

Use of Iodized Salt in Processed Foods in Select Countries Around the World and the Role of Food Processors

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Executive Summary: The Micronutrient Initiative (MI) issued the Institute of Food Technologists (IFT) a project to assess the extent to which iodized salt is used in processed foods, as well as food processors' level of knowledge on iodine nutrition. Iodine is an essential micronutrient required by the body that is found in a limited number of foods, thus many individuals require additional sources of iodine to meet their daily requirement. Without these additional sources, a range of disorders referred to as iodine deficiency disorders (IDD), including mental impairment, may become present, with over 2 billion people worldwide at risk due to insufficient iodine nutrition. IDD is especially damaging during the early stages of pregnancy and in early childhood. In their most severe form, IDD includes cretinism, stillbirth, and miscarriage, and increased infant mortality.

Since 1994 the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) have recommended universal salt iodization (USI) as a safe, cost-effective, and sustainable strategy to ensure sufficient intake of iodine by all individuals. However, USI has in practice tended to focus only on table salt and not all salt destined for human consumption. Recent trends, particularly in industrialized countries, show that individuals are consuming the majority of their salt through processed foods, in which iodized salt is generally not used, rather than through iodized table salt. Additionally, recent initiatives to encourage reduced sodium consumption have prompted many consumers to reduce their intake of iodized table salt. While these trends in sodium consumption are more frequently observed in industrialized countries, they are expanding into many developing countries where iodine deficiency is also a concern. Thus countries which focus on iodization of table salt alone may not achieve optimal iodine nutrition of their population.

This report provides an overview of the 2 Phases of this project. Phase I was to conduct an environmental scan/desk review of processed food consumption patterns in 39 countries selected by MI (see Table 1). Phase II was to conduct an electronic survey of food processors and detailed telephone interviews with a small sample of select company representatives from 16 countries (see Table 2). Per the scope of work, IFT conducted a desk review to determine the types and level of processed food consumption in the 39 countries of interest, as well as to identify suppliers of the major processed foods consumed and the use of salt as an ingredient in those products. Whenever possible, IFT also gathered information on the sodium content of widely consumed processed foods and the sources of salt currently used in these products; the types of processed foods and extent to which they are consumed by different socioeconomic groups; if iodized salt was used in processed foods; and whether or not there are policies in place to influence dietary salt reduction and how these efforts are implemented. For Phase II, IFT reached out to food company representatives to determine their use of iodized salt in processed food products; their sources of salt; their awareness of iodine nutrition and salt as a fortification vehicle; and their interest in learning more about salt iodization. For the purposes of this project, processed foods are considered to be all food products that have undergone a change of character or been altered from their original form.

To complete the desk review, IFT conducted literature searches and Internet reviews for each of the 39 countries of interest from May to September 2010. IFT reached out to its members with expertise in the countries of interest and 3rd parties such as government agencies, food companies, salt suppliers, and nongovernmental organizations to gain contacts and information. The acquisition of literature or access to databases or other sources of information which are not freely available was limited. For Phase II, IFT sent an electronic survey to over 800 individuals from all 16 countries in October 2010. IFT reached out to its members and other contacts with expertise in the countries of interest, which included food

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companies and salt suppliers who were asked to complete the electronic survey, but also 3rd parties, such as academics, government agencies, nongovernmental organizations, and so on, who were asked to pass the survey along to their food industry contacts. Outreach included over 15 multinational food companies. The survey responses IFT received were limited; however, IFT made a substantial effort to obtain useful information for each country. IFT also used survey responses and personal e-mail communications to locate 10 food company representatives to participate in telephone interviews to gain more detailed information.

Many of the 39 countries reviewed struggle with food insecurity, thus it was generally difficult to find food consumption data for these impoverished nations, particularly data on processed food consumption. Nationwide food consumption data were helpful to better understand processed food consumption for those countries that collected it; however, developing countries often lack the resources for such a large undertaking. Smaller, published academic studies were most useful in identifying types of foods that may be available in the different locales within a country, at times including minimally processed foods.

IFT found that residents in many of the developing countries typically consume minimally processed foods such as bread and cheese, but that they do not frequently consume what are considered processed foods in “Western” society (packaged, prepared foods). Although processed foods may be available, consumption often differs based on income and region in the country. The more affluent and urban areas of countries appear more able to purchase processed foods, and therefore more likely to have a higher consumption rate.

A pattern of processed food consumption or lack thereof did not present itself for the various country categories assigned to the 39 countries evaluated. Whether the country has a heavy or high IDD burden or an opportunity to progress did not correlate with the consumption of processed foods in that country. IDD is present in both developed and developing countries, and countries from each of these categories may or may not have processed foods available. Some countries with the heaviest burden for IDD may also have many processed foods available such as China, while another country with high IDD does not appear to have even minimally processed foods readily available. However, the majority of the European countries and Latin American countries identified on the list do have processed foods more readily available than some other countries identified, although not all are prepared with iodized salt.

Many of the developing nations reviewed have the highest prevalence for IDD, often due to the high level of food insecurity. IDD is more closely linked to food insecure populations, which are also often low-income and rural populations, who lack access to food, including food that may have been prepared with iodized salt. Some of the developing countries have enacted legislation to combat high rates of IDD and require iodization of all salt to be consumed; however, they also often lack regulatory infrastructure and therefore lack effective methods to monitor and enforce salt iodization. For this reason, it appears that even when legislation and other efforts have been enacted, they are not comprehensively implemented.

Future research needs surrounding iodine use in processed foods include the need for nationwide food consumption data and additional food science research. Nationwide food consumption data are most helpful to determine processed food consumption; however, developing countries often lack the resources for such a large undertaking. Nationwide food consumption information can also reveal sources of salt intake in the diet and help to determine vehicle(s) for iodized salt delivery. Food science research determines the amount of iodine that should be added to a product to still meet standards after food processing and time spent on a store or consumer’s shelf, and to ensure that iodization does not impact the taste or other qualities of food products.

Survey and telephone respondents reported potential challenges when using iodized salt in food products, including: trade barriers; increased costs; lack of resources and technical capability; lack of enforcement; instability of iodine; potential equipment and process overhauls; competing priorities; and consumer misconceptions. Salt suppliers also face challenges when iodizing salt in developing countries, as they may not have the technical capabilities, equipment, or resources to do so. The survey and telephone respondents indicate that food companies are willing to use iodized salt in food products; however, the use of iodized salt in food products may need to be mandated by law and effectively monitored as an incentive for a company to invest, and to create a level playing field in the industry. Although USI intends for all salt for human and animal consumption to be iodized (whether used in food products or not), in practice, that is not always the case. Iodized salt appears to primarily be used in food products only when required by legislation, and companies do not appear to use iodized salt in product categories that do not require it (such as beyond bread products in Australia) or for products sold in countries that do not require it. Suggested approaches to get food companies to voluntarily use iodized salt in food products include outreach and education to company nutrition departments, who would then recommend policy changes to top levels of management. Additionally, a strong educational campaign for consumers on how to address IDD through the use of iodized salt in food processing could provide an incentive for companies to meet consumer demand. In general, although most companies are open to discussing iodine nutrition in more detail, iodine nutrition is currently discussed infrequently at food companies. Most respondents appear to have a fair level of knowledge about iodine nutrition and the use of salt as a vehicle for iodine, although individuals working for different departments in a food company have differing levels of understanding. Companies did indicate that they would be open to localized educational efforts to inform select company representatives about iodine nutrition.

Background

Iodine is an essential micronutrient required in small amounts for the normal physiological function of the human body. Iodine is a critical component of the thyroid hormones, which are necessary for various metabolic and enzymatic processes. These processes include control of the body's metabolic rate, growth and development, and neuron function and development. The recommended dietary intake for adult men and women is 150 mg/d (IOM 2000; WHO 2004a). Seafood, dairy products, and plants grown in iodine-rich soils are good food sources of iodine. Most other foods contain low amounts of iodine so individuals require additional sources to meet the recommended amounts.

Insufficient intake of iodine results in a spectrum of disorders referred to as iodine deficiency disorders (IDD). They include mental impairment, goiter (enlargement of the thyroid gland), hypothyroidism, and dwarfism. IDD is especially damaging during the early stages of pregnancy and in early childhood. In their most severe form, IDD include cretinism (extreme case of neurological damage from fetal hypothyroidism), stillbirth and miscarriage, and increased infant mortality. IDD is a significant public health problem in more than 50 countries. According to the World Health Organization (WHO) (2004b) an estimated 2 billion people worldwide (35.2% of the world population) suffer from insufficient iodine intake, defined as urinary iodine (UI) levels below 100 $\mu\text{g/L}$.

Universal salt iodization (USI), or iodization of all salt for human and animal consumption, is regarded as the global strategy of choice for feasible and effective control of iodine deficiency. Iodization levels are determined based on estimated consumption of salt. On average, it is estimated that individuals consume around 10 g of salt per day in countries where most of the salt in the diet comes from table salt, used for cooking and at the table. The WHO, United Nations Children's Fund (UNICEF), and Intl. Council for Control of Iodine Deficiency Disorders (ICCIDD) recommend an addition rate of 20 to 40 mg of iodine per kg salt, depending on local salt intake (Klemm and others 2009).

In recent years, a developing issue related to the levels of salt intake and salt used in processed foods has drawn the attention of organizations interested in addressing IDD. In countries where most meals are prepared and consumed within the household, the iodization of household salt alone may be adequate for eliminating IDD. However, changes in salt consumption imply that the need for iodization goes beyond table salt as more individuals forgo this ingredient when cooking and consuming food at home. It has become clear that increasingly more people consume salt from processed foods rather than table salt. In countries where more salt is consumed from processed foods, the iodization of household salt alone is unlikely to assure sufficient dietary iodine. Mattes and Donnelly (1991) estimate that in the United States and United Kingdom approximately 75% of sodium intake is from processed or restaurant foods, only 10% to 12% occurs naturally in foods, and 10% to 15% is from salt use at the table or in cooking, but data to verify the assumption that iodized salt is not typically used in processed foods are scarce. Though the trend to con-

sume more salt from processed foods is particularly observed in industrialized countries, it is perceived to be expanding into many developing countries of interest to the Micronutrient Initiative's (MI) USI program. The use of iodized salt in processed foods and its implications for USI strategies were reviewed by the MI in collaboration with the Iodine Network. In June 2009, a session, "Ensuring the Public Health Triumph of Iodine Nutrition," was also held at the IFT Annual Meeting as this issue became more widely discussed. This specific session had more than 20 international attendees from universities, companies, government, and nonprofit organizations in the United States, Canada, Argentina, Ecuador, Singapore, South Korea, and Russia.

The WHO recommends that average consumption of sodium chloride should be less than 5 g/d (less than 2 g/d of sodium) (WHO 1983; WHO/FAO 2003). This is in recognition that a high level of dietary salt intake is associated with chronic diseases such as high blood pressure and other cardiovascular diseases. Various iodization methods can be used to fortify salt to provide the recommended iodine intakes even if per capita total salt intakes are reduced. It is generally understood that recommendations to reduce salt consumption to prevent chronic diseases and the policy of salt iodization to eliminate iodine deficiency do not conflict or compromise one another; however, there are no policies and guidance on these 2 combined issues to countries implementing USI programs.

To address these 2 emerging issues, it is important to understand the contribution salt-containing processed foods make to overall iodine intake, and the extent to which iodized salt is used in processed foods in order to provide adequate guidelines consistent with both objectives: (1) a decrease in total salt consumption, and (2) using salt iodization to prevent IDD (at appropriate levels based on consumption patterns). In addition, since there has been little engagement of food processors on this issue, there is a need to bring them into discussions about iodine nutrition, to study the potential connection and contribution that processed foods using iodized salt can play in the provision of iodine. Discussions held from April 14 through 17, 2010, during the Iodine Network meetings showed that partners such as the Salt Inst., Global Alliance for Improved Nutrition (GAIN), UNICEF, and WHO are also interested in the issues around salt and iodine intakes through processed foods.

In May 2010, MI issued IFT a project to assess the extent of usage of iodized salt in processed foods and the level of knowledge on iodine nutrition among food processors. To the extent possible, the project also attempted to determine the potential impact of salt reduction initiatives on iodine nutrition and to provide recommendations on the best practices to ensure adequate iodine nutrition. The project had 2 phases: *Phase I* was to conduct an environmental scan/desk review of processed food consumption patterns in 39 countries selected by MI; *Phase II* was to conduct an electronic survey of food processors and detailed telephone interviews with a small sample of select company representatives from 16 countries. IFT shared results from both Phases at a session entitled "The Role of Food Processors Worldwide in Preventing Iodine Deficiency Disorders" during IFT's 2011 Annual Meeting held on

Table 1—Preselected countries (from MI) for Phase I of the iodized salt in processed foods project.

Countries with heavy burden for IDD	Countries with high burden for IDD	Countries with opportunity to progress	Latin American countries	European countries
India	Russia	Senegal	Chile	United Kingdom
Pakistan	Afghanistan	Ghana	Argentina	Ireland
Ethiopia	United Republic of Tanzania	Ukraine	Mexico	Finland
China	Democratic Republic of Congo	Kenya	Bolivia	Netherlands
Sudan	Iraq	Mozambique	Uruguay	Australia
Indonesia	Bangladesh	Niger		New Zealand
Philippines	Yemen	Egypt		
	Angola	Haiti		
	Turkey	South Africa		
		Brazil		
		Nigeria		
		Nepal		

Table 2—Preselected countries (from MI) for Phase II of the iodized salt in process foods project.

Australia	Kenya
Bangladesh	Mexico
Bolivia	Nigeria
China	Pakistan
Egypt	Russia
Ghana	Senegal
India	South Africa
Indonesia	United Kingdom

July 13 in New Orleans, La. Speakers representing IFT, the Iodine Network, Nestlé, and the Pan American Health Organization shared strategies for iodine fortification combined with reduced sodium consumption with more than 25 international attendees from industry, academia, government, and nonprofit organizations.

Approach

MI provided IFT with the countries to focus efforts on for Phases I and II, selected based on programmatic interest to the MI (see Tables 1 and 2). For the purposes of this project, processed foods are defined as foods that have undergone a change of character or been altered from their original form. Processed foods may include fruits, vegetables, grains, nuts, eggs, and more, that have been subject to processing techniques such as canning, cooking, freezing, dehydration, or milling. This definition includes minimally processed foods, which have received minimal heat processing or other preservation treatments to ensure their safety, and also prepared foods which have already been cooked and are either ready-to-eat (RTE) as is or only need to be heated before consumption. Although responses to IFT outreach, and the acquisition of literature or access to databases or other sources of information, which are not freely available were limited, IFT made a substantial effort to obtain useful information for each country. Appendix A provides copies of the electronic surveys utilized during Phases I and II. Appendix B provides copies of IFT announcements and e-mail letters to individuals requesting information for this project.

Phase I. Phase I of the project was to conduct a desk review to identify processed food consumption patterns in 39 countries. The environmental scan of the 39 countries around the world began in May, 2010, and was completed in September, 2010. The aims of the environmental scan were to (as provided to IFT by MI):

- (1) Determine the types and level of processed food consumption in the selected countries and the use of salt as an ingredient; and
- (2) Identify suppliers for the major processed foods consumed.

Where information was available, IFT also collected the following:

- (i) Sodium content of widely consumed processed foods and the sources of salt currently used in widely consumed processed foods;
- (ii) Types of processed foods consumed by different socioeconomic groups;
- (iii) Extent to which these processed foods are consumed by different socioeconomic groups; and
- (iv) Whether or not there are policies in place to influence intake of sodium and iodine in processed foods (for example, via food labeling) and a description of how, and if, these efforts are implemented (for example, spot-testing label claims).

The environmental scan involved literature searches and Internet reviews for each of the 39 countries of interest, which included public databases, peer-reviewed publications, and so on. IFT reached out to members with subject matter expertise and knowledge of the 39 countries, as well as 3rd parties such as government agencies, food companies, salt suppliers, and nongovernmental organizations to gain contacts and information. More than 1250 IFT members and event attendees from many of the 39 countries of interest were contacted for information. Organizations contacted included the Pan American Health Organization, the Salt Inst., multinational food companies and salt suppliers, WHO and Food and Agriculture Organization (FAO) Regional Offices, Country Offices, and Collaborating Centers, and applicable ministries and departments in each country.

Phase II. Phase II of the project was to conduct an electronic survey of food processors from 16 countries and detailed telephone interviews with a small sample of select company representatives. The electronic survey was sent to individuals from all 16 countries in October, 2010. This phase was completed in November, 2010. The aims of the electronic survey and detailed telephone interviews were to determine (as provided to IFT by MI):

- (1) The use of iodized salt in processed food products, including challenges and opportunities associated with its use;
- (2) Sources of salt used;
- (3) Awareness by food manufacturers of iodine nutrition and salt as a fortification vehicle, and how decisions to use iodized salt are made in food companies; and
- (4) Food manufacturers' interest in salt iodization.

IFT staff researched Phase I findings and other resources to determine food companies and salt producers/suppliers in the 16 countries of interest. An electronic survey was administered to over 800 IFT members and contacts in all 16 countries. Responses were received from Australia, Bolivia, China, India, Mexico, Nigeria,

Table 3—Number of Phase I and II electronic survey responses by country.

Country	Number of Phase I survey responses	Number of Phase II survey responses	Total by country
Australia	26	5	31
Bangladesh	0	0	0
Bolivia	2	1	3
China	7	1	8
Egypt	3	0	3
Ghana	3	0	3
India	5	2	7
Indonesia	7	0	7
Kenya	0	0	0
Mexico	21	3	24
Nigeria	4	3	7
Pakistan	4	4	8
Russia	0	1	1
Senegal	0	0	0
South Africa	3	1	4
United Kingdom	9	1	10
Total by Phase	94	22	—

Pakistan, Russia, South Africa, and the United Kingdom (see Table 3). Although the survey was sent to over 800 individuals, only those who currently work for food companies or salt suppliers were asked to complete the electronic survey. Others were asked to pass the survey along to their food industry contacts. Responses to an electronic survey administered during Phase I of the project (which included details sought for Phase II) were also included since Phase I respondents were different from Phase II respondents. (Only Pakistan had 1 respondent who was the same for Phases I and II so their response was only used for 1 Phase.) IFT set up telephone interviews with individuals based on responses received via the electronic survey or personal e-mail letters, using a variety of contacts outside of the IFT membership.

Over 65 personal e-mail letters were sent to individuals with subject matter expertise and knowledge of the 16 countries, including academics, government agencies, food companies, salt suppliers, and nongovernmental organizations to gain contacts and information. Personal telephone calls were also part of IFT's outreach. Outreach included over 15 multinational food companies: ADM, Cargill, Coca-Cola, ConAgra, General Mills, Jungbunzlauer, Kellogg's, Kerry, Kraft, McDonald's, McCormick, Nestlé, PepsiCo, Starbucks, Tyson Foods, Unilever, and YUM Brands. Organizations contacted included the American Import Federation, Consumer Goods Council of South Africa, Egyptian Food Technology Research Inst., FAO, Ghana Inst. of Nutrition and Food Technology, Grocery Manufacturers Assn., Indonesian Assn. of Food Technologists, Kenya Union of Food Science and Technology, Natl. Fisheries Inst., Salt Inst., South African Assn. for Food Science & Technology, multinational food companies, and salt suppliers.

Summary of Phase I Findings by Continent Africa Angola

Types/levels of processed foods consumed and the use of salt as an ingredient in those foods. Angola is on the United Nations' list of Least Developed Countries, yet it is now growing again after over 25 y of civil war. Most farming after the war in Angola is subsistence farming, and the country depends on food imports to feed its population (CIA Factbook 2010).

One study showed that 60.6% of adult Angolan participants indicated a "preference for salty food, or food prepared with much salt," with salted fish, sausages, and corned beef being the most frequently mentioned foods of this type (Simão and others 2008).

Suppliers of processed foods. The CIA World Factbook lists food processing, fish processing, and sugar among Angola's industries, but also states that subsistence farming is the main livelihood for most. Still, private food companies have begun making investments in Angola. For example, a 2010 Nestlé press release announced the construction of a new factory in Angola to be completed by 2012. It also states that Nestlé products sold in Angola are currently sourced from Brazil, Portugal, and other markets (Nestlé 2010). Additionally, the UN Industrial Development Organization is aiming to help Angola rehabilitate the food industry through support for food safety and infrastructure development, among other initiatives (UNIDO 2010).

Democratic Republic of Congo (DRC)

Types/levels of processed foods consumed and the use of salt as an ingredient in those foods. The DRC is classified as a least developed country by the United Nations. It has suffered from over a decade of conflict, resulting in infrastructure destruction. Food security has not yet been achieved for much of the population, due to political instability, poor transportation infrastructure, lack of agricultural technology, and high food prices (World Food Programme 2010a). Rural areas of the country still partake in subsistence farming and hunting and gathering. For these reasons, packaged processed foods do not appear to be present in a significant amount in the DRC.

Economic data (Fiedler 2008) indicate that two-thirds of rural DRC households purchase wheat flour, 65% purchase bread, 35% purchase other wheat products (cakes and biscuits), 82% purchase sugar, and only 3% purchase pasta. Cassava is the main staple in much of the DRC.

Suppliers of processed foods. Nestlé sells sweetened and condensed milk, beverages such as coffee drinks, and baby food in the DRC, but they are currently produced out of the country. The extent of consumption of these products is unknown. Nestlé announced in June 2010 that it will build a new factory in the capital city of Kinshasa for the production of Nescafé and other coffee and beverage products (Nestlé 2010). Evidence of other food manufacturers was not directly apparent.

Approaches to influence intake of sodium/iodine in processed foods. DRC has implemented a USI program that forbids importing uniodized salt. Presumably, under this program, any salt used in food production would be iodized. However, due to the extremely limited amount of information available on processed foods in the DRC, IFT's search found no evidence to suggest that iodized salt was or was not used in food processing. Also, much of the food consumed in the DRC is imported, and it is not readily apparent if imported foods must be processed with iodized salt.

Egypt

Types/levels of processed foods consumed and the use of salt as an ingredient in those foods. Hassan-Wassef (2004) states that bread is a staple food in the Egyptian diet. It serves as the main component at all meals and is currently produced almost exclusively at commercial bakeries. This is supported quantitatively by national food consumption data as interpreted by Galal (2002), who states that urban households usually eat wheat bread daily, while rural households more typically consume a wheat/corn bread mix. Additionally, baking of bread in the home decreased from 56% in 1981 to 17.5% in 1998 (Galal 2002). Unfortunately, quantitative food consumption data more recent than 1998 could not be found, which is notable given the fast-changing food environment in Egypt.

Hassan-Wassef (2004) also mentions other foods in the typical Egyptian diet that are potentially processed: cheese, processed/canned meats, fried potatoes, and pickled cucumbers. Qualitatively, he continually discusses the replacement of traditional, healthy foods with “commercially produced carbonated drinks” and “sweets, candy, and junk foods.” Hamburger, pizza, and fried and grilled chicken are also said to be available in “Western style” neighborhoods. Galal (2002) indicated carbonated soft drinks were among the most commonly consumed beverages in 1998.

Suppliers of processed foods. Egypt has many producers of fish, dried fruits, vegetables and herbs, and other minimally processed foods that do not likely use large amounts of salt. Of those with more extensive processing, Dreem produces powder premixes (jellies, topping creams, filling creams, cake mixes, bread improvers, and instant drink mixes) and operates under the Unilever-Mashreq brand. Nestlé Egypt also produces dairy products, breakfast cereals, chocolate products, RTE meals, and beverages. Mazex Import Export supplies ingredients to the food industry, and their primary imports include dairy products, cocoa powder, oils, starches, and bakery products.

Other producers include:

- (1) Farms Assasa Co., which produces and mills rice, and refines and iodizes salt;
- (2) Miscro Farm Fresh, which produces pickled vegetables, such as olives and artichokes, near Alexandria;
- (3) Walaa, a chocolate and confectionary company producing foods for both domestic and international markets; and
- (4) Green Valley for Food Industries (GVFI), which opened in 2007 as part of the peanut-producing Green Valley Assn. family. GVFI now produces nuts and salty snacks, such as corn-coated peanuts.

Ethiopia

Types/levels of processed foods consumed and the use of salt as an ingredient in those foods. Studies regarding food consumption in Ethiopia tend to focus on adequacy of calories. An estimated 52% of rural dwellers and 36% of urban dwellers are unable to attain minimal nutritional requirements, and the country is “extremely dependent” on food imports and food aid (Adenew 2004). Thus, food security has been a bigger concern to date than consumption of processed foods. Any studies that mention type of food consumed are generally discussing commodities and are not specific enough to determine level of food processing.

Between 80% and 85% of Ethiopians live in rural areas and live on subsistence agriculture (Adenew 2004; Abuye and Berhane 2007). Thus, processed foods are not expected to play a large role (if any) in Ethiopians’ dietary intake. Staple crops in North and Central Ethiopia are teff (a grain) and cereals; in the South and Southwest, enset (a relative of the banana), maize, cereals, cassava, and other root crops; and in the East, sorghum and maize.

Suppliers of processed foods. Some wheat and maize in Ethiopia is supplied by private sector companies from Uganda. Nile Agro Industries Ltd. supplies wheat, while Maganjo Grain Millers supplies maize. Oil is also imported—Bidco Oil, Kapa Oil, Pwani Oil Products Ltd., and Menengali Oil Refineries Ltd. all operate out of Kenya and supply distributors in Ethiopia. Sugar is manufactured in Ethiopia by 3 state-owned factories.

Approaches to influence intake of sodium/iodine in processed foods. The Quality and Standard Authority of Ethiopia requires that iodine be present in salt at 60 to 80 parts per million (ppm) as potassium iodate. Average salt consumption has been reported to

Table 4—Consumption of foods by rural and semiurban villagers in Ghana.

Food	Rural villagers (%)	Semiurban villagers (%)
Koobi (salted fish)	60	42
Kako (salted fish)	26	29
Momoni (salted fish)	63	55
Salted pigs’ feet	16	32
Salted beef	9	23
Add bouillon cubes	52	56
Add salt when cooking	99	97
Add salt at table	59	45

Note: Table adapted from Kerry and others 2005.

be 10 g per day (Takele and others 2003). The salt iodization program is referred to as USI, indicating that all salt for consumption would be iodized; however, no information was found to confirm or deny that salt used in food processing is iodized.

Ghana

Types/levels of processed foods consumed and the use of salt as an ingredient in those foods. Economic data (Fiedler 2008) indicate that 86% of households in Ghana purchase bread and 33% of households purchase “biscuits or pastry.” Ninety-two percent of rural households and 82% of their urban counterparts purchase bread, while 45% of rural and 26% of urban households purchase “biscuits or pastry.” Nationwide purchases of wheat and maize flours by rural and urban households are relatively low, at 23% and 27%, respectively.

A questionnaire from 2001 to 2002 in Ashanti Ghana found that villagers living in rural and semi-urban locales consumed approximately the same amount of salt, as measured by urinary sodium (Kerry and others 2005). However, the sources of salt in the diet differed, as shown in Table 4. The authors speculated that consumers in semi-urban areas were likely eating more salt-containing processed foods because of its increased availability, which may explain why these consumers are less likely to add salt to food at the table.

A 2007 report from the World Bank Group Multilateral Investment Guarantee Agency stated that most food processing in Ghana occurs on a “small scale” except for maize and cassava, which are processed in “large quantities” (World Bank Group 2007a).

Suppliers of processed foods. Ghana is supplied by Nestlé with dairy products, breakfast cereals, confectionaries, RTE meals, and beverages. Unilever Ghana Limited has been operating since 1992 and produces foods under the brands of Lipton (teas), Blue Band (margarines), Royco (bouillon), and Ananpurna (iodized salt). Starkist has invested in Ghana’s canned tuna manufacturing, but the tuna is mainly for export.

Approaches to influence intake of sodium/iodine in processed foods. Salt iodization at a rate higher than 15 ppm has been mandatory for all salt produced, sold, or distributed for human consumption in Ghana since 1996, as required by the Food and Drugs (Amendment) Act 523. As the iodization program is universal, all salt used in processed foods in Ghana should be iodized.

Kenya

Types/levels of processed foods consumed and the use of salt as an ingredient in those foods. Multiple studies of food consumption of various population groups across Kenya indicate similar trends in consumption: a fairly simple diet of vegetables, fruits, roots/tubers, milk, little meat, and minimally processed grains, including ugali (a cornmeal dough-like accompaniment to stews or relish), fried wheat dough, porridge, biscuits/cookies, and plain white bread (Gewa and others 2007; Kamau-Mbuthia and Elmadfa

Table 5—Food consumption levels in Kenya—daily (d) or weekly (w) rate.

Food	Percent
Maize	74.0 (d)
Millet	36.6 (d)
Sorghum	35.1 (d)
Beans	32.2 (w)
Green grams	29.4 (w)
Cassava	18.9 (d)
Sweet potatoes	35.5 (w)
Kale	66.9 (d)
African leafy vegetables	37.0 (d)
Green bananas	26.4 (w)
Pawpaw	26.0 (w)
Avocado	24.9 (w)
Oranges	23.4 (w)
Mango	20.4 (w)
Large fish	46.4 (d)
Omena (dried fish)	34.3 (d)

Note: Adapted from Ohiokpehai and others 2007.

2007; Ohiokpehai and others 2007; Walingo and Musamali 2008; Kuria 2009). Notable exceptions to this are the occasional consumption of soft drinks and hard candy by schoolchildren (Gewa and others 2007), and pregnant women reporting that their main cooking fat was Kimbo, a hydrogenated (processed) fat (Kamau-Mbuthia and Elmadfa 2007).

Ohiokpehai and others (2007) noted that Kenya is transitioning from home-prepared foods to increased consumption of processed, energy-dense food products; however, their survey of 265 homes in the Suba District of Kenya also indicated that many of the homes were food-insecure and ate simple diets that are not highly processed. To show the frequency of consumption of common foods in Kenya, data collected by Ohiokpehai and others (2007) are presented in Table 5.

Differences have been noted in food consumption in Kenya based on income. Among urban dwellers in the capital city of Nairobi, wheat consumption consistently rose with income across all 5 quintiles (Muyanga and others 2004), to the point where the highest income quintile consumed approximately the same amounts of wheat and maize (approximately 5.5 kg/adult/mo each). Adults in the lowest income quintile consumed almost 6 kg maize/mo and 2.3 kg wheat/mo. Muyanga and others (2004) also reported that the majority of Kenyans purchased maize meal in 1992, and of those, 80% purchased the more highly processed and sifted meal, 12% purchased the less refined posho meal, and 8% purchased both types of meal. Households headed by a more professional individual were more likely to purchase the sifted meal than those headed by a less professional individual (such as an engineer compared with a shop attendant). Finally, as income increased across quintiles, consumers were more likely to shop in large supermarkets and less likely to shop in local dukas (shops).

Suppliers of processed foods. Hostess produces an “extremely refined” maize meal sold in small and large supermarkets (Muyanga and others 2004). Bidco manufactures multiple oil, fat, and margarine products in Thika, Kenya, including Kimbo cooking fat, a hydrogenated vegetable oil. Del Monte Kenya also operates in-country, producing mainly canned pineapples. Nestlé also operates in Kenya, and a 2010 press release indicated their commitment to expand a factory in Nairobi to support their new foodservice division (Nestlé SA 2010).

Approaches to influence intake of sodium/iodine in processed foods. USI legislation was initially enacted in 1978. In 2009, the Minister for Public Health and Sanitation amended the Food,

Drugs, and Chemical Substances (Food Labeling, Additives and Standards) Regulations in response to surveys indicating that Kenyans had high levels of iodine (Kenya Gazette Supplement No. 67. 2009). The level of salt iodization was lowered from 168.5 mg/kg to a range of 50 to 84 mg/kg (ICCIDD 2009).

Mozambique

Types/levels of processed foods consumed and the use of salt as an ingredient in those foods. A study by Rose and others (1999) found that maize is the most common staple food consumed in Mozambique, often produced by the consuming family. Maize products are also consumed more frequently than any other foods. Maize, along with manioc, beans, and groundnuts accounted for a large percentage of caloric intake for many Mozambiques surveyed. Sorghum, fruits and vegetables, and dried fish (used as seasoning) were also consumed by many individuals in the areas of Montepuez, Monapo, and Meconta using 24-h recalls. Other nuts and seeds and animal products may be consumed, but very rarely. Mozambique is a major producer of tobacco, cotton, cashews, sugar, and sesame seeds, and the fishing industry (shrimp in particular) shows great promise. Food, beverages, and tobacco make up 74% of total manufacturing sector output, and have fueled a 21% annual growth in the sector between 1999 and 2003 (World Bank Group 2007b).

Suppliers of processed foods. A 2007 report from the World Bank Group Multilateral Investment Guarantee Agency interviewed 52 food and beverage processors (manufacturing, processing, and preservation of meat, fish, fruit, vegetables, oils, and fats; manufacture of dairy products, grain mill products, starches, and starch products, and prepared animal feeds, bottled, and canned beverages (soft drinks, fruit juices, beer, and wine), and other food products (such as bread, sugar, chocolate, pasta, coffee, nuts, and spices) (World Bank Group 2007b). Of the 52 food and beverage processors:

- (1) 13 also produced horticulture items;
- (2) 19 were 100% locally owned;
- (3) 13 were joint ventures between local and foreign firms; and
- (4) 20 were 100% foreign-owned.

The names of these companies were not listed and it was difficult to find specific details of food producers. The grocery store chain Shoprite currently has 5 locations in Mozambique and there is also 1 Game store—a consumer goods store—operated by MassMart in Maputo, Mozambique.

Niger

Types/levels of processed foods consumed and the use of salt as an ingredient in those foods. A hunger crisis is currently occurring in Niger, one of the poorest countries in the world, which makes it difficult to find any food consumption data, as many of their few calories consumed come from food aid. A January 2010 government survey found that 7.8 million people in Niger are food-insecure, especially in areas hardest hit by drought, such as Tahoua, Diffa, Zinder, and Tillabery. The World Food Programme provides interventions such as blanket food distributions for almost 1 million children less than 2 y of age and supplementary nutritionally enhanced food for children less than 5 y of age, while their families receive standard staple food rations. Supplementary feeding is also provided to pregnant or nursing women (World Food Programme 2010b).

One article discussing the problem of childhood malnutrition presented the picture of an unvaried diet of millet porridges mixed with sugar and/or milk, rice, sauce, and sometimes a

meat dish (Hampshire and others 2008). People living in rural Niger depend on wild plant foods as part of their diets (Glew and Vanderjagt 2006) and are unlikely to be reached by highly processed foods.

Suppliers of processed foods. Information is extremely limited regarding processed food suppliers, or any food suppliers, in Niger. This review found great difficulty even in identifying milling operations.

Nigeria

Types/levels of processed foods consumed and the use of salt as an ingredient in those foods. Based on the topics uncovered during the literature review, it is fair to say that Nigeria's processed food sector is advanced beyond most of the other African nations studied in this review. (Topics such as food hygiene, microbial contamination of RTE products, advanced food chemical analyses, nutrient composition, and quality evaluation are returned on 1 PubMed search, as opposed to food security articles that arise from searches for other nations.) Additionally, intakes have been studied in relation to chronic diseases, such as type 2 diabetes and hypertension.

One study of food consumption patterns of Nigerian adolescents in Osun State gave examples of main meals that include boiled rice, stewed rice, bread, pounded yam, bean pudding, stewed beans, yam porridge, and cassava flour products (Olumakaiye and others 2010). Meanwhile, snacks were generally considered to be "finger foods" including biscuits, puff puffs (a type of doughnut), buns, meat pies, fish rolls, doughnuts, and cakes. In the study, the majority of both urban and rural students ate at least 3 meals each day. On average, the number of students eating 1, 2, or 3 snacks each day was equally divided; however, rural students were more likely to consume only 1 snack each day. The origins of the foods were not discussed.

Another study by Ogwu and others (2001) provides an assessment of the possession of household kitchen equipment and information on food preparation and consumption, also in Osun State. Of 210 respondents, 179 owned a kerosene stove, 156 owned a mortar and pestle, 134 had a grinding stone, 162 had a refrigerator (though only 29% had a consistent power supply, so these may be ice boxes), 84 had blenders, 71 had a bread toaster, and only 36 owned a microwave oven. In terms of food consumption, extent of processing was not discussed, but the number of respondents who prepared each food at home was listed. Sources of foods outside the home were not listed. Of those foods consumed, those with the potential for processing (and the percentage of respondents who reported preparing it at home) include vegetable soup (70.5%), soya bean milk (42%), fufu—a cassava flour product (60%), cakes (60%), bread and tea (42%), toasted bread (37.6%), and pancakes (30.6%).

Economic data (Fiedler 2008) suggest that 59% of rural Nigerian households purchase bread, whereas 67% of their urban counterparts do. Similarly, urban Nigerians consumed more wheat products (35% compared with 22%), and more maize and maize flour (51% compared with 31%) than rural Nigerians.

Suppliers of processed foods. UAC Nigeria operates both restaurants (Mr. Bigg's, Nando's, Chicken Inn, Creamy Inn, Pizza Inn, Dial-A-Delivery, and Village Kitchen) and food production in Nigeria (UAC Foods). UAC Foods offers snacks such as the Gala Sausage Roll, Funtime Coconut Chips, and Funtime Snaps (puffed maize product). Mr. Bigg's is a fast-food chain in Nigeria that self-reports serving 100,000 people daily. Chitis Pasteries sell bread, pastries, confectioneries, and baked goods like cakes and

Table 6—Median daily intake of Senegalese.

Food	Intake
Cheese	0.38 oz
Bread	18.07 in
Sugar	0.71 Tbs
Sauce/peanut paste	4.43 Tbs
Butter	0.71 Tbs
Ketchup	2.00 Tbs
Mustard	1.00 oz
Milk biscuit	0.64 pieces
Candy	3.00 pieces

Note: Table adapted from Anderson and others (2010a, 2010b).

pies. They also serve local and regional foods, "fast food," drinks, and ice cream. Safinabe Global Investment Limited, the 1st manufacturer of instant fura (a traditional millet and milk-based drink) reportedly opened in 2008 in Pwambara, Nigeria. Flour mills operating in the country include Flour Mills of Nigeria, Dangote Flour Mills, Maiduguri Flour Mills, and Niger Mills.

Approaches to influence intake of sodium/iodine in processed foods. USI was initiated in Nigeria in the mid-1990s. It is mandatory at a minimum level of 50 ppm at the factory and 30 ppm at the market available for consumer purchase. All salt used in food (including processing) is to be iodized and that is enforced by the Natl. Agency for Food and Drug Administration and Control (NAFDAC) and the Standards Organization of Nigeria (SON). The legislation provides labeling guidelines and makes a very clear distinction between food-grade and industrial salt.

Senegal

Types/levels of processed foods consumed and the use of salt as an ingredient in those foods. A recent study reports on the dietary intake of Senegalese men (Anderson and others 2010a). Though the sample size was relatively small ($n = 50$), the study collected data from both urban Dakar and the rural Sendou village. The authors indicated that they found no difference in consumption based on demographics or urban/rural locale. Also, they indicated some surprise at the limited intake of "Western" foods. The source of foods consumed was unclear. The top 25% of reported food items contained several foods that were potentially processed. They are listed in Table 6 with their median daily intake. Soft drinks, pasta/spaghetti/macaroni, pita bread, porridge, chocolate, mayonnaise, cake, and croissant were also consumed, but were not in the top 25%.

In 2005, Senegal imported 17439 tons of canned fruits and vegetables, 57630 tons of sugar, 10630 tons of "other sweet products," almost 20000 tons of "other drinks," and 642 tons of canned meat and fish products. That year they also imported 856369 tons of rice, 326287 tons of wheat, 96677 tons of corn, and 217820 tons of fresh fruits and vegetables (Ndiaye 2007).

Suppliers of processed foods. A 2007 U.S. Foreign Agriculture Service report included the names of several food manufacturers and processors in Senegal (Ndiaye 2007). SOCAS and Agroline are the major tomato paste processors in Senegal. Compagnie Sucrière Sénégalaise is a large sugar refinery. PAPEL is a government dairy development project. Nestlé Senegal, SATREC, CCMB, Saprolai, and les Mamelles Jaboot also operate in the milk market in Senegal. Grands Moulins de Dakar and Sentenac are 2 wheat flour mills that obtain most of their wheat from France.

Approaches to influence intake of sodium/iodine in processed foods. Secondary sources indicate that USI has been mandated by the Senegalese government since 1994, but this search was unable to verify the law.

Table 7—The most commonly consumed foods by rural and urban South African adults.

Food	Percentage of rural consumers (%)	Average portion (g)	Percentage of urban consumers (%)	Average portion (g)
Maize	95	907	63	772
White sugar	77	23	77	30
Tea	76	469	61	441
Brown bread	60	173	51	157
Nondairy creamers	30	6	21	7
Wild green leaves	23	184	—	—
White bread	22	157	—	—
Tomato and onion stew	20	118	—	—
Chicken	16	109	22	112
Cabbage	14	124	—	—
Eggs	13	104	—	—
Beef	13	129	—	—
Brick margarine	12	15	29	21
Full cream liquid milk	—	—	30	200
White bread	—	—	34	165
Coffee	—	—	27	437
Potatoes	—	—	27	167
Rice	—	—	23	156
Carbonated beverages	—	—	18	436

Note: Table adapted from Nel and Steyn 2000.

South Africa

Types/levels of processed foods consumed and the use of salt as an ingredient in those foods. A 2003 study by Harris and others examined the use of iodized salt as an ingredient in processed foods in South Africa; in particular, in bread, margarine, and salty snacks. These products were selected by using data from the 1998 Natl. Food Consumption Survey that found bread and margarine were among the 10 most frequently consumed foods in the country by children aged 1 through 9 y old. They also utilized the South African Demographic and Health Survey from the same year, which showed that salty snacks such as potato crisps were frequently consumed by black South Africans.

A study to create a table of “most commonly” consumed food items and average intakes of these items in the diets of South Africans to serve as a reference table for the Dept. of Health was completed in 2000 (Nel and Steyn 2000). The table was required to be representative of foods eaten by children and adults from all age and ethnic groups in South Africa. Method 1 results corresponded with results from the Natl. Food Consumption Survey, which was oversampled for lower socioeconomic areas. The main 3 food groups consumed by all age groups were cereals, sweeteners such as sugars and honey, and stimulants such as cocoa, coffee, tea, and ginger. Cereals were consumed by 99% of all groups surveyed, while sugar and honey were consumed by more than 80% of all groups. Differences in rural and urban consumption as indicated in Table 7 indicate that some “processed foods” are more accessible to urban individuals or more easily afforded by them.

Suppliers of processed foods. Unilever South Africa has many processed food brands available such as Glen, Joko, Lipton, Stork, Flora, Ola, Rajah, Knorrox, Knorr, and more.

Harris and others (2003) examined the use of iodized salt as an ingredient in bread, margarine, and salty snacks. As is similar for many other countries, they were unable to find documentation of the amount of iodine in processed foods from the literature, so they devised a study to determine amounts. They received information from 12 main manufacturers within the borders of South Africa: 6 bread manufacturers, 2 bread premix manufacturers, 2 margarine manufacturers, and 2 flavor houses. Names of the manufacturers were not provided. Eleven of the 12 companies reported that they did not use iodized salt in their food products. However, analysis of the salt used by each manufacturer showed that 4 of

the manufacturers who reportedly did not use iodized salt actually had iodine at levels ranging from 39 to 69 ppm in their salt, and the 1 company that had indicated they did use iodized salt, in fact, did not. The 4 companies using iodized salt in processed foods included 1 bread manufacturer, 1 margarine manufacturer, and 2 flavor houses. Three of the 4 supply food products countrywide, while the 4th distributes product to a metropolitan area. The 3 food manufacturers with the highest amount of iodine in their salt all received salt from the same producer in 50-kg bags.

Sudan

Types/levels of processed foods consumed and the use of salt as an ingredient in those foods. According to FAO of the United Nations, Sudan is both a least-developed country and a low-income food-deficit country (FAO 2010). Prevalence of malnutrition from 2000 to 2002 was 27%, and poor nutritional status is seen in both areas affected and unaffected by conflict (Salih and others 2005). Actual food consumption data in Sudan are extremely limited (Good Food for New Arrivals 2002; Salih and others 2005). A 1997 national survey reports on the number of daily meals, and percentage of the population who ate meat, fruits, milk, and vegetables daily (Good Food for New Arrivals 2002).

The information that is available indicates high cereal grain consumption, with the predominant grain varying by region: sorghum is a staple in rural areas, whereas wheat (in the form of bread) is increasingly prominent in urban areas and the North (Good Food for New Arrivals 2002). Millet and sorghum are important in Western Sudanese diets, while maize is more prevalent in the South. These grains constitute a major portion of Sudanese diets, and contribute up to 75% of calories for those living in states considered vulnerable to the current conflicts. Meats and eggs are consumed where/when available. A “substantial supply of milk” is also consumed (Salih and others 2005).

Suppliers of processed foods. The extent of food processing in Sudan is likely limited to milling and similar processes. Yet this review indicates that the infrastructure does not exist to reliably transport food even moderate distances, so it is expected that milling is performed regionally if not locally.

Approaches to influence intake of sodium/iodine in processed foods. Despite a ministerial decree in 1994 requiring all edible salt to be supplemented at a rate of 50 ppm with potassium iodate (which was later decreased to 25 to 35 ppm in 2003), USI in Sudan appears far from reality. Izzeldin and others (2009) posit the main causes for the ineffective implementation of the law to be inadequately trained salt producers and a lack of authority of any government entity to monitor or enforce the law. A separate work by Izzeldin suggests that lack of funding for IDD prevention in the national budget is also to blame. Also, the national law does not explicitly ban noniodized salt (UNICEF 2007).

United Republic Of Tanzania

Types/levels of processed foods consumed and the use of salt as an ingredient in those foods. A study of food consumption patterns in 1997 showed evidence of greater processed food consumption by urban dwellers than rural dwellers (Mazengo and others 1997). Among the 10 foods most likely to be consumed, urban dwellers listed 6 foods requiring processing: tea with sugar, bread, ugali—a stiff porridge of maize or cassava flour, vegetable oil, cookies, and industrial milk. Comparatively, rural dwellers listed only ugali and tea with sugar. The proportions these foods represent of the percentage of total foods consumed in each area are shown in Table 8.

Table 8—Total intake of select foods in urban compared with rural areas in United Republic of Tanzania.

Food	Intake (% of total foods)	
	Urban	Rural
Tea with sugar	8.4	9.0
Bread	7.0	—
Ugali	6.6	10.0
Vegetable oil	6.0	—
Cookies	4.8	—
Industrial milk	3.9	—

Note: Table adapted from Mazengo and others 1997.

Table 9—Purchase percentage of foods in urban compared with rural households in United Republic of Tanzania.

Food	Purchase percent	
	Urban households	Rural households
Bread	52	11
Baked wheat products (cakes/biscuits)	80	47
Pasta	8	1
Corn flour	89	59
Wheat flour	31	13
Edibles oils	63	40
Sugar	93	67
Salt	83	86

Note: Table adapted from economic data (Fiedler 2008)

Economic data (Fiedler 2008) echo this trend. While 20% of Tanzanian households purchase bread on average, this includes 52% of urban households and only 11% of rural households. Similar trends are shown in Table 9. The differences seen may be explained by rural households consuming more foods that were not surveyed, such as cassava, sweet potatoes, and coconuts; or that those in rural areas are less likely to meet their calorie needs and may consume less food overall (Mazengo and others 1997).

A list of “Locally Manufactured Pre-Packaged Food Products in Tanzania” provided by the Tanzania Food and Drugs Authority is 48 pages long and contains 406 items (Tanzania Food and Drugs Authority 2009). The list includes flours, breads, biscuits, butter, yogurt, various oils, teas and coffee, sugar, cheese, honey, tomato sauce, peanut butter, soft drinks/carbonated beverages, candy, frozen fish, dried fruit, fruit juice, potato chips, and a variety of beer, wines, and liquors. It is unclear how these foods currently contribute to the diets of Tanzanians.

Suppliers of processed foods. As obtained from the same list of registered food products discussed, the following manufacturers have registered food products with the Tanzanian Food and Drugs Authority:

- (1) Mugabe Bakery;
- (2) Kenmillers;
- (3) Akiyda;
- (4) Asas Dairy;
- (5) Said Salim Bakhresa & Co.;
- (6) Bi Shamsa Saleh;
- (7) Cefa Njombe Milk Factory;
- (8) Olam Tanzania Limited;
- (9) Natl. Milling Cooperation—Arusha Mill;
- (10) Njombe Milk Factory;
- (11) Ihfa Limited;
- (12) WEGCC Food Product (WEFOP);
- (13) Intl. Health Food Assn. Njiro;
- (14) Vin Mart Limited, which sells multiple highly processed products such as ketchup, potato chips, banana chips; and
- (15) Meat King.

Also, Tizi Foods operates out of Tanzania and produces potato crisps that are sold throughout Africa.

Approaches to influence intake of sodium/iodine in processed foods. Tanzania adopted a USI program after passing the Salt Iodinations Regulation Act of 1994, also known as the Salt Act of 1994, but specific information on the program was difficult to obtain.

Asia

Afghanistan

Types/levels of processed foods consumed and the use of salt as an ingredient in those foods. With the ongoing conflict in Afghanistan (extending for more than a decade before U.S. involvement), basic population statistics in Afghanistan are limited. Not surprisingly then, there is little available information regarding salt, food consumption, and iodization in Afghanistan. Even the recent prevalence of IDD is not as widely published as for other Least Developed Countries.

Although individual and household food consumption data are lacking for Afghanistan, population consumption data are available for the most basic commodities. Wheat is the main staple of the Afghani population, mainly in the form of flat breads prepared in the home (Chabot and Dorash 2007). Small commercial bakeries reportedly operate in urban areas. Wheat is said to contribute over half the caloric intake of the Afghani people, but exact production and consumption numbers vary among different sources and are considered somewhat unreliable (Chabot 2007).

Suppliers of processed foods. Chabot and Dorosh (2007) reported that wheat milling operations in the country were inadequate, and that only 8 medium-to-large industrial mills were present in the country. Only 2 of 5 publicly owned mills were listed as operational—their names were not provided, but they operated in Kabul and Mazar-e-Sharif. The Kabul mill also possessed facilities producing sweetened bread and cake products. Three privately owned, medium-sized mills also operated in Kabul and Mazar-e-Sharif, including Kabul Flour Mills.

Bangladesh

Types/levels of processed foods consumed and the use of salt as an ingredient in those foods. A Ministry of Foreign Affairs of Denmark report (2008) indicates that Bangladesh has a strong, growing food processing sector that relies on domestic agricultural production and mainly serves domestic food needs. Food processing currently includes rice and wheat milling, sugar refining, production of edible oils, processing and preserving of fruits and fruit juices, and fish processing (primarily white fish and shrimp). There is great potential for the processed food sector in Bangladesh, as it currently accounts for 5% of Bangladesh’s GDP, more than 22% of manufacturing, and employs approximately 20% of the labor force.

Economic data (Fiedler 2008) show that the mean amount of rice purchased per person is 10.9 kg, more than any other product. Urban individuals purchase more whole grain wheat (1 compared with 0.5 kg), wheat products (cakes and biscuits) (0.4 compared with 0.2 kg), sugar (0.4 compared with 0.2 kg), and edible oils (0.6 compared with 0.4 kg) than rural individuals.

Suppliers of processed foods. There are nearly 700 food manufacturers in Bangladesh that process foods such as bakery confectionaries, fruits and vegetables, cereal, dairy, fruits juices and others beverages, and other food products (Ministry of Foreign Affairs of Denmark 2008). A Danish fishing delegation visited Bangladesh in 2009 to introduce the 21 participating Danish

companies to their Bangladesh counterparts so they could explore future cooperation and potential joint ventures. The Food World website lists Bangladesh importers and exporters, the majority of which are fisheries such as Bio-Chemical and Seafood Export Co., Chalna Marine Products Ltd., Coastal Seafoods Ltd., Daffodil Fishery, Ocean Magix Ltd., and Tojamaso Seafoods (Food producers and exporters by countries. www.thefoodworld.com/food-exporters-importers/ Accessed 2010). Other companies include Nestlé Bangladesh and the Tea Board, which regulates and promotes the cultivation and sale of tea from more than 160 tea estates in Bangladesh.

Approaches to influence intake of sodium/iodine in processed foods. In 1989, the government of Bangladesh passed a law, Bangladesh Universal Salt Iodization Act No. 10, making it mandatory for all edible salt to be iodized (Bangladesh Gazette 1989). The law stipulates that all salt for human consumption must contain 45 to 50 ppm of iodine at the time of production and not less than 20 ppm at the time of retail to ensure a minimum of 15 ppm iodine at the household level (Yusuf and others 2008). Iodization of salt is noted as one of the policy priorities in the Bangladesh Natl. Food Policy Plan of Action, and the medium-term/long-term goal to be achieved is <5% of women with IDD by 2015.

The Bangladesh Council of Scientific and Industrial Research was given the responsibility to ensure compliance with the Act, but surveys (Khorasani and Rahman 1995; Khorasani 1997) showed that only a small percentage of the total salt produced was iodized. Furthermore, the iodization rate varied substantially with most salt containing inadequate amounts. Failure to enforce the law, due in part to lack of reliable testing systems, resulted in limited progress (Khorasani 1999), although penalties are in place. Companies or individuals who do not follow the salt iodization law face a fine of 5000 taka (approximately U.S. \$85) and/or a jail sentence of up to 3 y. Bangladesh also has Salt Committees at the district level to monitor and supervise local salt retailers. District Salt Committees can request that District Commissioners arrange mobile courts to fine those not in compliance on the spot (Iodine Network 2005a). A bylaw was passed in 1994 that enabled substantial investment in the salt iodization infrastructure. With the help of UNICEF, all 267 registered salt factories were equipped with salt iodization plants. The rate of IDD declined from 47% in 1993 to below 10% in 2005 after USI was enacted and after intensive public health campaigns and advocacy (Food Planning and Monitoring Unit, Ministry of Food and Disaster Management, Government of the People's Republic of Bangladesh 2010).

Salt intake in Bangladesh is known to be significantly higher than in Western countries, with average intake reported as 21 g/d in 1 study of 50 hypertensive patients (Penney 2009). The Hypertension Committee of the Natl. Heart Foundation is actively trying to reduce sodium consumption through educational campaigns, including dissemination of posters and brochures, arranging for expert interviews on radio and television, and reaching out to all doctors in the country (Khandaker 2009). They held a roundtable meeting on salt and hypertension to bring together food industry representatives, medical professionals, WHO representatives, and various social organizations to discuss "Salt and Health."

China

Types/levels of processed foods consumed and the use of salt as an ingredient in those foods. China is currently considered the world's fastest growing economy with the food industry included among the rapidly growing industries. From 2003 to 2007, China's

food processing sector grew on average 30% annually (Jun and others 2009). Sixty-two percent of the food processing sector in China is still focused on the primary processing of agricultural inputs such as animal slaughter, milling, and refining (compared with food and beverage manufacturing at 38%).

Jun and others (2009) noted that the Chinese diet is moving away from conventional fresh foods and wet markets to "Western-type" packaged foods and supermarkets or hypermarkets (department stores combined with a supermarket) due to increased urbanization and disposable incomes. Rural areas still consume more fresh foods, while urban areas prefer more processed foods, such as dining out (restaurant, fast food, and food stand fare), frozen, and convenience foods. A study by Bhandari and Smith (2000) showed that instant noodles, snacks, and frozen foods were growing in importance due to increased demand for convenience. Consumers spend a greater amount on processed food and beverage products including nonalcoholic beverages, meat products, cereal products, and fruits and vegetables. Growth in beer, oils/fats, juice, and dairy processing was very strong from 2004 to 2008 (Jun and others 2009). Sales of frozen processed red meat, seafood, poultry, vegetables, potatoes, and other frozen RTE products increased 12% from 2007 to 2008. Other popular frozen foods include dumplings, sticky rice cakes, buns, beef/pork/fish/shrimp balls, pizza, soup, noodles, and desserts.

Anderson and others (2010b) reported the dietary sources of sodium in China, and grouped results into Northern and Southern China. Total consumption of sodium in the South was less than half of what was observed in the North: 1836 mg compared with 4733 mg (corresponding to approximately 4.7 g and 12.1 g salt). In both Northern (Beijing and Shanxi) and Southern (Guangxi) China, table salt added during home cooking provided the majority of sodium in the diet—76.4% in the North and 73.7% in the South. Soy sauce provided the 2nd highest source of sodium for both regions, though still less than 10% of total salt consumed: 5.4% in the North and 9.8% in the South (Anderson and others 2010b).

Suppliers of processed foods. China has almost 30000 major food processors with sales revenue over \$735000 (Jun and others 2009). This number does not account for the likely large number of smaller processors who make less than this amount each year—it has been estimated that China may have up to 500000 total food processors. Jun and others (2009) reported that there were approximately 3000 quick-frozen processed food manufacturers in 2008, including brands such as Synear, Sanquan, Longfeng, Haibawang, Taixang, Jiayuan, and Haodangjia. Large-scale meat processors include Shuanghui, Jinluo, Yurun, and Zhongpin. Amoy Food Limited, a subsidiary of Ajinomoto Inc., is the main producer of soy sauce in China, and in Southeast Asia in general. Wanchai Ferry is a famous General Mills brand of dumplings and other food products. General Mills and the Japanese international firm Katokichi entered the Chinese market with General Mills investing \$13 million in Shanghai. An article in Economic Times (Bhushan 2010) states that Nestlé SA also plans to invest heavily in China, with \$1.35 billion slated for growth of operations in India, Brazil, Russia, and China between 2010 and 2012. Other multinational food companies that have operations in China include Tyson China, Cargill, Aramark, Coca-Cola, and PepsiCo (Frito Lay). Multinational brands such as Nestlé, Wyeth, Similac Advance, Ausnutria, Dumex, Annum, Mead Johnson, Primavita, Ausmeadow, and Good Health cover the infant formula market. Heinz, Nestlé, Beingmate, Gerber, Eastwes, and CEVO dominate the baby food market. Stores offering baked goods include

Starbucks Coffee Co., Circle K Convenience Stores, Bread Talk, Yamazaki, Maxim's Group, and Queens Cake Shop. The production and consumption of baked goods and baby foods are both growing markets.

Approaches to influence intake of sodium/iodine in processed foods. Commercially iodized salt has been in use in China for more than 40 y. In 1994 salt iodization was made mandatory through Order No. 163 from the State Council of the People's Republic of China. The regulation requires the iodine content of iodized salt to be no less than 30 mg/kg at the production level, no less than 25 mg/kg at the market level, and no less than 20 mg/kg at the household level (Chen and Wu 1998). In order to achieve these levels, the fortification rate is set at a range of 20 to 60 mg/kg. The Ministry of Health is responsible for setting the fortification standard. Potassium iodate and potassium iodide are the main sources of iodine. The Health Administration Dept. of the State Council is responsible for health inspection and supervision of iodized salt; the Salt Administrative Dept. for manufacture and marketing of iodized salt; and the Ministry of Commerce for enforcing the mandate.

In July 2010, the Ministry of Health proposed a revised standard for salt iodization of 20 to 30 mg/kg. The standard also authorizes provincial governments to increase or decrease the iodine content by up to 30% depending on local dietary requirements (China Daily 2010). The revision was necessary because of the high salt intake levels in some of the provinces (Hunan and also coastal cities where seafood is prevalent) resulting in excessive iodine intake. Recent Ministry statistics show abnormal levels of iodine in approximately 31 million people in the 3 provinces of Shandong, Hebei, and Jiangsu. Overall, iodine intake was excessive in 5 provinces and above normal in 16 provinces.

China introduced voluntary guidelines for salt labeling on packaged foods in 2008, where sodium content is to be listed per 100 g, per 100 mL, or per serving. Percentage of the nutrient reference value is also to be included. A 2007 campaign in Beijing distributed 5 million blue plastic teaspoons to residents to demonstrate suggested daily salt consumption (Penney 2009).

India

Types/levels of processed foods consumed and the use of salt as an ingredient in those foods. Bansal and others (2010) studied the food consumption patterns of factory workers in urban settings as compared to recent migrants between rural and urban settings (lived there less than 1 y) and their rural counterparts. Though the study did not directly examine processed foods, a distinct difference can be seen in the populations based on geographic area. Thirteen foods were identified to be eaten daily in at least one of the populations studied. Of those foods, the urban dwellers consumed more tandoori roti, clarified butter, sugar, and coffee than their rural or migrant counterparts. Interestingly, a large difference in consumption was not detected between geographic groups in consumption of plain milk, yogurt, or buttermilk. The rural dwellers did, however, consume more plain rice than urban or migrant dwellers. Finally, urban dwellers also tended to consume higher levels of Western-style foods than migrants or rural dwellers, including bread, ice cream, cakes, jam, noodles, ketchup, and French fries.

A working paper by Pingali and Khwaja (2004) suggests that the diet transformation of India is happening in 2 distinct stages: income-induced diversification and diet globalization. They posit that income-induced diversification occurred in the 1980s when demand for all traditional food groups rose. Then, globalization

began in the 1990s, with a change in the consumption patterns such as increased consumption of animal products, wheat, starchy roots, vegetable oils, sugars, and fruit, coinciding with a decrease in consumption of rice, pulses, and cereals.

Shetty (2002) explored the food transition in India from the perspective of overconsumption and chronic disease. Consumption of total cereals was shown to decrease from the 1970s to 1990s in both rural and urban areas. Cereal consumption was lower in urban areas than rural, while milk consumption was higher in urban areas.

Rao and others (2006) reported on the diets of adolescent tribal populations of India. Reportedly, tribal populations account for 8% of India's total population. Data from the 1998 to 1999 Natl. Nutrient Monitoring Database were used. The study did not specifically address processed foods. The intake of all foodstuffs (including those with potential for processing such as cereals, pulses, and roots/tubers) was lower for tribal adolescents than their rural counterparts. Additionally, a large portion of the adolescent population was considered undernourished with a BMI less than the 5th percentile (63% of boys and 42% of girls). Food consumption was not compared to socioeconomic status (SES), except to connect underweight with low SES.

A working paper by Chatterjee and others (2006) found that Indian household food expenditures of fruits, animal products, and processed foods have all increased. Processed foods and fruits had average annual growth rates between 1997 and 2003 of 20% for processed foods and 5.5% for fruits. In 2002, processed foods accounted for 13.5% of total food spending in urban households and 9.3% in rural households. Spending on animal products, fruits and vegetables, and processed foods, combined, increased from 44% to 50% in urban homes and 33% to 41% in rural homes between 1988 and 2002. By 2002, consumption of these food items was greater than consumption of staple cereals and pulses. In urban households, the largest portion of increased spending went to dairy products and processed foods, followed in importance by vegetables and fruit, rice, and meats, fish, and eggs in 2002. Rural households spent the largest amount of the increase on dairy products, followed by rice, processed foods, vegetables, fruits, and wheat. The marginal expenditure share doubled for processed foods from 1988 to 2002 in urban areas, while it also increased noticeably in rural areas.

Suppliers of processed foods. Major processed food manufacturers include Kellogg India Ltd. Mumbai; Huber Chemicals Ltd. Mumbai; Hindustan Lever Ltd. Bangalore; US Wheat Associates, New Delhi; Godrej Pillsbury Pvt. Ltd. Mumbai; Colour-Chem Ltd. Mumbai; Novartis Nutrition India Pvt. Ltd. Mumbai; and McCain, a major supplier to McDonald's who directly contracts with potato farmers. FoodWorld is the largest supermarket chain and has 67 stores in southern India.

An article in Economic Times (Bhushan 2010) states that many multinational food companies such as Unilever, Nestlé, Procter & Gamble, Kellogg's, GlaxoSmithKline Consumer Healthcare, which makes Horlicks and Boost milk-based health drinks, and Yum! Brands Inc., which owns Pizza Hut, KFC, and Taco Bell restaurants, have identified India as a critical market. Nestlé SA plans to invest \$1.35 billion in growth of operations in India, Brazil, Russia, and China between 2010 and 2012. Nestlé India, whose brands include Maggi and KitKat, plans to open a new R&D center in India in 2012. Yum! Brands Inc. also plans to invest \$100 to 120 million in Indian operations by 2012. Kellogg's indicated plans to increase operations in India, France, and Mexico.

Approaches to influence intake of sodium/iodine in processed foods. Salt iodization is required for salt for direct human consumption. The sale of uniodized salt for direct human consumption is banned under amendments to the Prevention of Food Adulteration Act. The ban was originally applied in 1997, lifted temporarily in 2000, and re-instated in 2005 (Tiwari 2006). The level of iodization is stipulated to be >30 ppm at the production level and >15 ppm at consumption. There is no direct stipulation for the use of iodized salt in processed foods. The government agencies involved in iodization efforts and monitoring are the Salt Commissioner, Salt Dept., Ministry of Industry, and the Central Council of Health and Family Welfare, which is responsible for the Natl. Iodine Deficiency Control Program.

Indonesia

Types/levels of processed foods consumed in select countries and the use of salt as an ingredient in those foods. Like most Asian countries, Indonesia's staple foods are cereal based consisting mostly of rice, wheat flour, and corn. Major processed foods appear to include rice noodles, bread, dry and wet cake, dry and wet pasta, corn flour products, sugar, and salt. Soy sauce is also a staple condiment countrywide. Other nonstaple commonly consumed processed food products may include snacks and meat products such as meatballs.

Suppliers of processed foods. Indofood is a major supplier of the Indonesian food market and calls itself a "total food solutions" co. They are one of the world's largest instant noodle producers and offer over half a dozen brands of noodles alone. They also produce or supply milk, yogurt, butter, seasonings (under the popular Maggi brand, among others), baby food products, flours, cooking oils, fats, pasta, and syrup. PT Indofood Fritolay Makmur offers Lay's potato chips, Cheetos, and other popular snacks such as Chitato, Chiki, and JetZ. Asia Sakti Wahid Foods Manufacture (ASWfoods) is a high-volume producer of biscuits (cookies), wafers, and chocolate products with its main factory in North Sumatra. Megasurya Mas produces margarines, shortenings, and specialty fats near Surabaya Port for both domestic and export markets. Cargill Indonesia is headquartered in Jakarta and has a sizable operation in-country, employing over 9000 people. Cargill's food industry activities include supplying soybeans for local tofu producers and sourcing palm oil and cocoa bean supplies for their international operations. Dolphin PT is a company specializing in chocolate, water, and snack confectionery products.

Approaches to influence intake of sodium/iodine in processed foods. A Presidential decree of 1994 enacted national legislation mandating iodization of all salt for human consumption. That decree was followed by a Ministerial decree on standards for manufacturing, quality, and packaging of iodized salt in 1995 by the Ministry of Industry and Trade. The standards were revised in 2000 to declare 94.7% sodium chloride and a minimum of 30 ppm iodine (added as potassium iodate) be used in salt. Monitoring and enforcement of these standards has reportedly not been optimal. Since January 2001, iodization efforts have moved from the federal government to regional governments for enforcement and/or development of their own legislation. A progress review toward sustained IDD elimination in Indonesia conducted by UNICEF in 2003 obtained information indicating routine use of iodized salt as an ingredient in product processing by many large food producers. However, the goal as prescribed in the decree of 1994 has not been achieved, thus it has been recommended that the authorities put efforts in verifying and compelling the use of iodized salt by all food processors.

Iraq

Types/levels of processed foods consumed and the use of salt as an ingredient in those foods. The contribution of packaged processed foods to Iraq's GDP was very low at 0.8% in 2004 (Izdihar 2006). However, this report also considers processed foods to include any item modified from its natural state. Basic commodities fitting this description are available in Iraq, such as flour, sugar, milk, and tomato paste.

An FAO/WHO/World Food Programme assessment of the food situation in Iraq in 2000 found many Iraqis to be very food-insecure, partly because of a serious drought during that time. Cereal and other crop harvests, such as vegetable and fruit, were down considerably, as were water resources (FAO/WHO/World Food Programme 2001). The drought also caused the price of many food products, including meat, milk, and vegetables to rise sharply, leaving many in Iraq dependent on food rations for sustenance. The Oil-for-Food Programme, which was established through the Security Council Resolution (SCR 986) in 1995 allows for many cereal imports and other food rations, although rations do not always provide a varied, nutritionally adequate diet. The assessment did mention that the Northern region of Iraq appeared to be more self-sufficient with food and to receive more assistance per capita than other regions in 2000.

A review of the potential for (packaged) processed foods in Iraq found extremely limited availability and demand for processed foods: "... a domestic supply of modern packaged foods is almost nonexistent" and "... demand for packaged foods is currently negligible" (Izdihar 2006). However, the review also expected the demand for processed foods to increase quickly, particularly for biscuits, snacks, tomato paste, powdered milk drinks, packaged cereals, and candies because they are easy to manufacture, are of lower cost, and appeal to a young generation who are expected to be early adopters. The authors also expected demand for protein-rich foods to increase "as conditions improve."

Al-Tariq Foods Co. of Baghdad lists the sodium content of several products in their Hello Foods line on their website: their tomato ketchup and tomato paste contain 2% and not more than 3%, respectively. Salt content is listed in mg/serving but serving size is not stated: tomato ketchup contains 150 mg/serving and tomato paste contains 610 mg/serving.

Suppliers of processed foods. Trans Iraq is a food distributor in Iraq with nationwide coverage. They are responsible for distributing Hello brand products from their sister company, Al-Tariq Foods in Iraq, whose product line includes jams, tomato pastes, sauces and ketchups, vinegar, and mayonnaise. The Saudi brand Zedny and Gulf Food Products from Jordan may also be found in Iraq.

Nepal

Types/levels of processed foods consumed and the use of salt as an ingredient in those foods. Nepal currently remains on the UN list of Least Developed Countries. Eighty percent of the Nepalese workforce is reportedly dependent on subsistence agriculture (Karki 2005), which is particularly disconcerting with recent droughts extending from 2009 to 2010. However, food processing does appear to be gaining a greater presence. For the 2004 to 2005 fiscal year, 129707 MT of flour, 97758 MT sugar, 24747 MT noodles, 6054 MT biscuits, 44376 kL soft drinks, and 108281 MT vegetable ghee and oil were produced. The major products in the food industry are tea and ghee/oil, but these are mainly for export to India. The distribution or consumption of the other products listed above is unclear. Karki also reported

Table 10—Daily intake value of consumption in Nepal.

Food	Average portion (g)
Rice	436
Cereals	458
Wheat	5
Potatoes	60
Milk and dairy	101

that these numbers indicated increases in noodles and alcoholic drinks. At that time, food laws were being updated, as were good manufacturing and agricultural practices.

An increase in the production of noodles noted by Karki fits with data seen by Heydon and others (2008), which noted that noodles were one of the most frequently consumed manufactured foods by Sherpas living in Kunde village in the Khumbu region of Nepal, in Mount Everest Natl. Park. Children were noted to consume noodle packs uncooked daily, while adults consumed noodles on a less than daily basis. While the noodles produced by 2 companies did not themselves have a notable iodine content (0.62 and 1.4 mg/kg), their accompanying flavor sachets had a reasonable level (18.3 mg/kg and 32.9 mg/kg). Other commonly consumed foods in the Sherpa village did not have notable iodine content (all below 1 mg/kg): potatoes, buffalo meat, and powdered milk. Consumption of powdered milk was said to occur 3 to 4 times/d during the majority of the year when fresh milk was unavailable, and the villagers consumed cheese 3 to 4 times per week. Most households in the study consumed both iodized salt (average 54.2 mg/kg) and uniodized rock salt. Interestingly, young children (less than 14 y old) and older adults (more than 55 y old) tended to have adequate levels of urinary iodine concentrations (UICs), while 15- to 54-year-olds were mildly iodine deficient.

An older survey of food consumption in Khargual village, in an agricultural region, found a similarly simple diet (Ohno and others 1997). This survey found no evidence of noodle consumption and did not mention salt or iodine content, though blood pressure ranges were found to be within normal levels at the time. Sources of food presented in Table 10 were unclear.

Suppliers of processed foods. Kwaliti Confectionary and Kwaliti Biscuits—separate arms of the Kabra Group—produce their candy, gum, chocolate, and biscuit products in Duhabi, Sun-sari, and Nepal. Annapurna Maida Mills of the same parent company also produces wheat flour domestically.

Approaches to influence intake of sodium/iodine in processed foods. Nepal has a long-term strategy of USI to combat IDD. However, a 2003 to 2004 study to determine salt iodine content levels found that of 1803 10-g salt samples collected from homes and analyzed, 289 (16%) had less than 15 ppm iodine and 637 (35.3%) had 15 to 30 ppm iodine. Thirty-six percent of the samples had an iodine level of 30 to 50 ppm, while 228 (12.6%) had iodine levels over 50 ppm. Ninety-three percent of these samples were powder salt, while 123 (6.8%) were phoda (dhike) salt. Although progress is being made to control IDD, this survey shows that more work remains to make sure all salt is properly iodized.

The Nepal Hypertension Society was established in 2004 with objectives of educating the people of Nepal about the importance of lifestyle measures, including salt reduction, in the prevention and treatment of hypertension. They conduct awareness programs, celebrate World Hypertension Day, and encourage research, surveys, and health camps that identify and treat hypertensive patients.

Pakistan

Types/levels of processed foods consumed and the use of salt as an ingredient in those foods. A survey completed by representatives from the Nutrition Wing of the Federal Ministry of Health of Pakistan estimates that 20% to 30% of food consumed in Pakistan arises from food manufacturers, while the remaining 70% is considered home-made food. They report that the manufactured foods are largely seen in urban settings and among the more affluent class. However, around 70% of the population is rural, and this rural population generally consumes home-made foods.

Cereals are the staple food in Pakistan—nan, roti, chapatti, and Jesus bread—are reported as commonly consumed and produced domestically by Natl. Foods and Shan Factory and by local suppliers. However, wheat consumption declined from 20 million tons to 18 million tons annually in 2009, and almost half of the population surveyed in crisis areas had inadequate food intake. The director of the World Food Programme in Pakistan expressed concern that food was out of reach for Pakistanis because of complications of the current economic crisis, including stagnant incomes and inflation (World Food Programme 2010c).

Suppliers of processed foods. Nestlé and Unilever are 2 of the leading food manufacturers in Pakistan, with annual sales around \$500 million. Both companies have seen growth in Pakistan in recent years—each saw at least a 20% increase in headline sales revenue in 2009 (Teatro Naturale Intl. 2010).

Approaches to influence intake of sodium/iodine in processed foods. Salt iodization is not mandatory in Pakistan, though USI at a level of 50 ppm is being sought in the legislature. The Nutrition Wing of the Ministry of Health is working toward this goal, with support from UNICEF, the World Food Programme, and the MI. The proposed law would require a Natl. IDD Control Advisory Board to be established for the oversight of USI, while compliance would be ensured by the Health Dept. and Food Dept.

Currently, inclusion of iodized salt in processed foods is voluntary, and de Jong (2007) quotes a salt producer's estimate that only about 5% of the market participates in the practice. The Nutrition Wing of the Federal Ministry of Health reported that wheat breads made by large manufacturers contain iodized salt due to the nature of their supply chains.

Philippines

Types/levels of processed foods consumed and the use of salt as an ingredient in those foods. Economic data show that 99% of urban households and 96% of rural households reportedly purchase bread. Lower percentages purchase pasta and noodle products: 69% of urban households and 70% of rural households (Fiedler 2008); 99% to 100% of urban and rural households purchase brown sugar, while a smaller percentage (11% urban and 27% rural) purchase white sugar.

However, these numbers do not describe the frequency of purchases. When looking at the amounts purchased, the rural dwellers spend on average 3 times as much money on noodles and pasta as their urban counterparts. Conversely, urban dwellers spend about one and a half times as much as rural dwellers on bread.

The amount of money spent on bread also increases with per capita income across all 5 quintiles. Meanwhile, consumption of pasta and noodle products is highest in the lowest income quintile and decreases consistently as income rises. Interestingly, money spent on brown and white sugar per household remains fairly constant across all 5 income quintiles.

Types of food consumed are inevitably affected by types of food available. As of 2005 to 2006, “sari-sari” stores, or small grocery/convenience stores that sell basic food and grocery essentials, accounted for about 70% of the retail food outlets—down from 80% in 1994 (Catelo 2005–2006). The same time period saw a rise in the number of supermarkets, particularly in urban areas, offering a greater variety of foods. Rural areas continue to be dominated by sari-sari stores.

Suppliers of processed foods. The San Miguel family of companies is very prominent in food processing in the Philippines, particularly the San Miguel–Purefoods Co., which is involved in food production from farm to distribution. Its product areas include milled flours and premixes, processed meats, dairy, and coffee products. Universal Robina Corp. is one of the largest food producers in the Philippines. It produces snack foods, confectioneries, bottled beverages, convenience products (such as noodle meals), and some canned grocery foods. Several fast food chains also operate in the Philippines, including Jollibee, the Triple V Group, and McDonald’s Philippines.

Approaches to influence intake of sodium/iodine in processed foods. The Act for Salt Iodization Nationwide (ASIN) was passed in 1995 and requires that all salt for human consumption (including salt used in food processing) be iodized (Republic Act No. 8172 1995). The Bureau of Food and Drugs is responsible for setting, monitoring, and enforcing standards for food-grade iodized salt. The Dept. of Trade and Industry is charged with regulating trade of iodized salt, and the Natl. Nutrition Council is to serve as the advisory board on salt iodization.

Given the extent of the current problem with IDD in the Philippines, IFT’s inability to find the established minimum level for iodization, and the reports of others (de Jong 2007), it is suspected that implementation of the ASIN Law has not yet been fully realized.

Russia

Types/levels of processed foods consumed and the use of salt as an ingredient in those foods. A study by Boylan and others (2009) that explored dietary habits in 3 countries, including Russia, noted that Russian subjects had the highest mean energy intake (as compared to Czech and Polish subjects) due to their high fat consumption. Few Russian subjects met dietary recommendations for fruit and vegetable intake, and this was often dependent on seasonal availability. A 2nd study that explored food preferences (Honkanen 2010) noted that the Russian diet consists mainly of carbohydrates and often fatty foods.

Suppliers of processed foods. An article in *Economic Times* (Bhushan 2010) states that Nestlé SA plans to invest \$1.35 billion in growth of operations in India, Brazil, Russia, and China between 2010 and 2012. PepsiCo is the largest multinational food and beverage company in Russia with sales of more than 2 billion dollars per year. PepsiCo, McDonald’s, and Coca-Cola all plan to continue to invest in their operations in Russia. McDonald’s plans to open 45 restaurants in Russia throughout 2010 (Farrell 2010). Wendy’s has also partnered with Russian Food Service Capital group to open its 1st restaurants in Russia in 2011.

Cargill also operates in Russia in the areas of grain milling, vegetable oil production, meat and poultry, syrup starches, and specialty food ingredients. Parmalat produces shelf-stable milks, tomato sauces, and juices, along with confectionery goods and pastas.

Approaches to influence intake of sodium/iodine in processed foods. Following the collapse of the Soviet Union, control of IDD

also collapsed. In 1991, the Moscow Endocrinology Research Center resumed efforts to control IDD. In April 1998, Resolution No. 11 “on Additional Measures to Prevent Iodine-Deficiency Conditions” introduced a new iodization standard of 40 ± 15 mg/kg. Salt producers were encouraged to meet the new standard, using potassium iodate, by the end of 1998. Resolution No. 1119 “On Measures to Prevent Iodine Deficiency Disorders” was passed in October 1999 making the Ministries of Defense, Interior, and Justice, and the Russian Federation Federal Border Service all responsible for purchasing iodized salt each year. Resolution No. 17, passed in December 1999, also makes it mandatory for children’s and medical institutions to be supplied with iodized salt. USI legislation made it to the Russian State Duma (Parliament) floor in 2004 because of advocacy by UNICEF (Gerasimov 2008). However, a UNICEF document blames “denial of the iodine deficiency problem” in Russia for creating an unsupportive environment (UNICEF 2004). Current IDD prevention strategies are voluntary, and it appears that enforcement is poor.

Also, a review by de Jong (2007) indicated that the population of the Russian Federation widely believes that iodizing salt impacts the quality of food. Iodized salt has been used in bread as a vehicle for iodine, though the extent of usage is unclear (Zimmerman 2007).

Turkey

Types/levels of processed foods consumed and the use of salt as an ingredient in those foods. As of 2002, wheat flour and semolina were responsible for 14.2% of consumption, whereas bread, biscuits, pickled olives, and tomato paste constituted 16%, 2.3%, 0.9%, and 0.6% of Turkish consumption (Alasalvar 2004). Akbay and others (2007) confirmed that bread and macaroni are among the main staples of the Turkish diet.

The 2006 Dietary Guidelines for Turkey (Ministry of Health of Turkey 2006) indicate a moderately high level of consumption of processed foods. The food groups are the milk group (milk, yogurt, cheese), the meat group (meat, poultry, fish, eggs, legumes, nuts, nut butters), the vegetable and fruit group (seemingly mainly fresh consumption), and the breads and cereals group (flour, starch, bread, cake/biscuit, macaroni).

Suppliers of processed foods. There are a large number of Turkish food and beverage manufacturers that also sell products beyond Turkey. These companies include Banvit Bandirma Vitaminli Yem Sanayii A.S. (Banvit), which processes and sells frozen or cooked poultry and meat products, including burgers, meatballs, kebabs, breaded meats, sausages, and so on. Dardanel Seafood Co. sells many seafood products. ETİ Pazarlama ve Sanayi A.Ş. (Eti Marketing and Industry Co. Inc.) makes more than 150 different pastry and confectionery products, such as cakes, pies, cookies, wafers, biscuits, crackers, and chocolates. Ulker also sells cookies, crackers, chocolates, and so on, and sells Cola Turka, which is a competitor to Coca-Cola. Anadolu Efes Biracılık ve Malt Sanayii A.Ş. (Anadolu Efes) sells beer and malt and soda beverages in Turkey, Russia, the CIS countries, Southeast Europe, and the Middle East, and is the 6th largest bottler for Coca-Cola products worldwide. Pinar Food Co. sells many powdered instant drink mixes and other beverages, and Sutas Dairy Co. sells soft drinks, fruit juices, and dairy and other beverages. Tekel Brewing sells a popular beer brand, Tekel Birasi. Assan Gıda Sanayi ve Ticaret A.Ş. (Kibar Holding A.Ş.) sells a number of products such as canned vegetables, ready meals, pickles, jams, and ketchup. Tat Konserve sells tomato, dairy, pasta, and meat products and is one of the largest food companies after merging Tat, Sek, Maret, and

Pastavilla brands. Penguen Foods sells a wide variety of fruit and vegetable products including preserves, pastes, pickles, ready meals, frozen foods, dried fruit, and more. Bim, Kiler, and Migros Turk are large Turkish supermarket chains, and Konya Seker and *Türkiye Şeker Fabrikaları A.Ş.* sell sugar throughout Turkey.

Approaches to influence intake of sodium/iodine in processed foods. Fine-milled table salt must be iodized at a level of 25 to 40 ppm potassium iodate. Use of iodized salt in processed foods is voluntary (Turkish Food Codex 1997). The 2006 Dietary Guidelines for Turkey explicitly state that table salt is iodized, but make no mention of the presence of iodized salt in processed foods.

Turkey's average salt intake was estimated in 2008 at 18.04 g/d (Penney 2009). Men had a higher intake than women, and intake was positively correlated with obesity and inversely correlated with education level. The Turkish Society of Hypertension and Renal Diseases is continuing research and aims to increase salt reduction awareness through leaflets and a traveling "hypertension truck" (Arici 2008).

Yemen

Types/levels of processed foods consumed and the use of salt as an ingredient in those foods. A recent review by the Intl. Food Policy Research Inst. (IFPRI) estimated food and calorie consumption of the Yemeni population (Ecker and others 2010). In the review, they detail food consumption by food group and do not directly provide data for processed food consumption. However, they do state that "few processed food items were available." The diets of rural dwellers were less varied than those of urban dwellers, with cereals supplying over 70% of their calories compared with less than 60% for urban dwellers.

The food industry is described by the Republic of Yemen's Ministry of Industry and Trade website as Yemen's 2nd most important after oil (Republic of Yemen, Ministry of Industry and Trade 2010); however, they neglect to give further details. Import and export data may help to shed light on the types of food consumption of the country: about 70% of cereals consumed in Yemen are imported, and this number is expected to rise in the coming years (Ecker and others 2010). IFPRI estimated imports of wheat, sugar, milk, and rice to be approximately \$450, 210, 140, and 140 million, respectively, in 2007. Meanwhile, IFPRI estimated that banana, coffee, and onion exports were in the range of \$18, 10, and 10 million, respectively, in 2007 (Ecker and others 2010), though fish and oil are the country's largest exports.

Bread is a major food in Yemen and is "present at the table during all 3 main meals of the day. . . by the majority of Yemen people. . ." (Al-Mussali and Al-Gahri 2009). At least in cities, bread is available for purchase at bakeries. As is the case in many countries, it appears that processed foods may be more available in cities. A study investigating the incidence of overweight and obesity in Sana'a City, the capital of Yemen, uncovered that 13% of schoolchildren consumed "fast food" within the last 24 h (Raja'a and Mohanna 2005). They neglected to define their interpretation of "fast food" but did classify it to be an unhealthy food choice.

In terms of salt content, 1 group studied the sodium content in 10 breads from randomly chosen bakeries in Aden, Yemen—sodium ranged from 58 to 556 mg/100 g (Al-Musalli and Al-Gahri 2009).

Suppliers of processed foods. Milling of wheat is known to take place at national milling plants in Aden at the Yemen Milling Co. and Al-Hoddidah (alternate spelling Al Hudaydah) at the Red Sea milling plant (Al-Mussali and Al-Gahri 2009). Zain Foods of India, which manufactures dairy products, frozen fruits, jams,

Table 11—Consumption of select processed foods by Finnish young men.

Food	0 to 1 d/ wk (%)	2 to 3 d/ wk (%)	4 to 5 d/ wk (%)	6 to 7 d/ wk (%)
Rye bread	21	23	23	30
Mixed bread	33	34	21	13
White bread	82	14	3	1
Porridge, breakfast cereal	67	18	8	7
Milk, sour milk	12	10	12	66
Yogurt, sour whole milk	53	28	12	6
Cheese	14	22	23	40
Sausage	64	27	7	3
French fries	78	19	3	1
Potato crisps and other snacks	83	15	1	0
Pizza, kebab	76	22	2	0
Hamburgers, hot dogs	81	17	2	1
Candy	55	37	6	2

Note: Table adapted from Bingham and others (2010).

spreads, and purees, self-reports that it exports food products to Yemen.

Approaches to influence intake of sodium/iodine in processed foods. Legislation requiring the iodization of salt for human consumption at a rate of 40 ppm was passed in 1996 (Hussein 2009). With the lack of widespread food processing, it is unclear if iodized salt is used in processing to any extent. Hussein (2009) does imply that enforcement of the legislation is lacking.

Europe

Finland

Types/levels of processed foods consumed and the use of salt as an ingredient in those foods. A strong trend is apparent in a handful of food consumption studies that have been published. By the age of 6 y old, consumption of at least some bread, cereal products, dairy products, and fat spreads/oils are near universal (Kyttala and others 2010; Lehtisalo and others 2010). Consumption of milk is notably high throughout life, with adolescent girls reportedly consuming 620 g/d (Lyytikäinen and others 2005) and pregnant women consuming 844 g/d of milk and dairy combined (Prasad and others 2010). Cereal product consumption is also notable: 190 g/d by adolescent girls and 174 g/d by pregnant women.

Table 11 summarizes the frequency of consumption of select processed foods by Finnish young men as reported by Bingham and others (2010). Highly processed foods (potato crisps, hot dogs, and soft drinks) are among those consumed least often, whereas milk and cheese continue to be the most frequently consumed.

In studying the association between processed meat consumption and chronic disease risk, Mannisto and others (2010) used the Alpha-Tocopherol Beta-Carotene Cancer Prevention Study data from 1993 to assess processed meat consumption by 26000 Finnish men. At the time, the highest quintile of men was consuming 139 g of processed meats per day. The 4th through 1st quintiles consumed 84, 62, 46, and 28 g/d, respectively.

Data from FINDIET 2007, the Finnish national dietary intake survey conducted every 5 y, showed salt consumption of adult men and women to be about 8 to 9 g/d and 7 g/d, respectively (Pietinen and others 2010a). This was a slight decrease in men's consumption of salt from the previous FINDIET survey in 2002, when salt intake of men and women registered at 9.9 and 6.8 g/d, respectively (Pietinen and others 2007). In the 2002 data, meat dishes contributed the most salt of any food for both men and women, at 23% and 22%. Bread was the 2nd largest contributor of salt in the diet at 19% of total salt consumed by both sexes. Vegetable dishes contributed 8.2% and 9.5% for men and women, processed meats contributed 8.3% and 4.2%, and cheese

contributed 4.4% and 5.4%.

Suppliers of processed foods. Nestlé Finland manufactures many products in-country and operates under the brands of Nestlé Bona, Piltti, Maggi, After 8, Fitness, Nescafé, and Premier to offer ice cream, breakfast cereals, bouillon cubes, pasta sauce, chocolates, children's foods, and coffee beverages. HK Ruokatalo Oy and LSO Foods Oy operate under the European parent company of HK Foods. The companies produce meat, processed meat, and convenience foods under the brands of HK, Kariniemen, Popsi, and Via. Atria Finland also produces processed meats, as well as ready meals, casseroles, bakery products, pancakes, and pizzas.

Fazer is a large Finnish company operating both restaurants/cafes and the manufacture of confectioneries and breads. Valio is the country's largest processor of milk and also offers cheese, butter, dry milk/whey powders, and probiotic yogurts and fruit drinks. HKScan Finnsoy operates out of Uusikaupunki, Finland, to produce soy protein ingredients as well as convenience foods, including vegetarian "heat and eat" products, meat replacers, cooking mixes, and snacks. Additionally, Heskburger is a popular fast food chain, serving hamburgers and fries.

Approaches to influence intake of sodium/iodine in processed foods. Iodization has been required in table salt in Finland since the 1940s, and is currently at a level of 25 mg/kg (Pietinen and others 2010b). Salt used in food processing is not required to be iodized, and Pietinen thus estimates that about 30% of salt in Finland is iodized. However, cattle feed is commonly supplemented with iodine, which translates into a milk and cheese supply with high iodine content. Because of the high consumption of dairy products by the Finnish people, milk and cheese products contribute significantly to iodine intake, in addition to iodized salt. The result is a population that consumes an estimated 160% to 170% of their iodine recommendations (Pietinen and others 2010a).

The Natl. Nutrition Council of Finland began a salt reduction campaign in the 1970s with a mass media campaign, voluntary reduction of sodium by the food industry, and education on the connection between salt and hypertension. Finland continues to actively promote lower salt intake of its citizens, continued reduction of salt in food formulations, informational campaigns, and guidelines for foodservice providers. A more complete history of Finland's salt reduction efforts is available through the World Action on Salt and Health (WASH 2009). According to WASH, some product groups, including bread, meat products, cheeses, and ready meals have had their salt content reduced by an estimated 20% to 25%. Also, Pietinen and others (2010b) credit a national requirement to label "heavily salted" foods for causing them to "almost disappear from the market."

Finland has also started a program to identify and label foods that follow certain criteria in salt, fat, fiber, and sugar contents. More than 430 foods from 70 companies have qualified to receive a "heart symbol." The criteria for Heart Symbol foods, such as bread and cereal products, are heavily based on salt content and if they are notable sources of sodium (Pietinen 2009).

Ireland

Types/levels of processed foods consumed and the use of salt as an ingredient in those foods. The Irish Universities Nutrition Alliance combined the efforts of 3 universities to produce the comprehensive North/South Ireland Food Consumption Survey in 2001 (Irish Universities Nutrition Alliance 2001). Consumption data for foods that were potentially processed as reported by the survey are shown in Table 12. Data are shown as the mean

Table 12—Mean intake of food/food groups in Ireland.

Food/food group	Population mean intake (g/d)	Percent consumers	Consumers only, mean intake (g/d)
White breads and rolls	78	94	83
Wholemeal and brown bread and rolls	45	73	61
Rice, pasta, flours, grains, and starches	20	44	46
Savouries	24	56	43
"Ready-to-eat" breakfast cereals	19	67	29
Other breakfast cereals	16	15	105
Biscuits	14	76	19
Cakes, pastries, and buns	17	60	29
Whole milk	150	73	205
Low-fat, skimmed, and fortified milk	88	45	194
Cheeses	12	74	17
Yogurts	16	32	49
Ice creams	7	37	20
Puddings and chilled desserts	16	50	32
Butter	6	47	12
Processed and home-made potato products	7	28	25
Chipped, fried, and roasted potatoes	59	82	72
Tinned or jarred vegetables	3	23	12
Bacon and ham	22	80	27
Sausages	10	59	16
Meat pies and pastries	5	19	29
Savory snacks	6	48	12
Soups, sauces, and miscellaneous foods	46	93	50

Note: Table adapted from Irish Universities Nutrition Alliance 2001.

intake of the population, the percentage of consumers who actually consume each food, and the mean intake of consumers only. Notably, almost all consumers (94%) eat white bread and a large portion eat potatoes, bacon, and ham. Salt and iodine intake are not reported.

Burke and others (2005) used the data from the North/South Ireland Food Consumption Survey to describe with exquisite detail the hourly consumption of white bread, wholemeal bread, cakes, rice, and pasta, breakfast cereals, total cereals, milk, cheese, and yogurt on all 7 d of the week.

Suppliers of processed foods. Aldi Stores, Superquinn, and Tesco are among the grocery chains operating in Ireland. Burger King, McDonald's, Subway, Supermacs, and KFC also have a presence. Allied Bakeries Ireland operates in Northern Ireland to produce breads, rolls, and buns under the Kingsmill and Sunblest lines. BWG Foods offers sausages, puddings, and baked beans under the Spar and Mace Own brands. Heinz Ireland offers baked beans, canned soups, frozen RTE meals, and the Amoy line of Asian cooking sauces. Kellogg's of Ireland offers breakfast cereals, including All Bran and Special K. The Kerry Group is a large player in the food industry of Ireland, offering dozens of its own brands of foods, in addition to supplying store-brand products. PepsiCo also operates in Ireland and produces the line of Walkers snack foods and chips.

Approaches to influence intake of sodium/iodine in processed foods. The Food Safety Authority of Ireland (FSAI) is among the most active government bodies working to reduce sodium intake of its population. In April 2005, FSAI published the report "Salt and Health: Review of the Scientific Evidence and Recommendations for Public Policy in Ireland," which found that Irish adults are consuming about 10 g of salt daily—higher than the recommended dietary allowance of 4 g per day (FSAI 2005). This report pushed FSAI to initiate a national salt reduction policy,

Table 13—Contribution of food staples and processed foods to total mean energy intake.

Food	Percentage of mean energy intake
Bread	15
Pasta, rice, grains, and other cereal products	2 to 3
Milk	3
Oil	1 to 2
Butter and animal fats	1 to 2
Sugar, honey, jam and syrup	5
Cakes and biscuits	7
"Other dairy products"	10
Margarine and deep-frying fats	6
Processed meat, fish, and eggs	6
Soft drinks	2

Note: Numbers are approximates.

Table 14—Mean daily consumption of the Dutch population.

Food	Daily consumption (g)
Pasta	35.3
Processed meat	41.2
Pastries	26.8
High-sugar beverages	118.9
Salty snacks	13.6
White bread	44.4
Whole grain bread	113.6
Cheese	35.5
Candy	14.2
Pizza	12.8
Breakfast cereal	4.2
Dairy	382.6

Note: Adapted from van Dam and others (2003).

which aimed to cut the average adult daily intake to 6 g by 2010. In 2009, Ireland adopted the United Kingdom's Food Standard Agency's salt reduction model to improve salt reduction efforts. Sixty-five companies and trade associations are registered in the FSAI salt reduction program as of 2011. Mostly, salt reformulation takes place in product groups that contribute most to salt intake, such as bread, meat and meat products, breakfast cereals, cheese, and soups and sauces (FSAI 2009). Companies' efforts are tracked and publicly available on FSAI's website.

FSAI reports that the 4 major bread bakers of the Irish Bread Baking Assn. have reduced their sodium content overall by 10% in 5 y to below the maximum level of 450 mg/100 g (FSAI 2009). FSAI has also set maximum goals for product categories—several examples are 400 mg Na/100 g for raw, fresh, and frozen burgers, sausages: 750 mg Na/100 g, bacon products: 1400 mg Na/100 g, and cooked uncured meats (such as cooked chicken or turkey): 600 mg Na/100 g.

Netherlands

Types/levels of processed foods consumed and the use of salt as an ingredient in those foods. Highly processed foods were found to contribute 78% to 79% of mean energy intake in adults living in Bilthoven and Utrecht (Slimani and others 2009). The authors defined a highly processed food to be industrially prepared and those "which require no or minimal domestic preparation apart from heating and cooking." The report tracked the contribution of nutrients by food, but neither sodium nor iodine were included. The percentage of mean energy intake from staple and processed foods is presented in Table 13.

The Monitoring Project on Risk Factors and Chronic Diseases in the Netherlands (MORGEN Study) was a large, cross-sectional study that examined the dietary intakes of almost 20000 Dutch men and women (Table 14). The study also identified 3 different

patterns of food consumption, one of which they termed the "refined-foods pattern," where people of this classification had greater consumption of French fries, sugary beverages, and white bread.

Interestingly, researchers at the Dutch Natl. Inst. for Public Health and Wageningen Univ. used a 1997 to 1998 Natl. Food Consumption Survey to mathematically model iodine consumption based on 3 different legislative requirements for iodization (Verkaik-Kloosterman and others 2009). Total iodine intake was estimated by the sum of 4 separate estimations of intake sources: (1) naturally occurring iodine, (2) iodized salt used in processing, (3) iodized salt added by the consumer, and (4) iodine-containing dietary supplements. The use of iodized salt in processing was estimated via a probabilistic approach: market shares of iodized salt used in processing of certain food groups were used to estimate iodine content of foods within a range. Then, the food consumption survey data were combined with estimated iodine contents to produce estimated total iodine consumption. The model predicted the mean iodine intake of adult men and women in the 3 legal requirements of iodization to range from 210 to 348 ig/d. Also, the model was used to estimate the percentage of the population consuming below the estimated average requirement of iodine after the latest round of regulations took effect in 2008 (from 2% to 6% of children 1 to 3 y old).

Suppliers of processed foods. Heinz offers a variety of brands and products in the Netherlands: they include the Amoy brand of Asian-inspired sauces and kits, the Brinta line of whole grain porridges, and Honig, which is a very popular brand that makes soups, baking mixes, dried pastas, and meal "helpers." Bolletje is a bakery company that produces crackers, biscuits/cookies, and various other snacks.

Approaches to influence intake of sodium/iodine in processed foods. Iodization of table salt is mandatory in the Netherlands at the rate of 30 to 40 ppm. Gerasimov (2009) reports that mandatory use of iodized salt in bread was repealed in 1984, but 90% to 95% of bread makers still use iodized salt. The recommended rate of iodization in bread salt was updated to take effect in 2008 at a maximum level of 65 ppm. Meanwhile, the use of iodized salt was approved for use in all other nonbakery, industrially processed items at a maximum rate of 25 ppm.

A range of adult daily salt intake is reported from 8 to 10 g (Verkaik-Kloosterman and others 2010). The Netherlands have joined the effort of the EU framework for Natl. Salt Initiatives that would reduce salt intake to no more than 5 g/d. Dutch Food Industry Federation (De Federatie Nederlandse Levensmiddelen Industrie 2010) launched the Action Plan Salt Reduction in 2008 to reduce sodium content in foods by 12% in 2010—they achieved an average 10% reduction as reported in an August 9, 2010, statement. Collaboration between the Natl. Inst. for Public Health and the Environment and Wageningen Univ. continues to follow the iodine intake of the population and predict how changes in salt will impact iodine intake (Verkaik-Kloosterman and others 2010). They predict if salt intake is cut by half, iodine intake may become inadequate for up to 10% of the population and require an increase in iodization level.

Ukraine

Types/levels of processed foods consumed and the use of salt as an ingredient in those foods. A study regarding consumer preferences listed the following potentially processed foods as "relatively readily available on the market" in Ukraine: white bread, whole grain bread, pasta, fruit/vegetable juice, milk, cottage cheese, hard

Table 15—Contribution of salt to the U.K. diet.

Food	Average salt intake (mg) ^a
Bread	1162
Bacon and ham	560
Breakfast cereals	337
Cheese	265
Sausages	233
Baked beans	225
Milk and cream	220

^aAdapted from Food Standards Agency (2004).

cheese, bologna, kielbasa, candy, cake/cookies, ice cream, and cola-type drinks (Biloukha and Utermohlen 2000). Consumption was listed in relative numbers, so absolute consumption cannot be estimated; however, white bread is the most consumed food on the list of both processed and fresh or minimally processed foods. Processed foods followed in the order of whole grain bread, pasta, cottage cheese, whole milk, and so on.

Suppliers of processed foods. Sandora LLC is a major juice manufacturer operating in Mykolaiv, Ukraine, and is now owned by PepsiCo, producing carbonated soft drinks, iced tea, and Lay's potato chips alongside its original juices.

United Kingdom

Types/levels of processed foods consumed and the use of salt as an ingredient in those foods. The Food Standards Agency (FSA) estimated the average U.K. adult's daily salt intake from food to be 6899 mg, plus 2500 mg discretionary salt (Food Standards Agency 2004), as divided between the foods in Table 15.

Anderson and others (2010b) reported a mean sodium intake value of 3406 mg/d, corresponding to 8515 mg salt per day. The breakdown of sodium sources was similar to that reported by the FSA and is as follows: bread grains and cereals (1178 mg), red meats, poultry, and eggs (696 mg), vegetables and vegetarian products (280 mg), dairy (267 mg), plus several less salt-dense categories.

A study by Slimani and others (2009) found that highly processed foods ("foods that have been industrially prepared . . . which require no or minimal domestic preparation apart from heating and cooking") contributed about 75% of the calories consumed by the general U.K. population. Broken down, food groups contributed the following approximate percentages of calories: bread 12%; pasta, rice, grains, and other cereal products 3%; milk 5%; vegetable oils 2%; butter and animal fats 2%; sugar, honey, jam, and syrup 3%; cakes and biscuits 9%; crisp breads and rusks (hard biscuits) 1%; breakfast cereals 4%; margarine and deep-frying fat 5%; and processed meat, fish, and egg products 6%.

Suppliers of processed foods. Supermarkets operating in the United Kingdom include Budgens, J Sainsbury PLC, Morrisons, Somerfield, Tesco, and Waitrose. Allied Bakeries (operated by Assoc. British Foods) produces the Kingsmill, Sunblest, and Allinson lines of bread. Assoc. British Foods also offers a host of other brands, with products in every aisle of the supermarket. Rank Hovis is a miller, selling a variety of flours, milling fractions, and baking mixes. United Biscuits of Middlesex produces a number of brands of biscuits, including BN, Carr's, Delacre, McVitie's, and many others. Mars UK produces chocolate confectioneries. The Dairy Crest Group produces milk, butter, margarine, and cheese under a number of different brands. Unilever, Campbell's, Proctor & Gamble, and Kraft all have a presence in the United Kingdom. Meanwhile, Walkers is a leading brand of snacks and potato chips distributed by PepsiCo.

Approaches to influence intake of sodium/iodine in processed foods. Salt iodization is voluntary in the United Kingdom and is not believed to be highly prevalent in processed foods. Regulations do exist to mandate a minimum dose in infant formulas, baby foods, and energy-restricted diet foods intending to replace the entirety of the daily diet (Expert Group on Vitamins and Minerals 2002).

The United Kingdom has been working to reduce salt content in processed foods since before the EU developed a framework for Natl. Salt Initiatives and has one of the most active salt-reduction communities in the world. Following the publication of a 2003 report by the United Kingdom's Scientific Advisory Committee on Nutrition that linked high salt intake with high blood pressure, the U.K. government set a target to reduce salt intake to an average of 6 g/d by 2010, as outlined in the Dept. of Health's Public Health White Paper and the FSA's Strategic Plan. The plan aimed to increase discussions with the food industry to reduce the salt content of food and to promote ongoing public awareness and guidance about reducing salt intake.

By October 2009, the Agency received over 90 formal commitments from all sectors of the food industry, including major U.K. retailers, multinational and national manufacturers and caterers, as well as trade associations, to reduce salt in their foods. Particular attention in salt reduction research has been paid to meat products and bread: meat products due to safety concerns and bread due to their high consumption rates, and therefore high contribution of daily sodium (20%). Furthermore, levels of salt in processed foods have been monitored through a Processed Food Databank, which contains the sodium content of 1000 commonly consumed products bought in the United Kingdom. The most recent edition sampled foods in 2007 (Food Standards Agency 2009).

In addition, the Natl. Inst. for Health and Clinical Excellence (NICE) called for reductions in salt in a series of guidelines issued in June 2010. The guidelines called for speeding up reductions in salt intake, aiming for a maximum intake of 6 g per day per adult by 2015 and 3 g daily by 2025. In addition, NICE wants industries to ensure that low-salt foods are cheaper than equivalent products with higher salt content (Natl. Inst. for Health and Clinical Excellence 2010).

North and South America Argentina

Types/levels of processed foods consumed and the use of salt as an ingredient in those foods. It is estimated that 93.7% of Argentina's population has access to commercially processed food (Micronutrient Initiative 2007).

A review by Rodriguez and others (2002) demonstrated that Argentinean consumers with higher education, income, durable assets, and consumer credit were more likely to shop at supermarkets where presumably processed foods are more readily available (as opposed to smaller, specialized shops). Also, residents of the poorer, more rural northern region of Argentina were less likely to shop at a supermarket. Finally, consumers were less likely to purchase fresh items (fruits, vegetables, meats) at supermarkets.

Suppliers of processed foods. In 2000, there were approximately 21500 food processors listed in Argentina, with almost a 3rd of them being oilseed processors. At that time, Argentina had a growing export market and was working with the arrival of United States and other foreign companies entering their food processing sector (GAIN Report #AR0010 2000). Also, 85% of ingredients used by large food manufacturers were from local sources, whereas the remaining 15% came from foreign sources.

Major food processing companies listed in the GAIN Report include:

- (1) Arcor (candies, chocolates, and flavors);
- (2) Molinos Rio de la Plata (flour, meat, fish, poultry, sausage, frozen foods, and bakery);
- (3) Danone (dairy, confectionery, and bakery);
- (4) Nestlé Argentina (frozen foods, prepared vegetables, dairy, snacks, bakery, and prepared meals);
- (5) Refinerias de Maiz (oils, sauces, cake mixes);
- (6) Nabisco Terrabusi (snacks, bakery, and confectionery);
- (7) Canale (bakery and dairy);
- (8) Kraft Suchard Argentina (juices, chocolates, and confectionery); and
- (9) Quimica Estrella (dry foods and beverages).

Among these, Molinos Rio de la Plata had the highest sales (\$1 107 000 000 in 1998) and is locally owned. Danone and Nestlé followed in sales. Companies involved with flours and milling in Argentina include Molinos Rio de la Plata SA, Monilo Canuelas, and Glencore subsidiaries. Ledesma is a major sugar producer in the country.

Approaches to influence intake of sodium/iodine in processed foods. Article 1272, Res 153 of Chapter 16 of the Argentine Food Code (Capítulo XVI – Correctivos y coadyuvantes; Código Alimentario Argentino; Article 1272; 1978) requires that “all salt (sodium chloride) that is sold for human consumption should contain 1 part of iodine in 30000 parts of salt, accepting a variation of plus or minus up to 25%.” In ppm, the requirement is 33.3 ± 8.3 ppm. However, “salt for industrial use, food or not . . . is excluded from the obligation referred to above and in these cases must be entered on the label legend industrial or pharmaceutical use (as appropriate).” (Capítulo XVI – Correctivos y coadyuvantes; Código Alimentario Argentino; Article 1274; 1978.)

Furthermore, Article 1274 prohibits the production, possession, and sale of uniodized salt that is destined for human consumption in endemic areas.

Bolivia

Types/levels of processed foods consumed and the use of salt as an ingredient in those foods. Bolivia is one of the poorest Latin American countries with many living in poverty and experiencing food insecurity. A study of diet in the northern Potosi region, a rural, indigenous area of Bolivia, gathered food recall data for 2178 d, yet only 92 different foods were observed (Berti and others 2010). Potatoes, such as chuño (freeze-dried potatoes), were consumed daily and tubers in general supplied over half of the respondents’ dietary energy. Oranges and lemons were infrequently consumed and represented the only fruit. Vegetables such as onions and carrots were consumed more frequently, as were legumes. Fats and oils and animal source foods were not uncommon, but were only eaten in small amounts.

A study found similar types of foods consumed by both rural and urban Bolivians (Pérez-Cueto and others 2006). Household surveys over 4 y found that preferred food groups in order of consumption were cereals, fruits, tubers (such as potatoes), vegetables, meats, and animal source products like milk or dairy products. Compared to 1999 data, availability of milk, meat, fish and other seafood, fruits, sugar products, and cereals decreased, while availability of tubers and added fats increased, perhaps due to lower agricultural yield and production from 1999 to 2002. As might be expected, urban households and those with higher social status had greater food availability of meat, milk, eggs, pulses, vegetables, fruits, and sugar products than rural households, which still con-

sume mainly tubers. Economic data collected by Fiedler (2008) agree with this finding. Urban households were consistently more likely to purchase rice, wheat, corn, flour, bread, and pasta than the rural population. The largest difference was seen in bread, where 92% of urban households purchased bread, as compared to 72% of their rural counterparts. Not surprisingly then, Pérez-Cueto and Kolsteren (2004) noted that urban Bolivian women were 1.2 times more likely to be overweight and 2.3 times more likely to be obese than their rural counterparts.

Further highlighting this disparity, Melgar-Quinonez and others (2006) compared the daily per capita expenditure on food groups by people according to their food security status. Those who were considered “food-secure” spent almost twice as much on foods as those who were considered “severely food-insecure.” The difference was most evident in foods of animal origin, but the food-secure also spent more on cereals, tubers, and legumes. This is of particular concern because the severely food-insecure may not have adequate access to even the most basic staples (Melgar-Quinonez and others 2006).

Suppliers of processed foods. Molino Andino is the largest mill in Bolivia producing wheat flour and noodles. Other millers include Sociedad Industrial Molinera (wheat flour, oat products, rice) and Molino y Fabrica de Fideos Aurora (wheat flour, noodles). Dillmann is a parent company operating under a number of brands in Bolivia: the Dillmann brand produces a comprehensive range of cold cuts and other processed meats for sale in-country and export, SanCor offers dairy and cheese products, Hogar offers jams and sauces and Bimbo offers breads. Industrias Alimenticias Del Valle produces fruit juices, jams, soup mixes, and tomato sauces for domestic and export sales. Companies offering processed dairy products include Pil Andina and Compañía de Alimentos Delizia. Finally, several multinational companies have a presence in Bolivia, including Archer Daniels Midland, Nestlé, and Cargill.

Brazil

Types/levels of processed foods consumed and the use of salt as an ingredient in those foods. A dietary assessment in a rural area of the state of Minas Gerais indicated that children’s diets contained mainly rice, beans, and corn meal, with some cow milk and minimal meat, poultry, fruits, and vegetables (Beinner and others 2010). Another assessment of school children conducted in Florianopolis, southern Brazil, studied the intakes of 1200 7- to 10-y-olds and compared them to the recommended servings per day. They found that 37.9% consumed adequate milk/dairy, 6.5% consumed adequate cereals (bread, crackers, rice, and pasta), 59.1% consumed adequate dried beans, 73.5% consumed adequate meat and fish, 27.2% consumed adequate fruits, 5.5% consumed adequate vegetables, while 78.7% consumed sweets (lollypops, ice cream, cakes, biscuits), 58.1% consumed salty snacks (chips, French fries, pizza, hamburgers), and 33.5% consumed soft drinks the previous day (de Assis and others 2010).

Lenz and others (2009) grouped most highly processed foods together as part of a “higher-risk diet of high cost” in their study of dietary patterns of women in southern Brazil. Overall, women consumed 30.1 servings from this group per month, including chocolate/candy, desserts, sweets, processed meats, cheese, mayonnaise, fast foods, and biscuits. Minimally processed foods such as wheat flour, bread, and milk were grouped with other foods in such a way that precludes understanding the prevalence of their consumption.

Table 16—Percentage of Brazilian men and women consuming foods outside the home.

Food group	Example foods	Consumption (% men)	Consumption (% women)
Soft drinks	Soda, pop	16.1	10.9
Deep-fried foods	"Common street foods made of dough filled with chicken, cheese, meat, and so on"	10.3	9.0
Fast foods	Burgers, pizzas, French fries, hot dogs, sandwiches	9.6	7.2
Sit-down meals (outside home)	"Dishes regularly eaten for lunch and dinner" such as rice and beans	18.5	12.4
Sweets	Candies, chocolates, ice cream, desserts	7.0	10.3

* Adapted from Bezerra and Sichieri (2009).

Bezerra and Sichieri (2009) used the Brazilian Household Budget Survey to study the consumption of foods eaten out of the home (Table 16). About 40.3% of the population was found to consume foods outside of the home.

The sodium contents of "industrialized foods" commonly eaten by children and adolescents in Brazil were tested and reported by Lobanco and others (2009). Corn snacks had an average sodium content of 88.8 mg/100 g. Wheat snacks, potato chips, and peanuts were also reported to be 75.4, 62.3, and 66.4 mg/100 g, respectively.

Suppliers of processed foods. Brazil has a large food processing industry with the presence of many major multinational companies, including Barilla, General Mills, Nestlé, Archer Daniels Midland, Bunge, and Cargill. An article in *Economic Times* (Bhushan 2010) states that Nestlé SA plans to invest \$1.35 billion in growth of operations in India, Brazil, Russia, and China between 2010 and 2012.

In terms of the production of minimally processed staples in Brazil, Moinho Sao Valentin operates a major milling operation with Cargill, and Bunge also operates in Brazil in the wheat flour and premix industries. For salt production, Salinor produces sea salt in Rio Grande do Norte, and Refineria Nacional del Sal (brand name Sal Cisne) operates near Rio de Janeiro.

Approaches to influence intake of sodium/iodine in processed foods. Legislation was first passed in 1953 in Brazil requiring all salt for human consumption to be iodized. Brazil passed an updated resolution on iodization in 2003, stating that iodization of all salt for human consumption is mandatory at the level of 20 to 60 ppm. Salt for processed foods is required to be iodized, except in cases where it is proven that iodine causes interference. In such cases, the manufacturers are responsible to provide the monitoring agency with evidence of the interference (Resolução – RDC nº 130 2003).

Interestingly, de Jong (2007) reported that iodization of salt in food processing is voluntary, and estimated that 25% of the general market uses iodized salt, whereas soup and seasonings are almost universally iodized. This perspective may be indicative of the number of manufacturers who choose not to include iodized salt on the basis of interference with their products.

Chile

Types/levels of processed foods consumed and the use of salt as an ingredient in those foods. On average, Chileans spend approximately 20% of their household income on food, drinks, and

tobacco. Chile is the 2nd biggest consumer of bread in the world (96 kg/y, per capita) after Germany, the 4th largest consumer of tea (700 g), and also a large consumer of pasta, rice, seafood, carbonated beverages, and beer (Herrera 2009). Chile processes and globally exports a variety of foods and beverages including canned, dehydrated, and frozen fruits and vegetables, wine, fruit juices and pulps, olive oil, pork, lamb, poultry, beef, and many dairy products. Most food products are purchased at supermarkets. Consumer spending on food and beverages has risen significantly from 2003 to 2008 due to a decline in unemployment and increased buying power. This also enables many consumers to purchase an increased amount of processed foods and offers food and drink manufacturers opportunities to launch new, innovative value-added products. Convenience and fast foods, "healthy" and light foods, and other foods purchased out-of-home (such as snacks which are frequently consumed by low-income households and younger consumers) are experiencing strong growth.

Suppliers of processed foods. Multinational food companies such as Nestlé and PepsiCo have a long history of manufacturing plants in Chile. Currently 53 food companies dominate the Chilean market (Herrera 2009).

Approaches to influence intake of sodium/iodine in processed foods. The Ministry of Health has declared that all edible salt for direct consumption or food preparation must contain 20 to 60 ppm of iodized salt (minimum NaCl content of 97%).

Uruguay

Types/levels of processed foods consumed and the use of salt as an ingredient in those foods. An estimated 95.3% of the population of Uruguay has access to processed foods (Micronutrient Initiative 2007). Yet there is a limited amount of information in the literature regarding actual food consumption in Uruguay. Interestingly, Eduardo De Stefani has led a group at the Hospital de Clinicas in Montevideo, Uruguay, to perform a number of studies comparing dietary intake to risk of various cancers. Unfortunately, their data are not presented in such a way to be useful in estimating processed food consumption (based on how foods are grouped for analysis or how data are reported). However, it is readily apparent from their reports that processed meats, dairy foods, desserts, and processed grains are available, at least to a portion of the population (De Stefani and others 2010). Similarly, a study by Ares and Gambaro (2008) analyzed and reported food consumption by food group. Those groups that may be good indicators of processed food consumption include the "milk and dairy products" and the "cereals and bakery" groups. Most of the surveyed population (72%) consumed milk and dairy products one or more times a day and 59% consumed "cereal and bakery" products one or more times a day.

Suppliers of processed foods. Nestlé del Uruguay operates out of Montevideo and offers breakfast cereals, condensed milk, chocolates, infant formula, and a variety of drink mixes, along with the popular Maggi brand of soup mixes. Soldo Hermanos focuses mainly on offering products within Uruguay, with a wide variety of food products including jams, condiments, tomato products, powdered soft drinks, margarines, oils, olives, and iodized salt. El Trigal has been producing biscuits (cookies) in Uruguay since 1948 and their product line currently includes wafers, cookies, crackers, and snacks. Blue Bird S.A. manufactures foods for store brands, including flavored rice, dessert and cake mixes, ice cream, and candy. Conaprole offers ultrahigh-temperature (UHT) processed milk, as well as cheese. In terms of grains, Industrias Harinas S.A. operates the Molino San Salvador wheat milling operation, and

SAMAN is a leading rice processor that operates the only par-boiling plant in-country. Glencore also produces rice through a subsidiary in Uruguay.

Approaches to influence intake of sodium/iodine in processed foods. The iodization of salt is voluntary in Uruguay but is required in endemic areas. There has been an educational campaign in Uruguay to promote the national food-based dietary guidelines, which limit salt intake to less than 5 g per day. In addition, the government is considering the possibility of forming a Working Group for Salt Reduction (Penney 2009).

Haiti

Types/levels of processed foods consumed and the use of salt as an ingredient in those foods. An estimated 59% of the Haitian population has access to processed food (Micronutrient Initiative 2007). Though the country imports 75% of its food, it is mostly in the form of staples such as rice, wheat, corn, and oilseeds.

Work by Dessalines and others (2008) reported on the food intake of women in rural south Haiti. They found only 3 foods reported to have been eaten more than 3 times a week by more than 75% of the women: local bread, rice, and mangoes. Powdered juice was consumed more than 3 times a week by 25% to 50% of the women, while evaporated milk, peanut butter, sweet and salty snacks (“bonbon sèl,” a sweet and salty biscuit), white bread, soft drinks, and cheese were consumed more than 3 times a week by less than 25% of the women. Still, 85% reported that they had consumed salty snacks within the last 3 mo.

While imported meat may arrive frozen in local grocery stores (as is the case with chicken), it does not appear to be largely processed, but merely cut into pieces (Dupraz and Collet 2010). Purchasing frozen chicken is an option, as is purchasing a live chicken produced in-country.

A description of “a traditional Haitian meal” included little room for processed foods: white rice with sauce made from fried red meat or fish, mixed with vegetables, accompanied by a puree of beans or nonfried tubers (Desilets and others 2006). Fruit juice and water are typical beverages, and dessert is likely fruit, if it is eaten.

Suppliers of processed foods. Many multinational food companies provided large donations of money and food products, including packaged goods to Haiti following the 2010 earthquake. Wal-Mart gave food kits; PepsiCo provided bottled water, Gatorade, and Quaker food products; Yum! Brands Inc. donated food products; and Nestlé Waters NA provided bottled water products (Gabert 2010).

Mexico

Types/levels of processed foods consumed and the use of salt as an ingredient in those foods. The proportion of the population estimated to have access to processed food is 83.9%. Per capita consumption of wheat flour, corn, and sugar are estimated to be 38.8, 65, and 53 kg, respectively (Micronutrient Initiative 2007).

A 2006 FAO Nutrition Paper (Barquera and others 2006) reports on the consumption of a variety of food categories across geographic (rural compared with urban) and socioeconomic index (low, medium, high) in Mexico (Table 17). The processed foods reported include breakfast cereals, processed meats, processed fish, processed/canned fruits and vegetables, soft drinks, and confectioneries. The mean intake of urban dwellers was higher for breakfast cereals, processed meats, processed fruits and vegetables, soft drinks, and confectioneries. Rural dwellers consumed only more

Table 17—Mean intake of processed food consumption by urban compared with rural dwellers of Mexico.

	Location		Socioeconomic index		
	Urban	Rural	Low	Medium	High
Breakfast cereal	4.8	0.8	0.2	3.7	6.8
Processed meat	11.0	5.6	6.0	8.6	13.4
Processed fish	0.9	1.2	1.0	1.1	0.8
Processed/canned fruits/vegetables	2.9	1.0	0.5	1.6	4.6
Soft drinks	210.7	103.4	120.8	167.8	248.7
Confectionary	6.7	4.5	3.3	8.3	6.6

Notes: Adapted from Barquera and others 2006. Values are mean g or mL of purchased food. Data are from the 1988 MNS-1 and 1999 MNS-2 surveys.

processed fish. As far as SES, high SES Mexicans consumed more breakfast cereal, processed meat, processed fruits and vegetables, and soft drinks than their medium or low SES counterparts.

Suppliers of processed foods. Major corn and wheat millers include Grupo Gruma; Grupo Minsa; Minsa; Trimex; Espiga; and Elizondo. The Latin American Assn. of Industrial Millers is the representative group for this industry. Gruma, S.A. is also involved in the production and distribution of tortillas, corn, and wheat flours. Sugar producers include La Union Nacional de Caneros and Cargill. An article in Economic Times (Bhushan 2010) states that Kellogg’s indicated plans to increase operations in France, India, and Mexico in the coming years.

Approaches to influence intake of sodium/iodine in processed foods. Salt iodization is mandatory at a rate of 30 ± 10 ppm according to Mexican Normativity 040-SSA1-1993, and an amendment that was published on September 23, 2003. Potassium iodide or iodate are to be used. “Salt for use in the food industry” also requires iodization. Table salt (but not food industry salt) must be fluoridated in addition to iodized. The Ministry of Health is responsible for compliance.

The Normativity and its amendments are very specific. Documentation requirements are outlined for various storage stages, analysis of the finished product, cleaning, maintenance, processing, and pest control. Chemical, physical, and contaminant specifications are provided, as are methods by which to test them.

Australia

Types/levels of processed foods consumed and the use of salt as an ingredient in those foods. The Australian Dept. of Foreign Affairs and Trade lists that the processed food and beverage industry is Australia’s largest manufacturing industry with turnover of over \$71.4 billion from 2005 to 2006 (Australian Dept of Foreign Affairs and Trade website 2008). The foods that contribute the most to Australians’ sodium chloride consumption are bread and bread rolls (25%), meat, poultry & game products, and dishes, including processed meat (21%), cereal products and cereal-based dishes (for example, biscuits and pizza) (17%), savory sauces and condiments (8%), and cheese (5%) (FSANZ 2010). Breakfast cereals contribute approximately 4% of total salt consumption and dried soup mixes less than 3%, the food standards body reported (FSANZ 2008b). Food Standards Australia New Zealand (FSANZ), which monitors the salt levels in Australian food, said that the food industry had been successful in reducing salt in the last couple of years but there remains potential for further improvement (Australia Food News 2009).

Suppliers of processed foods. Australia’s 50 largest food and beverage corporations produce the majority of the domestic industry’s revenue (almost three-fourth). Supermarkets and grocery

store chains provide the majority of food sales in Australia, with sales around 60% of total food and alcoholic beverages in 2006 to 2007. Goodman Fielder is one of Australia's largest food producers, and supplies both retail grocery stores and commercial food services. Their brands include Meadow Lea, Praise, White Wings, Pampas, Mighty Soft, Helga's, Wonder White, Vogel's (under license), Meadow Fresh, and Irvines, while their products span the entire range of processed foods, including baked goods, condiments, frozen foods, cooking oil, and more. The Forbes list of Australia's 40 Largest Companies includes a number of grocery store chains and 1 food company. Woolworth's food markets come in at #9; Coles Group food markets rank #15; Foster's Group, which sells beverages such as wine, beer, and soft drinks, is #23; and Metcash food markets are #37.

Approaches to influence intake of sodium/iodine in processed foods. The concern over reemergence of iodine deficiency resulted in government regulations mandating fortification of bread with iodine at an iodization rate 45 mg iodine/kg salt (FSANZ 2008a). This iodization level falls within the range of the current voluntary permission rate for iodized salt of 25 to 65 mg iodine per kg salt. The regulation introduced in October 2009 by FSANZ required the replacement of the existing salt in bread with iodized salt, with the exception of organic bread, which is not required to contain iodine because of the rules related to organic food production. Bread was selected as a preferred vehicle because it is a commonly eaten food product. States and territory governments are responsible for enforcement of food standards (usually the Health or Food Regulation Dept.). FSANZ notes that these fortification rates are not expected to meet the increased requirements of pregnant and breastfeeding women so iodine supplements of 150 mg/d are recommended for pregnant and breastfeeding women by various Australian states and territories including Tasmania and south Australia (Natl. Health and Medical Research Centre; Australia Food News 2010). Pregnant and nursing women are also encouraged to consult their health care professional regarding iodine supplementation.

The Australian Div. of World Action on Salt and Health (AWASH) has been active in Australia's efforts toward salt reduction. They aim to reduce Australian's daily consumption of salt to 6 g by 2012. To achieve this, their "Drop the Salt!" campaign plans to work with food producers and the catering industry to reduce salt content by 25%, to continue to educate consumers on low-salt diets and label reading, and to promote enhanced labeling (AWASH 2009).

FSANZ has also been working with food industries to lower salt levels in foods in the 2 nations, in addition to monitoring the salt content of the food supply. The Australia New Zealand Food Standards Code has allowed for label claims such as "low salt" (less than 120 mg sodium per 100 g), "no added salt," "reduced salt" (a 25% reduction compared to a standard/reference food), and "salt free."

New Zealand

Types/levels of processed foods consumed and the use of salt as an ingredient in those foods. The 1997 Natl. Nutrition Survey of New Zealand found that bread provided the most energy in an adult New Zealander's diet (Russell and others 1999). Milk, alcoholic beverages, cakes and muffins, nonalcoholic beverages, and sugar/sweets each contribute 5% of energy to the diets of New Zealand adults. Butter and margarine provided 6% of energy to adult diets. Approximately two-thirds of adults met the New Zealand Nutrition Taskforce guideline of at least 3 servings of vegetables per day (especially potatoes and kumara, which provide

7% of energy to adults), and almost half of the New Zealand adult population met the New Zealand Nutrition Taskforce guideline of at least 2 servings of fruit per day. Interestingly, half of the adult population in New Zealand had consumed a vitamin and/or mineral supplement in the year polled; 28% did so at least once a week. The 1997 Natl. Nutrition Survey polled a nationally representative sample of over 4600 New Zealanders older than 15 y of age.

Suppliers of processed foods. Food suppliers in New Zealand are similar to that of Australia—Goodman Fielder, with headquarters in Australia, also supplies food to and has manufacturing facilities in New Zealand.

Flour mills operating in New Zealand include Corson Grain and Weston Milling. Other major food companies in New Zealand include Fonterra Cooperative Group, which sells dairy products under the brand names Anlene, Anchor, Annum, Mainland, and Tip Top; Lion Nathan Ltd., which sells alcoholic beverages in Australia and New Zealand; Montana Group (wine); and Wattie's, which sells a variety of food products including baby food, canned chicken, fruit, vegetables, soup, sauces, creamed rice, frozen foods, and ready-to-serve meals.

Approaches to influence intake of sodium/iodine in processed foods. Efforts to influence intake of sodium and iodine are similar in New Zealand to Australia because of the joint Food Standards Australia New Zealand (FSANZ 2008a). See the "Australia" section of this report for more information.

Summary of Phase II Survey Findings by Country

It is important to note that the summaries of findings by country include both responses to an electronic survey administered during Phase I of this project (which included details sought for Phase II), as well as responses to a Phase II electronic survey since Phase I respondents were different from Phase II respondents. It is also important to note that respondents did not necessarily answer every question in a survey and that some questions were only found in 1 survey (such as awareness of/interest in iodine nutrition), so number of responses provided does not always total the numbers shown in Table 3. Survey and telephone responses were self-reported and IFT did not verify accuracy of the information provided.

Australia

Use of iodized salt in processed foods. According to IFT survey data, Table 18 shows the salt-containing processed foods most frequently consumed by middle- to low-income populations in Australia; whether the product is domestically produced or imported; who the manufacturer is; the sodium content of the product; and whether the salt used in the product is iodized.

As indicated in the table, most of the salt-containing products reported do not contain iodized salt, several respondents were not sure if the salt was iodized, and only bread products contain iodized salt. One respondent pointed out that iodized salt is used in some of their salt-containing food products. The products that contain iodized salt include sausage mixes, breading, and coating mixes and stuffing mixes, which are from bread manufacturing.

Sources of salt. Salt producers reported by survey respondents include: Dampier Salt (at Dampier in North West Western Australia—capacity of 4.7 million tons); Cargill Australia (at Port Hedland—capacity of 3 million tons); Onslow Salt (at Onslow—capacity of 2.5 million tons); Shark Bay Salt Joint Venture (at Shark Bay, also in the northwest—capacity of 1 million tons); WA Salt Supply (with a mine near Esperance in the south of

Table 18—Widely consumed salt-containing products and product information: Australia.

Salt-containing product (name)	Domestically produced or imported	Manufacturer/producer	Sodium content in this product (in mg/100 g product)	Is the salt iodized?
Indian butter chicken	Domestic	Enjoyo	213	Not sure
Beef & vegetables	Both	Hormel	442	Not sure
Bolognaise	Domestic	Leggos	298	Not sure
Ham with potatoes	Imported	St. Dalfour	444	Not sure
Beef rice & black pepper	Both	Minute Chef	245	Not sure
Roasted vegetable brown rice	Domestic	SunRice	290	No
Brown fried rice	Domestic	SunRice	390	No
Sweet & sour chicken	Imported	SunRice	340	No
Chicken rice	Imported	SunRice	510	No
Thai Satay vegetable	Imported	SunRice	172	No
Vegetable biriyani	Imported	Tilda	400	Not sure
Tomato & basil rice	Imported	Uncle Ben's	307	Not sure
Bread			400 to 600	Yes
Beef sausage			690 to 950	No
Cooked pizza			380 to 680	Not sure
Hard cheese			600 to 1400	No
Breakfast cereal			0 to 815	Not sure
Helga's	Domestic	George Weston Foods	476	Yes
Mighty Soft	Domestic	Top Taste	460	Yes
Lamingtons	Domestic	George Weston Foods	160	No
Bacon	Domestic	George Weston Foods	1500	No
Frankfurts	Domestic	George Weston Foods	754	No
Ham	Domestic	Primo Foods	1650	No
Processed cheese	Domestic	Bega Co-Op	1331	No
Vegemite	Domestic	Kraft	3000	No
Peanut butter	Domestic	Sanitarium	400	No
Tomato sauce	Domestic	Heinz	938	No
Meat pie	Domestic	Sargents	500	No
Smith's crisp/nuts	Domestic	Frito Lay	500 to 1500	No
Seasonings/sauces	Both	Mars Intl.	500 to 50000	No
Dry soups/sauces	Both	Unilever	1500 to 10000	No
Confectionery	Both	Nestlé	500	No
Frozen/canned products	Domestic	Simplot	50 to 1500	No
Soups/bakery	Domestic	Campbell	500 to 3000	No
Bread	Domestic	Tip Top	500 to 3000	No
Dairy	Domestic	Murray Goulburn	1500	No
Dairy	Both	Fonterra	1500	No
Dairy/desserts	Both	Natl. Foods	500 to 1500	No
Processed meats	Domestic	Primo	15 to 2000	No
Frozen/canned products	Both	Heinz	50 to 3000	No
Nutrigrain	Domestic	Kellogg		No
Corn Flakes	Domestic	Kellogg		No
Tomato soup	Domestic	Heinz		No
Big Red	Domestic	Heinz		No
Bega Cheddar	Domestic	Natl. Foods		No
French fries	Domestic	McCain		No
Smiths	Domestic	Frito Lay		No
Shapes	Domestic	Arnott's		No
Noodles	Both	Nestlé		No
Wonder White	Domestic	George Weston Foods		No
Vegemite		Kraft	3450	No
Table spread		Unilever, Goodman Fielder	700	No
Butter		Fonterra, Murray Goulburn, Warrnambool Cheese & Butter, Bega Co-op, Dairy Farmers	640	No
Cheese	Both	Murray Goulburn, Natl. Foods, Warrnambool Cheese & Butter	1736	No
Bread	Domestic	George Weston Foods, Goodman Fielder, Allied Mills, Brumby's Baker's Delight	526	Yes

Note: All information in this table is self-reported by electronic survey respondents and has not been verified by IFT.

WA, another near Koolyanobbing east of Perth and a refinery at Hamilton Hill near Kwinana—capacity of about 0.25 million tons); Cheetham Salt; Australian Gypsum Industries; Olsson Industries; Orica Chemicals; Leslie Salt; Saxa; Western Australian Lake Salt Co.; Cheltham Salt; Sunsalt (Larman P/L); Western Salt Refinery (Western Australia); Pacific Salt; N.T. Salt; Chetum; Cerebos; Penrice Soda Products Pty Ltd.; Salt of the Earth; Mulgundawa Salt; Southern Ocean Salt; The Linen Co.; Salt Distributors; and IXL.

Awareness of/interest in iodine nutrition. Of the 13 respondents, all believe that there are concerns with iodine deficiency in Australia and 7 believe there are strategies to address the problem

already in place. Two respondents were not sure if any strategies exist. The strategies to address iodine deficiency that were provided, and in parentheses the group(s) responsible for each strategy include: compulsory use of iodized salt in bread products by manufacturers (Food Standards Australia New Zealand [FSANZ]); advertising (government); recommended addition rates for staple foods (State Food Authority/ FSANZ); recommendation for pregnant and breastfeeding women to take iodine supplements (Natl. Health and Medical Research Centre); promotion of iodine supplements to pregnant and breastfeeding women (various Australian states and territories); increasing awareness of iodine deficiency and research to support Australian concerns (ICCID); iodized

table salt (salt manufacturers); and mineral and supplement tablets (vitamin manufacturers).

Three respondents reported levels of knowledge of 2, 4, and 5 that staff at their company had on iodine deficiency (on a scale of 1 to 5, with 5 being very knowledgeable). Two reported iodized salt as the main source of iodine in the diet, while another reported fish/seafood and 1 respondent was not sure of the main source of iodine in the diet. The respondents correctly reported that iodine is an essential mineral needed by the thyroid gland for proper functioning.

Only 1 respondent was interested in a phone call to discuss iodine nutrition in more detail. Two respondents reported that their company would not be interested in learning more about iodine deficiency and the important role that food products may play to combat this deficiency, while another respondent was not sure.

Bangladesh

Sources of salt. The salt producer, Tata Chemicals, which is produced in India, sells to Bangladesh (Salt Inst. personal communication June 9, 2010). There are approximately 38000 crude salt producers that operate in coastal areas of southeastern Bangladesh, so edible salt is not imported except following poor salt harvests. All domestic salt factories must be registered and licensed with the Bangladesh Small and Cottage Industry Corp. (BSCIC). The BSCIC keeps a record of all operating salt factories and wholesalers in the country using a computerized Management Information System installed at the BSCIC head office in Dhaka and in 9 regional offices (Iodine Network 2005a). However, there is reportedly illegal smuggling of relatively cheap noniodized salt from other nearby countries, including India, perhaps because the quality of salt produced in Bangladesh is often poor due to contamination with mud and other undesirable matter.

Awareness of/interest in iodine nutrition. One of the strategies identified to address iodine deficiency in Bangladesh is the Natl. Fortification Alliance. Salt iodization is one of the policy priorities in the Natl. Food Policy Plan of Action.

Bolivia

Use of iodized salt in processed foods. According to 1 IFT survey respondent, iodized salt is used in all of its company's food products because it is mandatory by law.

Sources of salt. IFT survey respondents reported that Bolivia's salt producers include: El Salerito; San Joaquin; PRODISAL; Industria Molinera Oriente Sonrisal; COPISAL; PISABOL; Molinos Santiago; Cooperativa Industrial Salera Illimani; Cooperativa Boliviana COIPASA; and Cooperativa Rosario.

Awareness of/interest in iodine nutrition. Of the 2 respondents, both believe that there are concerns with iodine deficiency in Bolivia. The strategies to address iodine deficiency that were provided and in parentheses the group(s) responsible for each strategy include: salt used must be iodized (government); and Natl. Program to prevent goiter (Ministry of Health).

One survey respondent felt that staff at his company are fairly knowledgeable about iodine deficiency. Iodized salt was reported as the main source of iodine in the diet. The respondent correctly reported that iodine is an essential mineral needed by the thyroid gland for proper functioning. The respondent is open to an in-person meeting to discuss iodine nutrition in more detail and reports that the company is interested in learning more about iodine deficiency and the important role that food products may play to combat this deficiency.

China

Use of iodized salt in processed foods. According to self-reported IFT survey data, Table 19 shows the salt-containing processed foods most frequently consumed by middle- to low-income populations in China. The table indicates whether the product is domestically produced or imported; who the manufacturer is; the sodium content of the product; and whether the salt used in the product is iodized. As demonstrated in the table, some manufacturers in China use iodized salt, some do not, and for others, it's unclear.

Sources of salt. There are numerous salt producers in China with a wide range of production capacity for sea salt, lake salt (solar salt), and mined salt. In 1998 there were 109 salt plants in China producing 800 million tons of iodized salt annually (Chen and Wu 1998). The China Natl. Salt Corp. is the largest salt producer that controls production and operation of table salt as well as salt chemicals. It is owned by the central government and has a production capacity of over 10 million tons for various salt products and 1.4 million tons for table salt. Other salt producers include Qing Dao Guanhai Salt Ltd.; Dingbian Changcheng Salt Co., Ltd.; Jiangxi Fuda Salt Ltd.; Weifang Dacheng Salt Ltd.; Zhongyan Jintan Salt Ltd.; Salt Seasoning Co., Ltd.; Qingdao Light of Day; Great Salt Group in Sichuan; Yunnan Salt Chemical Co., Ltd.; Jiangsu Dafeng Crystal Salt Co.; Long; Jiangsu Salt Corp.; General Salt Co. of China; Tianjin Changlu Hangu; Hebei Yinhe; Neimenggu Yabulai, Neimenggu Lantai; Yingkou Haihua; Dalian Lushun; Jiangsu Huaihai; Zhejiang Daishan; Fujian; Qingdao; Sichuan Jiuda Salt Industry; Anhui Salt Industry Co.; Hunan Light Manufacturing Salt Industry Corp.; Xiangxi Salt Industry Co.; Hubei Salt Industry Co.; Qinghai Salt Industry Co., Ltd.; and Fujian Salt Industry Co. Another salt producer is Shandong Ocean Chemical (Salt Partners Ltd. 2010).

Awareness of/interest in iodine nutrition. Four survey respondents believe iodine deficiency in China is a concern and there are strategies to address the problem. Only 1 respondent did not know if iodine deficiency was a concern in China. Some of the strategies identified to address iodine deficiency include: mandatory iodization of salt since 1995 by the Chinese government; salt manufacturers adding iodine to salt; and the Salt Industry Monopoly Bureau.

One respondent was unsure of the level of knowledge staff at his company have on iodine deficiency. The respondent did have a correct understanding that iodine is an essential mineral and that the thyroid gland needs iodine for proper functioning. He identified fish/seafood as the main source of iodine in the diet. The respondent was open to a phone call to discuss iodine nutrition in more detail. The respondent indicated that his company would be interested in learning more about iodine deficiency and the important role food products may play to combat this deficiency.

Egypt

Use of iodized salt in processed foods. According to IFT survey data, salt iodization is mandatory in Egypt. One survey respondent said the required rate is 30 to 70 ppm, but IFT has been unable to confirm this rate. The respondent also noted that iodized salt is used "even in bread" but that "full and effective implementation has not yet occurred." A review by Hussein (2009) indicates that a level above 15 ppm was "adequately iodized" but that only 70% of tested salt met this criterion.

According to survey data, Table 20 shows the salt-containing processed foods most frequently consumed by middle- to low-

Table 19—Widely consumed salt-containing products and product information: China.

Salt-containing product (name)	Domestically produced or imported	Manufacturer/producer	Sodium content in this product (in mg/100 g product)	Is the salt iodized?
Pickle egg		Homemade	3000 to 5000	Yes
Salted dried seafood		Qingdao Seafood Processing Corp.	5000 to 10000	Yes
Sports drink		ROBUST	1000 to 2000	Yes
Bacon		Wuhan Sanyl Corp.	800 to 1000	Yes
Soy sauce	Domestic	Zheng Yang He	3300	Yes
Sausage	Domestic	Rou Liang	150	Yes
Pickles	Domestic	Tong Qian Qiao	360	Yes
Spiced pork	Domestic	Tianjin Zhimeizhai Food	1000	Not sure
Sausage	Domestic	Zhejiang Jinhua Ltd.	5600	Not sure
Fermented bean curd	Domestic	Wangzhihe Ltd.	6500	No
Salted eggs	Domestic	Many	Larger	Not sure
Pickles	Domestic	Many	Larger	Not sure
Bacon	Domestic	Many	Larger	Not sure
Food eaten along with rice	Domestic	Family and restaurants	Normal	Yes
Dumplings	Domestic	Family and restaurants	Normal	Yes
Sausage	Both	Many	Normal	Yes
Steamed stuffed bun	Domestic	Family and restaurants	Normal	Yes
Barbecue	Domestic	Family and restaurants	Larger	Yes
Biscuits	Both	Many	Small	Yes
Bread	Domestic	Many	Little	Yes
Pickle cabbage	Domestic	Yanbian	1000	Not sure
Hydrolyzed vegetable protein				No
Soy sauce powder and flavors				No

Note: All information in this table is self-reported by electronic survey respondents and has not been verified by IFT.

Table 20—Widely consumed salt-containing products and product information: Egypt.

Salt-containing product (name)	Domestically produced or imported	Manufacturer/producer	Sodium content in this product (in mg/100 g product)	Is the salt iodized?
Chipsy	Domestic	PepsiCo		Not sure
Maggi	Domestic	Nestlé		Yes
Ketchup Gobar	Domestic	Gobar		Not sure
Feta cheese		Greenland		Not sure
Bread	Domestic	Many, many	Unknown	Not sure
Olives	Domestic	Many	Very high	Not sure
Pickled vegetables	Domestic	Many	Very high	Not sure
White cheeses	Domestic	Many	High	Not sure

Note: All information in this table is self-reported by electronic survey respondents and has not been verified by IFT.

income populations in Egypt; whether the product is domestically produced or imported; who the manufacturer is; the sodium content of the product; and whether the salt used in the product is iodized. As indicated in the table, in most cases it is unclear whether the salt used in food products is iodized.

Sources of salt. Salt production in Egypt varies between 3 and 3.3 million tons of raw unwashed salt, which can be used for iodized salt processing. Raw salt production in Egypt has doubled since 2000, which likely indicates an increase in production of traditional salt (Sayaha salt) as well (Iodine Network 2005b). Sasa; Masa; Easy Cook; Cook's; Tag El Melouk; Egypt Salt Co.; and El Mex Salines Co. were all listed as salt producers in Egypt by survey respondents. Additional salt producers include El Nasr Salines and Emisal (Salt Partners Ltd. 2010).

Awareness of/interest in iodine nutrition. One respondent believes that there are concerns with iodine deficiency in Egypt and that there are strategies to address the problem. The strategies provided include: the Ministry of Supply/Legislation banning non-iodized edible salt and the Ministry of Health's iodine supplements in oases.

Ghana

Use of iodized salt in processed foods. Salt iodization at a rate higher than 15 ppm has been mandatory for all salt produced, sold, or distributed for human consumption in Ghana since 1996, as required by the Food and Drugs (Amendment) Act 523. Survey respondents say this law is to be enforced by the Food and Drugs

Board and the Ministry of Health. As the iodization program is universal, all salt used in processed foods in Ghana should be iodized. As 1 respondent indicated, however, "The food processors use iodated salt but the local chop bars may or may not use it."

According to self-reported IFT survey data, Table 21 shows the salt-containing processed foods most frequently consumed by middle- to low-income populations in Ghana; whether the product is domestically produced or imported; who the manufacturer is; the sodium content of the product; and whether the salt used in the product is iodized. As indicated in the table, in most cases the salt in a food product is iodized.

Sources of salt. Thirty-five percent of the salt in Ghana is produced by small and micro processors (Mannar and Wesley 2010). Panbros Salt; Annapuna; Eldin Salt; Ningo Salt; Myroc Salt; Songhor Salt (alternate spelling Songor, marketed as Diamond Salt); Sege Salt; Shifu Salt Ltd.; and local salt winners (collection of salt from seawater typically by locals with primitive technology) were all listed by survey respondents as salt producers in Ghana. Ghana imports approximately 2 to 50 tons of salt each year from the United Kingdom, as well as smaller amounts from Germany and China. Fifty-eight percent of salt is iodated, yet at a rate below 20 ppm (Iodine Network 2001).

Awareness of/interest in iodine nutrition. Of the 2 respondents, both believe that there are concerns with iodine deficiency in Ghana and that there are strategies to address the problem. Reported strategies are the Ministry of Health's salt iodization program; UNICEF's salt iodization program; and The Council

Table 21—Widely consumed salt-containing products and product information: Ghana.

Salt-containing product (name)	Domestically produced or imported	Manufacturer/producer	Sodium content in this product (in mg/100 g product)	Is the salt iodized?
Bouillon cubes	Both	Nestlé/Unilever		Yes
Biscuits	Both	Several		Not sure
Margarine	Domestic	Unilever		Yes
Bread	Domestic	Several		Yes
Dried salted fish	Domestic	Traditional processors		Not sure
Ampepi	Domestic			Yes
Banku/AKPLE	Domestic			Yes
Rice	Domestic			Yes
Okro Soup	Domestic			Yes
Kontomire stew	Domestic			Yes
GA Kenkey	Domestic			Yes
Koose	Domestic			Yes
Tuo Zafi	Domestic			Yes
Riceballs	Domestic			Yes

Note: All information in this table is self-reported by electronic survey respondents and has not been verified by IFT.

for Scientific and Industrial Research—Food Research Inst.'s Salt Iodization Centre.

India

Use of iodized salt in processed foods. In India about 4.89 million tons of iodized salt was domestically supplied in 2006, according to information obtained from the Indian Salt Manufacturers Assn. on salt production and supply. Since the total production of edible salt was 5.2 million tons, one might conclude that use of iodized salt in foods industrially processed is common practice (de Jong 2007). However, the 2 survey respondents do not use iodized salt in their food products.

Sources of salt. Gujarat is the leading salt-producing state in India. Gujarat contributes 75% of the country's total salt production. Gujarat is not only the largest salt producer in the country but also excels in productivity and exports. The Indian salt industry has made rapid strides during the last 6 decades. Today India ranks 3rd among 120 salt-producing countries with an annual production of about 19 million tons. After meeting the country's domestic requirements, the industry exports an average 2 million tons to 30 countries (ICCIDD 2010).

Tata Chemicals Limited; Century Salt; Annapurna; ITC; Hindustan Unilever Ltd.; Kohinoor; Nirma; Gokul Salt; Balaji Salt; and VASP Salt were all listed by survey respondents as salt producers in India. Additional salt producers include: Ankur Chemfood; Anapam Intl.; Birla VXL; Chowgule; DAS & Co.; DCW; Dharun Exports; DS Foods; Gujarat Heavy Chemicals; Hindustan Salts; Jain Salts; Krishna Salts; Raj Salt & Chemicals Pvt. Ltd.; Saboo Sodium Chloro; Sri Balamurugan Trading Co.; and United Enterprises (Salt Partners Ltd. 2010).

Awareness of/interest in iodine nutrition. Three survey respondents reported that there are concerns with iodine deficiency in India and that there are strategies to address the problem. One of the strategies reported is work being conducted by the Indian Council of Medical Research to iodize salt, although IFT was unable to locate a specific initiative by this group. Two survey respondents answered the questions regarding IDD and they correctly understand that iodine is an essential mineral and that the thyroid gland needs iodine for proper functioning. Iodized salt is reported as the major source of iodine. Each respondent would be interested in discussing iodine nutrition in more detail via phone or in person. One respondent's company would be interested in learning more, while the other respondent was unsure of their company's interest in learning more about iodine deficiency and the important role food products may play to combat

this deficiency. One respondent reported a level of 3 and the other reported a level of 5 (on a scale of 1 to 5, with 5 being very knowledgeable) of knowledge that staff at their company had on iodine deficiency.

Indonesia

Use of iodized salt in processed foods. According to self-reported IFT survey data, Table 22 shows the salt-containing processed foods most frequently consumed by middle- to low-income populations in Indonesia. It also shows whether the product is domestically produced or imported; who the manufacturer is; the sodium content of the product; and whether the salt used in the product is iodized. As indicated in the table, it appears that some products include iodized salt.

Sources of salt. In 2003, there were approximately 20000 salt farmers and nearly 400 salt producers in the 13000 Indonesian islands (Iodine Network 2004). Seventy-one percent of all salt consumed in Indonesia was produced domestically in 2003. Since 1998, Indonesia has imported salt, mainly from Australia and India, to obtain the remaining approximately 30% of salt needed. Of domestically produced salt, PT Garam produces 20% of Indonesia's salt, while small salt farmers produce the remaining salt. IFT survey respondents provided the names of many salt producers including: PT Cheetham; PT Garam (Persero); PT Susanti Megah; Pabrik Garam Iodium Demak; PT Sumatraco Langgeeng Makmur; PT Chetam Garam; PT Garindo Sejahtera Abadi; PT Eliteter Prima Jawa; PT Sumatra PR; PT Unichem; and PT Budiono Madura Bangun Persada.

Awareness of/interest in iodine nutrition. Of the 2 respondents, both believe that there are concerns with iodine deficiency in Indonesia and 1 said that there are strategies to address the problem, although no strategies were identified. The other respondent was not sure of any strategies.

Kenya

Use of iodized salt in processed foods. According to the ICCIDD, there is a regular monitoring system of salt iodization, but it seems that the results are not analyzed as promptly as might be desired. An information and education plan is needed and it should be part of a long-range advocacy plan. The collaboration of the salt industry is exceptional. It might now be useful to move toward approaches for the food processing industry to press for use of iodized salt (Haxton 2010).

Sources of salt. Kenya is a major salt producer, and nearly 85% (235000 tons per year) of that salt is derived from sea water. Most

Table 22—Widely consumed salt-containing products and product information: Indonesia.

Salt-containing product (name)	Domestically produced or imported	Manufacturer/producer	Sodium content in this product (in mg/ 100 g product)	Is the salt iodized?
Meatball	Domestic	PT Bernardi		Yes
Noodle	Domestic	PT Indofood		Not sure
Snack	Domestic	PT Siantar Top		Not sure
Bread	Domestic	PT Nippon Indosari Corpindo		Yes

Note: All information in this table is self-reported by electronic survey respondents and has not been verified by IFT.

salt is processed in Malindi and Mombasa by 5 major salt companies, 1 of which is also a refiner (Iodine Network 2002a). Kensalt is based in Mombasa, Kenya, and gets salt through solar evaporation. They claim to be East Africa's largest edible salt provider. Also, Magadi Soda produces salt through evaporation from the waters of Lake Magadi.

Mexico

Use of iodized salt in processed foods. In Mexico, legislation states that all salt for human consumption needs to be iodized, including that for the food industry. Potassium iodide or iodate should be used, according to NOM-040-SSA1-1993 and Morton Salt Co. (personal communication June 18, 2010).

According to IFT survey data, Table 23 shows the salt-containing processed foods most frequently consumed by middle- to low-income populations in Mexico; whether the product is domestically produced or imported; who the manufacturer is; the sodium content of the product; and whether the salt used in the product is iodized. As indicated in the table, in most cases the salt used in the product is iodized. There were just a few cases in which the respondent was unsure if the salt is iodized.

Sources of salt. The main salt producers listed by survey respondents were Sales del Istmo; Industria Salinera de Yucatan; Industria del Alkali; Salina de Lobos (Sales de Valle); Sanudo; Sales del Golfo de Cortes (Cortez) Brand; Pegaso; Salinas del Ray; Sociedad Cooperativa de Salineros de Colima; Sales Ometepec; Salinera de Yavaro; and CYSDE. Other salt producers also listed include: Salina de (el) Rosario; Sal la Fina; Salinera la Boladena; Ind. Del Alkali; Cooperativa de Salineros de Villa de Alvarez; Distribuidora y Envasadora de Productos de Sodio; Soc. Coop. Industrial Salinera; Empresa Exportadora; Ruedas y Alba; Exportadora de Sal Guerrero Negro; Compania Salinera; Exportadora de Sal; Abastecedora de Sal; Productos Derivados de la Sal; Sal Astro; Cargill; Ecuasal; Salt Yodada; Sal Elefante; Alkali; Michoacan; and Oaxaca. Other salt producers include ESSA Exportadora de Sal and San Felipe Salt (Salt Partners Ltd. 2010).

One respondent reported: "We normally use sea salt, but there is available salt from salt mines. Most of the salt in Mexico comes from the sea." Another respondent reported that the company receives salt from Mexico and the United States.

Awareness of/interest in iodine nutrition. Of the 14 respondents, 5 believe that there are concerns with iodine deficiency in Mexico, while 3 do not and 2 are unsure. Four respondents believe that there are strategies to address the problem, while 1 respondent disagreed and 3 were unsure. The strategies to address iodine deficiency that were provided and in parentheses the group(s) responsible for each strategy include: all the salt for direct human and animal consumption and industry use must have iodine added (established by the Natl. Sanitary Legislation); iodine added to salt used in food (government / health authority); regulation to iodize salt for human consumption (Ministry of Health); by law, all processed foods that contain salt must use iodized salt (government); and the Official Mexican Normativity (NOM-040-SSA1-1993)

for prevention, control, and treatment of diseases related to iodine deficiency (Ministry of Health).

Two respondents indicated levels of knowledge on iodine deficiency of staff at their company as 3 and 4 on a scale of 1 through 5 (with 5 being very knowledgeable). Iodized salt is identified as the main source of iodine in the diet. All respondents reported that iodine was an essential mineral but only 2 knew that iodine is used by the thyroid gland for proper functioning. One respondent was not sure.

Two respondents were open to either a phone call or in-person meeting to discuss iodine nutrition in more detail, but 2 were not. Two respondents are not sure and 1 respondent reported that their company is not interested in learning more iodine deficiency and the important role food products may play to combat this deficiency.

Nigeria

Use of iodized salt in processed foods. According to IFT survey data, Table 24 shows the salt-containing processed foods most frequently consumed by middle- to low-income populations in Nigeria; whether the product is domestically produced or imported; who the manufacturer is; the sodium content of the product; and whether the salt used in the product is iodized. As indicated in the table, in most cases the salt used in the product was iodized. There were some cases in which the respondent was unsure if the salt was iodized.

Food company respondents identified some of their top products sold that contain iodized salt. The products included Standard Sweetened Cabin Shortcake, Coaster, Big Bite, and Nice biscuits, Gold's vanilla-, banana-, and strawberry-flavored custard powders, and seasoning cubes. According to survey respondents, the reasons for using iodized salt in their products include: that it is statutory to use only iodized salt for manufacturing purposes; to enhance taste and fortify; and to address iodine deficiency among the population and maintenance through a cheaper source.

Sources of salt. Nigeria has 3 major salt producers of non-iodized industrial grade salt: Dicon, Nascon, and New Nigerian Salt PLC; yet almost all of the country's salt is imported (Iodine Network 2002b). Salt manufacturers named by IFT survey respondents were Dangote Salt Co. (Dangote Group); Union Dicon Salt Co.; Natl. Salt Co. of Nigeria, PLC; Unilever Nigeria PLC; Royal Salt Co. Ltd.; Apapa Lagos Nigeria; and major distributors of Dangote.

Awareness of/interest in iodine nutrition. Of the 5 respondents, 4 believe that there are concerns with iodine deficiency in Nigeria and 1 respondent was unsure. Some of the strategies to address iodine deficiency that were provided and in parentheses the group(s) responsible for each strategy include: mandatory salt iodization policy (Federal Government through the Natl. Agency for Food Drug Administration and Control and Standards Organization of Nigeria); mandatory salt iodization program (Natl. Agency for Food Drug Administration and Control); legal standard for iodine content of salt products (Standard Organization

Table 23—Widely consumed salt-containing products and product information: Mexico.

Salt-containing product (name)	Domestically produced or imported	Manufacturer/producer	Sodium content in this product (in mg/100 g product)	Is the salt iodized?
Tamales	Domestic	Productos Chata, S.A. de C.V.	700 to 800	Yes
Totopos	Domestic	Many (traditional product)	180	Yes
Queso seco	Domestic	Many (traditional product)	580 to 1000	Yes
Chamoy	Domestic	Many (traditional product)	1200	Yes
Chicharron	Domestic	Barcel, S.A. de C.V.	1600	Yes
Carnitas	Domestic	Many (traditional product)	780 to 850	Yes
Dulces de tamarindo	Domestic	Many (traditional product)	800 to 900	Yes
Tortilla de harina	Domestic	El Trebol, S.A. de C.V.	500	Yes
Pan blanco	Domestic	Bimbo, S.A. de C.V.	487	Yes
Bolilo	Domestic	Many (traditional product)	687	Yes
Canned peas & carrots	Domestic	Herdez	332	Yes
Powder tomato soup chicken pasta flavor	Domestic	La Moderna	347	Yes
Canned peas & carrots	Domestic	La Costena	301	Yes
Canned peas & carrots	Domestic	Clemente Jacques	284	Yes
Canned pasta soup	Domestic	Knorr	299	Yes
Powder pasta soup	Domestic	Campbell	244	Yes
Refried beans	Domestic	La Costena	475	Yes
Tomato dressing	Domestic	Knorr	732	Yes
Sausages	Domestic	Fud	997	Yes
Sausages	Imported	Oscar Meyer	1364	Not sure
Cheese	Domestic	Alpura	683	Yes
Cheese	Domestic	Nestlé	677	Yes
Herdez-Peas & Carrots bits	Domestic	Herdez	332	Yes
La Moderna-Tomato soup chicken pasta flavor	Domestic	La Moderna	333	Yes
Knorr pasta soup	Domestic	Knorr	299	Yes
Tuny Tuna in Oil	Domestic	Tunny	434	Yes
La Costena fried beans	Domestic	La Costena	474	Yes
Knorr tomato soup	Domestic	Knorr	732	Yes
Fud sausages	Imported	Fud	1017	Yes
Oscar Mayer Jam & Sausages	Imported	Oscar Mayer	1364	Not sure
Appetizing dehydrated potatoes	Imported	NA	726	Not sure
Kikkoman Soya sauce	Imported	Kikkoman	5500	Not sure
Nishikawa salted peanut	Domestic	Nishikawa	542	Yes
Alpura Manchego cheese	Domestic	Alpura	683	Yes
Bread	Domestic	Bimbo S.A.		Yes
Biscuits	Domestic	Gamesa S.A.		Yes
Biscuits	Domestic	Galletas Cuetara		Yes
Biscuits	Domestic	Mac' Ma, S.A. de C.V.		Yes
Soups	Domestic	Productos Alimenticios La Moderna, S.A. de C.V.		Yes
Cheese	Domestic	Ganaderos Productores de Leche Pura, S.A. de C.V.		Yes
Poultry products	Domestic	Bachoco, S.A. de C.V.		Yes
Meat products	Domestic	Sigma Alimentos		Yes
Meat	Domestic	Sucame		Yes
Vegetables	Domestic	Herdez, S.A. de C.V.		Yes
Vegetables	Domestic	La Costena S.A. de C.V.		Yes

Note: All information in this table is self-reported by electronic survey respondents and has not been verified by IFT.

of Nigeria); campaign for iodization (Natl. Fortification Alliance); iodization of salt (UNICEF/Federal Ministry of Health); sensitization of the problem of iodine deficiency (UNICEF/Federal Ministry of Health); discouraging the consumption of noniodized salt (UNICEF/Federal Ministry of Health); and consumption of iodine-rich foods and vegetables (UNICEF/Federal Ministry of Health).

Of the 3 responses received, all feel that staff at their companies are fairly knowledgeable about iodine deficiency. One person was unsure. Two respondents identified iodized salt and 1 respondent identified fish/seafood as the main source of iodine in the diet. All 3 respondents identified iodine as an essential nutrient that the thyroid gland needs for proper functioning.

Two of the respondents are open to a phone call or in-person meeting to discuss iodine nutrition in more detail but 1 is not. One respondent indicated that his company would be interested in learning more about iodine deficiency and the important role food products may play to combat this deficiency while 2 of the respondents were not sure.

Pakistan

Use of iodized salt in processed foods. According to self-reported IFT survey data, Table 25 shows the salt-containing processed foods most frequently consumed by middle- to low-income populations in Pakistan; whether the product is domestically produced or imported; who the manufacturer is; the sodium content of the product; and whether the salt used in the product is iodized. As indicated in the table, only 1 manufacturer uses iodized salt, while most manufacturers do not or are unsure if iodized salt is used.

Due to the problems with food security and lack of access to processed foods in rural locations, the iodization of salt in processed foods may not be the best current vehicle for iodine. However, salt in wheat breads would likely be a good target. Natl. Foods was the most recognized domestic company and would likely be the best initial point of contact in-country. The Pakistani operations of Nestlé and Unilever are also potentially good references.

Sources of salt. According to a survey respondent, there are reportedly 600 salt producers in the country, which helps to

Table 24—Widely consumed salt-containing products and product information: Nigeria.

Salt-containing product (name)	Domestically produced or imported	Manufacturer/producer	Sodium content in this product (in mg/100 g product)	Is the salt iodized?
Bread	Domestic	UAC Foods		Yes
Moi Moi	Domestic	MR Biggs		Yes
Akara	Domestic	Domestic and cottage-scale producers		Not sure
Meat Pie	Domestic	Mr. Biggs		Yes
Egusi soup	Domestic	Chitis Foods		Yes
Pepper soup	Domestic	Mr. Biggs		Yes
Melon cake	Domestic	Domestic and cottage-scale producers		Not sure
Doughnut	Domestic	Mr. Biggs		Yes
Ugba salad	Domestic	Domestic and cottage-scale producers		Not sure
Suya	Domestic	Cottage-scale producers		Not sure
Geisha fish	Imported			Not sure
Noodles	Domestic	De United Food Co. Ltd.		Yes
Bread	Domestic	Several examples UAC Foods		Yes
Plantain chips	Domestic	Several		Yes
Cracker biscuits	Imported			Not sure
Corned beef	Imported			Not sure
Moi Moi	Domestic	Mr. Biggs		Yes
Akara	Domestic	Several		Yes
Pepper soup	Domestic	Several		Yes
Ugba salad	Domestic	Several		Yes
Bread	Domestic	UACN, Shaba, Leventis, Dangote, and several manufacturers specific to towns and regions	<0.02%	Yes
Biscuits	Both	Nasco, Okin, OK Foods, and so on	0.02% to 0.05%	Yes
Flours	Both	Nigerian Flour Mills, Eagle Flour Mills, Dangote Flours Mills, and so on	<0.02%	Yes
Semovita	Both	Nigerian Flour Mills, Eagle Flour Mills, Dangote Flours Mills, and so on	<0.02%	Yes
Noodles	Both	Indomie, Dangote, Mimi	<0.02%	Yes
Geisha fish/sardines	Both	Jobitex	0.02% to 0.05%	Yes
Maggi, Knorr, and other condiments	Both	Cadbury, Nestlé, Ajinomoto, and so on	0.05% to 0.10%	Yes
Suya	Domestic	Small local holdings	Varies, but usually <0.10%	Yes

Note: All information in this table is self-reported by electronic survey respondents and has not been verified by IFT.

Table 25—Widely consumed salt-containing products and product information: Pakistan.

Salt-containing product (name)	Domestically produced or imported	Manufacturer/producer	Sodium content in this product (in mg/100 g product)	Is the salt iodized?
Chicken nuggets	Domestic	K&N Chicken Products	40 g	No
Cheeses	Domestic	Nurpur	2 to 5 g	No
Butter	Domestic	Nurpur Dairies, Chaudhary Dairies	INTL STD	No
Potato fries	Domestic	Layman and others	2 g	No
Salted pickles	Domestic	Natl. Foods, Shezan Foods	80 g	No
Meat (kebabs)	Domestic	K&N Products	8 g	No
Bread (chapati)	Domestic			Not sure
Rice (cooked)	Domestic			Not sure
Curry of every type	Domestic			Not sure
Pulses curry	Domestic			Not sure
Street food	Domestic			Not sure
Potato chips	Both			Not sure
Mutton tikka	Domestic			Not sure
Mutton curry	Domestic			Not sure
Lassi	Domestic			Not sure
Maize bread/cooked pop corn	Domestic			Not sure
Salt peanut	Both			Not sure
Masala recipe	Domestic	Natl. Foods Limited	10000	Yes

Note: All information in this table is self-reported by electronic survey respondents and has not been verified by IFT.

explain the large number of producers listed by survey respondents. Also worthy of note, many of the producers listed were actually individuals' names, rather than a corporation. Locations of companies and individuals are included where they were provided: Natl. Foods Ltd., multiple locations; Dost Muhammad Salt; Main Bazar (producer); Batkhela NWFP; Shan Foods (packer only); Pak Salt Refinery; Al amin Salt Refinery, Karachi Central; Safi Ullah, Peshawar; Hameed Ullah, Swabi; Hasan Foods Industries (Colonel's), Rawalpindi; Karkhana Namak, Lahore; Crystal Corp.,

Lahore; Al Shafi Foods, Lahore; M. Saeed Khokhar, Gujranwala; Rana Muhammad Afzal; Rana Tahir, Khushab; Mirza Azher, Khushab; Muhammad Azam, Khushab; Punjab Salt, Khushab; Nazim Amin, Khushab; Malik Zameer Ahmad, Khushab; Hamdani Salt, Khushab; Lips Foods, Karachi; Hub Ahmed Foods; Shams Salt Dealer, Fazal Market Airport, Rd. Mingora NWFP; Maaz (producer), Peoples chouk, Madain Rd., Mingohra Swat, NWFP; Nazif Khan (salt dealer), DI Khan Rd. Tajazai, Lakki Marwat, NWFP; Haji Aslam (salt dealer), Chouk Fateh Jung,

Attock Punjab; Shaikh Abdul Majid (salt dealer), Gundum Mandi, Rawalpindi Punjab; M. Arshad (salt dealer), opposite Natl. Silk Mill, Faisalabad Punjab; Ahmad Salt (producer), Karachi Sindh; Gul Muhammad Salt (producer), Arbab Kanshi, Plaza Jan Muhammad Rd. Quetta Balochistan; Naheem Geo Qadri Salt Hyderabad, Karachi; utility stores; Ahmed Foods; and Hub Pak Salt. One survey respondent noted that he receives salt directly from suppliers, but also from the local market. Other salt producers include Al-Karam Group Dabheji Salt Works and Ittefaq Trading Co. (Salt Partners Ltd. 2010).

Awareness of/interest in iodine nutrition. Of the 7 survey respondents, 6 reported that there are concerns with iodine deficiency in Pakistan and that there are strategies to address the problem. One respondent was unsure if there are concerns with iodine deficiency in Pakistan or any strategies addressing the issue. Some of the strategies identified to address iodine deficiency include: MI and UNICEF initiatives to iodize salt and salt fortification with iodine by the Nutrition Section Planning Commission Islamabad.

According to survey data, food processors have a good understanding of what iodine is and its function in the body. The main sources of iodine in the diet were identified as iodized salt, fish/seafood, and dairy products such as milk, cheese, and butter. The company representatives were open to a phone call or meeting with IFT staff to discuss iodine nutrition in more detail. Half of respondents indicated that their company would be interested in learning more about iodine deficiency and the important role food products may play to combat this deficiency. One respondent indicated his company was not interested and another was unsure.

Russia

Use of iodized salt in processed foods. According to IFT survey data, 1 company indicated that for the top 5 products sold that contain salt, which includes bread from wheat flour, rye bread, pastries, pastry products, and full-flavored products, iodized salt was not used in the manufacturing.

Sources of salt. There are 4 major salt producers in Russia and several smaller producers, although nearly 20% of edible salt is imported from Ukraine and Belarus (Iodine Network 2005c). The Russian Assn. of Salt Producers was the only source for salt producers identified by a survey respondent.

Senegal

Use of iodized salt in processed foods. An Interministerial Decree in 1995 set conditions for the production and distribution of food-grade iodized salt (Iodine Network 2000). Senegal exports over 80% of the 350000 metric tons of salt produced each year to some 15 countries in western and central Africa. Most salt is produced by numerous small producers located near Lac Rose (Lake Retba), the deltas of the Sine and Saloum rivers, and the Gandiol salt marshes (Iodine Network 2000). Senegal has over 10000 operational small salt producers through the evaporation of salt water who are responsible for over one-third of Senegal's salt production (Miloff 2008; Ndao and others 2009). Ndao and others (2009) and Miloff (2008) encouraged small producers to join iodization cooperatives/associations (in French called groupements d'intérêt économique)—one such organization is the Lac Rose Iodization Cooperative (alt. name Lac Rose Salt Producers Assn.).

Sources of salt. The only large-scale salt producer listed with the United States Geological Survey in 2006 was the Société Nouvelle Des Salins Du Sine Saloum (Groupe Salins de France). Their brine plant operates in Kaolak, producing 160000 tons per year (Eros and Candelario-Quintana 2006).

A large portion of the domestic supply of salt is produced by a large number of very small producers (generally less than 50 tons/y). International aid groups are already working with these producers to make it feasible for small operators to effectively iodize their salt.

South Africa

Use of iodized salt in processed foods. According to 1 IFT survey respondent, in South Africa all products use iodized salt because it is required by legislation. Potassium iodate is added at 40 to 60 ppm to salt during the refining or packing process.

According to survey data, Table 26 shows the salt-containing processed foods most frequently consumed by middle- to low-income populations in South Africa; whether the product is domestically produced or imported; who the manufacturer is; the sodium content of the product; and whether the salt used in the product is iodized. As indicated in the table, it is unclear whether the salt used in most food products is iodized.

Sources of salt. South Africa has 24 registered salt companies, and half are believed to iodize salt for human consumption. Twenty-six percent of salt samples collected from the 12 companies that iodize were within the legal requirements of 40 to 60 ppm, 47% contained more than 30 ppm, and 44% had less than 20 ppm at production level. A questionnaire to producers showed limited knowledge of the health benefits of iodized salt and the legal requirements related to iodized salt in South Africa (Iodine Network 2005d). Cerebos; Marina Salt Works; Saltcor; Sun Salt; Orange River Salt Works (Upington); Oranje Soutwerke; and African Salt were all listed by survey respondents as salt producers in South Africa.

Awareness of/interest in iodine nutrition. Of the 2 respondents, both believe that there are concerns with iodine deficiency in South Africa. One of these respondents reported that, although iodine deficiency is a problem, the issue has been addressed since 1995. He reported that "it is well known in the industry that we iodate and why, across all food technologists." Some of the strategies to address the problem that were identified include: the Dept. of Health's mandatory iodization of food-grade salt and technical support to salt producers to improve internal monitoring of accuracy of salt iodization conducted by the Nutrition Intervention Research Unit, Medical Research Council.

According to 1 respondent, the level of knowledge of staff at the company on iodine deficiency was very low; however, that same respondent reported that the company is not interested in learning more about iodine deficiency and the important role food products may play to combat this deficiency and they were not open to meeting in-person to discuss the matter further.

United Kingdom

Use of iodized salt in processed foods. Salt iodization is voluntary in the United Kingdom and is not believed to be highly prevalent in processed foods. Regulations do exist to mandate a minimum dose in infant formulas, baby foods, and energy-restricted diet foods intended to replace the entirety of the daily diet (Expert Group on Vitamins and Minerals 2002). The permitted iodine source is potassium iodide at 10 to 22 mg/kg and it is allowed in all food products (de Jong 2007).

U.K. documentation of iodization policies gives the impression that the country is more concerned with iodine toxicity due to overconsumption than iodine deficiency. Their policies (or lack thereof) seem to be centered on this concern. It would be interesting to study the intake of those who do not consume dairy

Table 26—Widely consumed salt-containing products and product information: South Africa.

Salt-containing product (name)	Domestically produced or imported	Manufacturer/producer	Sodium content in this product (in mg/100 g product)	Is the salt iodized?
Bread	Domestic	Many		Not sure
Margarine	Domestic	Unilever		Not sure
Salty snacks	Domestic	Few		Not sure
Cheeses	Domestic	Many		Not sure
Processed meat	Domestic	Many		Not sure
Canned vegetables, meat, fish, and so on	Domestic	Several		Not sure
Prepared foods	Domestic	Several		Not sure

Note: All information in this table is self-reported by electronic survey respondents and has not been verified by IFT.

Table 27—Widely consumed salt-containing products and product information: United Kingdom.

Salt-containing product (name)	Domestically produced or imported	Manufacturer/producer	Sodium content in this product (in mg/100 g product)	Is the salt iodized?
Bacon	Both	Roach Foods		Not sure
Bacon	Both	Direct Table		Not sure
Cured ham	Both	Tulip		Not sure
Bread	Domestic	Allied Bakeries		Not sure
Bread	Domestic	Premier Foods		Not sure
Bread	Domestic	Greggs		Not sure
Breakfast cereal	Domestic	Kellogg		Not sure
Savory snacks	Domestic	Dallycer/ Delicia		Not sure
Savory snacks	Domestic	PepsiCo		Not sure

Note: All information in this table is self-reported by electronic survey respondents and has not been verified by IFT.

foods, given the assertion of the Expert Group on Vitamins and Minerals that iodine supplementation to dairy cattle is in large part responsible for the reduction in goiter prevalence.

The United Kingdom's official IDD control program is coordinated by the Ministry of Agriculture Fisheries and Food (MAFF). A 1999 MAFF survey of the iodine content of cow milk showed adequate iodine concentration in 220 milk samples and suggested that young children could exceed the recommended iodine intake, especially during the winter (MAFF 1999). Further monitoring has been recommended, but unfortunately little progress has been made in the last 10 y. A study of 15-year-old school girls supported by the Clinical Endocrinology Trust and Society of Endocrinology is currently in progress. The preliminary results of this survey ($n = 478$) show a median UIC of 62 to 85 $\mu\text{g/L}$ from individuals located in 6 cities; overall median UIC was 76 $\mu\text{g/L}$ (Pinchera 2010).

According to IFT survey data, Table 27 shows the salt-containing processed foods most frequently consumed by middle- to low-income populations in the United Kingdom; whether the product is domestically produced or imported; who the manufacturer is; the sodium content of the product; and whether the salt used in the product is iodized. As indicated in the table, it is unclear whether the salt in most food products is iodized. One company respondent reported that baked beans, tomato paste, chopped tomatoes, whole tomatoes, and soups/stocks are their top 5 products sold that contain salt; however, iodized salt is not used to manufacture any of these products.

Sources of salt. Salt producers listed by survey respondents include (in order of those that received the most mention to the least): British Salt; Cleveland Potash; Salt Union; Irish Salt Mining & Exploration; Anglesey Sea Salt Co.; Saxa; LoSalt; and Ineos. The Salt Manufacturers Assn. represents the U.K. edible and industrial salt industry. Other salt producers include Centura Foods; ICI; and New Cheshire Salt Works (Salt Partners Ltd. 2010). One respondent reported that their company imports finished products from around the world. Their company does not manufacture products but he noted that most salt in the United Kingdom comes from the deposits in Cheshire.

Awareness of/interest in iodine nutrition. Three respondents do not believe there are concerns with iodine deficiency in the United Kingdom and 1 respondent was not sure. Two respondents did not believe there are strategies to address an iodine deficiency problem, and 1 respondent was not sure.

One respondent reported that staff at his company are not knowledgeable on iodine deficiency. Iodized salt was identified as the main source of iodine in the diet. The respondent correctly reported that iodine is an essential mineral needed by the thyroid gland for proper functioning. The respondent is open to a phone call or in-person meeting to discuss iodine nutrition in more detail. However, the respondent reported that the company would not be interested in learning more about iodine deficiency and the important role that food products may play to combat this deficiency.

Summary of Telephone Interview Findings

Of the 10 companies that IFT conducted telephone interviews with, 6 are large multinational food companies, 1 company is medium size (100 to 500 employees), and the rest are small to very small; 1 company has just 50 employees and 2 have less than 20 employees. Two of the multinational companies provided global responses that covered all plants regardless of location, and 4 provided responses specific to the country that the representative was located in. IFT spoke to representatives whose roles span a number of departments within companies including sales, technology (2), research and development (R&D) (3), food safety (2), regulatory (2), quality (3), and nutrition. Representatives are based in Australia, China (2), India, Pakistan, South Africa, the United Kingdom, and the United States (3). Products of the companies interviewed are sold worldwide in Africa, Asia, Australia, Europe, North America, and South America, and to specific locations including Australia, Bangladesh, Belgium, Brazil, Canada, China, Denmark, Egypt, Ghana, India, Indonesia, Kenya, Mexico, New Zealand, Nigeria, the Middle East, Pacific Islands, Pakistan, Philippines, Russia, South Africa, the United Kingdom, and the United States.

Of the companies IFT spoke with, not all manufacture food products that contain salt. One company sells primarily ingredients that do not contain sodium. Salt may be added by their customers to formulate finished goods however. Two other companies do not produce any food products; they are import agents who source, sell, and distribute products around the world. One corporation works solely for a multinational food company, receiving products from the company's manufacturing plants in the United States and Brazil. The other corporation receives products from many different companies located in South Africa, Europe, Thailand, China, India, Philippines, and elsewhere, and then sells products primarily to Europe and North America, but it is up to the product manufacturer to use iodized salt and they have no preference for what they will purchase.

The 7 companies that manufacture products that contain salt offer a variety of widely consumed salt-containing products by sales. This includes RTE meals and sandwiches; processed cheese; deli/luncheon meats; seasonings; marinades; sauces; macaroni and cheese, and other boxed meal mixes; premixes (such as bakery premixes which contain all dry ingredients); savory snacks including nuts and biscuits (crackers); and frozen dumplings, like wontons; 5 use iodized salt in some processed food products and 2 use iodized salt in all products.

Of the 2 companies that use iodized salt in all products, 1 company is located only in Pakistan and has voluntarily used iodized salt since 1992 for public health concerns. There are no incentives in Pakistan to use iodized salt, and it is not mandated by legislation. Because there is no legislation or enforcement, they struggle with competing companies that sell counterfeit iodized salt—labeled as such, but not actually iodized. Salt suppliers that do not work in the private sector may be more likely to counterfeit. Iodization of salt was discussed daily or weekly when the company first decided to use iodized salt, but now conversation on this topic is infrequent, unless there has been a recent educational program that brings the topic to the forefront. Because this company has switched to using iodized salt, they feel very knowledgeable on the topic, although it is not as high a priority at work now since it is in progress. They are interested in learning methods to dispel misconceptions about iodized salt, and are interested in learning more about model countries where use of iodized salt in processed foods has been implemented and communicated to the public with success. The other company is located in South Africa and uses iodized salt in all processed food products due to South African legislation that requires potassium iodate to be added to food at a rate of 40 to 60 ppm.

The companies that use iodized salt in some processed food products also do so due to legislation. Companies that use iodized salt in only some products would be open to using iodized salt in other products primarily if it became required by law. The 2 multinational companies that provided global responses said they use iodized salt in only some food products due to the different legal requirements in each country they operate and sell products in. The multinational food companies all noted that they are decentralized and that decisions are made country-by-country with regard to use of iodized salt based on not only local legislation, need, and technical capability, but also local culture such as how consumers feel about the use of iodized salt in food products.

One company in Australia uses iodized salt only in bread products since it is mandatory in Australia and New Zealand for all bread products to contain iodized salt. Both companies from China use iodized salt depending on where the product will be sold. Chinese local government requires iodized salt to be used

in food products based on need in the region they are sold in, so not every region of China requires use of iodized salt. Therefore 1 manufacturing plant may use iodized salt, while another manufacturing plant for the same company operating in China may not depending on the region they are located in.

All companies purchased salt locally in the area of the country where the manufacturing plant is located. Cheetham Salt was named as a supplier in Australia, and Sun Salt, Cerebos, and African Salt were reported in South Africa. Each city or province in China has its own salt supplier and some may have up to 2 or 3 to choose from, although all are owned by the government. Some provinces allow the sale of both iodized and noniodized salt to provide consumers with a choice. In 5 countries, the same supplier is often used for purchase of both iodized and noniodized salt, while respondents from other countries were not sure if both iodized and noniodized salt are purchased from the same supplier.

One company representative noted that if not required by legislation, another potential way to get food companies to voluntarily use iodized salt may be by reaching out to a company's nutrition department. Someone in the nutrition department would need to highlight a strong need in the country they are located in or sell product to, and then recommend a policy to management, who would make a decision on the use of iodized salt in products. Top management positions, such as technical, quality assurance, or managing directors, are typically responsible for determining whether or not iodized salt would be used in food products. It was also noted that the decision to use iodized salt will typically be a collective effort involving individuals from many departments, such as food scientists and technologists from R&D, along with nutrition and regulatory affairs.

Similarly to the company in Pakistan, all companies noted that the use of iodized salt is discussed infrequently at best unless companies are beginning to implement use of iodized salt in products. Many companies noted that the use of iodized salt is not a high priority for their company at this time, and some multinational companies noted their current priority efforts to reduce sodium in food products. Although there is interest in learning more about iodine nutrition from 4 companies, the majority of food companies interviewed by telephone were not interested in learning more about iodine nutrition and the use of iodized salt in food products. Some indicated representatives from their company may be open to learning more in the form of educational programs offered locally in their country. Five company representatives felt that knowledge of iodine nutrition was medium (around level 3) at their company, based on a scale of 1 to 5, with 5 being very knowledgeable. Four remaining companies felt the level of knowledge at their company was below 3, with only 1 reporting level of knowledge as a 4. Company representatives also noted that knowledge of iodine nutrition typically differs by department, where food scientists and nutritionists will likely be more knowledgeable than management.

IFT also spoke to 2 major U.S. salt suppliers for this project, which offer both iodized and noniodized salt, but they primarily sell salt domestically in the United States with limited sales in Canada and Mexico. If they do export salt, they would follow that country's regulations on rate of iodization, if any. The majority of their customer requests are for noniodized salt.

Challenges/Opportunities to Using Iodized Salt

Both the electronic survey respondents and telephone interviews provided insight into potential challenges to using iodized salt in processed food products. Of note is that survey and

Table 28—Challenges using iodized salt.

Country	Challenges reported
Australia	Higher cost of iodized salt (2) Not requested by customer Unsure of effect on product quality Iodine nutrition not a high company priority
Bolivia	Small processors with little to no technology No enforcement
China	Trade barriers Instability of iodine ^a Equipment and process modifications Iodine nutrition not a high company priority
India	Higher cost of iodized salt Instability of iodine ^a
Mexico	Negative reaction with other specific ingredients
Pakistan	Higher cost of iodized salt (3) Consumer misconceptions (3) Lack of awareness Not permitted by law Instability of iodine
Global	Equipment and process modifications ^a

Note: Numbers in parentheses indicate number of companies with same response.
^aTelephone interview responses.

interview responses came from a wide variety of positions at food companies, and food scientists working in R&D departments at food companies are typically most familiar with challenges related to the use of iodized salt in products. According to Morton Salt Co., a team approach in addressing salt iodization that includes a food scientist is most helpful (personal communication June 18, 2010). A food scientist can ensure that food science-related issues, which include some of the challenges listed later, such as retention rate of iodine in processed foods, iodine sources, temperature effects, and sensory issues are addressed.

Survey and telephone respondents reported many potential challenges to using iodized salt in food products, including: higher cost of iodized salt; iodized salt not specified for use by a company's customers; humid environments, which make for poor stability of iodized salt if packaged improperly; different beliefs about iodine's effect on the body; lack of awareness about iodine deficiency; and misconceptions about iodine's usage and effect on quality of the food product (Table 28). Another challenge may be the loss of iodine during cooking, which can be as high as 50% to 70%, and during storage (Chen and Wu 1998).

Three respondents noted the instability of iodine as a potential challenge, such that the level of iodine in salt or food products decreases with time. Iodate is considered more stable than iodide, which oxidizes to iodine in humid environments or in the presence of oxidizing agents. Iodate can be reduced in the presence of reducing agents, and iodine itself is volatile (West and Merx 1995). Studies have shown iodine retention rates as low as 50% in various food products, and up to 100% in bread/cereal products (Kuhajek and Fiedelman 1973; Thomson 2009). Adjusting the amount of iodized salt used to meet the regulatory requirements at sale and consumption can be challenging.

A challenge may also be that food companies with a choice will opt to use noniodized salt due to the higher cost of iodized salt. Six respondents noted a higher cost for iodized salt as a challenge to use. Although U.S. salt companies charge the same price for retail iodized and noniodized table salt, and encourage this model in other countries, this is not always the case in other countries (Morton Salt Co. personal communication June 18, 2010). Reasons for an increased cost may be due to ingredients, such as potassium iodide which requires a reducing agent to stabilize the

iodide, which can be more costly than salt. Equipment to add and mix iodization compounds can add costs, as well as potential lab costs to analyze and verify the iodine level of the salt (Morton Salt Co. personal communication June 18, 2010). For example, in Pakistan potassium iodate is not readily available and the price varies from \$2.50 to \$20/kg. The average price of noniodized salt is \$0.033/kg, while the average price for iodized salt doubles to \$0.065/kg (Rose and others).

According to the Salt Inst., there is an extra cost to adding iodine to salt and processors can't recover this cost if competition isn't also required to iodize (personal communication June 9, 2010). In countries where iodization is not effectively implemented or monitored, processors may claim to iodize salt, when in fact they do not, and are able to sell the product for less than competitors' prices since they do not incur extra costs for iodized salt. A lack of enforcement of regulations creates the additional challenge of sale and use of counterfeit iodized salt in some countries. For example, a company may not use iodized salt in its food products but falsely claim to do so. This enables them to either charge less for their product or increase their profit margin. Meanwhile, a competitor who uses iodized salt must either charge more or decrease their profit margin. In several countries, the government does not have the enforcement capabilities and resources to ensure that regulations are being followed. Field visits to Ghana suggest that the 2 key constraints to use of iodized salt by food processors are: (1) a lack of enforcement, which may penalize processors who do carry the cost of iodization; and (2) an unreliable and difficult system for processors to gain access to iodate (Mannar and Wesley 2010).

Technical capability and limited resources for technology may be additional challenges to use of iodized salt. One company noted changes in granule size when iodine is added may cause equipment changes to be required, and processes will likely need to be tweaked. In some countries, such as Bolivia, where the use of iodized salt in processed foods is mandatory, many of the small salt processors have little or no technology to iodize salt. One company noted technical manufacturing problems related to the use of iodized salt, such as the need to modify equipment or processes to run more efficiently. One company stated that iodized salt changes color when used in dairy products, which would require considerable quality control and R&D to make sensory characteristics acceptable to consumers. However, a review by West and Merx (1995) showed that potassium iodate or iodide added to salt had no negative effects on the processing or quality (color, flavor, and texture) of food products, even after storage, although dairy products were not included in their review. They reported that a large amount of iodine would be necessary to create changes in taste.

Local culture (how consumers feel about the use of iodized salt in food products) was also noted as a potential challenge. Consumer misconceptions that iodized salt may taste or perform negatively in food products is a challenge. West and Merx (1995) noted that consumers particularly in the Middle East and Eastern Europe believe iodine will negatively affect the color or taste of foods, and that certain foods created with iodized salt may turn blue during storage. Many consumers understand salt is used for flavor and perhaps food safety, but many may not associate salt with health, especially with current demands for sodium reduction. Consumers may also believe that rock or sea salt, which is typically not iodized, is healthier or contains less sodium than table salt. The cost and time to create and use new product labels when iodized salt is used could be a challenge. One company noted that potassium iodate or other terms that may be unfamiliar to consumers could cause concern for the public when listed on

food labels due to the current trends toward less ingredients and more natural ingredients preferred on food labels.

In other countries there are more pressing concerns than iodine deficiency. For example, HIV/AIDS and food insecurity in many African areas are more urgent problems facing countries than iodine deficiency. Many food company representatives noted that their company had priority issues for product reformulations other than use of iodized salt.

Iodized salt may also not be used by food companies to prevent the sale of products in markets where it is not permitted or is only allowed at certain levels. In a few countries, such as France and Poland (which were not part of the IFT survey), the use of iodized salt in processed foods is not permitted. One of the challenges to using iodized salt in countries such as Russia is that, despite clear iodine deficiency, the government is reluctant to introduce mandatory iodization of table salt as this could allegedly “violate consumer’s right for choice and freedom of entrepreneurial activities” (Gerasimov 2009). Another challenge is ensuring that the correct amount of iodine is added. The dangerous, negative health impact of overconsumption of iodine needs to be considered and addressed, if necessary. Overconsumption of iodine can lead to toxicity symptoms and have negative effects, such as hyperthyroidism, in individuals who previously were in deficit. Ironically, excessive iodine consumption can also result in hypothyroidism and goiter, the same symptoms of iodine deficiency, in other individuals (Johnson 2008). However, it should be noted that iodine deficiencies far outweigh instances of iodine excess, which is much less common.

In 2007, the Iodine Network conducted a review of use of iodized salt in processed foods in the WHO European Region. In only 18 out of 43 countries in the WHO European Region iodized salt is mandatory in the food industry. In 2 countries (France and Poland) iodized salt was not permitted in the food industry while in 23 countries use of iodized salt was either voluntary or not regulated at all. Thus, iodization efforts in most of these countries are not focused on salt used in processed foods. In many of these countries, food processors are disinclined to use iodized salt due to concerns about the perceived negative effects on their food products and/or national trade barriers due to varying legislation (Gerasimov 2009). Gerasimov also reported barriers to using iodized salt in bread and cereal products which include: lack of awareness of iodine deficiency among policy makers and bread bakers; suspected adverse effects of iodine on food quality and acceptance; ingrained dietary customs and habits; costs of transitioning from noniodized salt to iodized salt; conflicting government strategies to reduce sodium consumption; and differences in legislation for various businesses and countries.

Conclusions and Next Steps

As directed in the scope of work, IFT conducted a desk review to determine the pattern of consumption of processed foods in 39 developing countries (Table 1) to complete Phase I of this task, and an electronic survey of food processors from 16 countries (Table 2) and detailed telephone interviews with a small sample of select company representatives to complete Phase II of this task. The Phase I environmental scan involved literature searches and reviews of the Internet for each of the 39 countries of interest, which included public databases and peer-reviewed publications. The acquisition of literature or access to databases or other sources of information which are not freely available was limited. IFT also utilized members familiar with the countries of interest and 3rd parties such as government agencies, food companies, salt suppli-

ers, nongovernmental organizations, and others to gain contacts and information for both Phases of the project.

Outreach for Phase II focused on fewer countries than Phase I, yet IFT still reached out to over 850 individuals. However, the response rate was significantly lower than what IFT received for Phase I. This may be due in part to the fact that many individuals were contacted for both Phase I and Phase II, and although the information IFT sought was different, they may have believed they had already responded to the request via their Phase I response. This is also likely due to the narrowed focus of Phase II on only individuals from food companies or salt suppliers/producers. Lack of responses from certain countries may be linked to larger issues at hand, such as volcano eruptions and tsunami impact in Indonesia during this same timeframe. IFT also noted that many individuals from multinational food companies had to receive corporate approval to answer questions, as many responses are not public information and that there was concern over who the responses would be shared with, what responses would be used for, and if responses would be linked specifically to companies. Some companies declined to participate for these reasons; others were interested in signing a nondisclosure agreement with IFT to provide information.

Although IFT obtained only limited information for Bangladesh, Kenya, Russia, and Senegal, IFT made a substantial effort to obtain useful information for all countries researched.

To the extent possible, IFT determined the types and levels of processed food consumption in the selected countries and the use of salt as an ingredient in many of those processed foods. IFT also identified many suppliers of processed foods consumed in each of the selected countries, when processed foods were indeed consumed (see Table 29). When information was available, IFT also provided whether or not there are policies in place to influence dietary salt reduction and how these efforts are implemented (see Table 30); processed foods consumed by different socioeconomic groups; and sodium content of processed foods in the selected countries.

Many of the 39 countries reviewed struggle with food insecurity. IDD is more closely linked to food-insecure populations, which are also often low-income and rural populations who lack access to food, including food that may have been made with iodized salt. It was difficult to find national food consumption data for these impoverished nations, particularly data on processed food consumption. In general, processed foods consumed in many of the developing countries are not typical of what may be considered processed foods in “Western” society (for example, packaged, prepared foods). Processed foods consumed in many of the 39 countries consisted of bread, cheese, and other foods that are minimally processed compared to some of the fare available in more developed nations, like the United States and the United Kingdom, such as convenience and snack foods, RTE meals, and so on. It is also important to note that, although processed foods may be available in a country, consumption often differs based on income and region in the country. The more affluent, and often urban, areas of countries appear more able to purchase processed foods and therefore more likely to have a higher consumption rate.

Nationwide food consumption data were found to be most helpful to better understand processed food consumption for those countries that collected it; however, developing countries often lack the resources for such a large undertaking. Smaller, published academic studies, where available, are presented in this report but must be interpreted with some caution—the small populations studied (a single rural village or adolescents in a suburb) are not

Table 29—Summary of processed foods and suppliers by country.

	Country	Commonly consumed processed foods	Suppliers of processed foods
Heavy burden for IDD	India	Roti (bread), butter, milk, buttermilk, yogurt, ice cream, cakes, jam, noodles, ketchup, French fries	Unilever, Nestlé, Procter & Gamble, U.S. Wheat Associates, Hindustan Lever, Godrej Pillsbury, Kellogg's, GSK, Yum! Brands
	Pakistan	Naan, roti, chapatti, and Jesus breads	Nestlé, Unilever, Natl. Foods and Shan Factory
	Ethiopia	Not commonly consumed due to the large rural population (80% to 85%)	None identified
	China	Instant noodles, snacks, frozen ready-to-eat foods (dumplings, sticky rice cakes, buns, beef/pork/fish/shrimp balls, pizza, noodles, soups, desserts), cereal products, nonalcoholic beverages, processed meats, oils/fats, juice, and dairy products	Amoy Food Limited, Ajinomoto Inc, Nestlé, General Mills, Tyson, Cargill, Aramark, PepsiCo (Frito Lay), Nestlé, Heinz, Synear, Sanquan, Longfeng, Haibawang (continued in text)
	Sudan	Sorghum, maize, milk, meats, eggs	None identified
	Indonesia	Rice, corn, wheat flour, rice noodles, bread, dry and wet cake, pasta, corn flour products, sugar	Indofood, Cargill, ASW Foods, Megasurya Mas
High burden for IDD	Philippines	Bread, pasta and noodle products, brown sugar, white sugar	San Miguel-Purefoods Co., Universal Robina Corp., Jollibee (fast food)
	Russia	Russian diet consists of carbohydrates and fatty fats	Nestlé, PepsiCo, Parmalat, Cargill
	Afghanistan	Flat breads	Kabul Flour Mills
	United Republic of Tanzania	Tea with sugar, bread, ugali, vegetable oil, cookies, milk (see chart for percentage of intake)	Mugabe Bakery, Kenmillers, Akiyda, Asas Dairy (continued in text)
	Democratic Republic of Congo	Wheat flour, purchase bread, other wheat products, purchase sugar, purchase pasta. Cassava is the main staple in the DRC.	Nestlé
	Iraq	Flour, sugar, milk, and tomato paste	Trans Iraq, Al-Tariq Foods, Zedny, Gulf Food Products
	Bangladesh	Rice, wheat, sugar, edible oils, preserved fruits and juices, fish	Nestlé, importers/exporters listed in text
	Yemen	Bread, few other processed foods but imports of wheat, sugar, milk, and rice	Yemen Milling Co., Al-Hoddidah, Red Sea Milling, Zain Foods
	Angola	Salted fish, sausages, corned beef	Nestlé
	Turkey	Wheat flour, bread, biscuits, pickled olives, macaroni, and tomato paste	Banvit, Ulker, Pinar Food Co., Sutas Dairy Co., Tat Konserve (continued in text)
Countries with opportunity to progress	Senegal	Cheese, bread, sugar, sauce/peanut paste, butter, ketchup, mustard, milk biscuit, candy, soft drinks	SOCAS, Agroline, Compagnie Sucriere Senegalaise, PAPEL, Nestlé, SATREC, CCMB, Sapolai, Sentenac, Grands Moulins
	Ghana	Bread, biscuits/pastry, dairy products, breakfast cereals, confectionaries, ready-to-eat meals, beverages	Nestlé, Unilever Ghana Limited, Lipton, Blue Brand, Royco, Ananpurna, Starkist
	Ukraine	White bread, whole grain bread, pasta, fruit/vegetable juices, milk, cottage cheese, bologna, kielbasa, candy, cakes/cookies, ice cream, cola-type soft drinks	Sandora LLC (Pepsi)
	Kenya	Porridge, bread and ugali, fried doughnuts, cake, milk	Hostess, Bidco, Del Monte, Nestlé
	Mozambique	Maize, manioc, beans, groundnuts, sorghum, dried fish (for seasoning)	Shoprite (grocery store)
Through political commitment	Niger	Most food comes from food aid since Niger is one of the poorest countries in the world; unvaried diet of millet porridges mixed with sugar and/or milk, rice, sauces, and sometimes a meat dish	None identified
	Egypt	Bread, cheese, processed/canned meats, fried potatoes, pickled cucumbers, pizza, fried/grilled chicken, soft drinks	Nestlé, Green Valley Food Industries, Unilever-Mashreq, Mazex Import Export, Farms Assasa Co., Micro Farm Fresh
Through programmatic interest	Haiti	Rice, wheat, bread, corn, oilseeds, powdered juice	No consistent outlets identified
	South Africa	Maize, white sugar, tea, brown bread, non-dairy creamer, wild green leaves, white bread, tomato and onion stew, chicken, cabbage, eggs, beef, brick margarine, coffee, potatoes, rice, carbonated beverages	Unilever (operating under the brands: Glen, Hoko, Lipton, Stork, Flora, Ola, Rajah, Knorrox, Knorr
	Brazil	Rice, corn meal, milk, bread, crackers, rick pasta, biscuits, chips, cheese, processed meats	Barilla, General Mills, Nestlé, ADM, Bunge, Cargill, Moinho Sao Valentin
	Nigeria	Boiled rice, stewed rice, bread, pounded yam, bean pudding, stewed beans, yam porridge, cassava flour products, biscuits, doughnuts, buns, meat pies, fish rolls, cakes	UAC Foods, Mr. Biggs, Chitis Pasteries, Safinable Global Investment Ltd.
	Nepal	Flour, rice, sugar, noodles, biscuits, soft drinks, vegetable ghee and oil, powdered milk, milk	Kwality Confectionary and Kwality Biscuits, Kabra Group, Annapurna Maida Mills
Latin American countries	Chile	Bread, tea, pasta, rice, seafood, carbonated beverages, beer	Nestlé, PepsiCo
	Argentina	Flour, sugar, meats, dairy, edible oils, cakes/candies/chocolates, snacks foods, juices, bakery items, prepared meals	Arcor, Molinos Rio de la Plata, Nestlé, Refinerias de Maiz, Terrabusi, Canale, Kraft, Quimica Estrella, Danone
	Mexico	Breakfast cereal, processed meat, processed corn, processed fish, processed/canned fruits & vegetables, soft drinks, confectionery	Grupo Gruma, Grupo Minsa, Munsa, Trimex, Espiga, Elizondo, Tablex, Cargill, Kellogg's
	Bolivia	Potatoes, milk, sugar products, wheat and corn flour, bread, pasta	Molino Andino, Sociedad Industrial Millers, Dillmann, Del Valle, Pil Andina, Delizia, ADM, Nestlé, Cargill
	Uruguay	Milk and dairy products, cereals and bakery, processed meats	Nestlé, El Trigal, Maggi, Soldo Hermanos, Blue Bird, Conaprole, SAMAN, Glencore, Industrias Harinas

Table 29—Continued.

Country	Commonly consumed processed foods	Suppliers of processed foods
European countries		
United Kingdom	Breads, bacon/ham, cereals, cheese, sausages, baked beans, milk, and cream	Budgens, J Sainsbury PLC, Morrisons, Somerfield, Tesco, Waitrose, Allied Bakeries, Kingsmill, Sunblest and Allinson, Assoc. British Foods, The Dairy Crest Group, Unilever, Walkers, PepsiCo
Ireland	Breads, rice, pasta, breakfast cereals, biscuits, milk, cheese, potatoes, bacon, ham, sausages, butter, cakes, pastries, and buns	Heinz, Kellogg's, BWG Foods, The Kerry Group, Allied Bakeries, PepsiCo. Groceries: Aldi, Superquinn and Tesco
Finland	Bread, cereal products, milk, cheese, fat spreads/oils, porridge, yogurt, sausage	Nestlé, HK Foods, Atria Finland, Fazer, Valio, HKScan Finnsoy, Hesburger
Netherlands	Bread, pasta, rice, grains, cereal, milk, oil, butter, sugar, honey, jam, syrup, cheese, cakes, biscuits, processed fish, meat and eggs, soft drinks, margarines	Heinz, Amoy, Brinta, Honig, Bolletje
Australia	Bread, processed meat, cereal, savory sauces and condiments, cheese, breakfast cereal, dry soup mix	Goodman Fielder. Groceries: Woolworth's, Coles Group, Metcash
New Zealand	Bread, milk, alcoholic beverages, cakes and muffins, nonalcoholic beverages and sugar/sweets, butter/margarine	Goodman Fielder, Corson Grain, Weston Milling, Fonterra Cooperative Group, Wattie's

quantitatively representative of an entire nation. This information is perhaps most useful in identifying types of foods that may be available in the different locales within a country, at times including minimally processed foods. Furthermore, many researchers did not identify the source of foods that people consumed, making it difficult to interpret if even minimally processed foods were self-produced, locally sourced, or obtained from a more complex supply chain. For example, when various grain flours are consumed, it is often unclear if consumers are grinding their own grain or purchasing it premilled. Investigation into the food suppliers in each country sheds some light on this dynamic, but a more thorough investigation (conducted in the country of interest, if possible) is necessary for a more complete understanding of food supplies in those developing countries.

As shown in Table 31, a pattern of processed food consumption, or lack thereof, did not present itself for the various country categories assigned to the 39 countries MI identified for this project. Whether the country has a heavy or high IDD burden or an opportunity to progress did not correlate with the consumption of processed foods in that country. Countries from each of these categories may or may not have processed foods available. Some countries with the heaviest burden for IDD may also have many processed foods available, such as China, while another country may not appear to have even minimally processed foods readily available. However, the majority of the European countries and Latin American countries identified on the list do have processed foods more readily available than some other countries identified.

Many of the developing nations reviewed have the highest prevalence for IDD, often due to the high level of food insecurity. Some of the developing countries have enacted legislation to combat the high rates of IDD that require iodization of all salt to be consumed, but because they are a developing nation, they also often lack regulatory infrastructure and therefore lack effective methods to monitor and enforce salt iodization. For this reason, it appears that even when legislation and other efforts have been enacted, they are not comprehensively implemented. Whether a country has USI-related legislation varies widely, as do the specific requirements of USI-related legislation or standards when they are present, such as level of iodization, permitted iodizing substances, and enforcement. Iodized salt appears to primarily be used in food products only when required by legislation, and companies do not appear to use iodized salt in product categories that do not require it (such as beyond bread products in Australia) or for products sold in countries that do not require it.

Survey and telephone respondents reported potential challenges when using iodized salt in food products, largely operational, political, or related to markets. Such challenges include a higher cost for iodized salt (which may need to be passed on to consumers); poor stability of iodine in salt and food products; lack of enforcement of regulations; lack of resources and technical capability; potential equipment and process overhauls; and consumer misconceptions about iodine's effect on sensory/quality characteristics of food products, and in the body. In some countries there are public health concerns deemed to be more pressing than iodine deficiency, and in food companies competing priorities could make moving the focus to use of iodized salt in products a challenge. In countries where the use of iodized salt in food products is not mandated, the lack of a level playing field can prevent many companies from using iodized salt as competitors may be able to sell their product for less. A lack of enforcement of regulations creates the additional challenge of sale and use of counterfeit iodized salt in some countries, and claims that companies use iodized salt while they do not in fact do so. Other challenges include trade barriers with countries that prohibit the use of iodized salt in food products or that have concerns about overconsumption of iodine.

The electronic survey and telephone interviews indicate that food companies are willing to use iodized salt in food products; however, the use of iodized salt in food products may need to be mandated by law as an incentive for a company to invest and to create a level playing field in the industry. Approaches to increase voluntary use of iodized salt by food companies include outreach and education to the nutrition departments at companies, who would then recommend policy changes to top levels of management. Additionally, a consumer education campaign on the use of iodized salt in food processing to address IDD could provide incentive for companies to meet consumer demand.

Although a wide variety of salt suppliers were reported for the majority of the 16 countries, suppliers in developing countries may not have the technical capabilities or resources to iodize salt. In the more developed countries, both iodized and noniodized salt are available, typically from the same suppliers.

As shown in Table 31, most respondents appear to have a fair level of knowledge about iodine nutrition and the use of salt as vehicle for iodine, although individuals working for different departments in a food company will have differing levels of understanding. Most respondents noted iodine deficiency was present in their country, except the U.K. respondent who believes IDD has been addressed adequately in the United Kingdom and that it

Table 30—USI legislation and standards in countries of interest.

Country	USI legislation/ standards	Level of iodization	Enforcement	Salt reduction initiatives
Africa				
Angola	—	—	—	—
Democratic Republic of Congo	DRC has USI program that forbids the import of uniodized salt	—	—	—
Egypt	—	—	—	—
Ethiopia	Quality and Standard Authority of Ethiopia requires that iodine be present in salt, and refers to this program as USI	60 to 80 ppm as potassium iodate	—	—
Ghana	Food and Drugs (Amendment) Act 523 in 1996 made it mandatory for all salt produced, sold, or distributed for human consumption	> 15 ppm	—	—
Kenya	USI program since 1978. In 2009, the Minister of Public Health and Sanitation amended the Food, Drugs, and Chemical Substances Regulations to alter level of iodization	50 to 84 mg/kg	—	—
Mozambique	—	—	—	—
Niger	—	—	—	—
Nigeria	USI program initiated in mid-1990s—all salt used in food should be iodized; clear-designation between food-grade and industrial-use salt; legislation gives labeling guidelines	Min. level of 50 ppm at production and 30 ppm at retail	Natl. Agency for Food and Drug Administration & Control (NAFDAC); Standards Organization of Nigeria (SON) responsible for enforcement	—
Senegal	USI program since 1994 (not verified)	—	—	—
South Africa	—	—	—	—
Sudan	Ministerial decree in 1994 required all edible salt to be supplemented	25 to 35 ppm since 2003	USI not a reality likely due to lack of authority to monitor and enforce legislation	—
United Republic of Tanzania	USI program since 1994 under Salt Iodations Regulation Act of 1994	—	—	—
ASIA				
Afghanistan	—	—	—	—
Bangladesh	Bangladesh Universal Salt Iodization Act No. 10 passed in 1989 made it mandatory for all edible salt to be iodized; 1994 bylaw provided investment for iodization infrastructure	45 to 50 ppm at production; no less than 20 ppm at retail	Bangladesh Council of Scientific and Industrial Research responsible for enforcement	The Hypertensive Committee of the Natl. Heart Foundation conducts educational campaigns & annual roundtable meeting
China	State Council of the People's Republic of China Order No. 163 in 1994 made salt iodization mandatory	20 to 30 mg/kg was proposed in July 2010	Ministry of Commerce responsible for enforcement	2007 campaign to show suggested daily salt consumption level; China introduced voluntary guidelines for salt labeling on packaged foods in 2008
India	Iodized salt required for direct human consumption; sale of uniodized salt for direct human consumption banned since 2006 through amendments to the Prevention of Food Adulteration Act	> 30 ppm at production; > 15 ppm at consumption	—	—
Indonesia	Presidential decree of 1994 mandated iodization of salt for human consumption	Min. 30 ppm	Monitoring and enforcement have reportedly not been optimal; Ministry of Industry and Trade to enforce standards	—
Iraq	—	—	—	—
Nepal	USI program in place	avg. 54.2 mg/kg	—	The Nepal Hypertension Society (est. 2004) conducts awareness programs and more
Pakistan	Not mandatory although USI at 50 ppm has been sought in the legislature	—	—	—
Philippines	1995 Act for Salt Iodization Nationwide requires all salt for human consumption (incl. salt used in processing) to be iodized	Unable to find established min. level	Bureau for Food and Drugs responsible for monitoring and enforcing	—

Table 30—Continued.

Country	USI legislation/ standards	Level of iodization	Enforcement	Salt reduction initiatives
Russia	Current IDD prevention is voluntary, although salt for children's and medical institutions must be iodized	40 ± 15 mg/kg	Moscow Endocrinology Research Center resumed efforts to control IDD in 1991	—
Turkey	The Turkish Food Codex states that fine milled table salt must be iodized; use of iodized salt in processed foods is voluntary	25 to 40 ppm with potassium iodate	—	The Turkish Society of Hypertension and Renal Diseases aims to increase salt reduction awareness
Yemen	Legislation passed in 1996 requires iodization of salt for human consumption	40 ppm	—	—
Europe Finland	Table salt iodized since 1940s—salt used in food processing is not required to be iodized	25 mg/kg	—	The Natl. Nutrition Council of Finland began a highly successful salt reduction campaign in the 1970s
Ireland	—	—	—	FSAI working to reduce sodium intake; in 2009 Ireland adopted the FSA's salt reduction model to improve salt reduction efforts
Netherlands	Iodization of table salt is mandatory; mandatory use in bread was repealed in 1984, although many bread makers still use iodized salt	30 to 40 ppm; max. 65 ppm if used in bread salt; 25 ppm in all other nonbakery items	—	Dutch Food Industry Federation launched the Action Plan Salt Reduction in 2008 to reduce sodium in foods
Ukraine	—	—	—	—
United Kingdom	Voluntary salt iodization and is not believed to be highly prevalent in processed foods	Min. dose for infant formula, baby foods, and diet foods has been established	—	One of the most active salt-reduction communities; government set a target to reduce salt intake to an average of 6 g/d by 2010; Natl. Salt Initiatives and Natl. Inst. for Health and Clinical Excellence
North & South America Argentina	Article 1272, Res 153 of Chap 16 of the Argentine Food Code requires that salt for human consumption be iodized and prohibits the sale of uniodized salt in endemic areas; salt for industrial use, food or not is excluded	33.3 ± 8.3 ppm	—	—
Bolivia	—	—	—	—
Brazil	1953 legislation requires all salt for human consumption to be iodized; iodized salt is required for food processing, except when iodization causes interference	20 to 60 ppm	—	—
Chile	All salt for human consumption or food preparation must be iodized	20 to 60 ppm	—	—
Uruguay	Voluntary iodization of salt; required in endemic areas	—	—	Educational campaign to promote the Uruguay's Dietary Guidelines, which limit salt intake to less than 5 g/d; government may form Working Group for Salt Reduction
Haiti	—	—	—	—
Mexico	Mexican Normativity 040-SSA1-1993 requires mandatory table salt iodization and fluoridation; salt for use in the food industry must be iodized as well	30 ± 10 ppm	The Ministry of Health is responsible for compliance	—
Australia	—	—	—	—
Australia	Mandatory iodized salt use in bread since 2009; voluntary use of iodized salt elsewhere	45 mg/kg in bread; voluntary permission rate 25 to 65 mg/kg	States and territory governments are responsible for enforcement	AWASH conducts salt reduction campaigns, that is, "Drop the Salt"
New Zealand	See above, Australia	See above, Australia	See above, Australia	Similar to Australia

Note: Information was obtained for every country possible, but is not all-encompassing.

Table 31 – Awareness of/ interest in iodine nutrition.

Country	Interested in discussing iodine nutrition in more detail with IFT?	Interested in meeting IFT to discuss iodine nutrition in more detail?	Level of knowledge staff at your company have on iodine deficiency?	Do you know if iodine deficiency is a concern in your country?	Do you know what iodine is?	What is the main source of iodine in the diet?	Which part of the body needs iodine for proper functioning?	Is your company interested in learning more about iodine deficiencies?
Mexico	Yes	No	4	Yes	Essential mineral	Iodized salt	Thyroid gland	No
	Yes	Yes	3	Yes	Essential mineral	Iodized salt	Thyroid gland	Not sure
Bolivia	No	Yes	4	Yes	Essential mineral	Iodized salt	Unsure	Not sure
India	No	Yes	3	Yes	Essential mineral	Iodized salt	Thyroid gland	Yes
	Yes	Yes	3	Yes	Essential mineral	Iodized salt	Thyroid gland	Not sure
	Yes	Yes	5	Yes	Essential mineral	Iodized salt	Thyroid gland	Yes
Australia (developed)	Yes	No	4	Yes	Essential mineral	Iodized salt	Thyroid gland	No
	No	No	2	Yes	Essential mineral	Iodized salt	Thyroid gland	No
	No	No	5	Yes	Essential mineral	Unsure	Thyroid gland	Not sure
United Kingdom (developed)	Yes	No	2	Yes	Essential mineral	Iodized salt	Thyroid gland	No
	Yes	Yes	1	No	Essential mineral	Iodized salt	Thyroid gland	No
Nigeria	Yes	Yes	3	Yes	Essential mineral	Iodized salt	Thyroid gland	Yes
	No	Yes	4	Yes	Essential mineral	Iodized salt	Thyroid gland	Not sure
Pakistan	Yes	No	3	Not sure	Essential mineral	Fish/seafood	Thyroid gland	Not sure
	Yes	Yes	3	Yes	Essential mineral	Iodized salt	Thyroid gland	Yes
	Yes	Yes	5	Yes	Essential mineral	Iodized salt	Thyroid gland	No
	Yes	Yes	2	Yes	Essential mineral	Fish/seafood	Thyroid gland	Yes
China	Yes	No	4	Yes	Essential mineral	Dairy	Thyroid gland	Not sure
	Yes	Yes	Not sure	Not sure	Essential mineral	Fish/seafood	Thyroid gland	Yes
	Call ^a	No	4	Yes	Essential mineral		Thyroid gland	No
	Call ^a	Yes	3	Not sure				No
South Africa		No	1	Yes				Yes
Totals	14 yes/6 no	12 yes/10 no	Average 3.24	18 yes/1 no/3 not sure	19 essential mineral	14 iodized salt/3 fish/seafood/1 unsure/1 dairy	18 thyroid gland/1 unsure	7 yes/8 no/7 not sure

^aTelephone interview responses.

is no longer an issue. The majority of respondents were aware that iodine is an essential mineral and only 1 respondent was unaware of the part of the human body that requires iodine for proper functioning. The main source of iodine in the diet was primarily reported as iodized salt, although 1 respondent was unsure. Fish/seafood were reported by 3 respondents and dairy products by 1 respondent.

In general, most company representatives are open to discussing the issue of iodine nutrition in more detail, although iodine nutrition is currently discussed infrequently at most food companies. Respondents willing to discuss the issue indicated a slight preference for a telephone conversation, as opposed to an in-person meeting. Representatives had mixed responses on whether their company would be interested in learning more about iodine nutrition, with most stating no, and an equal number saying yes or that they were unsure of their company's stance. Only 1 country representative from Russia did not answer the questions listed in Table 31, which could be indicative of their level of interest. Company representatives did indicate that companies would likely be open to educational efforts to inform company representatives about iodine nutrition.

Future research needs surrounding iodine use in processed foods include the need for nationwide food consumption data and additional food science research. Future research needs surrounding iodine use in processed foods include the need for nationwide food consumption data and additional food science research. Nationwide food consumption data are most helpful to determine processed food consumption; however, developing countries often lack the resources for such a large undertaking. Nationwide food consumption information can also reveal sources of salt intake in the diet and help to determine vehicle(s) for iodized salt delivery, such as was done in Australia.

Food science research determines the amount of iodine that should be added to a product to still meet standards after food processing and time spent on a store or consumer's shelf. Advances in food science and technology can continue to enhance product packaging with effective barriers to protect iodine from degradation due to light, heat, and humidity, and research can further determine iodine stability throughout various processing and storage conditions. There is also concern in some countries that the use of iodized salt will negatively affect the sensory attributes of food products. Sensory studies are essential to ensure that iodization does not impact the taste or other quality attributes of a food product.

List of Abbreviations

ASIN = Act for Salt Iodization Nationwide (Philippines)
 AWASH = Australian Div. of World Action for Salt and Health
 BMI = Body mass index
 BSCIC = Bangladesh Small and Cottage Industry Corp.
 CIA = U.S. Central Intelligence Agency
 CIDA = Canadian Intl. Development Agency
 CODEX = Codex Alimentarius
 DOC = U.S. Dept. of Commerce
 DRC = Democratic Republic of Congo
 EU = European Union
 FAO = Food and Agriculture Organization
 FDA = U.S. Food and Drug Administration
 FSA = Food Standards Agency (UK)
 FSAI = Food Safety Authority of Ireland
 FSANZ = Food Standards Australia New Zealand

g = Gram
 GAIN = Global Alliance for Improved Nutrition
 GDP = Gross domestic product
 GVFI = Green Valley for Food Industries (Egypt)
 HIV/AIDS = Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome
 ICCIDD = Intl. Council for Control of Iodine Deficiency Disorders
 IDD = Iodine Deficiency Disorders
 IFPRI = Intl. Food Policy Research Inst.
 IFT = Inst. of Food Technologists
 IOM = Inst. of Medicine
 kg = Kilogram
 kL = Kiloliter
 L = Liter
 MAFF = Ministry of Agriculture Fisheries and Food (UK)
 mg = Milligram
 MI = Micronutrient Initiative
 MORGEN = Monitoring Project on Risk Factors and Chronic Diseases in the Netherlands
 MT = Metric ton
 Na = Sodium
 NA = North America
 NaCl = Sodium chloride
 NAFDAC = Natl. Agency for Food and Drug Administration and Control (Nigeria)
 NICE = Natl. Inst. for Health and Clinical Excellence (UK)
 NZFSA = New Zealand Food Safety Authority
 oz = Ounce
 ppm = Parts per million
 RTE = Ready-to-Eat
 R&D = Research and Development
 SA = South America
 SES = Socioeconomic status
 SON = Standards Organization of Nigeria
 Tbs = Tablespoons
 UAC = United Africa Co.
 UHT = Ultrahigh temperature
 UI = Urinary Iodine
 UIC = Urine Iodine Concentration
 UK = United Kingdom
 UN = United Nations
 UNICEF = United Nations Children's Fund
 UNIDO = United Nations Industrial Development Organization
 U.S. = United States
 USGS = United States Geological Survey
 USI = Universal Salt Iodization
 WASH = World Action on Salt and Health
 WFP = United Nations World Food Programme
 WHO = World Health Organization
 μ g = Microgram

Acknowledgments

This work was carried out with the aid of a grant from the MI, Ottawa, Canada, through financial assistance of the Government of Canada through the Canadian Intl. Development Agency (CIDA).

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Appendix A Survey questionnaires

Phase I electronic survey questionnaire on use of iodized salt in processed foods. The Inst. of Food Technologists is under contract with the Micronutrient Initiative to conduct a study on “Use of

iodized food in processed foods” in select countries worldwide. The overall goals of the study are to assess the extent of utilization of iodized salt in processed foods, the level of consumption of the foods, and the level of knowledge of iodine nutrition among food processors; and second, to attempt to determine the potential impact of salt reduction initiatives on iodine nutrition.

Your expertise as a food professional living in a country of interest to the project is extremely valuable. We are asking for your assistance to complete a brief questionnaire regarding the use of salt in processed foods in your country. The information you provide to us will be compiled with that of other food professionals in the country in the final report. Your name will not be associated with specific information. The information we collect will be used to shape future initiatives in your country to reduce iodine deficiency disorder, the leading cause of preventable brain damage in the world. Thank you for your time and expertise!

Please complete the questionnaire below and return to Betty Bugusu by June 21, 2010 via e-mail at bbugusu@ifet.org or fax to 202-315-5174. Please contact Betty if you have any questions (Telephone 202-330-4980).

Name: _____

Current country of residence: _____

(1) Please list the major salt producers in your country: _____

(2) Sodium is a commonly used ingredient in a wide variety of processed foods—examples include: breads, meats, soups, bouillon cubes, cheeses, and so on. Please list 10 or more salt-containing processed foods “most frequently consumed by middle- to low-income populations” in your country, and answer questions regarding the consumption patterns and regions that predominantly consume these products.

(If additional products should be added to this list, please complete on a separate sheet of paper and return with this questionnaire.)

	Salt-containing product (name)	Brief product description, if not a conventional product type like bread. For example, deep fried corn flour product	Consumption: Specify if this food is a —staple/ frequently consumed (1); —nonstaple but commonly consumed (2); —occasionally consumed food (3)	Regions in country where mostly consumed, for example, countrywide, rural compared with urban western compared with southern part of the country
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

(3) Please list the manufacturers of the 10 or more processed foods predominantly consumed by middle and lower income populations in your country that you listed above, and provide product information on product type, salt content, and if the salt is iodized. (If additional products should be added to this list, please complete on a separate sheet of paper and return with this questionnaire.)

	Salt-containing product	Domestically produced or imported	Manufacturer/producer	Sodium content of this product (in mg per 100 g product)	Is the salt iodized? —Yes (1) —No (2) —Not Sure (3)
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

(4) Are there any concerns currently with high salt intake in your country?

- Yes
- No
- Not sure

(5) If yes, are there any strategies/initiatives to address high salt intake? And who is responsible for the strategies?

Salt intake reduction strategies/initiatives	By whom

(6) Are there any concerns currently with iodine deficiency in your country?

- Yes
- No
- Not sure

(7) If yes, are there any strategies/initiatives to address iodine deficiency? And who is responsible for the strategies?

Iodine deficiency mitigation strategies/initiatives	By whom

(8) Is salt iodization mandatory in your country?

- Yes, if yes move to questions 9 to 11
- No
- Not sure

(9) What is the iodization rate in parts per million (ppm)?

(10) Does the legislation specify whether salt used by the food industry should also be iodized?

(11) What government ministry or branch is responsible to ensure compliance?

(12) If it is possible to collect a copy of the legislation please provide.

Phase II electronic survey questionnaire on use of iodized salt in processed foods—food companies

The Inst. of Food Technologists is under contract with the Micronutrient Initiative to conduct a study on “Use of iodized food in processed foods” in select countries worldwide. Your expertise

as a food professional familiar with a country of interest to the project is extremely valuable. We are asking for your assistance to complete a brief questionnaire to gather information on:

- (1) Extent of use of iodized salt in processed food products;
- (2) Sources of salt used;
- (3) Extent of knowledge or awareness on iodine nutrition and of salt as a fortification vehicle; and
- (4) Interest in salt iodization.

These questions are specifically targeted to individuals currently working for a food company, so please complete *only* if you work for a food company. Please send to your food company contacts to complete otherwise. The information you provide to us will be compiled with responses from other food professionals in the country of interest, and your name will not be associated with specific information. The information we collect will be used to shape future initiatives in countries of interest to reduce iodine deficiency disorders, the leading cause of preventable brain damage in the world. Please complete the questionnaire below by Friday, October 22, 2010. Please contact Sarah Ohlhorst if you have any questions (sohlhorst@ifft.org or 202-330-4976). Thank you for your time and expertise!

- (1) Name _____
- (2) Company name _____
- (3) Your title and responsibilities at company _____

- (4) Country location(s) of company _____

- (5) Does your company manufacture products that typically contain salt?
 - (i) Yes
 - (ii) No (skip to Question #10)
- (6) What are your company's top 5 products *sold* (using sales data) that contain salt?
 - 1. _____
 - 2. _____
 - 3. _____
 - 4. _____
 - 5. _____
- (7) Is iodized salt used to manufacture any of these food products?
 - (i) Yes, all products
 - (ii) Yes, some products
 - (iii) No (skip to Question #9)
 - (iv) Not sure
- (8) If all products use iodized salt, why is that the case? _____

- (9) If only some products use iodized salt, what product types typically contain iodized salt and why?

- (10) Where and who does your company receive salt from? _____

- (11) Please explain why iodized salt is *not* currently used in food products, if applicable.
 - (i) Unsure of affect on food taste, appearance, and so on
 - (ii) Cost of iodized salt compared with non-iodized salt
 - (iii) Fear of trade barriers
 - (iv) Not permitted by law
 - (v) Not sure
 - (vi) Other _____
- (12) Can we call you to discuss iodine nutrition in more detail?
 - (i) Yes, contact me at _____ (insert phone number)
 - (ii) No
- (13) Would you be interested in meeting with IFT staff to discuss iodine nutrition in more detail?
 - (i) Yes
 - (ii) No
- (14) On a scale of 1 to 5, with 5 being very knowledgeable, what is the level of knowledge staff at your company have on iodine deficiency?
 - (i) 5 (very knowledgeable)
 - (ii) 4
 - (iii) 3
 - (iv) 2
 - (v) 1 (not knowledgeable at all)
 - (vi) Not sure
- (15) Do you know if iodine deficiency is a concern in your country?
 - (i) Yes
 - (ii) No
 - (iii) Not sure
- (16) Are you aware of what iodine is?
 - (i) An essential vitamin
 - (ii) An essential mineral
 - (iii) A herb
 - (iv) I do not know what iodine is
- (17) What is the *main* source of iodine in the diet?
 - (i) Fish/seafood
 - (ii) Iodized salt
 - (iii) Dairy products such as milk, cheese, butter
 - (iv) Not sure
- (18) Which part of the body needs iodine for proper functioning?
 - (i) Kidneys
 - (ii) Thyroid gland
 - (iii) Pancreas
 - (iv) Not sure

- (19) Is your company interested in learning more about iodine deficiency and the important role food products may play to combat this deficiency?
- (i) Yes
 - (ii) No
 - (iii) Not sure

Phase II electronic survey questionnaire on use of iodized salt in processed foods—salt suppliers

The Inst. of Food Technologists is under contract with the Micronutrient Initiative to conduct a study on “Use of iodized salt in processed foods” in select countries worldwide. Your expertise as a food professional familiar with a country of interest to the project is extremely valuable. We are asking for your assistance to gather information on:

- (1) Extent of use of iodized salt in processed food products;
- (2) Sources of salt used;
- (3) Extent of knowledge or awareness on iodine nutrition and of salt as a fortification vehicle; and
- (4) Interest in salt iodization.

The information you provide to us will be compiled with responses from other food professionals in the country of interest, and your name will not be associated with specific information. The information we collect will be used to shape future initiatives in countries of interest to reduce iodine deficiency disorders, the leading cause of preventable brain damage in the world. Thank you in advance for your time and expertise!

(1) Name

(2) Company name

(3) Your title and responsibilities at company

(4) Country location(s) of company

(5) How many employees are in your company overall?

- (i) Very small (less than 50)
- (ii) Small (less than 100)
- (iii) Medium (100 to 500)
- (iv) Large (over 500)

(6) What is the main reason your company iodizes salt?

- (i) Mandated by law
- (ii) Voluntary for public health concerns
- (iii) Special customer orders only
- (iv) Other

(7) Are there any incentives to iodize salt in your country?

- (i) Yes
- (ii) No
- (iii) Not Sure

(8) Is salt fortified with any micronutrients other than iodine?

- (i) Yes
- (ii) No
- (iii) Not sure

(9) If yes, what additional micronutrients AND what percentage of salt produced?

(10) Is salt produced for one company only, or do you sell salt to other customers?

- (i) Yes
- (ii) No
- (iii) Not sure

(11) If yes, who are your primary customers?

- Wholesalers
- Retail
- Consumers
- All of the above
- Other (please specify)

(12) What year did your company begin to iodize salt?

(13) What, if any, are the challenges associated with iodizing salt?

(14) Have you encountered any challenges when using iodized salt in products?

(15) Are there future opportunities to use iodized salt in products that do not currently contain iodized salt?

- (i) Yes
- (ii) No
- (iii) Not sure

(16) If yes, which products might contain iodized salt in the future, that use noniodized salt now?

(17) Who in the company is responsible for determining iodization policies/making decisions regarding the use of iodized salt?

- _____
- _____
- _____
- (18) How frequently is the use of iodized salt discussed at your company?
- (i) Daily
 - (ii) Weekly
 - (iii) Monthly
 - (iv) Annually
 - (v) Less frequently
 - (vi) Not sure
- (19) Do you have knowledge on how decisions are made regarding whether or not to use iodized salt?
- _____
- _____
- _____
- (20) Are iodization policies the same country-to-country (if organization is in multiple countries)?
- (i) Yes
 - (ii) No
 - (iii) Not sure
- (21) If no, why do iodization policies differ?
- _____
- _____
- _____
- (22) Are different suppliers used for iodized compared with non-iodized salt?
- (i) Yes
 - (ii) No
 - (iii) Not sure
- (23) If salt is received from suppliers in another country, does that country's iodization policy affect the salt received?
- _____
- _____
- _____
- (24) On a scale of 1 to 5, with 5 being very important, how important does your company believe iodized salt is in terms of promoting public health?
- (i) 5 (very important)
 - (ii) 4
 - (iii) 3
 - (iv) 2
 - (v) 1 (not important at all)
 - (vi) Not sure
- (25) On a scale of 1 to 5, with 5 being very knowledgeable, what is the level of knowledge top executives/decision makers at your company have on iodine deficiency?
- (i) 5 (very knowledgeable)
 - (ii) 4
 - (iii) 3
 - (iv) 2
 - (v) 1 (not knowledgeable at all)
 - (vi) Not sure

- (26) Do you know if iodine deficiency is a concern in your country?
- (i) Yes
 - (ii) No (skip to Question #29)
 - (iii) Not sure
- (27) If yes, how severe do you think it is?
- (28) What has contributed to your awareness of iodine deficiency and whether it is a problem in your country or not?
- _____
- _____
- _____
- (29) Is your company interested in learning more about iodine deficiency and the important role food products may play to combat this deficiency?
- (i) Yes
 - (ii) No
 - (iii) Not sure
- (30) Would you be interested in meeting with IFT staff to discuss iodine nutrition in more detail?
- (i) Yes
 - (ii) No

Phase II telephone interview questionnaire on use of iodized salt in processed foods

The Inst. of Food Technologists is under contract with the Micronutrient Initiative to conduct a study on "Use of iodized salt in processed foods" in select countries worldwide. Your expertise as a food professional familiar with a country of interest to the project is extremely valuable. We are asking for your assistance to gather information on:

- (1) Extent of use of iodized salt in processed food products;
- (2) Sources of salt used;
- (3) Extent of knowledge or awareness on iodine nutrition and of salt as a fortification vehicle; and
- (4) Interest in salt iodization.

The information you provide to us will be compiled with responses from other food professionals in the country of interest, and your name will not be associated with specific information. The information we collect will be used to shape future initiatives in countries of interest to reduce iodine deficiency disorders, the leading cause of preventable brain damage in the world. Thank you in advance for your time and expertise!

- (1) Name
- _____
- (2) Company name
- _____
- (3) How many employees are in your company overall?
- 1. Very small (less than 50)
 - 2. Small (less than 100)

3. Medium (100 to 500)
 4. Large (over 500)
- (i) Yes
 (ii) No
 (iii) Not sure
- (4) Your title and responsibilities at company
- _____
- _____
- _____
- (5) Country location(s) of company
- _____
- _____
- _____
- We have a special interest in: Australia, Bangladesh, Bolivia, China, Egypt, Ghana, India, Indonesia, Kenya, Mexico, Nigeria, Pakistan, Russia, Senegal, South Africa, United Kingdom
- (6) Does your company manufacture products that typically contain salt?
- (i) Yes
 (ii) No (skip to the end)
- (7) What are your company's top 5 products *sold* (using sales data) that contain salt?
1. _____
2. _____
3. _____
4. _____
5. _____
- (8) Is iodized salt used to manufacture any of these food products?
- (i) Yes, all products (skip to Question #9)
 (ii) Yes, some products (skip to Question10)
 (iii) No (skip to Question #12)
 (iv) Not sure
- (9) If all products use iodized salt, why is that the case?
- _____
- _____
- (10) If only some products use iodized salt, what product types typically contain iodized salt and why?
- _____
- _____
- _____
- (11) Have you encountered any challenges when using iodized salt in products?
- _____
- _____
- _____
- (12) Are there future opportunities to use iodized salt in products that do not currently contain iodized salt?
- (13) If yes, which products might contain iodized salt in the future, that use noniodized salt now?
- _____
- _____
- _____
- (14) Who in the company is responsible for determining iodization policies/making decisions regarding the use of iodized salt?
- _____
- _____
- _____
- (15) How frequently is the use of iodized salt discussed at your company?
- (i) Daily
 (ii) Weekly
 (iii) Monthly
 (iv) Annually
 (v) Less frequently
 (vi) Not sure
- (16) Do you have knowledge on how decisions are made regarding whether or not to use iodized salt?
- _____
- _____
- _____
- (17) Are iodization policies the same country-to-country (if organization is in multiple countries)?
- (i) Yes
 (ii) No
 (iii) Not sure
- (18) If no, why do iodization policies differ?
- _____
- _____
- _____
- (19) Who/where does your company receive salt from?
- _____
- _____
- _____
- (20) Are different suppliers used for iodized compared with non-iodized salt?
- (i) Yes
 (ii) No.
 (iii) Not sure
- (21) If salt is received from another country, does that country's iodization policy affect the salt received?

- _____
- _____
- _____
- (22) Please explain why iodized salt is *not* currently used in food products, if applicable.
- Unsure of affect on food taste, appearance, and so on
 - Cost of iodized salt compared with noniodized salt
 - Fear of trade barriers
 - Not permitted by law
 - Not sure
 - Other _____
- _____
- (23) On a scale of 1 to 5, with 5 being very knowledgeable, what is the level of knowledge top executives/decision makers at your company have on iodine deficiency?
- 5 (very knowledgeable)
 - 4
 - 3
 - 2
 - 1 (not knowledgeable at all)
 - Not sure
- (24) Do you know if iodine deficiency is a concern in your country?
- Yes
 - No (skip to Question #27)
 - Not sure
- (25) If yes, how severe do you think it is?
- (26) What has contributed to your awareness of iodine deficiency and whether it is a problem in your country or not?
- _____
- _____
- _____
- (27) Is your company interested in learning more about iodine deficiency and the important role food products may play to combat this deficiency?
- Yes
 - No
 - Not sure
- (28) Would you be interested in meeting with IFT staff to discuss iodine nutrition in more detail?
- Yes
 - No

Appendix B

IFT outreach on project

Listed in IFT weekly newsletter (06/23/10): IFT-MI study on use of iodized salt.

The Inst. of Food Technologists (IFT) in collaboration with the Micronutrient Initiative (MI) is conducting a study on “Use of iodized salt in processed foods” in select countries worldwide. The overall goals of the study are to assess the extent of utilization of iodized salt in processed foods, the level of consumption of

the foods, and the level of knowledge of iodine nutrition among food processors; and second, to attempt to determine the potential impact of salt reduction initiatives on iodine nutrition. IFT is looking for experts with knowledge in use of iodized salt in food processing and iodine nutrition, with a focus on developing countries. If you are interested in contributing to this study, please contact Betty Bugusu at bbugusu@ift.org or 202-330-4980.

Posted on IFT’s food, health, and nutrition community page (06/22/10 to 07/01/10). IFT is under contract with the Micronutrient Initiative to conduct a study on “Use of iodized salt in processed foods” in select countries worldwide. Iodine deficiency is a major concern around the world. The objectives of the study are to assess the use of iodized salt as an ingredient in foods in select countries, as well as consumption of these foods and their producers. Please contact Sarah Ohlhorst at sohlhorst@ift.org if you’d be willing to speak with IFT regarding iodized salt use in food products in countries other than the United States or if you have any questions about this task.

E-mail communication (06/08/10)

The Inst. of Food Technologists is under contract with the Micronutrient Initiative to conduct a study on “se of iodized salt in processed foods” in select countries worldwide. The overall goals of the study are to assess the extent of utilization of iodized salt in processed foods, the level of consumption of the foods, and the level of knowledge of iodine nutrition among food processors; and second, to attempt to determine the potential impact of salt reduction initiatives on iodine nutrition.

Your expertise as a food professional living in a country of interest to the project is extremely valuable. We are asking for your assistance to complete a brief questionnaire regarding the use of salt in processed foods in your country. The information you provide to us will be compiled with that of other food professionals in the country in the final report. Your name will not be associated with specific information. The information we collect will be used to shape future initiatives in your country to reduce iodine deficiency disorder, the leading cause of preventable brain damage in the world.

Please go to the following link to complete the questionnaire online: <http://www.surveygizmo.com/s3/309955/IFTsaltsurvey>. If you are unable to access the website, please respond to this e-mail (msslavin@ift.org) and we will send the questionnaire as an e-mail attachment.

Please complete the questionnaire by June 21, 2010. Feel free to contact Betty Bugusu with any questions (Telephone 202-330-4980; e-mail bbugusu@ift.org; fax 202-315-5174).

Thank you for lending your time and expertise.

E-mail communication (06/14/10)

As you may have already read from our previous e-mail and questionnaire, the Inst. of Food Technologists is under contract with the Micronutrient Initiative to conduct a study on “se of iodized salt in processed foods” in select countries worldwide.

We are writing to you again because you are registered to attend IFT’s Annual Meeting and Food Expo in Chicago, Ill. on July 17 to 20, 2010. We would like to meet with you briefly during this time to further discuss the consumption of processed foods and the use of iodized salt in your country. An understanding of your country’s iodization policies is welcomed, but is not necessary. We hope these meetings will give a more nuanced understanding of food consumption in your country than the questionnaire could provide. This information will potentially be used to evaluate

iodine consumption and assess opportunities for using iodized salt as a strategy to mitigate iodine deficiency.

If you are willing to meet with IFT, please select one of the following meeting times and let mslaviv@ift.org know of your willingness to help. We anticipate needing 30 min or less of your time for this discussion. Available meeting times are: Sunday, July 18th from 5:00 to 6:00 p.m.; Monday, July 19th from 5:00 to 6:00 p.m.; OR Tuesday, July 20th from 1:30 to 6:00 p.m.

Thank you, and we look forward to seeing you in Chicago!

Listed in IFT monthly newsletter (10/16/2010): help IFT learn more about the use of iodized salt in processed foods

IFT is under contract with the Micronutrient Initiative to study “Use of iodized food in processed foods” in select countries worldwide. If your company has operations in any of the following countries and you are willing to answer a few brief questions about iodized salt used in food production, please contact Sarah Ohlhorst (sohlhorst@ift.org or 202-330-4976).

Australia	Ghana	Nigeria	UK
Bangladesh	India	Pakistan	
Bolivia	Indonesia	Russia	
China	Kenya	Senegal	
Egypt	Mexico	South Africa	

We are specifically looking for information on:

- (i) Use of iodized salt in processed food products;
- (ii) Sources of salt;
- (iii) Awareness of salt as a fortification vehicle and iodine deficiency disorders and interest to learn more.

The information we collect will be used to shape future initiatives in countries of interest to reduce iodine deficiency disorders, the leading cause of preventable brain damage in the world. The information you provide to us will be compiled with responses from other food professionals in the country of interest, and your name will not be associated with specific information. Thank you for your time and expertise!

Listed on IFT LinkedIn network (10/15/2010): interested in working with IFT’s grants and contracts program?

IFT has a growing grants and contracts program and constantly seeks to engage IFT members (and occasionally nonmembers) with targeted expertise to assist in the completion of work. If you are interested in helping out, let Jennifer McEntire know (jmcentire@ift.org).

E-mail communication (10/11/2010)

Dear food science professional:

The Inst. of Food Technologists (IFT), is under contract with the Micronutrient Initiative to conduct a study on “Use of iodized salt in processed foods” in select countries worldwide. The information we collect will help shape future efforts to reduce iodine deficiency disorders, the leading cause of preventable brain damage in the world.

We are asking for your assistance and hope you will take a few moments to complete a brief questionnaire by Friday, October 22, 2010. Your expertise as a professional who is familiar with a country of interest is extremely valuable. We seek your input regarding:

- (1) the extent of use of iodized salt in processed food products;
- (2) sources of salt used;
- (3) extent of knowledge or awareness on iodine nutrition and salt as a fortification vehicle; and
- (4) interest in salt iodization.

Questions are specifically directed to individuals currently employed by a food company. If you are not presently working for a food company, please do not complete our survey. However, we would be grateful for your assistance in forwarding this request to a food industry colleague within your country.

To access the questionnaire online, please copy and paste this link into your Internet browser: <http://www.zoomerang.com/Survey/WEB22BAU2CXZNE>

The answers you provide will be compiled and analyzed along with responses from other food professionals in each country of interest. Your name will not be associated with specific responses. If you have any questions, or are unable to access the survey online, please contact Sarah Ohlhorst at sohlhorst@ift.org or 1+ 202 330 4976.

Thank you for your time and expertise.

E-mail communication (10/13/2010) targeted to multinational food company representatives

Hello XXX,

IFT is under contract with The Micronutrient Initiative to conduct a study on “Use of iodized salt in processed foods” in select countries worldwide. The information we collect will help shape future efforts to reduce iodine deficiency disorders, the leading cause of preventable brain damage in the world. As an employee of XXX, a multinational food company, we hope you will take a few moments to speak with IFT or forward this request to an appropriate colleague.

IFT is specifically interested in information on (1) use of iodized salt in processed foods; (2) sources of salt; (3) awareness of iodine nutrition and salt as a fortification vehicle; and (4) interest in salt iodization in the following countries:

India	China	UK	Russia
Mexico	Australia	Ghana	
Indonesia	Bolivia	Senegal	
South Africa	Egypt	Pakistan	
Kenya	Nigeria	Bangladesh	

The information you provide will be compiled and analyzed along with responses from other food professionals in each country of interest. Your name need not be associated with specific responses. If you are willing to answer a few brief questions about iodized salt use in foods in these countries of interest, please contact me at sohlhorst@ift.org or 202-330-4976. Thank you!