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Haiti, Malnutrition

The Protein Tower: Combating Malnutrition in Haiti

Malnutrition is an increasingly pressing worldwide problem. One-in-nine people of the world's population suffer from nutritional deficiency. Malnutrition is the number one risk to health worldwide, and 2.6 million children – a third of children globally - die each year due to the effects of malnutrition (Fast Facts About Malnutrition, 2012). In Haiti, 35.3% of the population suffers from malnutrition and 7% of Haitian children die before their fifth birthday (Haiti Malnutrition Statistics, 2019). Solutions to combat child death due to malnutrition, not only in Haiti but worldwide require immediate priority attention.

Haiti suffers from one of the heaviest burdens of hunger and nutritional deficiency in the western hemisphere (Agriculture and Food, 2018). Malnutrition is a long-standing problem in Haiti exacerbated by natural disasters, such as a severe three-year drought from 2013 to 2016, the devastating 2016 hurricane “Mathew”, and a crippling 5.6 magnitude earthquake in 2018. The continuous barrage of natural disasters destroys crops, erodes soil, damages the economy, and displaces families. Haitians also struggle to obtain employment, thus 82% of the population is unemployed (Malnutrition Statistics in Haiti, 2019). The income for the average Haitian family has not increased in over twenty years, and in most rural areas the average family of six, two adults and four children, earns less than five hundred dollars per year (Haiti: Food and Economy, n.d.). Farmers work small private landholdings and depend on their labor and the labor of their relatives to survive. In Haiti, soil erosion is severe, and only 30% of the land is

considered suitable for agriculture. Despite this, more than 40% of the land is worked (Haiti: Food and Economy, n.d.). The traditional rural staples grown are sweet potatoes, manioc (cassava), yams, corn, rice, pigeon peas, cowpeas, and coffee. Haitians generally eat two meals daily: a small breakfast and a larger afternoon meal dominated by carbohydrates. Rice and beans are the national dishes of Haiti and the most commonly eaten meal (Haiti: Food and Economy, n.d.). The afternoon meal always includes beans or a bean sauce, and usually a small portion of protein, such as fish or goat meat. Most residents in Haiti have a full understanding of Proper dietary needs but lack the resources to fulfill deficiencies.

Research has revealed that of the eleven million people living in Haiti, four million, one-third of the population, are children under the age of fourteen. Of these children, one million suffer from nutritional deficiency and approximately seven-hundred thousand children suffer from severe malnutrition. As a result, two-hundred-sixty-thousand Haitian children will die before their fifth birthday (Haiti Malnutrition Statistics, 2019). Research has also shown that the practice of eating insects is called entomophagy, and two million people, 80 percent of the world's population, consume bugs as a regular part of their diet. More than two-thousand insect species have been documented as edible, the most commonly eaten insect groups including larva, caterpillars, ants, crickets, and grasshoppers (Edible Insects: Future Prospects For Food and, 2013). Insects provide similar nutritional levels as conventional protein sources and they create a smaller environmental impact. One hundred (100) grams of raw crickets contains 12.9 grams of protein and one hundred (100) grams of raw mealworms contains 20 grams of protein. One hundred (100) grams of beef contains 23.5 grams of protein (Under Armour, Insect- Crickets, 2019). The space requirement, water consumption, and the carbon gas emissions related to the production of insect-based protein are significantly smaller when compared to ruminant sourced

protein (Why You Should Eat Insects: Crickets versus Beef, 2019). The solution to malnourishment in Haiti may reside in the practice of entomophagy. Insects provide similar protein levels to conventional protein sources while creating a smaller environmental impact and requiring fewer resources. By utilizing insects as an alternative protein source, Haitians could supplement the protein and vitamins lacking in their diet.

Like so many parts of the world, Haitians will benefit from the proposed solution of introducing a portable, multi-species insect cultivator and vertical garden, “The Protein Tower”. This device could potentially combat malnutrition and increase the nutritional value of diets consumed by Haiti’s population. Creating a space-conserving, low maintenance edible insect and plant cultivating enclosure will make nutrition-boosting ingredients more accessible to impoverished individuals. The design goal was to create a child constructible and manageable insect cultivator and vertical garden with adaptable compartments, using readily accessible materials. The Protein Tower was constructed from easily recycled items with minimal skill or tools. Individual compartments contain crickets, mealworms, and a vertical garden. The researched insect and plant species can be interchanged with species that are environmentally available and culturally acceptable. The crickets and mealworms added to meals raise protein and vitamin availability and the vegetable greens grown in the garden provide important nutrients, such as vitamin A and C, lacking in a typical Haitian diet (see attached chart, “Comparison of Selective Nutrients for Haitian Dietary Supplements”).

One question that has been asked is “Why would raising insects be more beneficial than raising only plants?” The author’s response is, while growing edible plants would offer some dietary supplementation, the protein levels would still remain extremely low due to the plants’ function being to increase vitamin intake, not protein. In addition to this, the plants can only

provide so many harvests from each root system. If the Protein Tower's contents were reduced to just plants more seeds would be required in order to adequately feed an individual, which means people would struggle to acquire more seeds. In addition to this, if the tower relied solely on plants, there would also be a long wait time before each harvest matured without supplementation during the wait time. Besides their protein content and low maintenance care, the insects would allow an individual to have nutrient rich food products while the plants mature. The selected insect and the plant species were discovered to be the most nutritious and heat tolerant; crickets and mealworms, as well as spinach, chard, and arugula, were found to be best suited for Haiti's average daily temperature and humidity. These chosen insect species are harmless to handle, have non-seasonal life-cycles, can be consumed raw or cooked, and can be dried and stored. The continuous cultivation process of the Protein Tower provides increased availability to dietary supplementation of nutrients lacking in the present diet of the Haitians. In addition to nutritional supplements, the insect waste by-product and enriched compost provide soil-enhancing fertilizer to add to family crop plots. These provide improved nutrition supplementation, both immediately and in the future, and goods that provide options for income or bartering. This "micro-farm" can easily be transported in backpack form. The vertical design allows multiple self-contained units to be strapped together and remain space conservative. The design also allows the unit to be maintained in a family's living area or outside. Insects and green leafy vegetables supplemented into meals increases nutritional levels and lessens the encumbrance of malnutrition with which Haitian families struggle.

The goal of the design was to achieve a portable cultivator from recyclable materials. To implement the design, Haitians would require materials and instructions, and possibly people to guide them through the construction and maintenance of the tower and its contents. The Protein

Tower would ideally be introduced to Haiti in a kit containing all the materials necessary, along with a schematic, in order to construct the tower. A starter crop of crickets and mealworms, as well as simple instructions on insect care, would be included in the kit as well. If kits could not be distributed in Haiti, simpler, eco-friendly materials compatible with the design already exist on the island. In Haiti, plastic pollution is also an increasing prevalent issue, meaning materials such as plastic bottles, tubing, and netting are readily found on beaches around the island.

Random trash such as shoes and soda bottles are commonly found floating in the ocean close to Haiti. Bottles, tubing, and netting are all used in this design, and materials that are not available can also be substituted. The clasps featured on my design can be made from string and twigs; hollowed out coconut tree trunks can be used in place of the connectors; shoe laces can be braided together to form the back straps of the design. Introducing the Protein Tower and the concept of entomophagy to Haitian citizens would require some educating on the care of the insects and possibly the plants. Crickets and mealworms require very little care. Similarly to the United States, entomophagy is not a common practice in Haiti, and may be met with hesitance. With gentle education on the benefits of entomophagy, and the preparation of insects for consumption, it is possible the citizens of Haiti will adopt the practice of eating insects to combat malnutrition.

Another question that has been posed about the Protein Tower is “Is the similar work already happening in Haiti?” To answer this question, though there is no evidence of a device that functions like the Protein Tower, several organizations do currently exist and function in Haiti. These organizations, such as UNICEF™, Doctors without Borders™, Shoulder-to-Shoulder With Haiti™, Yéle Haiti™, and several others work to provide healthcare, education, food, and volunteers in Haiti for the benefit of the people. Many of these organizations are non-profit, or

based on donations. The Protein Tower was created with hope that it could be used alongside these organizations to make nutritionally rich ingredients available to those suffering from malnutrition.

To conclude, malnutrition is the number one risk to health in the world. Children are at the merciless grip of malnutrition, and they pay with their lives. The Protein Tower provides a portable, multi-species insect cultivator with a vertical garden to increase the protein availability and provide nutrient-rich fresh greens to individuals suffering from nutritional deficiency. By supplementing a diet lacking nutrients with entomophagy and readily accessible leafy green vegetables it is possible to combat malnutrition and increase the nutritional value of the meals consumed by the population of Haiti, and eventually, the world.

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Comparison of Selective Nutrients for Haitian Dietary Supplements

| | Amount | Protein | Fat | Carbs | Iron | Potassium | Vitamin A | Vitamin C |
|------------------|---------------|----------------|------------|--------------|-------------|------------------|------------------|------------------|
| Rice | 100 g | 8 g | 3 g | 78 g | 0% | 0 mg | 0% | 0% |
| Beans | 100 g | 4 g | 0 g | 15 g | 8% | 243mg | 0% | 0% |
| Goat | 100 g | 20 g | 2 g | 0 g | 15% | 385mg | 0% | 0% |
| Beef | 100 g | 23.5 g | 21.2 g | 0 g | 9% | 312mg | 0% | 0% |
| Crickets | 100 g | 12.9 g | 5.5 g | 5.1 g | 52% | 0 mg | 0% | 0% |
| Mealworms | 100 g | 55 g | 18 g | 3 g | 0% | 11mg | 0% | 0% |
| Spinach | 100 g | 2 g | 0 g | 3 g | 15% | 558 mg | 187% | 46% |
| Chard | 100 g | 1 g | 0 g | 3 g | 10% | 379 mg | 122% | 50% |
| Arugula | 100 g | 2 g | 0 g | 3 g | 10% | 369 mg | 12% | 25% |

(My Fitness Pal - Food, 2019)