Genetically Modified Foods and Reproductive and Public Health Challenges in the Tropics: A Narrative Review

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ABSTRACT

In tropical regions such as sub-Saharan Africa, challenges related to food security and reproductive health are closely connected. As a response to persistent malnutrition and food insecurity, genetically modified foods (GMFs) have been developed as an innovation intended to increase crop productivity and nutritional content. Despite their potential, there are concerns about their long-term complications and implications for human health, especially reproductive health outcomes. This review explores current evidence on the relationship between GMFs and reproductive/public health in tropical settings, especially in Africa. It highlights potential benefits, including improved nutrition and reduced pesticide exposure, while also exploring possible risks such as endocrine disruption, allergenicity, and the limited availability of long-term human data. The review further considers the socioeconomic, ethical, and policy issues that shape adoption. Although GMFs present promising opportunities to improve maternal and child health, important knowledge gaps remain, underscoring the need for cautious, well-regulated implementation and context-specific research.

Keywords: genetically modified foods, reproductive/public health, tropics, maternal health, food security, biotechnology

INTRODUCTION

In tropical Africa, food security and reproductive health remain strongly interconnected health concerns. Several countries across the continent persistently face poverty, malnutrition, infectious illnesses, and insufficient healthcare access. Together, these multiple difficulties significantly promote reproductive ill-health and poor outcomes for mothers and children. Genetically modified foods (GMFs) have emerged as a promising, albeit contested, solution to malnutrition and poor health outcomes in many developing countries. By changing the genetic structure of crops, scientists intend to introduce useful traits, including pest resistance, drought adaptability, and greater nutritional quality (Inhorn and Patrizio, 2025). Since their introduction in the 1990s, GMFs have generated significant debate, more particularly in low-resource settings where both the potential benefits and risks are most pronounced.

Reproductive health outcomes across these regions remain poor and alarming. Sub-Saharan Africa accounts for close to 70% of maternal deaths globally (World Health Organization [WHO], 2023), while infertility, a commonly overlooked issue, affects many couples due to infections, limited healthcare, and nutritional shortages (Ibekwe and Attah, 2006; Inhorn and Patrizio, 2015). Against these backdrops, understanding how GMFs may influence reproductive health becomes very timely, necessary, and important.

Historical Evolution of GM Foods

The advancement of genetically modified organisms began in the 1970s following major discoveries in recombinant DNA technology. By 1994, the first commercially marketed GM food, the Flavr Savr tomato, was introduced to the market. Shortly after, genetically modified crops such as herbicide-tolerant soybeans were adopted on a large scale. Over the following decades, the use of GM crops expanded rapidly, particularly in the production of maize, cotton, and soybeans. More recent innovations have focused on biofortification, with crops like Golden Rice designed to address micronutrient deficiencies. While these advances reflect significant

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scientific progress, they have also sparked ongoing debates about safety, environmental sustainability, and ethical responsibility.

In tropical regions, where agriculture is often challenged by pests, drought, and poor soil quality, GMFs offer practical solutions. Crops such as Bt maize and cotton reduce losses from pests, while drought-tolerant maize improves resilience to climate variability. Biofortified crops, including cassava and banana enriched with essential vitamins and minerals, are being developed to tackle widespread nutritional deficiencies.

These innovations are particularly relevant because they address underlying determinants of poor reproductive health, especially malnutrition. However, there are serious concerns about their long-term safety, especially regarding reproductive outcomes.

Reproductive Health Burden in the Tropics

Reproductive health challenges in sub-Saharan Africa are complex and appear intractable. Maternal mortality remains unacceptably high, with obvious inequalities between low- and high-income settings (WHO, 2023). Infant and child mortality also remain elevated, often linked to poor maternal health indicators, weak health systems and inadequate nutrition.

Concurrently, infertility remains an understated but equally vital public health challenge. In some regions, as many as 30% of couples are influenced, often as a result of untreated infections and limited reproductive healthcare services (Ibekwe, 2010). Nutritional shortages, particularly deficiencies in vitamin A and iron, additionally impair reproductive outcomes (Inhorn & Patrizio, 2015) These health challenges are compounded by broader socioeconomic, sociocultural and environmental factors, including poverty, infectious diseases, and exposure to agricultural chemicals. It has been suggested that these factors combine to nurture poor reproductive health (Ibekwe and Ibekwe, 2010).

Socioeconomic and Cultural Dimensions

The impact of GMFs cannot be completely comprehended without looking at the broader social setting. Public perceptions are often shaped by limited awareness and misinformation, leading to serious doubts in many communities. Weak labeling systems further limit consumers' ability to make informed choices in whatever is being consumed. In most instances, there is the absence of consumers' protection. The poor socioeconomic conditions of these regions make them vulnerable because of biosafety implications.

Gender dynamics are also critical. Women play central roles in both food systems and reproductive health, meaning they are likely to experience both the benefits and risks of GMFs more directly. Unfortunately, these are the most vulnerable group regarding the adverse outcomes of GMFs.

Policy and Regulatory Context

Regulatory approaches to genetically modified foods (GMFs) vary significantly from one country or region to another (Ademola A. Adenle, 2013). These differences are often influenced by political priorities, economic goals, public opinion, scientific knowledge, and ethical concerns. While some countries have developed policies that support the cultivation and commercial use of genetically modified crops, others remain more cautious because of concerns related to biosafety, environmental protection, human health, and possible socioeconomic effects.

Countries such as South Africa, Brazil, and Argentina have strongly embraced genetically modified crop production and are now among the world's leading producers of GM agricultural products (Moises Burachik, 2010). They have incorporated GM technology into large-scale agricultural systems, especially in soybean production for local use and export purposes. These nations have established regulatory frameworks that allow the cultivation of genetically engineered crops including maize, soybean, and cotton. The main goal has been to improve agricultural productivity, enhance resistance to pests and diseases, and reduce crop losses caused by drought and other harsh climatic conditions (Gruère & Sengupta, 2010). In South Africa, for instance, GM maize is widely cultivated to strengthen food security and support commercial farming.

On the other hand, several countries in Europe and parts of Africa remain hesitant or resistant towards the adoption of GMFs. Their concerns are mainly centered on possible long-term health risks, environmental consequences such as loss of biodiversity and gene transfer, ethical debates, and fears of over-dependence on multinational biotechnology companies. In some regions, inadequate scientific infrastructure and weak regulatory systems have also slowed down approval processes and encouraged stricter biosafety regulations. In addition, public criticism and campaigns by environmental advocacy groups have played an important role in shaping government policies regarding GMFs.

Consequently, the regulation and acceptance of GMFs continue to differ widely across the world, reflecting the complex relationship between scientific advancement, public health, agricultural development, environmental protection, and national policy interests.

In most parts of Africa, including Nigeria, adoption is gradually emerging but remains contested and marred with skepticism (Ngongolo & Mmbando, 2025)). Key challenges include weak biosafety systems, limited independent research, and inadequate enforcement of regulations.

Ethical Considerations

The adoption of GMFs has generated very pertinent ethical issues and questions. The more critical ones include how to balance potential risks with urgent food security needs, how to ensure informed consumer choice, and how to address global inequalities in technology deployment. In all these circumstances, protecting the vulnerable populations from preventable risks must remain a priority.

Role of Global Health Institutions

The World Health Organization, in collaboration with the Food and Agriculture Organization, plays a critical role in evaluating GM food safety. Through the Codex Alimentarius Commission, these institutions provide internationally recognized guidelines for food safety, risk assessment, and labeling (Liivat, 2025). Strengthening these institutions have become imperative in reducing the wanton and indiscriminate proliferation of GMFs.

Future Directions

Future efforts should focus on generating stronger evidence to support globalization of GMFs, and improving governance structure. Priorities include conducting long-term, region-specific studies on reproductive outcomes, strengthening biosafety regulations, ensuring transparent labeling, and integrating GMFs into broader public health and nutrition strategies.

CONCLUSION

Genetically modified foods present both meaningful opportunities and important uncertainties for reproductive health in contemporary sub-Saharan Africa. While they offer potential solutions to malnutrition and food insecurity, questions about their long-term effects, especially on fertility, reproduction, and pregnancy, remain unresolved.

Moving forward, a careful and balanced approach is very important. Strengthening research, policy frameworks, and ethical oversight will be essential to ensuring that GMFs contribute positively to reproductive health and sustainable development in these regions.

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