THE IMPACTS OF HARMFUL ALGAL BLOOMS ON WOMEN'S HEALTH IN LAKE VICTORIA, KENYA

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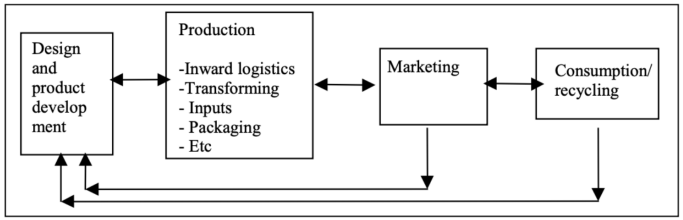
Gender and Fish Value Chain Analysis

A value chain describes the range of activities and phases of production required to create a product. This includes the entire input-output process that brings some product from initial conception to the consumer's hands

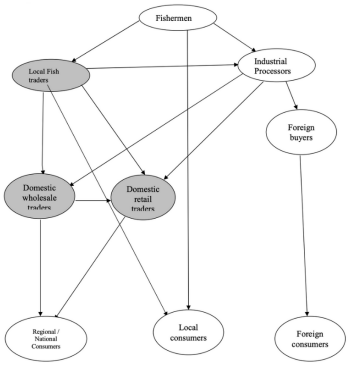
Figure 1. Four Links in a Simple Value Chain



Kaplinsky, R., & Morris, M. (2000). A handbook for value chain research(Vol. 113). Brighton: University of Sussex, Institute of Development Studies.

- Disparate access to resources, services, and capital are key limiting factors that affect active participation for women
- Women are often overlooked as potential buyers and suppliers in value chains, but their participation would expand the client base and target more niche markets
- Intra-household dynamics play an important role in women's value chain participation
- Women tend to be concentrated in specific aspects of value chains, including food production, domestic and social services, and apparel, compared to men who are more evenly distributed across a wider range of different occupations that involve global value chains

Figure 2. Fish Value Chains in Kenya



NB: The shaded nodes are where women dominate.

Kamau, P., & Nggi, S. (2013). Potential for Women Fish Traders to Upgrade within the Fish Trade Value Chain: Evidence from Kenya. 3(2).

Figure 3. Bloom Distribution of Lake Victoria

- Nyanza Gulf and Kisumu Bay are labeled as hypereutrophic
- Cyanobacteria are now far more diverse and are seen to dominate primarily bays and gulfs, as opposed to open lakes (irrespective of the season)

Aim

We aim to elucidate the effects of harmful algal blooms (specifically microcystin presence) on the health of women in the basin by:

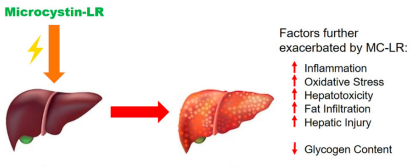
- Conducting fish value chain analysis and women's involvement in them, with a special focus on the dagaa value chain
- Identifying potential exposure routes and the magnitude of their effects
- Better elucidating impacts of microcystins specific to women

Health Impacts

Chronic exposure affects expression of proto-oncogenes & tumor suppressor genes and can lead to:

- Hepatocellular cancer
- Renal cell carcinoma
- Colorectal cancer

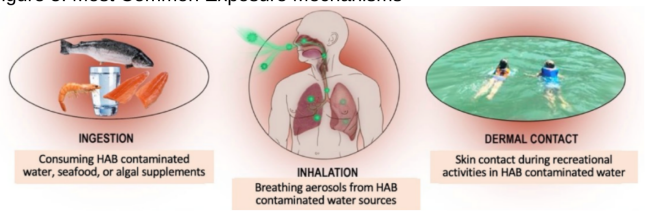
Figure 4. Hepatotoxicity of Microcystin-LR



Potential relationship between microcystins and chronic pelvic inflammatory disease located around female genitals. Increased risk of infertility, chronic pelvic pain, and ectopic pregnancy

Exposure Routes

Figure 5. Most Common Exposure Mechanisms



Lad, A., Breidenbach, J. D., Su, R. C., Murray, J., Kuang, R., Mascarenhas, A., Najjar, J., Patel, S., Hegde, P., Youssef, M., Breuler, J., Kleinhenz, A. L., Ault, A. P., Westrick, J. A., Modyanov, N. N., Kennedy, D. J., & Haller, S. T. (2022). As we drink and breathe: Adverse health effects of microcystins and other harmful algal bloom toxins in the liver, gut, lungs and beyond. Life, 12(3), 418. https://doi.org/10.3390/life12030418

- Key limiting factors that affect active participation for women: disparate access to resources, services, and capital
- Suggested methods of transmission unique to women's health: breastfeeding, sexual contact, and placental transfer
- Women within nearshore communities in the basin clearly interact with the water more, offering a socioeconomic variable
- Women utilize the lake for their daily household activities and cleaning, as well as for the tedious aspects of fish preparation-processing, drying, and marketing

Reasons for Toxin Concentrations

There are a few factors that we have identified may have potentially caused increased eutrophication, and therefore increased concentrations of microcystin in the area

Climate change	Increased population growth	Shift in urbanization

• Increased water temperature and acidity
• Decreased oxygen
• Shift from diatoms to cyanobacteria
  ○ Cyanobacteria are now more diverse
  ○ Cyanobacteria dominate all aspects of the basin, regardless of season
	• Economic benefits
	• Forced migrations within the area from Rwanda, Burundi, and Democratic Republic of Congo
		• Increased pollution in the lake
		• Increased deposition of phosphorus and nitrogen
		• Increased soil erosion

Future Avenues

Research Gaps

- Not enough epidemiological studies that assess women's responses to toxins
- Inability to identify vulnerable populations
- No appropriate biomarkers for diagnosis
- Unclear mechanisms through which microcystins impact people

PLAN

Analyze data collected from water and fish sampling to better understand nutritional benefits and contaminant risks within fish collected over the last year

Collect field data from interviews with women and men involved in the fishery with the assistance Kenya Marine and Fisheries Research Institute (KMFRI) and Maseno University

- Craft a participant profile to identify the roles that each individual holds in the fishery
- Collect information on social perceptions of Lake Victoria and algal blooms
- Contrast the views of experts with others involved in the fishery
- Gather information regarding access to water and food

- Synthesize the association between risk, exposure, socioeconomic status, and gender
- Identify whether resources, education, training, greater decision-making power, burden of domestic work, and cooperative and networks for women shield any of negative impacts of microcystin exposure.