NUTRITION INTERNATIONAL

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THE NEED FOR INVESTMENT IN UNIVERSAL SALT IODIZATION

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SUMMARY

Iodine deficiency disorders (IDD) cause a spectrum of negative health and cognitive developmental outcomes. It is estimated that 16.2 million babies are born each year without the protection that iodine offers the growing brain. Iodine deficiency is a public health problem in many countries. Investing in universal salt iodization (USI) has been, and continues to be, the best intervention for the control and prevention of IDD. There is a need to continue to invest in USI in key countries to ensure that children can reach their full human capital potential.

THE PROBLEM – IODINE DEFICIENCY DISORDERS

Iodine is a micronutrient essential to the production of thyroid hormones that control many functions in the body, including growth and development.[1] The human body does not naturally produce iodine. While many foods such as seaweed, fish, cheese, milk, and lima beans contain iodine, the amount of iodine present in the soil and water varies with the level of the mineral across different regions where these products come from. A teaspoon of iodine is all a person requires in a lifetime, but because iodine cannot stay in the body for a long time small amounts are needed regularly.

Iodine deficiency causes a spectrum of disorders, collectively termed as Iodine Deficiency Disorders (IDD), ranging from retarded development, poor cognitive function, and goiter, to severe cognitive disability and death. It is most damaging during fetal development and in the first few years of a child's life.[2] In developing countries, approximately 16.2 million babies are born each year without the protection that iodine offers the growing brain.[3] Overall, nearly one billion people globally remain at risk of iodine deficiency.[4] Based on the latest data, 28 out of 194 World Health Organization (WHO) member countries are categorized as iodine deficient.[5]

IDD result from inadequate thyroid hormone production due to insufficient iodine in the body. During pregnancy and early infancy, iodine deficiency can cause irreversible effects that last a lifetime.[11] Breast milk contains iodine; however, if a mother's iodine levels are low, infants may suffer from iodine deficiency. A study of 57 healthy lactating women in the Boston area in United States found that 47% of the women may have been providing their infants breast milk containing insufficient amounts of iodine.[12] Therefore, to ensure that infants receive sufficient amounts of iodine, it is crucial to reduce iodine deficiency in breastfeeding mothers and infants.

This knowledge brief aims to provide information about the costs, health and human capital benefits of investing in universal salt iodization (USI), and to call on policymakers across the world to scale up USI programs to ensure all children can reach their full development potential.

THE SOLUTION – UNIVERSAL SALT IODIZATION

The most effective way to combat this public health threat is through salt iodization. Salt iodization has been one of the most successful public health campaigns in the world over the last few decades. The WHO adopted USI in 1993 as the recommended intervention to provide adequate dietary requirements of iodine regularly to people. Salt is widely available and consumed in regular amounts by people of all dietary intakes through all seasons. Therefore, USI was rapidly scaled up to become the primary intervention for IDD control in the world.

Currently, 108 of the total 139 low- and middle-income countries have legislated the mandatory fortification of salt.[6] The number of countries where iodine deficiency is a public health problem was halved from 110 in 1993, to 54 by 2003, and subsequently further decreased — as it currently stands at only 28 countries.[5] However, at least 22% of households in low-income countries around the world still consume salt that either is not iodized or is not adequately iodized.[9] Coverage of iodized salt is highest in East Asia and the Pacific region (92%), followed by South Asia (89%). Iodized salt coverage is the lowest in West and Central Africa, where about 25% of the population consumes salt without any iodine in it.[10]

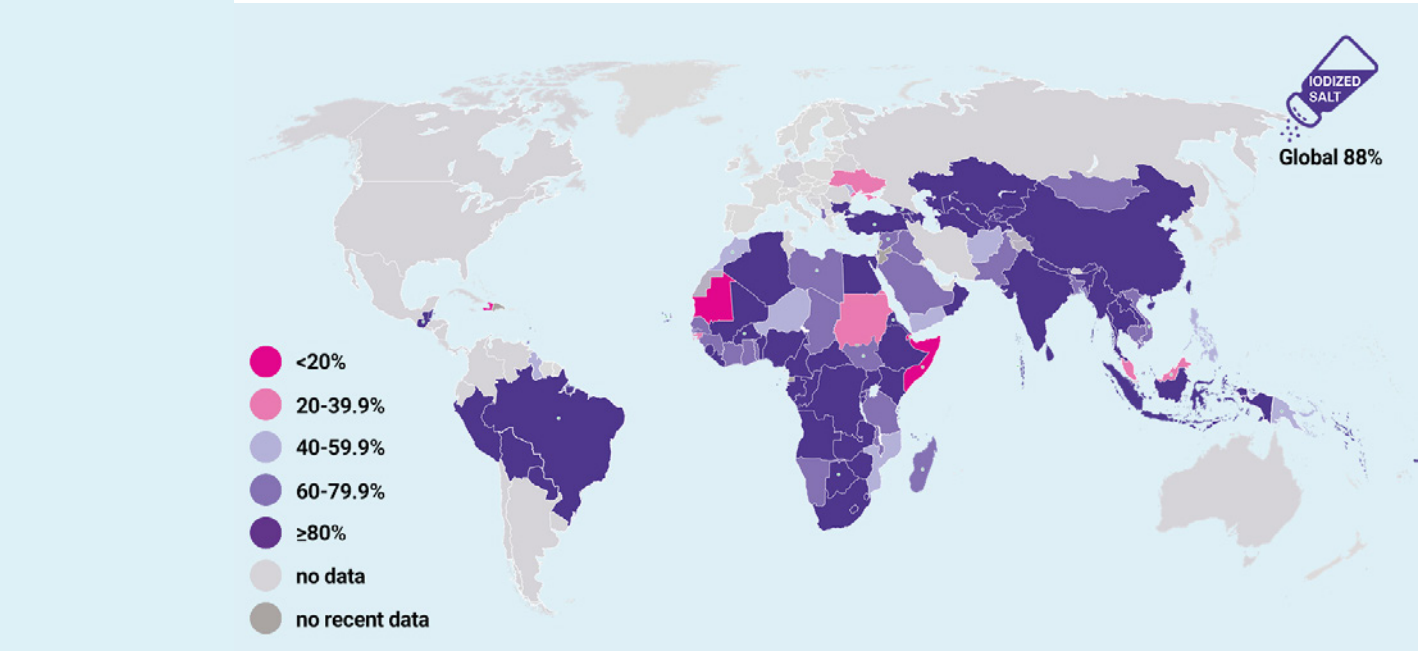

Figure 1. Percentage of households consuming salt with any iodine, 2018

Source: *UNICEF global database, 2019, based on Multiple Indicator Cluster Surveys (MICS), Demographic and Health Surveys (DHS) and other nationally representative household surveys, 2013-2018.*

Note: *The most recent country data between 2013 and 2018 are mapped. However, countries with older data (2000-2012) are denoted with a circle and are not included in the global or regional aggregates.*

Salt iodization involves various cost components such as the costs for micronutrient premix (KIO^3), special fortification equipment and processes, transportation, marketing, and sales costs incurred by the salt industry as well as quality assurance and monitoring, testing, and enforcement costs necessary to initiate and oversee the industry.

After initial external seed funding and technical support, in a self-sustained USI intervention, the costs are usually borne by the public and private sectors, with public sector bearing 10% and the private sector salt industry firms bearing 90% of the cost. These costs borne by the private sector then pass on to consumers of iodized salt.[35] The scarce data available on the costs of salt iodization suggest that this intervention may cost as little as USD $0.05 per person per year in public sector funding. The cost of scaling up USI programs vary depending on the country context, existing coverage, and market delivery mechanisms. However it is generally considered a low-cost nutrition intervention.

The health and human capital benefits of USI

There is abundant evidence on the effectiveness of iodized salt in preventing IDD. A recent systematic review spanning more than eight decades, and across low-, middle- and high-income countries found that exposure to iodized salt was associated with reduced risk or prevalence of goiter, cretinism[13], low intelligence or low urinary iodine excretion[14], and increased median and mean urinary iodine excretion.[15,16] Iodized salt also reduced the risk of goiter regardless of age group, the concentration of iodine in salt, or underlying risk of iodine deficiency at baseline.[17]

Estimating the full health and economic benefits of USI programs have proved difficult due to the lack of comparability in indicators used. In the 1960s, Total Goiter Rate (TGR) was the recommended indicator of population level iodine status.[18] Development of goiter in an individual takes years, and, once their nutrition has been corrected, it takes years for their thyroid to return to normal size.[19] In some cases, the thyroid may never return to normal size.[20] This made it hard to assess the success of USI programs, since TGR reflected past, rather than present iodine deficiency. To correct this, a new indicator, median urinary iodine concentration (MUIC) was adopted, which helps classify countries as having optimal iodine, iodine deficiency, or iodine excess. Since the baseline (TGR) and endpoint (MUIC) indicator data isn't exactly comparable, there hasn't been much published on the economic benefits of USI.[21]

However, recently researchers have examined the relationship between TGR and MUIC, and undertook regression modeling to predict hypothetical national TGR values based on 2019 MUIC data.[22] They then compared national TGR values from 1993 and the hypothetical values for 2019 for 139 countries, in order to estimate the health and economic benefits that have been realized due to USI programs.[23] As per this analysis, between 1993 and 2019, about 720 million cases of IDD have been prevented by USI,

resulting in about $33 billion in potential global economic benefits.[24] They also estimated that about 4.8 million newborns will be affected by IDD in 2019, which would result in lifelong productivity losses equal to approximately of $12.5 billion.[25] Therefore, there may be a strong economic argument in support of investing in USI.

Increase in height, IQ, and cognition

There is ample evidence of the association between iodine exposure and cognition. A 2014 systematic review by WHO found that children exposed to iodized salt during gestation, infancy, and early childhood had an IQ score of more than 8.18% higher than unexposed children.[26] This effect was significantly greater among children who were exposed to higher concentrations of iodine in salt. A similar 2013 systematic review and meta-analysis of 10 intervention studies found that iodine supplementation in utero increased IQ in children five years old and under by an average of 7.4 points.[27]

Tafesse et al. (2018) found that USI in India led to significant increases in height in children up to one year — increasing height by 1.85 cm.[28] The effects of USI on height-for-age Z-scores are most substantial for children zero to six months. Tafesse also studied the cognitive effects of mandatory iodine fortification on children aged five to 10 years in rural India and concluded that exposure to higher availability of iodized salt in early life improved basic numeracy skills by 4.81% for girls and with 2.67% for boys.[29] Additionally, girls also improved their literacy scores.[30]

Another study examining the long run impact of an intensive iodized oil supplementation program that took place in Tanzania between 1986 and 1997 found that children protected from iodine deficiency during their first trimester in utero attain an estimated 0.35 to 0.56 additional years of schooling relative to others. Furthermore, this effect is almost twice as high for females.[31] This is important since one extra year of schooling, as estimated by the World Bank, results in an increase in income of nine percent per year, though it may range from 5.7% to 11% depending on the geography.[32]

Increase in workforce productivity

According to human capital theory, investment and increase in education leads to an increase in the future productivity of the population. Adhvaryu et al. (2018) compared the outcomes for cohorts introduced to iodine-fortified salt in utero as opposed to older, unexposed cohorts, in the United States. They found that exposure to iodized salt in utero led to an increase in labor force participation by 1.2 percentage points among women, and total income increased by 11%.[33]

Adhvaryu et al.'s findings are consistent with findings from Switzerland. Politi (2015) estimated the long-term impacts of large-scale salt iodization in Switzerland, which took place from 1920 to 1930. It was found that cohorts who were born in previously highly iodine-deficient areas were three percent more likely to enter top tier occupations with higher cognitive demands (such as legislators, senior officials, technicians and associate professionals) after the introduction of iodized salt. The estimated impact of iodization on the wages of these cohorts was higher, accounting for about 1.9% of annual median earnings in 1991.[34]

Economic analyses suggest that USI programs, with an estimated benefit-cost ratio of 30:1, offer among the highest return on investment from public health interventions.[36]

NUTRITION INTERNATIONAL'S LEADERSHIP IN USI

Through the support of the Government of Canada, Nutrition International has been programing in USI since its inception in 1992. Nutrition International works with national governments, industry and other partners to strengthen the enabling environment for USI by fostering government leadership, ownership and commitment to sustainable salt iodization programs; supporting policy development and strengthening legislative and regulatory systems.

Nutrition International improves salt industry capacity in target countries by providing simple and easy iodization techniques to small, local salt producers. Working with local salt producers is critical to increase iodized salt consumption in hard to reach households. Nutrition International also provides technical support to help industry improvements in the iodization process, technology, and internal quality control.

Since 2002, Nutrition International has invested approximately CAD $90 million to support the USI agenda in many countries across the world, particularly in its core countries in Africa (Ethiopia, Kenya, Nigeria, Senegal, and Tanzania) and Asia (Pakistan, India, Indonesia and Bangladesh).[37] Moreover, Nutrition International is a board member of, and critical influencer in, the Iodine Global Network which aims to keep salt iodization on the agenda as a key intervention for the global nutrition community.

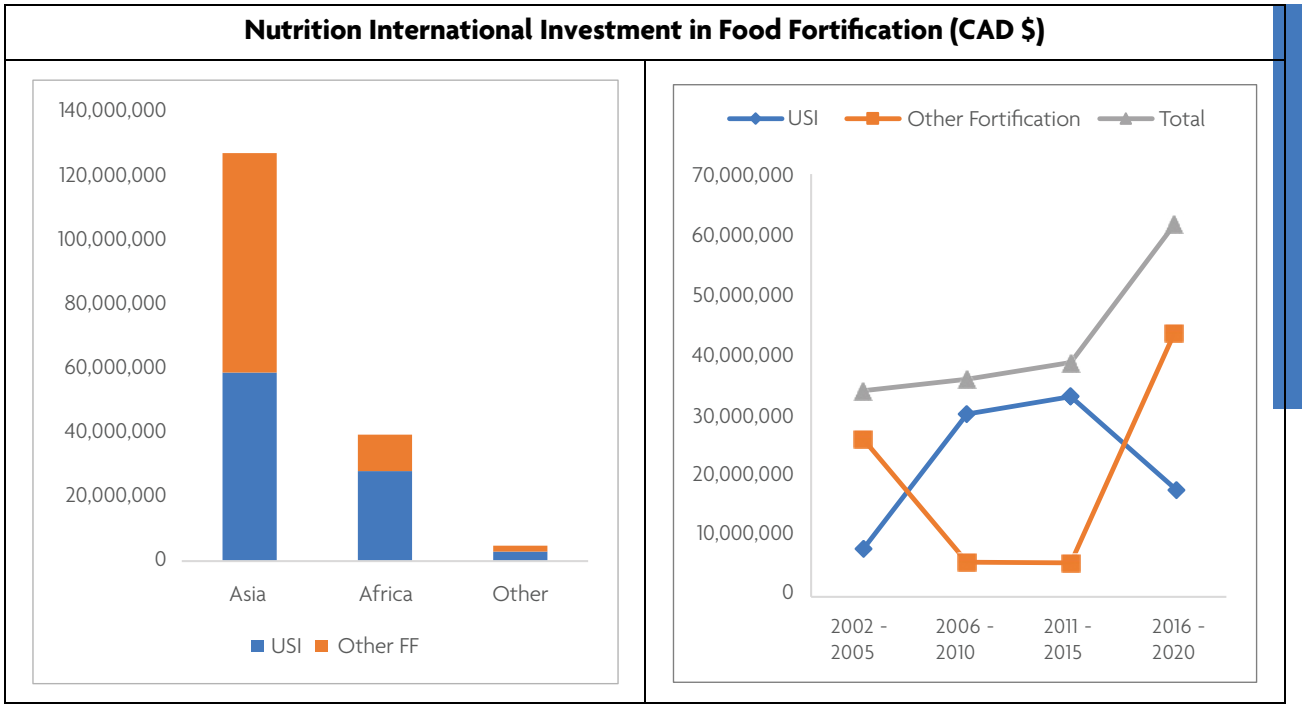

Figure 2: Nutrition International Investment in Food Fortification

Since 2011, Nutrition International's investment in USI programs has decreased. This is because with the passage of time, in most of Nutrition International's program countries, the major costs of salt iodization have moved from the donor to the salt industry and the country governments. In this way, in many countries, the USI programs are run via successful public-private partnerships which are aimed to ultimately become independent of any external funding assistance.

Between 2014 and 2020, Nutrition International's work in USI reached 440 million additional people yearly, including more than 110 million women of reproductive age. By ensuring adequate iodine level in mothers, Nutrition International's work helped protect 45 million newborns, and prevent 936,000 cases of mental impairments from 2014 to 2018.[38]

While the investment and the resulting health and human capital impact of Nutrition International's investment to date has been substantial, there is a clear case for sustaining and further scaling up of USI programs in strategic countries around the world.

RECOMMENDATIONS

1. **Renew commitment to USI by investing more domestic and international resources.** USI is one of the world's most impressive success stories of scaling and sustaining a public health nutrition intervention. Investment in salt iodization gives the best return in the form of human capital, and for its sustainability, public and private industry investments are crucial. However, the development sector and donors' seed funding is also fundamental. Nutrition International will continue its efforts in generating donor support for building viable partnerships amongst the public and private sector and civil societies to achieve the last mile in USI.
2. **Improve quality control and enforcement mechanisms.** Although governments have increased commitments to USI, budget and human resource constraints continue to make monitoring and enforcement of USI interventions challenging, especially in contexts where the industry is composed of many scattered and disorganized processors. Nutrition International will continue to support governments to strengthen their monitoring and enforcement capacity and to put in place sound and innovative systems, including data collection and reporting.
3. **Harmonize standards and policies at the regional and global levels per global best practices and evidence.** Though all countries have full or partial iodization policies and practices in place, work is still needed to ensure that these are aligned with international best practices and based on existing global evidence.
4. **Collect USI-related data.** There is a lack of updated data related to the status of iodization at the production level, the iodine status of the population, and the costs of USI programs. The Global Scorecard of Iodine Nutrition notes that significant data are missing, and nearly half of the iodine consumption estimates of countries are over ten years old and in many cases missing.[5] There is a need to address this data gap.
5. **Strengthen the capacity of the small-scale salt industry.** In many Nutrition International intervention countries, the small-scale salt sector still provides much of the salt supply, particularly for the lower socio-economic strata. As such, there is a need for ongoing support to strengthen the capacity to produce adequately iodized salt for the small-scale production sector, in parallel with efforts to promote industry consolidation.

6. **Raise awareness for USI to increase demand for iodized salt.** As the program matures, the production of adequately iodized salt has advanced considerably in many countries. The next step is to strengthen the demand for adequately iodized salt among the general population. Nutrition International will continue to support its government and other partners to develop appropriate promotion and behavior change strategies to encourage iodized salt consumption and raise awareness of IDD.
7. **Support Small Scale Salt Industry consolidation.** Many countries are facing difficulty in achieving USI as a sizeable portion of the salt industry in these countries is comprised of many small scale salt processors (SSSPs) which are widely scattered, often not registered/ informal using very primitive techniques of salt production and salt iodization lacking quality control practices and becoming the main source of un-iodized salt. To address the challenge, Nutrition International will support approaches towards salt industry consolidation, where SSSPs' salt is sold to a central investor, quality improved, iodized, packaged and then marketed and or the SSSPs are merged and graduated to medium or large scale industry.

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