

Destiny Taylor Detroit Edison Early  
College of Excellence Detroit, MI, USA  
Malawi, Zinc Deficiency

## **The Use of Pumpkin Seed Spread Supplement to Combat Zinc Deficiency in Malawi**

**Abstract** Do you know anyone who constantly has no appetite? Have they lost their sense of smell and taste completely? If you are a citizen in the United States, your answer to these questions will most likely be no, but if you are a citizen in Malawi, your answer will more than likely be a yes. These are the characteristics of zinc deficiency. One-third of the world's population suffer from zinc deficiency ([WHO 2002](#)). This paper will concentrate on Malawi, a country where over 60% of their population is zinc deficient. This study will also examine how pumpkin seeds, which are a good source of zinc, can be used to combat zinc deficiency in Malawi.

**Introduction** Malawi ranks among the world's least developed countries. The economy is predominantly agricultural with about 80% of the population living in rural areas. Agriculture accounts for about one-third of GDP and 80% of export revenues. The performance of the tobacco sector is key to short-term growth as tobacco accounts for more than half of exports, although Malawi is looking to diversify away from tobacco to other cash crops.

Malawi depends on substantial inflows of economic assistance from the IMF, the World Bank, and individual donor nations. Donors halted direct budget support from 2013 to 2016 because of concerns about corruption and fiscal carelessness, but the World Bank resumed budget support in May 2017. In 2006, Malawi was approved for relief under the Heavily Indebted Poor Countries (HIPC) program but recent increases in domestic borrowing mean that debt servicing in 2016 exceeded the levels prior to HIPC debt relief.

Heavily dependent on rain-fed agriculture, with corn being the staple crop, Malawi's economy was hit hard by the El Nino-driven drought in 2015 and 2016, and now faces threat from the fall armyworm. The drought also slowed economic activity, led to two consecutive years of declining economic growth

**Demographics of the Malawi People** Malawi has a population of 19.03 million people, with 45% of the population under age 14, and 3% over age 56. Malawi has one of the highest densities in African, with over 10 major ethnic groups (Every Culture). About 60% of the population speaks the language of Chews, however the language of the government, industry, and commerce is English. When it comes to education, English is taught. Malawi has a low adult literacy, with an adult literacy rate estimated at 58%. The female literacy rate is at 44% (Loeb and Eide).

Like many other countries, employment in Malawi is directly correlated with education and literacy rates for men and women. Agriculture is a key sector, accounting for 90% of employment in Malawi (Castel, Phiri, and Stampini).

Malawi Communications Regulatory Authority (MACRA) is an organization established in 1998 oversees Malawi's telecommunications, broadcasting, postal services, and internet. It was established to

Page 1 of

6

regulate the country's communications sector. Its goal is to ensure that communications is provided throughout Malawi as long as it is practicable, reliable, and affordable. In 2018, an average of 70% of Malawians own mobile phones. Malawians use mobile phones for phone calls more than they do for texting or getting on social media. Radios is the main and most trusted form of communication when it comes to receiving news and information (Messenger).

Over a period of 9 years, the number of registered vehicles has doubled from 104,800 in 2008 to 290,935 in 2016. This is only 17 vehicles per 1,000 population, 1.7%. This is the same rate Hungary had in 1963 and China in 2002. In 2002, 44% of registered vehicles were light passengers and 8% were motorcycles. (Kaunda). Most of Malawi's main roads are sealed, but side roads have potholes and are rutted. Under some weather conditions, it is hard to drive on roads, even with a 4WD. In Malawi, you need a full driving license and must be 23 years old to legally drive (Lonely Planet).

**Malawi Economy and Agricultural Framework** According to the Central Intelligence Agency, Malawi's economic performance is constrained by policy inconsistency, macroeconomic instability, poor infrastructure, rampant corruption, high population growth, and poor health and education. The agriculture sector accounts for about one-third of GDP and 80% of export revenues. The major crops and production areas include tobacco, sugarcane, tea, corn, potatoes, sweet potatoes, cassava (manioc, tapioca), sorghum, pulses, cotton, groundnuts, macadamia nuts, coffee; and cattle.

**Zinc Deficiency in Malawi** Zinc is a very common deficiency in Malawi, but you do not want to overdose on zinc. Short term effects of zinc overdose include vomiting, loss of appetite, and nausea. Long term effects include a decrease in immune function and copper deficiency. Copper is an essential mineral that regulates metabolism and your nervous system (Ryan). Malawi's median zinc intake is 5.7 mg/day, while it's supposed to be 12 mg/day.

Over 60% of the citizens in Malawi are zinc deficient. Malawi's population is 19.03 million people. Malawi's average zinc deficiency population is 62% (2016) (NSO). This means that 11.79 million of citizens in Malawi are zinc deficient. The numbers are only getting higher. As of 2005, 40.6% of their population was zinc deficient (OWD). The percentage has increased 21.4% in 11 years. Zinc deficiency is the highest micronutrient that Malawi's citizens are deficient in, with inflammation following behind it with an average of 29%. This makes perfect sense. As stated earlier, zinc plays an important role in inflammatory responses. According to (NSO), more men are zinc deficient than women with just a 3% lead. There are 66% of men that are zinc deficient and 63% of women that are zinc deficient. 60% of both, preschool children and school-aged children, life stages are zinc deficient (NSO).

Malawi's dietary habits have to be a huge part of the problem. Most of their dishes are centered on starchy carbohydrates that have phytic acid and different fish consisting of sardine, whitebait, and tilapia (WTG). Sardines are the only fish in their diet that is a great source of zinc, but the starchy carbohydrates have phytic acids that absorb minerals like iron and zinc. Phytic acids appear in planted foods and staple foods like cereal, nuts, seeds, corn, and rice (Department of Nutrition). Even though they are eating sardines, which are rich in zinc, they are eating phytic acids that absorb all of the iron and zinc, which makes the sardines completely useless.

Page 2 of

6

Zinc is present in all cells throughout the body. In order for the body's immune system to function properly, zinc is needed. Zinc specifically plays an important role in inflammatory response and T lymphocytes activation. Inflammation is a condition in which a part of the body becomes swollen, red, hot, and painful. It is initiated by the immune system in response to physical injury or infection and can be deadly if triggered in the bloodstream. Inflammation is the body's way of signaling that there has been damage to tissue. Without zinc, inflammation is likely to trigger much more quickly. T lymphocytes, also known as T cells, are in white blood cells that keep the immune system stable by attacking infected or cancerous cells (Nordqvist).

Zinc is also involved in the processes of wound healing, cell division, cell growth, and the breakdown of carbohydrates (MedlinePlus). Zinc is mainly essential for cells' growth, which is important for the human body to grow. The pituitary gland, a pea-sized gland, is a part of the endocrine system. This gland's role in the body is to produce hormones that regulate other hormone-secreting glands (Society for Endocrinology). The pituitary gland produces many hormones, but I'm focusing on the growth hormones. Growth hormones' circulation concentration in the body's blood decreases as zinc concentration decreases, as well as the failure of growth hormone secretion from the pituitary gland. Limited zinc availability is directly responsive to growth hormones in bone marrow (MacDonald). Growth hormones have many vital functions in the body, such as regulating sugar and fat metabolism, and regulating muscle and bone growth. Zinc is very important for many functions in the body, which is why zinc deficiency is such an important topic. Zinc deficiency can lead to many unfortunate outcomes.

Pregnant women especially need an adequate amount of zinc during pregnancy because of the rapid cell growth. They need 11-12 mg of zinc compared to the normal 8-9 mg a female would usually need (NIH). A pregnant female between the ages of 14-18 should have an amount of 11 mg. A pregnant female ages 19+ should have an amount of 12 mg. Zinc plays an essential role in the construction of your baby's cells and DNA during pregnancy. Cell division and tissue growth is something that you want to happen perfectly as your baby grows so that they can develop normally (Aptaclub). The highest concentration of zinc is found in the brain, specifically the hippocampus. The hippocampus contributes to learning and development. Babies sure need that as they begin their journey called life. However, babies aren't the

only ones who have a lot to learn.

Zinc cannot be produced by the human body and must be consumed. This brings me to my proposal. I am proposing a substitution of dietary habits. My proposal for Malawi's zinc deficiency solution is to substitute nsima with pumpkin seeds spread. They're both a staple and will both taste the same. Pumpkin seeds will give the blood more nutrients, especially zinc. Although pumpkin seeds do, in fact, have phytic acids, there is an easy and affordable way to degrade the amount of phytic acid in pumpkin seeds. Soaking pumpkin seeds in water for 24 hours and letting them sprout just a little will decrease the concentration of phytic acids in the pumpkin seeds ([Arnarson](#)). Doing so will give you a 76% phytate reduction. 76% of the phytate organically in the food will not be gone. I would encourage sardines to still be a part of the diet, since it is such a good source of zinc. There is such a thing as having too much zinc in your blood, though, as stated earlier.

### **Use of Pumpkin Seed Spread As a Dietary Supplement**

I recommend to only have either fish or pumpkin seed spread for one meal a day. Zinc stays inside of your bone for 3-4 days. One serving of sardines (3 ounces) only contains 1.1 mg of zinc ([Chemicool](#)), while one serving of pumpkin seeds (one ounce or 53 grams) only provides the body with 3 mg of zinc, a quarter of the zinc needs ([Grape Tree](#)). Both of these in one

Page 3 of  
6

serving will only give a third of what the daily value of zinc is supposed to be (12 mg) in one day. That is okay. After all, zinc stays in the bones and blood for 3-5 days. At the 3 day mark, you'll have the correct daily value of 12 mg. Taking large concentrations of nutrients can shock the body and other chemicals bonding with it.

Another common dish that is consumed in Malawi is Nkhwaniwotendera. It consists of pumpkin leaves in peanut powder stew ([WTG](#)). This indicates that citizens in Malawi are available to pumpkin and are very familiar with pumpkin. This won't be anything totally new to them. It won't be a foreign food or taste. My proposal will only be a small alternative in their diet. Food security will be no problem.

Pumpkins are planted in warm weather and warm soil. It usually takes 90-100 days after planting for the squash to be ripe. Food security in Malawi is no problem due to their climate and close proximity of where the pumpkins can be sold or grown. Once citizens get their own seeds, they should be able to grow their own pumpkins for the leaves, the seeds, and anything else they may eat off of the pumpkin. If a family doesn't wish to grow their own pumpkin, there are a lot of people around who will be planting and selling pumpkins. Pumpkin is very plentiful in Malawi, so it shouldn't be expensive.

Pumpkin seeds can be eaten in many different forms-act oil, a spread, seeds, powder, a mixture of normal household dishes. The good thing about pumpkin seeds is that many of them come in one pumpkin so

that you can plant more and more pumpkins. There is no average number- it depends on the number of ribs that the pumpkin has.

**Implementing the Use of Pumpkin Seeds** It is not popular to eat pumpkin seeds to combat zinc deficiency in Malawi. Through the research I've done, pumpkin seeds have not been used to combat zinc deficiency in any other countries. Individual citizens may know about it, but their government has not made it known to their people. I urge the Malawi government to educate the citizens of Malawi about pumpkin seeds and its effects, For my pumpkin seeds solution to work effectively, people have to be educated about pumpkin seeds. There should be information about its effects on the human body, how much to eat in a day, how it can significantly affect their country, and the different forms that pumpkin seeds can be eaten, and nutrients that pumpkin seeds have, other than zinc. When people are more knowledgeable about things, they are happy to practice it. Since Malawi's most trusted form of communication for news and information is radio, these quick facts about pumpkin seeds should be broadcasted through a radio.

Pumpkin seed distribution should not be a difficult task. It should be fairly easy for citizens to have access to pumpkin seeds, knowing they already eat pumpkin leaves. Pumpkins are plentiful in Malawi. Again, pumpkins are a familiar taste for Malawians, so this will not be uncomfortable for Malawians to consume them more often. There is not much transportation for pumpkin seeds to be distributed, but there are many farmers in Malawi. There will be pumpkins in close proximity for Malawians to reach them. Pumpkins do take 3-4 months to grow and become ripe and there are 60% of Malawians that are zinc deficient. There will be a high demand for pumpkin seeds once the citizens of Malawi are educated about them. My solution for this high demand is for the surrounding countries of Malawi to supply Malwai with some of their pumpkin. The surrounding countries are also zinc deficient, but not as zinc deficient as Mawali.

Page 4 of

6

## **Works Cited**

American Optometric Association. *American Optometric Association*, American Optometric Association,

[www.aoa.org/patients-and-public/caring-for-your-vision/diet-and-nutrition/zinc](http://www.aoa.org/patients-and-public/caring-for-your-vision/diet-and-nutrition/zinc). Accessed 26 Apr. 2020.

*Aptaclub*, Aptaclub, 11 Aug.  
2017,

[www.aptaclub.co.uk/pregnancy/diet-and-nutrition/key-vitamins-and-nutrients/pregnancy-vitamins-zinc.html](http://www.aptaclub.co.uk/pregnancy/diet-and-nutrition/key-vitamins-and-nutrients/pregnancy-vitamins-zinc.html)

Braverman. *NCBI*, PubMed.gov, 17 Apr. 1982,  
[www.ncbi.nlm.nih.gov/pubmed/7082716](http://www.ncbi.nlm.nih.gov/pubmed/7082716).

Castel, Vincent, et al. *Education and Employment in Malawi*, June 2010,  
[www.afdb.org/fileadmin/uploads/afdb/Documents/Publications/WORKING%20110%20PDF%20d%2022.pdf](http://www.afdb.org/fileadmin/uploads/afdb/Documents/Publications/WORKING%20110%20PDF%20d%2022.pdf)

Culture, Every. "Culture of Malawi." *Countries and their Cultures*, Advamed,  
[www.everyculture.com/Ja-Ma/Malawi.html](http://www.everyculture.com/Ja-Ma/Malawi.html)

Kaunda, Chimwemwe. "Malawi Vehicle Population and Growth Rates." *Ministry of Transport and Public Works*,  
[wedocs.unep.org/bitstream/item/21643/Malawi%20Vehicle%20Population%20and%20Growth%20Rates%20Chimwemwe%20Kaunda%20Ministry%20of%20Transport%20and%20Public%20Works%20Malawi.pdf?sequence=5](http://wedocs.unep.org/bitstream/item/21643/Malawi%20Vehicle%20Population%20and%20Growth%20Rates%20Chimwemwe%20Kaunda%20Ministry%20of%20Transport%20and%20Public%20Works%20Malawi.pdf?sequence=5)

Loeb, Mitchell, and Arne Henning. "Living Conditions among People with Activity Limitations in Malawi. A National Representative Study." *SINTEF*, 2004,  
<https://sintef.brage.unit.no/sintef-xmlui/handle/11250/2461628>.

MACRA, MACRA,  
[www.macra.org.mw/?page\\_id=9131](http://www.macra.org.mw/?page_id=9131).

Mayo Clinic Staff. *MAYO Clinic*, MFMER, 16 May  
2019,

[www.mayoclinic.org/diseases-conditions/diarrhea/symptoms-causes/syc-20352241](http://www.mayoclinic.org/diseases-conditions/diarrhea/symptoms-causes/syc-20352241)

Page 5 of

6

Messenger, Chloe. "Digital Insights Malawi: Information and Communication in Rural Communities."

*Digital @ DAI*, 2 May  
2018,

[dai-global-digital.com/digital-insights-malawi-communication-among-rural-communities.html#:~:text=On%20average%2C%20just%20under%2070,high%20penetration%20for%20rural%20Malawi.&text=Inte](http://dai-global-digital.com/digital-insights-malawi-communication-among-rural-communities.html#:~:text=On%20average%2C%20just%20under%2070,high%20penetration%20for%20rural%20Malawi.&text=Inte)  
restin

National Institute of Health. *Zinc*, USA.gov, 10 Dec. 2019,  
[ods.od.nih.gov/factsheets/Zinc-Consumer/](https://ods.od.nih.gov/factsheets/Zinc-Consumer/).

Nordqvist, Joseph. "What are the health benefits of zinc?" *Medical News Today*, edited by Debra R.

Wilson, World Health Organization, 5 Dec. 2017,  
[www.medicalnewstoday.com/articles/263176](http://www.medicalnewstoday.com/articles/263176).

Plus, Medline. "Zinc in diet." *Medline Plus*, edited by Emily Wax, MelinePlus, 9 Apr.  
2020,

[medlineplus.gov/ency/article/002416.htm](https://medlineplus.gov/ency/article/002416.htm).

Planet, Lonely. "Malawi in Detail." *Lonely Planet*, Lonely Planet,

[www.lonelyplanet.com/malawi/narratives/practical-information/transport/getting-around/car-motorcycle](http://www.lonelyplanet.com/malawi/narratives/practical-information/transport/getting-around/car-motorcycle)

Ruth S. MacDonald, The Role of Zinc in Growth and Cell Proliferation, *The Journal of Nutrition*,

Volume 130, Issue 5, May 2000, Pages 1500S–1508S,

<https://doi.org/10.1093/jn/130.5.1500S>

World Health Organization. *The World Health Report*, World Health Organization,

[www.who.int/whr/2002/chapter4/en/index3.html](http://www.who.int/whr/2002/chapter4/en/index3.html). Accessed 26 Apr. 2020.

You and Your Hormones. *You and Your Hormones*, Society for Endocrinology,

[www.yourhormones.info/glands/pituitary-gland/](http://www.yourhormones.info/glands/pituitary-gland/). Accessed 26 Apr. 2020.