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Incorporating Insects into Yemenis' Diets

Bounteous food and plentiful water; two commodities many Yemenis dream about. Out of the global population, ten percent are undernourished. One of the countries with the most cases of undernourishment is Yemen. Four out of ten Yemenis are undernourished. (Yemen - Prevalence of Undernourishment (% of Population), n.d.). This lack of food in Yemen can be correlated with a high unemployment rate and insufficient salaries. The wealth gap in Yemen is constantly growing making it more and more difficult for low-income households to provide for themselves let alone their families.

The average population in Yemen as of 2021 was 32.98 million people (Home, n.d.). With an average household size of nine individuals (Average Household Size - Area Database - Table, n.d.). Yemen is governed by a constitutional Republic. The current president of Yemen is Mahdi al-Mashat. Mahdi al-Mashat has been advocating for Yemen's farmers and working class since his inauguration in 2018. President Mhadi al Mashat understands how Yemen's farming industry is critical to his country's survival. A whopping 34% of Yemen is covered in farmland.

In Yemen, the majority of farms are under two hectares, which is approximately the size of four football fields. The average farm size in the United States is 250 hectares. This goes to show that the farms in Yemen are much less industrialized. The climate in Yemen is very arid, on average it only rains five inches per year compared to the 30 inches received in the United States. Due to the minimal rain the country receives, they rely heavily on underground aquifers.

Yemen is facing some major agricultural issues. One of which is the shortage of water in underground aquifers. This shortage of water is causing Yemeni crops to be small and less productive, accelerating the food shortage, and impacting affordability. Some of the more common crops in Yemen include sorghum, chickpeas, and corn. While these all have nutrients, there is one nutrient that is lacking in Yemeni diets. This is protein.

The average human needs 60 grams of protein per person. Even more for people under the age of 21. The average Yemeni consumes 46 grams of protein per day. This protein

shortage is due to meat being too expensive for most families to afford. Therefore legumes are the main source of protein for individuals in Yemen. Legumes have less protein than meat making legumes insufficient in providing ample protein.

With the increasing demand for meat, livestock farmers look to maximize their profits even if it means sacrificing sustainability and animal welfare. For example, the typical chicken farm keeps about 15 chickens per square meter. Keeping chickens close together can have many downsides. The main downside is the increased rate of disease transmission. To prevent these diseases from spreading farmers pump their chickens full of antibiotics. In recent years some bacteria have become antibiotic resistant. This means that antibiotics could lose their effectiveness. Overall making industrial livestock farming exponentially more expensive.

Limited funds make agricultural practices unsustainable. The vast majority of Yemeni farmers practice monoculture because there are few crops that are suitable for farming in Yemen's terrain and climate. Therefore crop rotation is a difficult method to use. 46% or about 391,000 lbs of crops grown in Yemen are used to feed livestock (Yemen Production, 2022). The main livestock consumed in Yemen is lamb. On average it takes six pounds of feed to produce one pound of lamb. This is a significant problem.

The solution to this problem is utilizing Entomoculture. Entomoculture is the process of raising insects for food. The insects, mainly mealworms, are raised in warehouses and then dried. Once the insects are dried they are ground up into a powder. This powder can be used to replace flour. When the insects are ground for a shorter period of time the insect meal can be mixed with water to create a meat alternative. This meat alternative can be cooked the same way as ground beef. Ground up mealworms have a very similar taste to that of ground beef, allowing for a smoother transition from meat to mealworms.

On average it only takes one and a half pounds of feed to produce one pound of insects (three oz dried). On the other hand it takes 12 pounds of feed to produce one pound of beef. Three ounces of insect meal has as much protein as 12 ounces of lamb. Furthermore, insect meal also has ten times the amount of iron as red meat. This is a much healthier alternative to meat and much less harmful to the environment. If all the feed grown in Yemen was used to produce insects instead of meat, approximately 342,609 pounds of feed would be saved. This would in turn allow farmers to use all this freed up space to grow produce for human consumption. This will allow the farmers to significantly increase their profits. Feed typically sells for about one third the price of

produce sold directly to customers. This change will allow the farmers to make 2.5 times more money than they would have if they were just growing feed.

Additionally, crickets have evolved to be highly resistant to disease. Not only will this allow Yemenis cricket farmers to raise their crickets without antibiotics but it will allow crickets to consistently provide nourishment even when the livestock farmers livestock is plagued with disease.

While there are alternative ways to fight hunger sustainably none are as future proof as implementing Entomoculture. One new technology that is being utilized more and more is hydroponics. Hydroponic farming uses less water than traditional farming but only plants can be grown therefore without meat or legumes it would still be difficult to meet daily protein requirements, additionally, hydroponic farming equipment is expensive and would require a high initial investment.

The conventional idea in many countries especially in Europe and North America is that insects are a nuisance and are not an acceptable food source. This could not be further from the truth. If all meat raised in Yemen was replaced with insects the amount of feed needed would go from 391,000 lbs to only 58,000 lbs, overall saving 333,000 lbs of feed per year. With all the extra farmland, crops intended for human consumption could be grown making the farmers more money than if they would have grown feed. In turn, this will increase the affordability and accessibility of food.

Implementing this new system in Yemen will be a simple endeavor. First, the Yemenis government will ask the insect meal corporation Ynsect if they would be open to building a factory in Yemen and the government in turn would provide tax breaks and other financial benefits. These benefits would include, the corporation tax being lowered from 20 percent to 10 percent for the first ten years, and a grant for one million dollars under the World Bank SME Fund. This grant would be guaranteed due to this deal meeting all the SME grant criteria (World Bank SME Finance: Development News, Research, Data, n.d.). Lastly, the company would be required to donate 20% of their insect protein to underprivileged communities in Yemen, this would help provide food to the Yemenis while altering the stigma around eating insects in a positive manner. Over time as more people begin to understand they are not eating insects but rather using a powder. The demand for insect meals in Yemen will increase. As the demand grows farmers will start raising insects to make insect meal. This insect meal can then be sold for a profit to locals making the farmers money and boosting the economy in Yemen.

Overall, incorporating crickets into Yemenis diets will not only be a sustainable move but also financially vitalizing one. With the growing search for sustainable food

sources the Entomoculture industry is just waiting to boom. Insect farming is a highly profitable industry. The profit margins are very high once the proper equipment has been obtained. Once Yemen has a foot in the Entomoculture industry they will be able to export their insect products to other countries with companies interested in utilizing insect meal in their products. This will generate the Entomoculture companies within Yemen lots of capital which in turn leads to the Yemenis government obtaining more money from the taxes paid by Entomoculture companies.

Implementing crickets into Yemenis diets will not be a simple task. It will require lots of time and effort. A few ways citizens of Yemen can help are cooking with cricket powder, buying products with insect meal in them and informing others of the benefits of choosing insects over meat. Moreover, insufficient education and awareness about the nutritional and environmental benefits of crickets contribute to their underutilization. Many individuals are unaware of the high protein content, micronutrients, and low environmental impact of crickets compared to traditional livestock. This lack of knowledge and understanding prevents people from considering crickets as a sustainable and nutritious food option. Lastly, marketing and branding strategies can play a critical role in making crickets a socially acceptable food source. Creating appealing packaging, emphasizing the nutritional benefits, and framing it as a trendy and forward-thinking choice can help attract consumers. Collaboration with celebrity endorsements and influencers can be the difference between consumers choosing crickets over meat.

Yemen is in dire need of support. Overall incorporating insects into the diets of people living in Yemen will not only save water, feed, and farm space but will also provide the Yemenis with an abundant supply of sustainability-sourced nutrients.

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