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Mali, Anemia

Breaking the Cycle of Anemia in Mali with Women-Led Chakti Millet Production

In seventh grade, I suffered from severe anemia due to abnormal menstrual bleeding. My hemoglobin level had fallen dangerously low, to 5 g/dL, requiring two blood transfusions to treat. During this time, I experienced severe anemic symptoms, including extreme fatigue, physical weakness, and dizziness, making it one of the worst years of my life. Unfortunately, my experience is not unique, with anemia and iron deficiency being the most prevalent deficiency for adolescent girls globally (WHO, 2011). More specifically in Mali, where the prevalence rate of anemia in women ages 15-19 is incredibly high at 65.5 percent, young women face similar debilitating symptoms every day (Armah-Ansah, 2023). This alarming statistic places Mali as having one of the highest prevalence rates of anemia in adolescent girls worldwide. It is crucial to address this crisis and improve the overall health and well-being of young girls who are growing up in Mali's already harsh living conditions, which include lack of healthcare, food insecurity, and poor sanitation. Like me, girls in Mali deserve a solution that restores their health and independence for a higher quality daily life. In Mali, the most promising solution for anemia is biofortified Chakti millet.

Today, Mali is one of the poorest countries in the world, ranking 186th out of 191 countries in the 2021 UNDP Human Development Index with a score of .428. Approximately 41 percent of Malian children live in multidimensional poverty (a form of poverty that goes beyond income to include health, education, and living standards), often lacking access to nutritious food and reliable healthcare (UNICEF MALI, 2024). The most severe and widespread poverty is located in southern regions, which contain 90 percent of the country's overall poverty (WBG, 2024).

Growing up in Mali is not easy. From the first moment Malians enter the world, they are vulnerable to diseases such as pneumonia, diarrhea, and malaria. While these are certainly preventable, Mali lacks access to quality health care services, resulting in the morbid statistic that only about one in ten children in Mali survives to age five (UNICEF). Twenty-five percent of children experience chronic malnutrition and growth stunting, creating long-term developmental issues (UNICEF). Additionally, many children in Mali are not able to receive an education due to overall economic and political insecurity, child labor, child marriage, and household poverty. UNICEF approximates that more than two million children in Mali from ages 5 to 17 are not enrolled in school.

Girls in Mali face additional hardships as the culture is male-dominated and male-centric. In Mali, over 70 percent of girls undergo female genital mutilation (UNICEF), 18 percent of girls ages 15-19 are already mothers, and many are forced into child marriage, all factors that often prevent girls from

participating in education and the workforce (Tambadou, 2023). As these young women grow up, they will continue to face Mali's extreme gender inequality, which ranks 155th out of 170 countries on the 2021 UNDP Gender Inequality Index (Tucker, 2023). Only 51.6 percent of women participate in the labor force and only 10.4 percent of women are involved in making major household decisions (WorldBank). In rural, southern parts of Mali, 75.3 percent of women of reproductive age suffer from anemia (Mankelkl & Kinfe, 2023).

One of the primary causes of anemia is a lack of essential nutrients, particularly iron, in the Malian diet. Iron deficiency is the single most prevalent micronutrient deficiency for young women in Mali, which directly correlates to higher rates of anemia (Fanou-Fogny et al., 2010). Over 56 percent of the country's children under five fail to eat enough iron-rich foods, attributing to an extremely high incidence of iron deficiency anemia (Emmanuel Osei Bonsu et al., 2024). The main cause of this deficiency is the limited availability of affordable iron-rich foods such as meat, fish, and legumes, particularly in rural regions. As a result, the Malian diet primarily consists of starchy foods.

Adolescent girls are particularly vulnerable to iron-deficiency anemia due to the iron lost during menstruation, alongside the increase in demand for iron as they grow. Additionally, young women who suffer from irregular bleeding often lack access to necessary healthcare, resulting in more severe cases of anemia. Another contributing factor is poor sanitation, which increases the chance of parasitic infections like malaria. Malaria destroys red blood cells, causing hemoglobin levels to drop and exacerbating anemia. This is significantly prevalent in Mali, where malaria had a morbidity rate of 43 percent (Mali SMC, 2021).

Young women suffering from anemia face both physical and developmental consequences. One of the biggest symptoms of anemia is overall weakness and fatigue, which makes even the simplest daily chores and activities extremely difficult. If attending school, girls suffering from anemia can face severe cognitive impairments, leading to a lack of focus and memory, affecting their overall scholastic performance and potential. In a study conducted in India, researchers showed anemic girls scored lower in cognition tests, took longer to recover from a step test, and had a more limited physical work capacity compared to non-anemic girls (Sen & Kanani, 2006). Girls suffering from severe anemia are often too weak to attend school, further contributing to Mali's gender inequality in education. Pregnancy among adolescents with anemia is particularly destructive because it increases the demand for iron. Pregnant women with anemia are more likely to experience complications such as maternal deaths, low birth weight, preterm delivery, and infant death (Armah-Ansah, 2023). At any period of life, women who suffer from anemia are significantly more at risk for severe health consequences and delayed recovery from diseases and infections such as malaria (White, 2018). Additionally, many adolescent women suffering from anemia are often unable to earn a stable income, contributing to generational poverty. Generational poverty leads to child marriage, lack of iron-rich foods, and poor sanitation, continuing the cycle of anemia.

To enable young women in Mali to reach their full potential, we must prioritize sustainable, effective solutions. Medical interventions such as iron supplements and transfusions can provide temporary relief but are costly and dependent on external supply chains. Preventive measures like malaria nets and deworming have mixed success, while fortified foods and micronutrient powders face cultural and infrastructure barriers.

Due to the scale and complexity of anemia in adolescent Malian girls, a long-term, community-driven, sustainable approach is required to tackle such a multifaceted problem. Based on my research, biofortification stands out as the most impactful solution to combat it. Biofortification is a nutrient-based solution that involves breeding crops to increase nutritional levels, such as iron. This method is incredibly sustainable for more isolated and rural regions such as southern Mali, because once the crop is integrated into the food system, little additional effort is required while gaining significant nutritional benefits.

In 2018, HarvestPlus supported the International Crops Research Institute for Semi-Arid Tropics (ICRISAT) in breeding a high-yielding pearl millet grain called Chakti (Jemima Mandapati, 2023). This grain was biofortified by ICRISAT to contain higher iron and zinc content and was released into Niger, eventually spreading to regions in neighboring Mali. Chakti contains 8.2 mg of iron per 100 g, and fermenting it can increase the bioavailable iron by up to 3.4 times (Jemima Mandapati, 2023). Due to the high iron content of this fortified millet, it can be extremely effective at lowering anemia rates. A meta-analysis of 30 different studies showed that regular consumption of biofortified millet increases hemoglobin levels by 13.2 percent in anemic individuals, and girls with moderate anemia specifically saw their hemoglobin levels rise to normal (Anitha et al., 2021).

This solution works for Mali specifically because of its similarities to Niger, where Chakti was initially produced and found to be successful (Aind, 2025). Chakti is perfect for Mali's climate, being drought resistant, and millet is already a staple food there. Introducing Chakti requires little change in traditional diets and farmers are already showing their willingness to produce this type of improved pearl millet, proving that it is a culturally accepted solution that people in Mali want.

In Gao, a northeastern region of Mali, a group of women entrepreneurs has come together to take advantage of the nutritional benefits of this grain. Their work focuses on producing Chakti products for schools and healthcare centers in conflict zones, integrating it into a ready-to-eat product line (Jemima Mandapati, 2023). The business model these women have created provides a sustainable system to get iron into the diets of women and children while simultaneously creating jobs and empowering women to be involved in the workforce, provide for their families, and gain nutritional knowledge that will carry on to their children. Supporting these women-led businesses not only combats anemia, but also strengthens communities as a whole.

So far, 30 similar women-operated initiatives have been formed in five regions across Mali, mostly in

conflict zones where there is major food insecurity due to armed groups blockading supply routes (Jemima Mandapati, 2023). In the short term, expanding this initiative to southern regions, where anemia rates are most prevalent, could be achieved by connecting existing women entrepreneurs with interested groups in the south, creating a mentorship network to share skills and offer hands-on training in Chakti processing, production, and business management.

Ongoing partnerships with the UN World Food Programme and ICRISAT, which initially supported the Chakti initiative, could provide critical funding and resources, giving women the tools they need to start strong while keeping decision-making, ownership, and profits in the community's hands. In the long term, regional co-ops could be established to scale up production, enabling women to collectively market their products, reinvest profits, and expand to additional communities without relying on outside assistance. By growing into a coordinated, self-reliant network, these women can address a critical health need while also creating stable income and leadership opportunities for future generations.

Barriers to this kind of long-term growth include cultural food preferences, limited financial literacy, high start-up costs, and transportation insecurity. These can be addressed through incorporating Chakti into traditional recipes, partnering with local universities for business training, offering microloans or seed grants, and creating decentralized processing centers. Ordinary citizens can also support this solution by purchasing Chakti products, participating in local co-ops, and sharing nutrition knowledge within their communities. The good news is that key stakeholders in Mali have demonstrated that they have the power will to overcome the country's challenges in this area. As noted earlier, farmers have already indicated a desire to grow biofortified crops, and the Malian government has recently shown its willingness to invest in food and nutrition-based solutions to health crises by implementing its National Response Plan to Food Insecurity, providing meaningful resources to combat malnutrition (Cérémonie de lancement PNR-2025).

While biofortified Chakti millet is the solution with the most potential to have the largest impact, its effectiveness can be compounded with complementary efforts such as parasitic infection prevention, a consistent supply of iron supplements, and reliable access to quality health care.

Young women in Mali deserve to live their lives without anemia holding them back from realizing their full potential. Now more than ever, global health needs are rising, particularly in Malian communities, where a recent \$149 million cut in USAID funding will leave many without crucial aid (Sandefur & Kenny, 2025). Scaling Chakti millet production and distribution through women entrepreneurs could drastically reduce anemia in adolescent girls while creating hundreds of new jobs for women. Without the symptoms of anemia, which take a toll on physical and mental well-being, more girls will be able to receive a full education, empowering them to join the workforce and become leaders in their communities. Additionally, lower levels of anemia could lead to fewer maternal and infant deaths, resulting in healthier babies who can fully develop both physically and intellectually, shaping future generations of Malians. This solution would also empower and educate women who are able to work

and earn money, combating generational poverty, which is one of the root causes of anemia. By addressing anemia through biofortified foods, we are not only improving the health and well-being of adolescent girls but also empowering women to create a better future generation in Mali.

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