coliform counts are suggestive of health risk.

Among samples of cow's milk collected in Kisumu and Eldoret, 43% purchased from the informal sector did not meet the East African standard for microbial contamination, while 71% purchased from the formal sector did not meet the stricter standards for pasteurized milk. A separate study in Nandi found that 60% of both raw and boiled milk sold by vendors exceeded microbial standards, and one study in Nairobi found that 96% raw and 21% pasteurized milk exceeded the standard for total bacteria, whereas 78% of raw and 5% of pasteurized milk exceeded the coliform standard. A study of raw milk purchased from shops in Kiambu found that 64% and 54% of samples exceeded coliform and TBC standards respectively. Finally, a study of camel milk in Nanyuki and Isiolo counties, and another conducted in an unspecified county, found between 75% and 100% of samples exceeded microbiological standards. Differences in microbiological contamination across and within counties may arise based on the distance between where milk is produced and where it is consumed, as bacteria reproduce over time leading to higher levels of contamination. The rate of contamination may also be affected by climate and season, as bacteria reproduce more rapidly at warmer temperatures.

- Antimicrobial (AM) residues. These may be present if an animal is treated with antibiotics or if antibiotics are added to milk to help preserve it. The presence of trace AM residues is not usually a problem, but AM residues above a certain amount, expressed as the maximum residue limits (MRL) are in violation of standards. AM residues present a minimal risk to human health but they can interfere with milk processing and they are an indicator of AM use, which drives AM resistance, which in turn can result in human and animal infections that are more difficult or impossible to treat. Unacceptably high AM residues

were found by studies in Lamu (18% of samples) and Nakuru (43%), but a study in Kiambu did not detect AM residues over the limit in any samples. Differences in AM residues depend on farm practices, which may vary regionally; farmers practicing more intensive animal husbandry (for example zero grazing and keeping a larger number of cattle) typically rely more heavily on antibiotics.

- Aflatoxins. Aflatoxins are a toxin produced by certain molds, and may be present in milk if animals eat feed containing aflatoxins. The presence of aflatoxins is not problematic at low levels, but excessive amounts are associated with health risk. Different administrations have different standards for aflatoxins and it is not clear which standards apply to dairy products in Kenya. The European Union (EU) standard for aflatoxins in milk are more stringent (50 ng/kg) than the US standard (500 ng/kg). One study found that 31% of formally marketed milk samples collected in Nairobi, Machakos, Nyeri, Nakuru and Eldoret exceeded the EU standard, and another of informally marketed milk in Nairobi found that 66% (7.5%) exceeded the EU (US) standards respectively. Finally, one study conducted in Bomet County found no aflatoxin in pasteurized or UHT milk. Differences in aflatoxin could arise from feeding practices, as aflatoxin is commonly found in animal feed, and is not typically a problem for pasture-raised animals.

- **Other contaminants**. Certain specific substances are also prohibited, for example hydrogen peroxide, which may be added to preserve the quality of milk. In Kiambu, hydrogen peroxide was not found in any samples analyzed.

Some of the papers reviewed also documented lack of compliance with KS1552:2016 (Code of hygienic practice for milk and milk products). Wanjala (2017) and Alonso et al. (2018) describe contamination of raw milk procured from within municipalities, which is prohibited. Orregård reports that farmers in Kiambu held milk for an average of 5.4 hours, far longer than the two-hour maximum set out in the Code.

## CONCLUSIONS AND POLICY RECOMMENDATIONS

While comprehensive, representative, national surveys of milk compliance do not exist, several studies have looked at different aspects of compliance. A substantial proportion, often the majority, of milk sampled fails to comply with or more standard.

- Household milk handling practices affect bacterial contamination. Improving household practices (e.g. boiling milk immediately prior to consumption) and reducing contamination of milk at the point of sale, can improve safety and reduce health risk.

- Farmers and vendors' awareness of the regulations related to the sale of milk are inadequate. Increasing producers' and vendors' awareness of regulations, and offering them practical training on how to comply, are crucial starting points for improving compliance. Previous research in Kenya has shown that training and certifying small-scale dairy vendors can improve practices and food safety. This approach also facilitates inclusion of small-scale vendors in the modern dairy sector.

- While regulations affecting the production and sale of dairy products are national, counties have an important role to play. Consumers can be educated on the importance of milk safety through mass media campaigns and outreach by community health workers; producers' awareness and capacity can be improved through agricultural extension; county public health officers can train milk vendors on the regulations and how to comply.

- Aflatoxin contamination in milk can be addressed through the development of local standards for the use of mycotoxin binders as additives to animal feed. Mycotoxin binders are widely used globally to prevent livestock from absorbing aflatoxin and other fungal toxins, and some binders have been shown to reduce aflatoxin contamination in milk (Diaz et al., 2004). However, the effectiveness of binders varies greatly, and there are no specific standards governing the addition of binders to feed in Kenya.

- While milk sold through the formal sector tends to have higher rates of compliance than informally marketed milk, non-compliance is also widespread in the formal sector. This is typical of the situation in low and middle-income countries (Grace, 2015), and implies a need to improve capacity in both among both formal and informal market actors. Strengthening the capacity of formal sector firms is typically easier than doing so in the informal sector due to the larger scale, greater sophistication, and existing relationships with government regulatory bodies of these firms.

- Proposed changes to the Dairy Act would include routine product sampling and strengthen penalties for non-compliance. Given the low level of awareness and capacity among many market actors, an approach that allows firms to correct their actions after a negative finding is likely to be more effective than one relying on harsh punishments alone. Punitive enforcement of regulations without opportunities for correction risks driving firms out of business or underground.

- A risk-based approach should be taken to addressing the widespread non-compliance documented in this note. In some cases, health risk may be very small (e.g. aflatoxins in milk may lead to with 0.04 cases of hepatocellular cancer per million people which is relatively minor (Ahlberg et al. 2018)) while in other cases, particularly in the case of microbiological contamination, it may be considerable). Tools from participatory rural appraisal can be adapted for use in participatory risk assessment, a low-cost, inclusive approach that treats research participants as co-creators of konwledge (Grace et al., 2008). Participatory methods can complement or even substitute for conventional risk analysis, depending on the resources available.

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### Table 2. Recent literature on compliance with standards in Kenya

| Site | Sample | Failure to comply with standards | Reference |
|---|---|---|---|
| Lamu County (rural) | Milk vendor (informal) | 25% unacceptable composition<br>18% outside limit for AM residues<br>29% failed composition or AM residue | Ondieki et al., 2017 |
| Nakuru County (rural) | Milk from farms, transporters and bulking centers | 43% outside limit for antimicrobial residue | Orwa et al., 2017 |
| Nanyuki & Isiolo (rural) | Camel milk | 75% outside microbiological limits | Kaindi et al., 2011 |
| Not reported | Camel milk | 92% exceeded TVC<br>100% exceeded coliform | Matofari et al., 2013 |
| Kisumu & Eldoret (urban) | Informal and pasteurised | 43% informal milk and 71% of formal milk did not meet TBC standard | Alonso et al., 2018 |
| Nandi (rural) | Raw & boiled vended | 60% raw & boiled milk above coliform standard | Ogot et al., 2015 |
| Nairobi (urban & per-urban) | Raw & pasteurised | 96% raw & 21% pasteurised exceeded TVC<br>78% raw & 5% pasteurised exceeded coliform | Wanjala, 2017 |
| Kiambu (rural) | Raw vended | 64% milk exceeded coliform<br>54% exceeded total plate count<br>27% exceeded adulteration (compositional)<br>0% exceeded AM residue<br>0% with hydrogen peroxide | Orregård, 2013 |
| Nairobi, Machakos, Nyeri, Nakuru and Eldoret (urban) | Formal | 31% exceeded the EU standard for aflatoxin | Kang'ethe & Lang'a, 2009 |
| Nairobi county (peri-urban) | Informal | 55% over EU standard for aflatoxin and 6% over US standard | Kirino et al |
| Bomet county | Formal | No aflatoxin in processed milk or UHT | Langat et al., 2016 |

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