Conference

Proceedings

DRAFT 15 JANUARY 2020

DO MICRONUTRIENT DEFICIENCY CONDITIONS EXIST IN ISRAEL IN 2019? Challenges and Opportunities for Food Fortification

Conference Date: Thursday, November 7th, 2019
Location: Ashkelon Academic College Conference Center
Ben Zvi St, 12, Ashkelon, Israel

Sponsorship

Department of Nutrition, Israel Ministry of Health
Ashkelon Academic College
Israel Association of Public Health Physicians

Conference Steering Committee	
Prof. Zohar Mor– Chairman	Ashkelon College, Public Health turkiz1@013net.net
Prof. Ronit Endevelt	Nutrition Department, Ministry of Health ronit.endevelt@moh.gov.il
Prof. Ted Tulchinsky	Ashkelon College, School Health Professions tulchinskyted@hotmail.com
Prof. Aron Troen	Hebrew University, Department of Nutrition aron.troen@mail.huji.ac.il
Prof. Niva Shapira	Ashkelon College, Nutrition niva@nshapira.co.il
Prof. Hagai Levine	Igud Rofei Briut Hazibur hagai.levine@gmail.com
Prof. Nadav Davidovich	Ben Gurion University, School Public Health nadav.davidovitch@gmail.com
Eli Gordon	Sherut Hamazon, Ministry of Health eli.gordon@moh.health.gov.il
Ofer Amsalem	Ashkelon College, Publicity Department ofer1973@gmail.com

Rapporteurs
Yael Wolff Sagy, MPH PhD
Shani Rosen, BsC Nutrition
Ted Tulchinsky, MD MPH

PROGRAM	
9:00-9:30	**Welcome**: Prof. Shlomo Grossman – ACC President Prof. Sigal Sidetski – Head Public Health Services, Israel Ministry of Health Prof. Hagai Levine – Chair, Israel Association of Public Health Physicians, Braun School of Public Health, The Hebrew University of Jerusalem
9:30-10:15	**Keynote 1:** ***Fortifying Food and Monitoring Nutrition Worldwide*** Prof. Omar Dary, USAID
10:15-10:35	***Keynote 2:Findings and Recommendations of the MOH Committee on Food Fortification*** Prof. Ronit Endevelt, Ministry of Health
10:35-10:55	***Are We Magnesium Deficient?*** Prof. Yonah Amitai, Bar Ilan University
10:55-11:10	***National Iodine Survey among Children and Women in Maccabi Health Services*** Dr Jonathan Arbelle, Maccabi Health Services
11:10-11:25	***Vitamin D Deficiency in Israel*** Prof. Ted Tulchinsky, Ashkelon Community College
11:25-11:40	***Is There Still Folic Acid Deficiency in Israel?*** Dr. Matan Cohen, Hebrew University
11:40-11:25	**Coffee Break**
12:15-12:30	***Findings from the "MABAT" Israel Health and Nutrition Surveys*** Dr. Tali Sinai, Israel Center for Disease Control, MOH
12:30-12:45	***Regulatory Aspects of Food Fortification*** Ms. Anat Kabiah Ben-Yosef, Israel MOH Food Services Dept.
12:45-13:00	***Fortifying the Food Chain with Nutrition Sensitive Agriculture*** Prof. Niva Shapira, Ashkelon Academic College, Nutrition Dept.
13:00-13:15	***Salt Iodization – An Industry Perspective*** Ms. Aliza Ravitzki – Melach Haaretz (Salt of the Earth) Ltd.
13:15-13:30	***Should We Spoon Feed Health - Mandatory Fortification or Free Choice?*** Prof. Boaz Lev, Emeritus Director General of the MOH
13:30-14:15	***Panel Discussion - all Speakers*** Chair, Prof. Aron Troen, The Hebrew University of Jerusalem School of Nutrition Science
14:15-14:30	***Conference Summary: A Road Map for Prevention of Nutritional Deficiencies and Food Fortification for Israel*** Prof. Aron Troen, The Hebrew University of Jerusalem School of Nutrition Science
14:30	**Lunch**

OPENING STATEMENT AT THE NUTRITION ENRICHMENT CONFERENCE

Prof Sigal Sidezki
Head Public Health Services, Israel Ministry of Health

Public health is fundamental multidisciplinary profession, and nutrition and food play a key role in promoting health and preventing morbidity. As everybody knows, both the research and the label guidelines and recommendations, not to mention standardization on this subject, are very complex. Disagreements are not straightforward and there is no doubt those are the effects of economic, cultural, and fashion aspects. Through this tangle, we try to have a scientific and sustainable discourse.

Nutritional enrichment is considered to be of high benefit because it enhances the nutritional values of the consumed food without the need to invest resources in the behavioral change of the public and upon fairly effective coverage of vulnerable target populations. This aspect is in line with the approach to social responsibility and equality and resolves multiple failures we have seen in trying to impose the responsibility and implementation of health promotion in solitary human behavior. Unfortunately, there are many failures in this strategy.

Those benefits include additional nutritional enrichment features:

The cost of added nutrients is low in relation to the total cost of the enriched food (supplementation of micrograms of dietary ingredient per kg of food increases the price by only fractions of a percentage), so that in many cases the enrichment cost can be lowered for the consumer.

Quality control costs are often borne by the manufacturer. Global cumulative experience proves that mandatory enrichment programs are more effective than voluntary programs with a certain price control.

When there is experience with one nutrient component, for example, iron-enriched flour, it is easier and cheaper to add another nutrient to the same agent, for example adding folic acid to iron-enriched flour. It is widely accepted that standard-related enrichment costs, raising public awareness, as well as oversight and monitoring apply to governments. Therefore, the government must set a dedicated budget for this purpose.

The savings can be seen in improving the public's health and wellness, in reducing social gaps, and in reducing health care costs accordingly.

In Israel, the flour used to be enriched with Vitamin B until the 1970s but due to logistical problems and difficulties in quality control as well as thinking that the diet of the population and therefore there were no more shortages, it was decided to stop enriching the food.

Nowadays, many foods in Israel are voluntarily enriched mainly to make the product look more attractive and healthy to the public, thus snacks and cereals (ultra-processed foods) are enriched while basic products such as milk and flour are not.

Along with the increase in obesity rates, we are witnessing a population nutritional deficiency in what we call "hidden hunger."

In an attempt to settle this matter, the Ministry of Health set up a number of advisory committees, the most recent of which was established in 2015, with the appointment of the then-head of public health services, Prof. Itamar Grotto.

The head of the committee was Prof. Ronit Endevelt, who directs the Nutrition Department at the ministry, and it was attended by leading researchers and nutritionists in the various sub-committees. After more than two years of work, the committee submitted its recommendations, which we would like to present today, while discussing population deficiencies and trying to answer whether the enrichment mechanism is the most effective contemporary mechanism and under what conditions.

This conference will serve as a basis for the ongoing discussion in the Ministry of Health regarding the possibility of nutritional enrichment regulation, and this, of course, provided the discussion receives economic and legal prioritizing in the Ministry of Health.

MANDATORY FOOD FORTIFICATION FOR PREVENTION OF NUTRITIONAL DEFICIENCIES: HEALTH IN ALL POLICIES PERSPECTIVE

Prof Hagai Levine

Chairperson, Israeli Association of Public Health Physicians, Israel Medical Association
Associate Professor, School of Public Health, Hadassah-Hebrew University

Health in all policies is an approach to public policies across sectors that systematically takes into account the health implications of decisions, seeks synergies, and avoids harmful health impacts in order to improve population health and health equity.

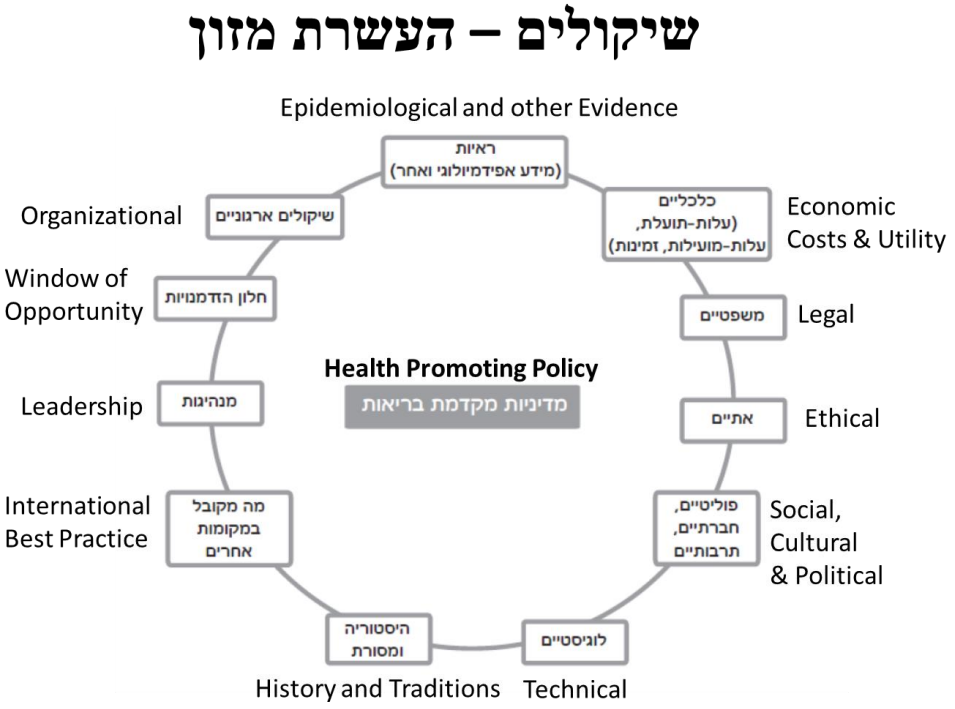
From health in all policies perspective, ensuring healthy food and prevention of nutritional deficiencies at the population level, could be achieved by several combined strategies, such as: taxation of unhealthy food and subsidized healthy food, ban on advertisement and limiting marketing of unhealthy food, health education and mandatory food fortification. Prevention strategies should pay special attention to health disparities and disadvantaged populations.

In order to promote healthier food for improving public health we need a multi-dimensional partnership of professionals, researchers, civil servants, politicians, journalists and activists. This coalition should be strong enough to overcome the massive

power of the food industry, who is affecting policy for their commercial interests, rather than for the public interest.

There are many considerations to take into account while making decisions regarding health promoting policy, such as mandatory food fortification (Fig. 1, adapted).[1] We should first base our decisions on evidence: the epidemiology of nutritional deficiencies in our target populations and on evidence from interventions elsewhere. But we should not neglect other considerations: economic, legal, ethical, political, social, cultural, logistic and practical, organizational, history and tradition. Last but not least, leadership and timing may be crucial, and this may be the key element missing so far in Israel.

We look forward to learn from discussion of all aspects, with focus on the evidence, in this important conference, initiated by the Ashkelon Academic College, Ministry of Health and Israeli Association of Public Health Physicians.



Levine H, Krentzler Y, Davidovitch N. (2016). Health in All Policies – A Model for Health Promoting Policy. Chapter 14 in: Health Promotion: From Theory to Practice. ["In Hebrew"].

INTRODUCTION

Prof Ted Tulchinsky

Ashkelon Academic College, School of Health Professions

Deficiencies of key micronutrients at clinical and subclinical levels account for approximately 7.3% of the global burden of disease. Food fortification is the addition of essential minerals and vitamins to basic foods likely to reach the majority of a population in an effective, safe and inexpensive manner. Pharmacological supplements are also used to increase the supply of micronutrients, but this intervention is expensive with small population coverage and with risks of excessive intake1.Food fortification is one of the most successful public health intervention methods and as recommended by the World Health Organization [2] and UNICEF [3] as an effective strategy for addressing global public health in high, medium and low-income countries worldwide, as common edible products are manufactured by well-developed industries and accessed by high percentages of consumers in high, medium and low income countries.

Food fortification has been implementedover the past centurymainly in the Americas, less in Europe, and more recently in Africa, the Middle East, and Asia. Along the years, fortification initiatives have shown their safety, efficacy and cost effectiveness to reduce the damaging effects of micronutrient deficiency on human health.[4] Switzerland introduced iodization of salt in 1922 and maintains it to the present time.In the United States food fortification was first instituted in 1924 with iodization of salt to reduce the high prevalence of goiter, [5] and thyroid deficiency conditions.[6] Strong support by WHO, UNICEF and an international consortium on iodine deficiency has brought success in this global effort in most countries in the world, although continued monitoring and fortification adjustments may be needed.[7, 8]

Widespread awareness of rickets and the identification of Vitamin D brought voluntary fortification of milk with vitamin D in the US in the 1930s in order to eliminate rickets, which was very widespread in industrial cities of the US and Europe.[9, 10] The return of rickets in vulnerable population groups, and recognition of milk fortification as

essential to reduce osteomalacia, osteoporosis and fractures in the elderly promoted mandatory fortification of milk in some countries.[11], [12] Flour fortification enriched with iron and vitamin B complex (thiamine, riboflavin, and niacin) became the norm of enriched foods following the horrendous epidemics of pellagra in the southern US in the early decades of the 20th century.

More recently, wheat flour has been used as the vehicle of folic acid (vitamin B9) for preventing neural tube defects, as this abnormality appears within the first days of pregnancy when women might not be aware of it.[13]Food fortification is considered by the CDC (Centers for Disease Control and Prevention) to be one of the ten great US achievements of public health in the twentieth century.[14, 15] Folic acid for the prevention of birth defects (Neural Tube Defects) was proven to be highly effective in 1991, and as a result, daily intake of folic acid intake was recommended for all women in the age of fertility, but compliance was generally less than one third of this population group. In order to overcome this limitation, fortification of flour was made mandatory in 1998 in the US, Canada and Chile, with subsequent documented reduction in NTD births, and is currently successfully applied in 84 countries.[16, 17, 18, 19]

Prof Dary, our guest keynote speaker has consulted on this topic in many countries including Jordan and the Palestinian Authority (PA), both of which strengthened their salt iodization programs, and introducedmandatory fortification of wheat flour in consultation with Prof Dary and other world class consultants in 2005-06, including fortification of basic foods imported from Israeli manufacturers.

The topic of micronutrient deficiency has been reviewed extensively over many years by the Ministry of Health, which appointed a series of expert committees since the Berry Committee in 1996, and in Healthy Israel 2020 [20, 21], which was adopted as a national government policy paper in 2011, but not acted upon. In 2015, a new food fortification committee headed by the Director of the Nutrition Department of the Ministry was convened, and reported to the Ministry, which now faces the challenges of implementation of mandatory fortification following “the Canadian model”. The new findings and recommendations of the Endevelt Committee were presented to this conference, including data from national intake surveys (MABAT) of representative

samples of children, adults and the elderly in the following abstract by Tali Sinai and colleagues of the Israel Center for Disease Control of the Ministry of Health..

Over the years many reports in Israel have been published in the professional literature demonstrating high rates of micronutrient deficiency conditions and recommending national needs to be addressed in keeping with international best practice of food fortification. [22, 23] In addition to long standing issues of iron deficiency and anaemia in infants,[24, 25] vitamin D deficiency has been amply documented in Israel.[26,27,28,29] Recent unpublished data from the Ministry of Health hospitalization data set reports hospitalization of 124 cases of rickets between 2012 and 2017 with a total of 2072 days of hospital care (Haklai Z - personal communication, 2019). Barnea and colleagues reported a study of the Israeli national burden of hip fractures resulting from vitamin D and calcium deficiency osteoporosis costing nearly 720 million NIS in 2013.[30] Both rickets and the results of osteoporosis call for urgent measures to increase the vitamin D intake in all age groups by food fortification.

Iodine deficiency was demonstrated in reports of goiter studies as far back as the 1950s. Through monitoring the iodine concentration in urine, recent surveys, have shown high rates of iodine inadequacy among pregnant women and school-age children [31, 32] with regional variations, and recently in relation to areas using higher levels of desalinated seawater.[33,34] This situation is worrisome because iodine deficiency is the main cause of preventable mental retardation, as well as thyroid disorders even in adults. Israel ranks poorly in a recent report of iodine deficiency globally.[35] Increasing use of desalinated sea water in Israel exposes the population to water which has removed levels of natural intake of iodine, fluoride, magnesium and other minerals. The low levels of iodine and magnesium are presumed to be due to decreasing these elements in the nutritional status of the Israel population. The growing trend of development of desalination as planned to meet the water needs of the population and agriculture thus bears with it health risks unless these elements are replaced in desalinated water supplies. Other mineral inadequacies that need attention are iron, magnesium, calcium, zinc and selenium.

Ministry of Health national surveys of nutrient intake in Israel for the years 2014-2016 of the most recent representative samples of the population were presented at the conference. These "MABAT" surveys show alarmingly high levels of deficiencies of important micronutrients that affect the Israeli population in all age groups surveyed. These very marked deficiencies include vitamins A, B group, C, D, E, folate and B12, as reported at this conference by Ronit Endevelt and by Tali Sinai. Abstracts of these studies are included in these Proceedings.

Low fat 1% milk and margarine have been fortified by law in Israel with vitamin A and D for many decades, however, the amount or the coverage appears to be insufficient to prevent deficiency of these vitamins in vulnerable groups. Infant supplements of vitamin A and D and iron have been routine for many years, but attention to other age groups is still necessary. Israel also fortified flour in the 1950s but this practice was stopped in 1989 for unknown reasons.

Sadly, Israel has been very slow to re-adopt food fortification to reach most of the population despite the growing literature of serious micronutrient deficiencies. Since 1996, the Ministry of Health appointed three expert committees, all of which recommended mandatory fortification of salt with iodine, cows' milk with vitamin D, and flour with iron, vitamin B complex and folic acid, as well as labelling, enforcing fortification, and population monitoring i.e., "the Canadian model".

Our neighbours in the Palestinian Authority and Jordan have successfully implemented food fortification since 2006, in some cases involving Israeli food industries to supply fortified flour and salt.[36, 37]Studies of the efficacy of fortification on raising biomarkers of essential minerals and vitamin are shown in studies from the US,[38] Finland[39] and even well documented in a low income country, the Cameroons in Africa.[40]

Our keynote guest speaker Prof. Dary presented an international overview of food fortification[41]. Israeli presenters covered many topics on providing evidence from national surveys of high levels of deficiencies in folic acid, vitamin D, iodine, iron, magnesium, and all vital issues for human health along the lifespan.

The Conference summary panel strongly supported mandatory fortification. This conference will hopefully mark a major step forward in nutritional security policies for

Israel and with implementation reduce the demonstrated nutritional deficiency conditions and health inequalities in the Israeli population.

The societal and ethical context is important to consider as well. Israel has some 2.3 million people (530 thousand families) living in poverty out of some 9 million total population. [42, 43] In 2016, 18.6% of families (463,300 families) lived in poverty.1.8 million (22%) people, lived in poverty. Of these, 842,300 (31.2%) were children. Voluntary fortification is not helpful for them. Israel's poverty rates are among the highest in OPEC countries, and nutritional security is harmed by poverty among minority groups, and in the general population as well. This is a public health issue of utmost importance. We hope this conference will hasten long delayed implementation of fortification of basic foods such as salt, milk and flour and catch up to best practices of public health nutrition to promote the health and well being of all Israelis.

This topic is the subject of a national conference held by Ashkelon College on 7 November 2019 co-sponsored by Ashkelon College School of Health Professions including the bachelor's degree programs in Public Health and Nutrition, with the Israeli Ministry of Health, in collaboration with the Israeli Association of Public Health Physicians. The MOH Director of the Public Health Service and Director of Nutrition Department presented a new food fortification policy commitment of the Ministry.

Updated sources from the US National Academy of Science, the international reference standards, are listed below. [44]

The conference summary panel strongly supported mandatory fortification as recommended by the Endevelt Committee and the Ministry of Health. This conference will hopefully mark a major step forward in nutritional security policies for Israel and with implementation to reduce the demonstrated nutritional deficiency conditions and reduce health inequalities in the Israeli population.

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KEYNOTE PRESENTATIONS

OMAR DARY:FORTIFYING FOOD AND MONITORING NUTRITION WORLDWIDE

USAID

RONIT ENDEVELT: FINDINGS AND RECOMMENDATIONS OF THE MOH COMMITTEE ON FOOD FORTIFICATION IN ISRAEL: FROM RESEARCH TO POLICY

The Israeli Committee for Food Fortification Recommendations [2015-2019]

KEYNOTE 1: FORTIFYING FOOD AND MONITORING NUTRITION WORLDWIDE

Omar Dary

Micronutrient deficiencies are recognized as a globe public health concern, affecting an estimated 2 billion people worldwide (Silvia Maggini, 2018, Regan L. Bailey, 2015). Micronutrients are essential for human health. (Regan L. Bailey, 2015). Micronutrient sufficiency status can be characterized along a continuum, with several key marginal points; Estimated Average Requirement, **EAR;** Tolerable Upper Intake Level, **UL;** maximum requirement (two standard deviations higher than the EAR values) and Nutrition Recommended Nutrient Intake, **RNI**).

Determination of nutrient requirements at the individual level is complex, therefore, recommendations for individual purpose are based on RNI values; whereas, populational recommendations aim towards the intake of quantities between the EAR and the UL values.When large proportions of the population are unable to reach the EAR values, a practice for complementing the nutritional value of the diet has been providing micronutrients beyond those present in the natural foods, such as supplementation and food fortification. These practices have been used in public health since the beginning of the 20th Century.

The individual biological impact of any micronutrient intervention depends on the need of that nutrient and on the quality and amount of the supplied micronutrients rather than to the vehicle, although the nature of the latter determines the population coverage and the sustainability and permanence of the intervention. Food fortification, when implemented using commonly and widely consumed food vehicles that are manufactured by formal and a few food industries, has shown to be the most effective and low-cost intervention, as it takes advantage of already existent delivery mechanisms. (Monitoring and Evaluating Food

Fortification Programs: General Overview Technical Consultation July 7, 2006) Thus, for example, only $0.02/year per person are needed for providing sufficient iodine through iodized salt, and from $0.25-$0.50/year per person for complementing together most of the other micronutrients in the diets, using food vehicles such as cereal flours, dairy products, vegetable oils and sugar. The accuracy of a suitable food vehicles depends on population dietary habits e and the food industry structure.

Several successful cases of food fortification have been documented: neural tube defects associated with folate deficiency are being prevented by the addition of folic acid to wheat flour in Canada, the United States, Australia, South Africa, Chile, Costa Rica, and the Middle East;incorporation of iron to both wheat flour (Makhumula et al. Manual for internal monitoring of fortified wheat flour, 2007) and milk has improved the iron status and reduced anemia in Costa Rican children; vitamin A supplied through sugar has maintained vitamin A sufficiency in Guatemala and other countries of Central America;iodine provided through salt maintains iodine sufficiency worldwide. Similar achievements have not been demonstrated for reduction of rickets due to vitamin D deficiency, as well as nutritional status of vitamin B_{12} and zinc, because the provided amounts have been insufficient or, most probable, because the impact has not been well measured.

Implementation of effective food fortification programs requires not only the enactment of standards and regulations but also the introduction of reliable mechanisms of compliance and enforcement, as well as surveillance and evaluation of the performance and benefits of these programs at the population level. In the absence of these elements, permanent appreciation and attention for the food fortification programs cannot be created and maintained. These activities can be implemented at low cost, but it requires of novel, simple, and common-sense methodologies. Thus far, too complicated and costly procedures are limiting the introduction, expansion and monitoring of these programs. In conclusion, there is a clear need for collaboration of professionals from different disciplines to promote an efficient food enrichment program.

KEYNOTE 2: FINDINGS AND RECOMMENDATIONS OF THE MOH COMMITTEE ON FOOD FORTIFICATION IN ISRAEL: FROM RESEARCH TO POLICY

The Israeli committee for food fortificationrecommendations [2015-2019]

Ronit Endevelt

Director of the Nutrition Department of the Israel Ministry of Health

Background

Food fortification is considered to be a cheap and cost-effective method to balance the nutritional needs of populations while increasing equality. Previously- appointed committees recommended food fortification: the Berry Committee, 1996 recommended mandatory iodine supplementation in salt, iron, calcium and vitamins B in flour; and vitamin D in milk. The National Nutrition Committee 2020 published its recommendations in 2011 once again advocating in favor of food fortification, similarly to the recommendations of the Berry Committee.

The Current Fortification Committee

In 2015, the current Nutrition committee focused on a framework for policymaking and implementation. Fundamental elements included review of existing data on nutritional status in Israel, investigation of fortification and food regulatory status, quantifying the prevalence of current morbidity, examining public and professional knowledge on the topic, and the development of recommendations, guidelines, and regulatory tools. Four professional committees were created:

1. Food chain from the agriculture crops to the plate
2. The regulation committee
3. The bio-monitoring committee
4. The surveillance committee

Results

Why it is important to fortify?

1. Nutritional fortification enhances the nutritional values of the food consumed without the need to invest resources in the behavioral change of the public and within effective coverage of vulnerable target populations.

2. The cost of micronutrients is minimal in relation to the total cost of the fortified food; in many cases the enrichment costs can be reduced to the consumer.
3. Quality control costs are often borne by the manufacturer.
4. Cumulative evidence across multiple countries suggests that mandatory enrichment programs are more effective than voluntary programs with some price control.
5. It is easier and cheaper to add additional nutrients to an existing carrier (e.g., adding folic acid to flour already fortified with iron). Fortification costs related to regulation, labeling, communication and public awareness, and government control and monitoring are minimized when fortifying a single vector with multiple micronutrients.
6. Benefits include overall improvement in the health and quality of life for the population, in reducing social gaps, and in reducing health care costs accordingly.

Type of fortifications:

1. Mandatory(i.e., legislation)
2. Voluntary, although sometimes enshrined in legislation regarding the amount allowed to be added, and sometimes not

Challenges in developing a national fortification policy:

1. Lack of a proper national nutrition status monitoring system that includes biochemical data (biomarkers).
2. Unknown scope of fortification of food in Israel
3. Unknown current contribution of the total intake of nutrients in the population
4. Uncertainty about how many foods are fortified without any control?
5. Excess consumption, especially for nutritional components where the gap between recommended intake and UL is low.
6. Unnecessary fortifications of many foods; Manufacturers use fortification as a tool for healthcare and commercial marketing of harmful foods such as soft drinks, snacks, and sweets to be perceived by the consumer as "healthier".

Food Chain Committee recommendations:

1. Finding solutions for climate change impact on Mediterranean crops.
2. Promoting nutritional/ health value of basic foods and strengthening the nutritional aspect - functional of plant and animal food.
3. Improving the quality of the animal- and plant-food chain.
4. Study the control of desalinated and recycled water and the effects on food quality.
5. Promoting agricultural waste management and waste utilization.

6. Emphasizing the nutritional aspect of agricultural quality indices relating to the food chain, to promote health-oriented agriculture to both man and the environment.
7. Developing a network of researchers raising levels of nutritional components - vitamins and minerals, natural substances, and phytonutrients to improve the food chain
8. Establishing a comprehensive laboratory to create a validated and updated food composition database of all food components currently being consumed in Israel.

Resources and actions are needed to improve nutritional deficiency states:

1. Establishment of a monitoring and control management system
2. Legislation on mandatory fortification:1) Salt iodization, 2) Milk enrichment with Vitamin D; 3) Iron, Vitamins B, Folate and B12 in flour
3. Details of the standard fortification specification for each dietary supplement and the appropriate vector
4. Create partnerships with all stakeholders - population, science, research, industry, law
5. Social market for public partnership

Personnel resources and budget to implement fortification policies

1. MOH Nutrition Division: A unit that includes nutritionists looking to improve the databases and regular monitoring, including updated fortification mandatory and voluntary mandates, with regular academic and international consultations.
2. MOH Food Services: Enrichment quality control and internal-industrial quality control: laboratories must be recognized by the Ministry of Health on a frequent basis in accordance with existing international rules.
3. External quality control: quality control of state monitoring and laboratory samples.
4. Composing the regulations and passing it in the Knesset

Recommendations for Legislation

Fortification vector	Nutrients
Milk and milk substitutes	Vitamin D 400 Microgram
Table salt	Iodine 30 ppm

Flour including gluten free	Vitamin B's, folic Acid, B12, Iron

Developing a suitable national fortification policy will improve the wellbeing of the Israeli public, reduce health and social disparities, prevent enormous waste of unrealized human potential and significantly reduce health system costs to the Israeli economy.

Conclusion

The committee recommends the urgent enactment of a sustainable, statutory fortification policy based on reliable and up-to-date data as part of an overall nutrition and health strategy for Israel, in keeping with international and WHO best practice guidelines.

MICRONUTRIENT DEFICIENCY CONDITIONS IN ISRAEL:

ABSTRACT SUMMARIES OF PRESENTATIONS

Do Nutrient Deficiencies Exist in Israel 2019? Gathering the Evidence

The conference offered an opportunity to gather and present evidence on the state of micronutrient deficiencies in the Israeli population. These included the study of magnesium deficiency reported by Yona Amitai, a problem recently aggravated by the process of increasing reliance on seawater desalination; a process presenting an important step towards water supply sustainability for Israel, but carrying significant public health consequences that should be carefully considered.

A survey of iodine levels conducted among Maccabi Health fund members and reported by Jonathan Arbelle, showed mild to moderate iodine insufficiency among school age children and iodine deficiency among pregnant women. Iodine deficiency is also aggravated by increasing use of desalinated seawater for community water supply.

Vitamin D deficiency was found in Ministry of Health MABAT studies in all age groups. Hospitalization data of the Ministry of Health showed unexpectedly high rates of rickets in Israeli children up to adolescence were reported by Ted Tulchinsky, as additional evidence representing the tip of an iceberg of vitamin D deficiency.

A study by Annie Reiss and Matan J Cohen assessed the rated of Neural Tube Defects (NTDs) over a twelve-year period in Israel following the Ministry of Health recommendation for Folic Acid supplementation by women in the age of fertility, showing nearly twofold reduction in NTD rates. Nonetheless, Israeli NTD rates remain higher than in other developed countries that have fortified flour with Folic Acid.

Finally, results from the Israeli National Health and Nutrition Surveys, 2014-2016 were presented by Tali Sinai, showing the majority of the Israeli population to be at risk for micronutrient deficiency, especially vitamins A, C, D and E, folate, calcium, magnesium and iron.

ARE WE MAGNESIUM DEFICIENT? MAGNESIUM DEFICIENCY AGGRAVATED BY SEAWATER DESALINATION AND ADVERSE HEALTH EFFECTS

Yona Amitai, Meital Shlezinger, Michael Shechter

Bar *llan University*

Israel produces 600 million cubic meters of desalinated seawater (DSW) per year, which constitutes 60% of the drinking water (DW) supply. While using DSW is vital, it may cause adverse health effects, because magnesium, fluoride, and iodine, essential for human health are removed during desalination. The Ministry of Health (MoH) estimated ten years ago, that lack of magnesium in DSW could cause 250 fatalities annually. As DSW supply has doubled since then, the number of life lost is probably twice.

Only 20% of a person's daily magnesium supply comes from water, and 80% from food. Magnesium derived from water is a "safety net" for the majority of the Israeli population whose dietary magnesium intake is below the recommended WHO levels. Consumption of magnesium deficient water may aggravate magnesium deficiency.

Numerous papers have shown that magnesium deficiency can cause increase cardiovascular morbidity and mortality, diabetes and colon cancer. Studies have shown higher cardiovascular morbidity and mortality in association with consumption of DW with low magnesium content.

We have conducted the first study of evaluating the risk of cardiovascular mortality in association with consumption of DSW. We evaluated 30-day and 1-year all-cause mortality of acute myocardial infarction (AMI) patients enrolled in the biannual Acute Coronary Syndrome Israeli Survey (ACSIS) during 2002-2013. Patients (n=4678) were divided into 2 groups: those living in regions supplied by DSW (n=1600, 34.2%) and non-DSW (n=3078, 65.8%). Data were compared between an early period [2002-2006 surveys (n=2531) - before desalination] and a late period [2008-2013 surveys (n=2147) - during desalination].

The thirty-day all-cause-mortality was significantly higher in the late period in patients from the DSW regions compared with those from the non-DSW regions (HR=2.35 CI 95% 1.33-4.15, P<0.001) while in the early period there was no significant difference (HR=1.37 CI 95% 0.9-2, P=0.14). Likewise, there was a significantly higher 1-year all-cause mortality in the late period in patients from DSW regions compared with those from the non-DSW regions (HR=1.87 CI 95% 1.32-2.63, P<0.0001), while in the early period there was no significant difference (HR=1.17 CI 95% 0.9-1.5, P=0.22).

Admission serum magnesium level (M±SD) in the DSW regions (n=130) was 1.94±0.24mg/dL compared with 2.08±0.27mg/dL in 81 patients in the non-DSW (P<0.0001). Thus, higher 30-day and 1-year all-cause mortality in AMI patients, found in the DSW regions may be attributed to reduced magnesium intake secondary to DSW consumption (1).

A following historical prospective analysis was done in 177,900 members aged 25-76 during 2004-2013 of Clalit Health Services, using its electronic medical record database. Multivariable analyses were adjusted for age, sex, socioeconomic status, smoking status, and body mass index, comparing population living in regions where DSW provided the main DW supply compared with those living in regions with no DSW. An increased odds ratio was found for Ischemic Heart Disease (IHD) (0.96, 95% CI 0.93-0.99 at baseline and 1.06, 95% CI 1.02-1.11 at the end of the follow-up period), in those living in the DSW regions, but no time trend was observed. While the risk for IHD increased during the study period, the risks for diabetes and colorectal cancer (CRC) were unchanged. Long-term studies are needed for assessing the risk for CRC due to the long latency. The higher risk for IHD has practical public health implications and raise the need to add magnesium to DSW.

Scientists from Gilat Research Center examined the effects of irrigation with DSW on agriculture. They found a gradual decrease of magnesium and sodium concentrations in produce grown in Israel since the inception of nationwide seawater desalination in 2008. Also in 550 samples of 29 different fruits and vegetables, magnesium levels were considerably lower than in those taken from the USDA database.

In conclusion: The use of DSW in Israel is associated with increase in cardiovascular morbidity and mortality and marked reduction of magnesium in DW and in fruits and vegetables. We call the Israeli MoH to enhance the plan for adding magnesium to DSW, with no further delay.

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IODINE DEFICIENCY IN A NATIONAL IODINE SURVEY AMONG CHILDREN AND WOMEN IN MACCABI HEALTH SERVICES

Jonathan Arbelle

Maccabi Health Services

Data regarding iodine sufficiency amongst populations have been collected and presented for many years on the Iodine Global Network's (IGN) website. Many countries around the world have set up programs to increase population consumption of iodine and thus reduce worldwide iodine insufficiency disorders.

Data regarding iodine sufficiency in Israel was lacking until 2017, when the first national Israeli iodine sufficiency survey was completed and published (Ovadia Y, Arbelle JE, Gefel D et al. Thyroid 2017:27). Urine samples were collected and tested in the Maccabi Health Service (MHS) central laboratory. Our data showed mild to moderate iodine insufficiency among school age children and iodine deficiency among pregnant women. All areas of the country were similarly affected. Both groups had amongst the lowest levels of 24-hour urinary iodine published on the IGN website.

The importance of our publication was not only in the presentation of novel data on iodine sufficiency in Israel. No less important than novel data presented was the novel method used for screening the population. The Ministry of Health's Helsinki Committee approval board accepted the concept that in this case public good overrode autonomy of the individual and allowed for testing of pre-throw-away urine samples after clinical tests had been completed. The possibility to collect and test multiple samples a data set from all sections and sectors of the country allowed the quick and inexpensive survey of iodine sufficiency in the country. Additionally as electronic clinical records have been used for decades in MHS, big data is available to proceed with studies which will enable follow-up of future iodine supplementation programs in Israel

In view of the low level of iodine sufficiency affecting all sectors and all parts of the Israeli population, a call is made for the urgent implementation of a national iodine supplementation program. Using methods such as we have developed for iodine sufficiency screening and using big data routinely collected in electronic medical records, such a program could be easily monitored.

Source: Ovadia YS, Arbelle JE, Gefel D, Brik H, Wolf T, Nadler V, Hunziker S, Zimmermann MB, Troen AM. First Israeli National Iodine Survey

Demonstrates Iodine Deficiency Among School-Aged Children and Pregnant Women. Thyroid. 2017.27(8):1083-1091. doi: 10.1089/thy.2017.0251

VITAMIN D DEFICIENCY IN ISRAEL

Ted Tulchinsky

Ashkelon Academic College

Vitamin D deficiency is a long-standing health concern and currently considered a worldwide pandemic requiring a high priority public health response. Vitamin D is a fat-soluble vitamin normally produced by sunlight acting on the exposed skin. It is essential for bone health for preventing rickets, osteoporosis resulting in hip and other fractures, carcinogenesis, cardiovascular diseases and other diseases associated with aging.

The commonest clinical manifestation of vitamin D deficiency is rickets, yet even milder deficiency damages foetal development. Development of nutritional sciences in the 1920s revealed the cause of rickets to be lack of sun exposure in blighted urban slums, and a successful method to ensure adequate vitamin D intake in the public by recommending cod liver oil in the diet for children. Vitamin D fortification of milk began in North America in the 1930s and grew rapidly in the 1940s. As seen in Canada, premature cancellation of wartime milk fortification led to a comeback of rickets, which is now reappearing around the globe, including in high-income countries.

Adequate vitamin D fortification and supplementation to prevent rickets during pregnancy and childhood are vital public health policy issues globally. In 2003, the American Academy of Pediatrics (AAP) recommended vitamin D supplementation for all infants, especially those being breast fed, and for children; in 2008, the AAP recommended an increase in the daily intake for all children up to age 18 to 400 IU per day. Well-baby clinics in Israel have for many decades recommended supplements with vitamin D drops for all infants from birth to one year of age; however, the rate of compliance has not been studied.

Recent studies of nutritional intake of children adults and elderly MABAT studies between 2015-2017 show high percentages of low levels and frank deficiency in all three study groups a presentation in this conference by Tali Sinai and colleagues. A second study of large numbers of clients of three of the four Israeli Sick Funds providing care to some 40% of the Israeli population in a big data study also reported in this conference by Ronit Endevelt The study shows biomarker blood test level deficiency of vitamin D with over 80% with low vitamin D levels or frank deficiency in all age groups. High rates of vitamin D deficiency in the total child and adult population are the tip of an iceberg for developmental damage to infants lasting into school age, and of osteoporosis and

fractures among adults and the elderlyplacing a heavy burden of disease and economic cost to the health system. Hospital discharge data in Israel between 2012 and 2017 show unexpectedly high rates of rickets especially between infancy and 14 years of age.

Israel has mandated vitamin A and D fortification of margarine and in 1% milk for many decades. The Israel Standards Institute is now in the process of mandating fortification of all cow's milk. Fortification in flour as in the Palestinian Authority may also be necessary.

Unpublished data from the Ministry of Health on hospitalization for rickets shows an average of 17.7 admissions utilizing an average of 296 days of care in the same time period 2012to 2017. A 2018 publication by Berner et al reported a study of hip fracture incidence and costs of care by Sinai and colleagues showed costs of over 270 million shekels in treatment with high rates of death in the first and subsequent years following the hip fractures mostly due to long term vitamin D and calcium deficiencies.

Vitamin D deficiency in Israel, as in many countries, is a preventable condition that results in important morbidity in all age, gender and ethnic groups.

Mandatory milk fortification of all milk and a monitoring program should be urgently implemented in Israel as recommended by three major special committees of the Ministry of Health and by former and current director generals of the Ministry. The Milk Committee of the Israeli Standards Institute which is responsible for milk regulations approved mandatory fortification of milk in the past year which should take effect in approximately 2 years. It is incumbent on the Ministry to supervise the compliance of manufacturers in the process, production and follow-up on Vitamin D in the population, as well as a program to promote public awareness and knowledge of vitamin D in milk and supplements for special groups such as pregnant women, infant and children as well as older population groups. Caregivers should promote suitable vitamin D supplements during pregnancy, lactation as well as for infancy, child, adult and senior groups.

Vitamin D Insufficiency* in Blood Test of Sick Fund Members Survey, Israel 2018

Age	% Borderline or Deficient
0-12 months	28%
1-3 years	53
4-10	76
11-18	85
19-50	84
51-64	85

65+	79
All ages	**83**

Source: Endevelt R, Director Department of Nutrition, Israel Ministry of Health
Data from ¾ Sick Fund lab reports data sets
Notes: % rounded to nearest number. Based on survey of Sick Fund members.
*International Norms: Borderline 10-32 ng/ml; deficient <10 ng/ml

Hospitalizations and Length of Stay for Rickets in Israel, 2012-14 and 2015-17

Age/Discharges/ Total Days	Discharges		Bed days		Mean Length of Stay	
Age	2012-14	2015-17	2012-14	2015-17	2012-14	2015-17
00_	9	10	508	640	56.4	64.0
01_04	13	8	92	156	7.1	19.5
05_14	21	20	88	92	4.2	4.6
15_34	8	12	33	58	4.1	4.8
35_54	8	5	86	137	10.8	27.4
55_64	0	3	0	10	0	3.3
65+	4	9	73	99	18.3	11.0
All	60	64	880	1,192	14.7	18.6

Note: Includes ICD9 826.0 and 826.1 i.e., acute and chronic rickets, 2012-2017
Source: Haklai Z. Hospital Discharge Information System, Israel Ministry of Health, 2019

IS THERE STILL FOLIC ACID DEFICIENCY IN ISRAEL?

ISRAELI NATIONAL NEURAL TUBE DEFECTS FOLLOWING FOLIC ACID SUPPLEMENTATION POLICY

Annie Reiss, Matan J Cohen

Hebrew University

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Neural tube defects (NTD) are common and disabling congenital malformations. Despite prevention efforts, these defects remain a public health challenge both globally and in Israel. In 2000, the Ministry of Health published recommendations on daily folic acid (FA) supplementation for women of reproductive age. We evaluated the long-term impact of the supplementation policy on NTD rates in Israel and the need for further changes in policy.

We found a substantial, nearly twofold reduction in NTD rates over a twelve-year period following the FA recommendations, from 17.9 to 9.7 cases per 10,000 live births. Rate reductions were seen in all ethnic groups, although rates in the Bedouin population remain high. Nonetheless, Israeli NTD rates remain higher than in other developed countries. Most NTD affected pregnancies were terminated. This was true in all subgroup analysis except for women with primary school education alone. These were the same group with overall higher NTD rates.

There is a need for further vigorous implementation of FA interventions in Israel, especially in vulnerable population. The global success of mandatory fortification of grain strongly advocates its consideration in Israel.

MICRONUTRIENTS IN THE ISRAELI DIET: RESULTS FROM THE ISRAELI NATIONAL HEALTH AND NUTRITION SURVEYS, 2014-2016

Tali Sinai

Israel Center for Disease Control, MOH

Sinai T, Lubel S, Axelrod, Shimony T, Nitsan L,Goldsmith R, Keinan-Boker L

Background: Low intake of several micronutrients, in particular vitamin D, iodine, calcium and magnesium, were reported to be of public health concern. Iron and folate

consumption may also be lacking in certain groups, e.g., young children, women of childbearing age and during pregnancy.

Objective: The aim of this study was to estimate the prevalence of inadequate consumption of 16 micronutrients in the Israeli diet by various age groups.

Methods: We used the 2014-2016 Israeli National Health and Nutrition Surveys (RAV-MABAT) data. The representative cross-sectional surveys included: MABAT KIDS (2-11 years old, n=1792), MABAT ADULTS (18-64 years old, n=2957) and MABAT ZAHAV (≥65 year old, n=1039). Nutritional intake assessment was based on the 24-hour dietary recall method, conducted in a face-to-face interview, at the interviewee's home. Micronutrient consumption were estimated using the Israel Food and Nutrient Database, and were compared to the Dietary Reference Intakes (DRI). Results are presented as % below the Estimated Average Requirement (EAR).

Results: There was complete information on food intake for 1768 children (98.7%), 2904 adults (98.2%) and 937 (90.2%) elderly. Prevalence of nutrient intake below the EAR by survey is presented in Table 1. Over 40% of the adults and the elderly intakes were below the EAR for 10 of the 16 nutrients. Results varied from 3.6% for copper to 95.9% for vitamin D (ages ≥2 y).Noticeable deficiencies were observed in the intake of vitamin D and calcium with over 90% and over 75% of the population, respectively.

For the 9-11-y-old subgroup, the percentages of nutrient intakes below the EAR (i.e. vitamin A - 77.1 %, folate - 56.8%, magnesium - 45.7%) were similar to those of the older age groups and about 1.5-3.5 fold higher compared to those aged 2-3 y and 4-9 y. Insufficient consumption of phosphorus was markedly high (81.6 %) in the 9-11-y-olds.The prevalence of low iron and folic acid intakes was higher in females than in males, mainly in children (4-11 y) and woman of childbearing age(18-44 y).

Analysis by ethnic group showed similar results among Arabs and Jews, with slightly higher percentages of intakes below EAR of vitamin A, vitamin D, Riboflavin and iron, and lower percentages for calcium and zinc, among Arabs compared to Jews, in most age groups. No data were available regarding iodine intake, as food content of iodine is lacking in the Israeli database.

Table 1: Prevalence below EAR of micronutrient in the Israeli diet

Nutrient	**MABAT KIDS 2-11 y N=1768**	**MABAT ADULTS 18-64 y N=2904**	**MABAT ZAHAV ≥65 y N=937**
Vitamin A	55.3	75.3	71.4
Vitamin C	30.2	58.3	54.3
Vitamin D	95.9	92.3	92.8
Vitamin E	64.2	87.4	90.6
Thiamin (Vitamin B_1)	17.5	47.0	56.9
Riboflavin (Vitamin B_2)	11.1	30.2	27.0
Niacin (Vitamin B_3)	18.0	23.0	26.9
Folate (Vitamin B_9)	33.2	72.5	77.0
Vitamin B6	11.2	35.0	56.9
Vitamin B12	17.2	45.6	49.5
Calcium	77.6	80.7	88.6
Iron	9.1	29.3	23.7
Zinc	23.8	57.3	67.8
Magnesium	14.7	54.8	59.4
Phosphorus	25.6	18.8	20.6
Copper	3.6	20.5	24.3
Percentages are presented with sample weights applied. EAR, Estimated Average Requirement			

Conclusions

The majority of the population in Israel is at risk for micronutrient deficiency, especially for vitamins A, C, D and E, folate, calcium, magnesium and iron. Efforts are needed to increase essential nutrient consumption especially among high risk populations such as children, pregnant women and the elderly. Systematic and periodical monitoring of micronutrient consumption is warranted, as well as completion of the Israel Food and Nutrient Database with respect to missing micronutrients.

Surveys design, operation and results have been described in detail, and partially available at https://www.health.gov.il/UnitsOffice/ICDC/mabat/Pages/default.aspx

REGULATION DILEMMAS WHILE STRUCTURING A NEW FOOD ENRICHMENT POLICY

Anat Chavia Ben-Yosef, Food Control Services and Avidor Ginsberg, Division Of Nutrition – Ministry of Health

When introducing to the food regulation as a whole, a clear separation must be kept between the primary and the secondary legislation. Food enrichment regulations are handled under secondary regulation and are initiated by the government's Ministry of Health. The regulatory procedure has several steps, is time demanding and involves many interest holders. This procedure begins at detecting the need for a specific regulation and continues until the final publication in the official journal once the Social Welfare and Labor committee of the Knesset has approved it.

The current regulatory referral on food enrichment is held in few food standards, most of which require the enrichment process in order to restore nutrients that may have been lost through the production process. Moreover, there is voluntary enrichment in the food industry, which is yet to be regulated.

While determining food enrichment regulations obvious considerations to the existing legislationhave to be made in order to incorporate it For example: the food additives Regulations (some food additives may have a dual function in the food), food labeling regulations which relates to the product's name, nutritional information, nutrition and health claims), food supplements.

The following challenges and dilemmas are required to be taken into consideration while determining local regulations:

1. Determining a suitable approach for Israel, whether voluntary or mandatory, or a combination of the two.

2. Determining vectors, food nutrients and theiradded amounts based on the nutrition status of the local population in Israel.

3. The future legislation must be based on validated data expressing the lack or excess of food nutrientsin the Israeli population.

4. Creating preliminary conditions to ensure the safety of use, including specific production aspects for the enrichment of the food, (mainly dispersion of the food

nutrients, and their stability throughout the products shelf life), storage and transportation of food.

5. Development of research and surveys tools in order to constantly maintain and monitoringthe effects ofthe enrichmenton the nutrition status of the local population in Israel.

6. Being a food-importing country, may require Israel to justify and scientifically substantiate local requirements for food enrichment in any future trade barriers.

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A MANUFACTURER VIEWPOINT

Aliza Ravitsky,

Melach Haaretz salt company,

Melach Haaretz voluntarily produces iodized salt for the Israeli market in consultation with the Ministry of Health. She identified the high cost of advertising and creating a market for iodized salt as a major barrier to the use of iodized salt by Israeli households, and signaled industry's expectation that government would underwrite a marketing campaign

SHOULD WE SPOON FEED HEALTH - MANDATORY FOOD FORTIFICATION OR FREE CHOICE?

Boaz Lev

Emeritus Director General of the MOH

Food fortification is a way to add food components that are missing or insufficiently provided by the diet. There are at least four ways to make these nutrients accessible to the public.

Each of these ways has its merits and downsides. Mandatory fortification is the most effective method of making the nutrients reach the desired target since it does not necessitate any behavioral change on the side of the individual - provided we know and understand his intake of foods.The addition of the nutrient is translucent and there is no extra effort by the consumer to achieve the nutrient as provided in the food.

Mandatory fortification regulated and enforced by the government has a downside. This method is fortification across the board through a specified food vehicle

and thus is consumed by groups who may not need it or even suffer from untoward health consequences.

On the ethical level it infringes the values of autonomy and freedom of choice while the dilemma is between autonomy and utility- maximizing social benefits.

Alternatives to mandatory fortification are voluntary fortification. This is lead by food industries. While on the choice issue this may be less coercive than mandatory fortification, there might be an inherent conflict of interest since the industry may promote foods with lower health values via claims of beneficial fortification. This may be mitigated by regulation and control over which foods and what claims may be used.

A more targeted method means to fortify by providing supplements such as tablets or other means to be used by those who need these supplements. This method while stronger on the autonomy and choice values is less effective due to compliance issues and the need for personal involvement and action. Health education and promotion are the most ethical involvements since they respect autonomy and choice yet are the least effective in achieving the targeted population.

The required change in behavior and active choosing may be an obstacle in achieving the level needed for health maintenance.

The role of government is to balance the risks and benefits of each fortifying methodology and weigh the ethical, behavioral and technical issues involved.

A pre-requisite is to gather relevant food consumption and diet composition in order to make decisions and to change them if necessary. A framework to make such decisions lies in implementing methodologies that stem from social justice theories. As an example – John Rawls, in Theory of Justice, suggests the use of "A veil of ignorance" which enables choosing an alternative that is least harmful to all parties involved (The minimax principle).

Risk analysis, social values, behavior and dietary information should be part of the moral equation leading to sound and healthy decisions while avoiding over medicalization of food and adhering to principles of variety, and moderation.

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1. Mark Lawrence Oxford University Press 2013 Food fortification: The evidence, ethics, and politics of adding nutrients to food,
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FORTIFYING THE FOOD CHAIN WITH NUTRITION SENSITIVE AGRICULTURE

Niva Shapira

Department of Nutrition, Ashkelon Academic College

Despite the age of abundance and the increase in availability and accessibility of food components, suboptimal nutrition and hidden hunger is still highly prevalent even in high income countries. This is due to factors including loss of vitamins and minerals over the course of industrial processing, nutritional poverty in weak populations, and/or primary and secondary deficiencies in soil and water due to geographical, climate, and agricultural factors like exhaustion of land and sea resources, overuse of fertilizers and pesticides, and more.

"Health Oriented Agriculture" aims to redirect food composition toward positive effects on human and environmental health, beyond the price-driven agriculture that may harm sustainability of the food chain.

Food enrichment/fortification with specific nutrients is the accepted nutritional/medical way of protecting public health against specific deficiencies proven to be a common risk factors in a population. However, because food components – nutrients and phytonutrients – work together, and all are required for optimal body health and function, awareness is growing of the potential advantage of the agricultural bio-fortification (BF) approach for enhancing the complete nutritional value of the food chain.

Carrier foods would be those widely and frequently consumed in regular diets, have tendency to concentrate the insufficient/deficient/missing components, and demonstrating synergism with the supplemented nutrients – supporting their assimilation and contribution to health, e.g., iron in beans, iodine and selenium in carrots, and many essential nutrients in milk and eggs.

BF in plants can be achieved through a variety of technological, agricultural, and genetic methods – conventional hybridization and/or genetic modifications/manipulations –with proven cost-benefit advantage and very high utility.

Soil fertilization and/or foliar spray have been shown to increase zinc and iron in grains and beans, and nitrate fertilizers potentially enhance their absorption and concentration in the edible parts. In repeated field studies, foliar spray of mixed nutrients increased grain zinc by 65%, iron 12%, and selenium and iodine approximately 300% and 900%, respectively. Selenium and iodine concentrations demonstrated effective augmentation in vegetables like carrots, lettuce and cauliflower. Beta carotene has been significantly genetically enhanced in sweet potato, rice and maize, to attain pro/-vitamin A Dietary Reference Intakes (DRI) through regular diets.

Animal foods would be advantageously selected as nutritional enhancers for their inherent nutritional value, including high-quality proteins and concentrated vitamins and minerals. Primary foods – milk and eggs, which have complete composition and unique capacity to concentrate essential nutrients for development and function – are leading carriers, especially eggs, which can effectively concentrate many micronutrients, including vitamins A, D, and E, and essential minerals selenium and iodine, and effectively enhance effectiveness of omega-3 polyunsaturated fatty acids. All the above can be attained by low marginal added costs, and thus widely affordable. This is especially important for malnourished populations, where animal-based BF can be considered as nutritional enhancement even in small amounts.

Israeli studies on food fortification with vegetarian (Flaxeed/Linseed) Omega-3 ALA showed significant increase in chicken eggs, meat, fish, and milk of omega-3 Polyunsaturated fatty acids **(**PUFA) and n6:n-3 ratio - about 3-5 times; and eggs with alpha Linolenic acid (ALA) further showed significant elongation of ALA-to- Docosahexaenoic acid (DHA) (18:3,n-3 to 22:6,n-3) long-chain polyunsaturated fatty acids (LCPUFA), resulting with one fortified egg attain ≈75% of minimal Daily Recommended Intake (DRI) of n-3 LCPUFA (DHA) for minimal added costs (≈5%). This is especially crucial for women of childbearing age, young children and the elderly for prevention of cardiovascular diseases –and otherwise deficient in the food chain.

Agricultural BF has the potential for significantly upgrading the food chain by adjustments according to regional climate, soil, and population conditions. BF requires regulation and controlled price, to enable affordability and accessibility of BF foods, as a primary tool. BF together with industrial fortification, are critically important for enhancing dietary contribution to nutritional security and public health in Israel and globally to reduce the burden of micronutrient deficiency conditions on health.

REGULATORY ASPECTS OF FOOD FORTIFICATION: MINISTRYOF HEALTH PERSPECTIVE

Ms. Anat Kabiah Ben-Yosef, Israel MOH Food Services Dept.

Avigdor Ginsberg - Nutrition Division, Ministry of Health

Several steps are needed to put in place a regulatory system for food fortification. It is a time-consuming process involving many stakeholders. Once a problem arises, regulations need to be drafted and the approved by the Knesset Health, Work and Welfare Committee and finally the regulations need to be published.

Currently, there are several regulations regarding enrichment of nutrients to foods. These regulations focus on the required addition of nutritional components to restore

original contents which were lost in production processes. Additionally, voluntary enrichment exists, which is not regulated by legislation.

It is challenging to develop food enrichment regulations because of the need to coordinate with regulations regarding food supplements, food marketing regulations, and other factors.

One starts with the existing laws and regulations, and needs to coordinate with the regulations regarding food supplements

Challenges accompanying the designing of local regulations including:

- Choosing a suitable method for Israel, which could be voluntary, mandatory or a mix of the two
- Selecting vectors, nutrients and quantities according to the dietary status of the Israeli population
- Assembling valid data expressing the nutritional status to make the case for enrichment
- Creating threshold conditions to ensure safety of use, including regulations related to the production (dispersion, stability), storage and transport of food.
- Developing a monitoring program to assess the effects of enrichment on the nutritional status.
- Establishing the scientific base for food import and trade enrichment requirements to justify future trade restrictions.

PANEL SUMMARY,

Chair, Prof. Aron Troen,

Hebrew University of Jerusalem School of Nutrition Science

The closing panel discussion responded to the coyly phrased title “Are there prevalent micronutrient deficiencies in Israel 2019? Challenges and opportunities for food fortification"by asking the speakers and audience three questions: 1) Is the presented evidence of prevalent micronutrient deficiencies in Israel credible and concerning?; 2) Would adopting mandatory food fortification as practiced internationally and recommended by MOH committees over the years be a safe and effective measure to alleviate such deficiencies, provided it is adapted to local conditions?; and 3) What are the key barriers and solutions to realizing and implementing the MN committee’s recommendations?

The answer to the first two questions was unequivocally affirmative. In Prof. Dary’s expert opinion the evidence presented on iodine insufficiency and the current rates of neural tube defects alone, are compelling arguments for initiating fortification immediately. He reiterated his view that Israel’s advanced scientific, medical and health capacity provide it with a unique opportunity to become a world exemplar of how to fortify food correctly, provided we learn from international experience and avoid the pitfalls that have weakened or undermined programs elsewhere.

Prof. Hagai Levine (Chair of the Israel Association of Public Health Physicians) stated that failure to proceed with mandatory, regulated food fortification would be

irresponsible. Prof. Sigal Sadetzki (Head of Public Health Services at the MOH) agreed, although she noted that the "devil is in the details". The ensuing discussion highlighted several issues that have hindered previous attempts to advance fortification, and outlined a road map to legislating a sustainable mandatory fortification policy, as recommended by the fortification committee and endorsed by the Deputy Minister of Health and the MOH Director General.

Scientifically, there are no major obstacles to specifying food fortification standards for Israel. The MABAT national nutrition and health surveys provide the necessary data to both determine the prevalence of deficient micronutrient intake, and to model how adding a given amount of a micronutrient (i.e. folic acid) to a vehicle food (i.e. flour), can deliver safe and effective increases in the population's intake of the required nutrients. Such models must account for the distribution of micronutrient intake from food, supplements and voluntarily fortified foods in the target and vulnerable populations, and identify the gap between the current and desired intake levels.

The population's intake of the intended vehicle is subsequently analyzed and used to calculate the optimal amount of micronutrient that can be added to the vehicle to safely and effectively improve intake in the target population without risk of excessive intake in other population subgroups. Specifying those foods that may and may not be fortified can also improve the safety profile of fortification programs by avoiding unanticipated and uncontrolled introduction of supplemental micronutrients into the food supply.

Although the MABAT surveys describe dietary *intake* they do not evaluate biomarkers of nutritional *status*. Ascertaining the prevalence of inadequate status is important both to motivate action and to provide a baseline against which the effectiveness and safety of fortification can be monitored. Until they do, existing health services can provide essential data. For example, as with the recent national iodine survey, national birth registries, sick fund laboratories, and electronic databases can be used for surveillance of sentinel populations. Use of such Big Data sets provide for feasible and cost-effective monitoring of the impact of fortification on nutritional status and related health outcomes. Funding will need to be appropriated for this purpose.

The technological hurdles are also minimal. Israel's food industry and supply chain has all the attributes that are necessary to provide for effective mandatory food fortification, including centralized manufacturing and milling and excellent technological expertise and capacity. Indeed, Israeli firms already export fortified salt and flour to the Palestinian Authorityand offer a small line of voluntarily fortified products to the Israeli market at a premium price.

Aliza Ravitsky, of the *Melach Haaretz* salt company, described how *Melach Haaretz* voluntarily produces iodized salt for the Israeli market in consultation with the Ministry of Health. She identified the high cost of advertising and creating a market for iodized salt as a major barrier to the use of iodized salt by Israeli households, and signaled industry's expectation that government would underwrite a marketing campaign.

Nevertheless, despite the negligible cost of iodization, the retail price of iodized salt is typically 4 – 12 times higher than that of regular price-controlled table salt. The unintended result is that government economic policy actually *discourages* the use of iodized salt.

International experience shows that when iodized salt and fortified food is sold at a premium, it increases health disparities because the less affluent households and food-insecure households that are most in need are less likely than more affluent households to purchase fortified foods. Moreover, advertising iodized salt as a healthful alternative to regular salt runs counter to the public health interest of reducing sodium intake. It also opposes the inherent logic of mandatory food fortification, which benefits the public's health by increasing nutrient intake without changing behavior. In short, the *status quo* favors voluntary, market-driven fortification, at the expense of public health, and is therefore untenable.

Thus, the main impediments to mandating fortification are neither scientific nor technological. Rather, the challenge has been to draft and pass legislation designed to regulate, enforce and fund fortification, according to the specific health and nutrition needs of the Israeli population. The decades-long failure to do so partly reflects concern over those significant regulatory, budgetary and political efforts that are necessary to give public health priority over competing interests.

WHO guidelines on food fortification and extensive international experience are important in support of the new Israeli policy and can help to reassure and guide Israel's response to these concerns. In fact, the first step of setting standards for fortified foods is already underway. At the urging of the MOH, the Israel Standards Institute has already begun to revise the salt and milk standards for fortification with iodine, calcium and vitamin D. However, the MOH Nutrition Division has only formal modeled the impact of fortification on intake for iodized salt, and targets for fortifying Israeli milk with vitamin D, and flour and bread with folic acid, vitamin B12, iron and other micronutrients remain to be completed.

Once ratified, new food standards will allow food producers and importers to market fortified foods and label them as such. Theoretically, such market-driven, voluntary fortification might improve the dietary intakes of some Israelis, but extensive international experience shows that uncontrolled voluntary fortification is less effective, more prone to promote risk of excessive intake and more likely to increase health disparities than mandatory (compulsory) and controlled food fortification. Indeed, the failure of voluntary salt iodization to prevent population iodine insufficiency in Israel is typical. Thus, it is crucial that in addition to revising the food standards, Israel enacts corresponding regulations following the "Canadian model" approach of specifying those food vehicles that must, may, and may not be fortified.

Another concern flagged by the MOH Food Services is that mandatory fortification might restrict free trade, particularly with Europe. But in fact, the World

Trade Organization allows countries to create their own national food standards in accordance with the CODEX Alimentarius, and to legislate mandatory fortification of locally produced and imported food, when required for public health. Indeed, the European Union does not require harmonized food standards. Rather, each European Member State regulates fortification based on the health needs of its own population. For example, of the 25 EU member states, 7 have compulsory enforcement of iodized salt use. Ten EU member States permit iodide (KI or NaI) only, two permit iodate (KIO_3) only, and 9 permit both iodide and iodate. Furthermore, the required iodine concentrations differ between member states based on each population's iodine status, and none of this prevents European trade. Simply stated, trade considerations do not trump mandatory fortification, provided the legislation is necessary to ensure public health.

Finally, the panel discussed the ethical issues raised by Prof. Boaz Lev, who was unable to advance fortification during his tenure as MOH Director General, and who framed the choice of mandatory over voluntary fortification in terms of paternalism vs. autonomy. While the panel supported the effectiveness and safety of fortification, there was not time to fully discuss the ethical justification for mandatory fortification.

Nevertheless, Prof. Ilana Belmaker, a public health physician from the audience, argued forcefully for the notion that the concept of autonomy includes state protection for those individuals whose choices are limited due to their economic and social circumstances, such as those most in need of mandatory fortification. Similarly, Prof. Ted Tulchinsky made a compelling case for the moral imperative for the State to protect the lives and wellbeing of its citizens who would otherwise suffer the consequences of the silent hunger of micronutrient deficiencies.

Permanently eliminating prevalent micronutrient deficiencies in Israel along with their grievous consequences will require perseverance and determination. This conference demonstrated that the MOH has the backing of national and international public health and nutrition professionals to do what is necessary to end silent hunger of micronutrient deficiencies through fortification, in the framework of a comprehensive national nutrition strategy.

The Conference supported the policy of food fortification as presented by Prof Endevelt. The MOH Public Health Services must include the drafting of fortification legislation in the MOH annual work plan; update cost utility analyses; make administrative arrangements to sustain fortification; establish a steering committee with a mandate to design, oversee and enforce the program; and provide for the periodic monitoring of the population's nutrient intake and status.

The MOH must continue to place public health over competing interests and resist political pressures that threaten to weaken and undermine effective and responsible policy. Doing so will ultimately improve the wellbeing of the Israeli public, by helping to lessen health and social disparities, reduce health system costs to the Israeli economy and

prevent the tragic waste of unrealized human potential from preventable deficiency conditions prevalent in Israel. The time to act is now.

CONFERENCE SUMMARY: THE WAY AHEAD

Aron Troen

In conclusion, the conference supported the recommendations of the Ministry of Health Committee on food fortification presented by Prof Ronit Endevelt,,Director of the Nutrition Department for mandatory fortificationof salt with iodine, Milk with Vitamin d, and flour with iron, vitamin B complex, folic acid and vitamin B12.

The conference recommended consolidating and sustaining a statutory fortification policy based on reliable and up-to-date information is urgently needed as an integral feature of an overall nutrition and health strategy for Israel.

Three key conditions that must be met to achieve this goal: maintaining political support, creating necessary administrative arrangements and ensuring sustained assessment and follow up monitoring.

Continued MOH leadership will be vital to establish a “fortification coalition” that can build the needed political support in partnership with stakeholders across government, the academy, the health professions, the food industry, consumer groups and most importantly the Israeli public. It is suggested to hold a follow-up conference in about one year to maintain continued support forf implementation and monitoring of the sorely needed policy recommended by the Endvelt Committee.