



# Rwanda Triumvirate Small Fish Flour: From Sambaza Lake Fish to Protein Supplement For Children

Carol Civettini & Scott Hagedorn



## Food Science in Action:

- ✓ Food processing
- ✓ Food safety
- ✓ Nutrition
- ✓ Food quality

Rwandan children being fed traditional foods supplemented with Triumvirate fish flour.  
(Photo courtesy of Triumvirate)

**Triumvirate Food** began as a youth-owned Rwandan company selling dried fish to a successful social enterprise that developed a dried small fish flour used to enhance the nutritional value of foods for children in Rwanda. The fish flour is derived from an indigenous small fish, sambaza, that is native to the Kivu Lake of Rwanda. The fish are grown by aquaculture in submerged cages in the Kivu Lake. The fish is dried and milled to a powder with quality and food safety controls for moisture, heavy metals, aflatoxin, and foodborne pathogens. Triumvirate currently has capacity for manufacturing and distributing about 2 metric tons per month of fish powder. They are currently feeding 200 children funded by Triumvirate but want additional funding to feed a total of 600 children. They are working towards the goal of doubling their manufacturing capacity. In May 2024 Triumvirate was selected as a finalist in the UN World Food Programme “Ignite Sprout” food innovation conference in Copenhagen.

## Introduction

Significant progress has been made in the per capita income in Rwanda over the last 40 years, according to the World Bank. However, 39% of Rwandans still live on less than \$2.50 per day making nutritious food unaffordable for a large segment of the population and especially for

Rwandan children in rural communities.<sup>1</sup> Roughly one-third of children under the age of 5 still suffer from malnutrition in Rwanda according to the World Food Programme (WFP).<sup>2</sup>

Triumvirate Food began as a small youth-owned start-up food company in Rwanda that has evolved into a food supplement company that



**Figure 1.** Amani Twagirayezu - CEO & Founder of Triumvirate. (Photo courtesy of Land O'Lakes Venture37)

uses dried sambaza, a native small fish, for malnourished children.<sup>3,4</sup> The Rwanda traditional diet is based primarily on banana, potatoes, and beans, and diets are often low in protein. It has been shown that malnourished children (ages 5 to 6) in Rwanda consume less protein than recommended by the WFP and are disproportionately affected by higher poverty rates which further contribute to the low protein diets. The company's goal is to increase the consumption of protein to 15 grams of protein per day through the use of Triumvirate fish flour made from sambaza. Fish is recognized as a high quality protein source based on its PDCAAS.<sup>5</sup>

Amani Twagirayezu (CEO and founder of Triumvirate; Figure 1) was born and educated in Rwanda, earning a degree in Agribusiness and Rural Development from the University of Rwanda.<sup>6</sup> When Twagirayezu was in high school, he would deliver fish to local fresh markets, but the fish would spoil quickly. After graduating from college, he created a business of drying sambaza small fish to sell into the local markets using small

food driers and packaging equipment.

In 2022 Triumvirate was the recipient of a \$40,000 grant from USAID to create a business plan and train Triumvirate employees and suppliers on the production of dried small fish flour as a protein supplement in foods for malnourished children.<sup>7</sup> The fish flour is derived from aquaculture and further processed by drying and milling, while following food safety controls. Triumvirate is working with 94 local fish co-ops that are 80% owned by women with the goal of eventually feeding 2,000 Rwanda households. These fish co-ops include Orora Wihaze (which translates to "Raising Animals for Self Sufficiency") in Rwanda who are funded by a USAID grant that is administered by Land O'Lakes Venture37 and who are scaling up the production of sambaza fish by aquaculture.<sup>8,9</sup>

Triumvirate has successfully scaled up the production of dried fish flour to 2,000 kg per month and is working towards producing and distributing 4,000 kg per month using state-of-the-art food processing equipment provided by Land O'Lakes Venture37. Currently they distribute their product through local markets and grocery stores using business-to-business (B2B) distribution networks.

Triumvirate is also working with other local NGO nutrition programs, where the goal is to feed 600 children using foods supplemented with fish powder and in partnership with local early child development centers (ECDS) in partnership with World Vision.

Twagirayezu traveled to Denmark in March and May 2024 as part of the WFP "Ignite Sprout Innovation Hub for Eastern Africa" conference held at the Denmark Technology University (DTU). At the meeting Triumvirate also received



**Figure 2.** Aquaculture harvesting of sambaza fish from Lake Kivu, Rwanda. (Photo courtesy of Land O'Lakes Venture37)



**Figure 3.** Packaged Triumvirate Sambaza Fish Flour (Photo courtesy of Land O'Lakes Venture37)

The commercial small fish flour is packaged into aluminum bags and sealed for freshness (Figure 3). Packaging is sourced through Uganda, but the company is currently looking for a more local, sustainable, and cost-effective packaging solution.

*Triumvirate was started as a local youth-owned, innovative, entrepreneurial, start-up food business and today is focused on using local sambaza dried fish flour as a protein food supplement to alleviate protein malnutrition in children in Rwanda.*

training on food processing and nutrition measurement technologies and networked with other food innovators worldwide. Triumvirate was selected as one of three organizations to pitch their innovative fish flour protein supplement product at a week-long WFP Innovation Week in May 2024.<sup>10</sup>

## Project Overview

Sambaza is a small smelt-like fish, with a high protein content, that is native to Rwanda and grown by aquaculture in cages submerged in Lake Kiva, a freshwater lake in Rwanda (Figure 2).<sup>5</sup> It serves as raw material for the Triumvirate fish flour. The sambaza fish is supplied by local fish co-ops who are working with the Feeding the Future Rwanda Orora Wihaze project. This project is a consortium led by Land O'Lakes Venture37 and also includes Catholic Relief Services (CRS), Market Share Associates, and the Manoff Group (TMG).<sup>8,9</sup>

Triumvirate's goal is to supply 15 grams/day per child of dried fish flour powder for children aged 6 months to 5 years to supplement the protein content of basic indigenous foods in Rwanda including dried banana, potato flour, and dried beans.

Triumvirate is working with local fish cooperatives in Rwanda for two reasons: 1) the co-ops provide a daily reliable supply of fish, and 2) doing so empowers local fish producers with a market and sustainable income for their fresh fish.

## Food Contaminant Regulatory Compliance

In order to ensure a safe food product, Triumvirate uses HACCP as well as production procedures that they developed in partnership with USAID. Good food hygiene procedures are used throughout the factory and are a core element in the food safety plan and culture. The fish powder is tested by an independent third-party national lab at the Rwanda Standards Board (RSB) for the presence of heavy metals, food pathogens, mycotoxins, and other food contaminants. The RSB has standards for manufacturers to ensure product quality and safety. Triumvirate is finalizing their RSB Food Processing certification, testing, and approval to go to market. They feel that they are 80% towards being fully compliant including aligning with RSB Food Safety and HACCP regulatory policies and international food safety standards of the FAO/WHO Codex Alimentarius for food contaminants.<sup>11</sup>

In addition to meeting the regulatory requirements of the RSB, Triumvirate also tests the fish powder product by working with the Rwanda FDA national laboratories to test for nutrient content, contaminants, and food pathogens.

While government permits are important, Triumvirate is working towards strengthening their internal test capacity so that every batch of fish powder produced is tested for protein content, *C. perfringens*, *E. coli*, aflatoxin, and heavy metals.

## Moisture Controls

Moisture level is a Critical Control Point of Triumvirate's HACCP plan, and proper controls are required to both minimize spoilage and ensure safety of the packaged fish powder. Improperly dried fish flour can result in the formation of mycotoxins and food pathogens (*Clostridium perfringens*, *Salmonella*, and *Listeria*). To minimize spoilage of the packaged fish powder, sambaza fish are first dried to 65% moisture, which is an RSB regulated fish drying standard.

Triumvirate has installed modern food drying ovens with a moisture indicator that monitors the correct percentage of moisture for the dried fish (Figure 4). The entire dried fish is then milled to a specific granulation. After milling, the particle size of the flour is measured to pass through a 200-mm sieve before it can be packed. The final moisture of the packed fish powder must be below 20%, which is measured for each batch.

## Heavy Metals Controls

During the preparation of this report, international food safety expert Delia Grace Randolph<sup>12</sup> (University of Greenwich) was interviewed about the safety of small fish harvested from Kivu Lake, who referred us to Jean Bosco Ntivuguruzwa at the University of Rwanda regarding concerns about the heavy metal content of Kivu Lake. Ntivuguruzwa provided a publication by the Fisheries Society of Nigeria that confirmed water heavy metal contaminants in Lake Kivu in Rwanda met international water quality standards.<sup>13</sup>

According to Triumvirate, the small sambaza fish are intrinsically lower in heavy metal content due to less bioaccumulation by their position lower in the natural food chain. However, there was no data provided to support this claim. It should be noted that heavy metals have been tested in the finished fish flour by the RSB, but an internal testing protocol is needed as part of the Triumvirate quality process to ensure the small fish flour meets international standards of FAO/WHO Codex Alimentarius.<sup>11</sup>

## Successes

In less than 5 years Triumvirate has grown from a youth-owned dried fish business in Rwanda to a food processor of a small fish flour supplement for malnourished children with the capacity of producing 2 metric tons of fish flour. They currently have 8 employees and are working with three cooperatives. Most of Triumvirate's fish flour is sold into local commercial markets. Triumvirate also donates and feeds more than 200 children from their profits and in collaboration with World Vision.

In May 2024 Triumvirate participated and made presentations to the WFP "Ignite Sprout" program at the Denmark Technology University in Copenhagen. They were selected as one of the four finalists from more than 18 international start-up companies in their UN Country Team (UNCT) to address the UN Sustainable Development Goals (SDG) of zero hunger.



**Figure 4.** Drying methods of fresh sambaza fish: traditional drying (left picture), controlled oven drying (right picture). (Photo courtesy of Land O'Lakes Venture37)

## Looking Ahead

Triumvirate is looking for potential partners, foundations, and investors that believe in the product to help secure funds to further grow the company. This includes plans to partner with international feeding and aid programs such as the WFP.<sup>10,14,15</sup> While currently Triumvirate donates the fish flour from their budget to feed 200 children, they are looking for additional partners and funding to feed 600 children. Triumvirate has also prepared a Growth Grant application for the IFT Seeding The Future - Challenge Grant to be submitted in October 2024 to help expand and grow their business.

Triumvirate primarily markets its sambaza fish flour by word-of-mouth marketing and sales agents to distribute the product to local markets and kiosks. Future commercial plans are to expand outside of Rwanda through an enhanced Triumvirate website, radio advertising, sales, and marketing efforts through distributors. Triumvirate will continue to partner with USAID and Orora Wihaze group to build its value chain for its small fish flour and feeding undernourished children in Rwanda and Rift Valley of Kenya and Burundi with safe and nutritious supplemented foods.

Triumvirate is working toward building their own food processing infrastructure, including a cold room to store fresh fish during the high season of fish harvesting, which is the final step for a fully RSB certified Food Processing Facility. Triumvirate would also like to acquire a truck to help distribute and deliver their fish flour safely and maintain quality. Current rental trucks run the risk of cross contamination with other commercial products.

This article highlights the role that food science can play in the development of a new food supplement product from an idea that originated for commercializing a dried fish product with a longer shelf life in Rwanda.

*“From the lake through production, we have high food safety standards that govern all of our food products.”*

**Amani Twagirayezu - CEO & Founder of Triumvirate**

## References

- 1 World Bank Group. Rwanda Economic Update, 21st ed. 2023 [cited 2024 Sep 10]. Available from: <https://openknowledge.worldbank.org/server/api/core/bitstreams/982206fa-fa03-4083-820d-39171ca6f80b/content>
- 2 World Food Programme. WFP Rwanda Country Brief August 2024 [cited 2024 Oct 5] <https://docs.wfp.org/api/documents/WFP-0000161458/download/>
- 3 Triumvirate Food Ltd. About Triumvirate Food [cited 2024 Aug 20]. Available from: <https://triumviratefood.rw/about/>
- 4 Triumvirate Food, Triumvirate Food's Post, LinkedIn [cited 2023 Dec 19]. Available from: [https://www.linkedin.com/posts/triumvirate-food-co-ltd\\_usaidorawihaze-nyamasheke-activity-7144763123814612992-PpSH?utm\\_source=share&utm\\_medium=member\\_desktop](https://www.linkedin.com/posts/triumvirate-food-co-ltd_usaidorawihaze-nyamasheke-activity-7144763123814612992-PpSH?utm_source=share&utm_medium=member_desktop)
- 5 Schaafsma, G. The Protein Digestibility-Corrected Amino Acid Score (PDCAAS). *J Nutr.* 2000;7:130
- 6 Amani Twagirayezu [LinkedIn page], LinkedIn [cited 2024 Sep 11] Available from: <https://rw.linkedin.com/in/amani-twagirayezu-87909b275>
- 7 USAID Feeding The Future. Rwanda Orora Wihaze, Contract #72069619C0001 Fiscal Year 2022 Quarter 3 Performance Report.
- 8 Scaling Up A Youth-Owned Fish Business To Combat Malnutrition. USAID MarketLinks. 2023 Aug 4. Available from: <https://www.marketlinks.org/blogs/scaling-youth-owned-fish-business-combat-malnutrition>
- 9 Scaling Up A Youth-Owned Fish Business To Combat Malnutrition. Land O'Lakes Venture37. 2023 Aug 9. Available from: <https://www.landolakesventure37.org/insights-hub/scaling-up-a-youth-owned-fish-business-to-combat-malnutrition>
- 10 WFP Innovation Accelerator Pitch Event | February 2024 [video]. YouTube, 2024 Feb 19 [cited 2024 Sep 11]. Available from: [https://www.youtube.com/watch?v=bEiqYrc2K\\_I](https://www.youtube.com/watch?v=bEiqYrc2K_I)
- 11 FAO and WHO. General Standard for Contaminants and Toxins in Food and Feed CXS 193-1995. Codex Alimentarius International Food Standards. 2023. Available from: [https://www.fao.org/fao-who-codexalimentarius/sh-proxy/en/?lnk=1&url=https%253A%252F%252Fwww.space.fao.org%252Fsites%252Fcodex%252FStandards%252FCXS%252B193-1995%252FCXS\\_193e.pdf](https://www.fao.org/fao-who-codexalimentarius/sh-proxy/en/?lnk=1&url=https%253A%252F%252Fwww.space.fao.org%252Fsites%252Fcodex%252FStandards%252FCXS%252B193-1995%252FCXS_193e.pdf)

- <sup>12</sup> Global Alliance for Improved Nutrition (GAIN). Food Safety: The Biggest Development Challenge You've Never Heard Of. [video]. YouTube. 2023 Oct. 30. Available from:  
<https://www.youtube.com/watch?v=Vc7sQ2hM34>
- <sup>13</sup> Nsabimana A, Habimana V, Gaidashova S. Heavy Metal Concentrations in Water Samples from Lake Kivu. *Rwanda Journal of Engineering, Science, Technology and Environment* 2020;3(2):53-62.
- <sup>14</sup> World Food Programme. WFP Global Data Strategy 2024-2026 [cited 2024 Sep 11]. Available from:  
[https://docs.wfp.org/api/documents/WFP-0000157192/download/?\\_ga=2.145098804.1240753010.1711460909-533141195.1711460909](https://docs.wfp.org/api/documents/WFP-0000157192/download/?_ga=2.145098804.1240753010.1711460909-533141195.1711460909)
- <sup>15</sup> World Food Programme. Hunger Map [cited 2024 Sep 11]. Available from:  
[https://hungermap.wfp.org/?\\_ga=2.49178278.1240753010.1711460909-533141195.1711460909](https://hungermap.wfp.org/?_ga=2.49178278.1240753010.1711460909-533141195.1711460909).

## Further Reading

Olapade OJ, Omitoyin BO. Fish Species Composition In Lake Kivu, Rwanda - East Africa. *Fisheries Society of Nigeria*. 2010:284-289.

World Food Programme. WFP Global Data Strategy 2024-2026 Rwanda [cited 2024 Oct 5]. Available from:  
[https://hungermap.wfp.org/?\\_ga=2.49178278.1240753010.1711460909-533141195.1711460909](https://hungermap.wfp.org/?_ga=2.49178278.1240753010.1711460909-533141195.1711460909)