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Protecting Infants All Along the Food Chain

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Consumer's beliefs about serious health hazards in the food supply have changed over the last few years. In 1990, Canadian consumers identified pesticide residues, environmental pollutants and dietary issues (cholesterol, salt, and sugar) as more important than bacteria that cause food borne illness. In a follow-up study in 1998, Canadian consumers identified bacteria as the most dangerous of health hazards in food.¹

The food supply in Canada and the United States is considered by both governments to be among the safest in the world. However, food borne illness remains a substantial public health burden. Government agencies estimate that annually, there are one million cases of food borne illness and approximately 30 Canadians die.² In the U.S., there are more than 5,000 deaths annually with an estimate of 76 million cases and 325,000 hospitalizations.³ Expressed in monetary terms, the value of lives shortened, lost productivity, legal settlements, recall and disposal of food, loss of sales to the food industry, constraints on the health care system, add up to billions of dollars. Improvements in the food industry have contributed to a recent 20% decline in the incidence of food borne illness from meat and poultry sources in the U.S. However, there has been an increase in the proportion of illnesses caused by fruits and vegetables so that the overall incidence has not improved.

Food borne illness occurs when a person gets sick by eating food that has been contaminated with a sufficient quantity of a pathogenic microorganism or its toxin. Some organisms can cause illness with a dose of only 100 organisms (E.coli) or 500 (Campylobacter) while others require a population of 10,000 or more.



Donna Secker, MSc, RD (Donna's article appears on page 4)

Donna Secker obtained her nutrition degrees from the University of Toronto and completed her dietetic internship at Victoria Hospital, London, Ontario. A pediatric dietitian at heart, Donna worked initially as a sports nutritionist with adolescent competitive athletes before working as a dietitian in a centre for handicapped children. As a clinical dietitian at the Hospital for Sick Children in Toronto for the past 18 years, Donna has worked in a variety of medical programs, including her current position in the Division of Nephrology.

Donna represents Dietitians of Canada (DC) on the Canadian Paediatric Society's Nutrition Committee as well as the Canadian Neonatal and Pediatric Nutrition Network. She has had the opportunity to participate in the development of a number of pediatric nutrition statements and documents, including the most recent Canadian guidelines on infant nutrition, *Nutrition for Healthy Term Infants*, developed collaboratively by The Canadian Paediatric Society, Dietitians of Canada and Health Canada. Donna has authored and co-authored pediatric nutrition chapters in texts and articles in peer-reviewed journals; most recently she co-authored the Infant Nutrition chapter in the soon-to-be-released Manual of Clinical Dietetics, co-published by the American Dietetic Association and Dietitians of Canada, and Pediatric Practice Guidelines on Acute Renal Failure for the American Dietetic Association. Donna was one of five dietitians recently recognized for their volunteer commitment through Dietitian of Canada's inaugural Volunteer Recognition program.

Food borne illness occurs when the microorganism penetrates the intestinal mucosa and colonizes the gastrointestinal tract, producing an adverse effect.⁴ Salmonella species, Shigella species and some strains of E.coli function this way. In other cases, the microorganism travels from the GI tract to other tissues, such as the liver (Hepatitis A) or muscle (Trichinella spiralis). A third mechanism is for the organism to release toxins as it multiplies and the toxins cause the symptoms. Examples of this method of infection include Vibrio cholerae, Clostridium perfringens and some strains of E.coli.

Symptoms of food borne disease can range from typical flu symptoms (headache, fever, stomach pain, diarrhea, nausea, chills) to severe consequences, including death. These symptoms can appear from 30 minutes to two weeks after contact with contaminated food. While some consumer studies show that food

Symptoms of food borne disease can range from typical flu symptoms (headache, fever, stomach pain, diarrhea, nausea, chills) to severe consequences, including death.

borne illness is considered a mild inconvenience, there can be serious side effects of the infections. Guillain-Barre Syndrome, kidney disease, heart disease, spontaneous abortion, septicemia, local infections and arthritis are all complications of food borne illness.

Individuals at highest risk of serious consequences include infants, pregnant women, the frail elderly, those

who are already ill, and those who are immunocompromised by other disease conditions. In 1997, in Canada, among infants under one year of age, there were 34 cases of E.coli infections, 340 infants with Salmonellosis and 246 reported cases of Campylobacteriosis.⁵

Today, there are many opportunities for exposure to the organisms that may cause food borne illness.

- New emerging pathogens. Twenty years ago, E.coli, Campylobacter, Listeria and Cyclosporidium were unknown.
- More food is consumed away from home. Food is being handled by more people, treated and distributed in stages, and held before being sold. These factors increase the chance that food may become contaminated or held at improper temperatures.
- Preference for fewer preservatives, less salt and sugar, which could reduce the growth of harmful bacteria.
- Longer transportation distances with heavy reliance on cold storage
- Globalization of the food system that brings food from all parts of the world into the marketplace
- Consumers eat more raw or minimally processed fruits and vegetables
- A smaller number of food processing facilities provide food to increasingly larger numbers of consumers enhancing the extent of harm that can arise from any one incident. For example, one outbreak of Listeria infection involved consumers in 16 different U.S.A. states, who had eaten hot dogs produced in one plant on one day.

- More people have compromised immune systems because of age, illness or medical treatment
- New food sources of bacteria – cider, watermelon, sprouts, eggs
- Better methods of detection and identification of sources of illness



Be Safe Around Food

Health Canada found that between 1990 and 1993, 11% of cases of food borne illness were acquired by mishandling in the home, 72% in food service and the remaining, in a variety of settings.⁶

In an international study, auditors went into 106 households in Canada and the U.S. to evaluate food-handling

practices. The consumers knew they were being watched so were likely more careful than usual. The auditors found cross contamination in 76% of kitchens, neglected hand washing in 57% and improper cooling of leftovers in 29%. Major violations were storing foods without covers, improper thawing, and smoking, eating or drinking while preparing food. Another study found that 20% of dishcloths and sponges contained Salmonella and Staphylococcus organisms.⁷

Almost half the 2013 Canadians surveyed in their homes in a 1998 study, believed that they could tell if food might cause food borne illness by looking at it or smelling it.¹ 29% felt it was acceptable to defrost turkey at room temperature. There was confusion about the safety of raw eggs and mouldy cheese. Most Canadians believed it was acceptable to leave uncooked ground beef in the refrigerator for ½ day to five days before it was a hazard. Most seemed to be aware of the danger of allowing raw meat to come in contact with other foods.

A 1992 survey conducted by Cornell University's Department of Food Sciences found that only 54% of food preparers knew to wash a cutting board with soap and water after cutting fresh meat and before preparing fresh vegetables; 37% would know only to rinse the cutting board and 5% would immediately chop the vegetables without washing the board.⁸ Cutting boards should be free from deep scratches, separate boards should be used for different foodstuffs and all boards should be regularly sanitized especially after contact with raw foodstuffs. Microwaving on high for four minutes can disinfect wooden boards.⁹ Plastic boards may be cleaned in the dishwasher and sanitized in a sanitizing solution of 5 ml (1 tsp.) bleach in 750 ml (3 cups) water.²

Use of an instant read thermometer to determine doneness of meat and poultry and internal temperature of casseroles is one of the best lines of defense against food borne illness as long as the user knows what temperatures are safe. A survey of 1002 randomly selected U.S. adults showed low usage of instant read thermometers (7% usage). Only 8% correctly identified 160° F (70° C) as the internal temperature to which ground beef should be cooked.¹⁰

Another study showed 67% of illnesses were due to improper

hand washing. The 20-second scrub followed by rinsing and drying with a disposable towel and using the towel to turn off the tap and open the door, is the best method to ensure the hands are clean and not recontaminated.

Creative marketing has capitalized on the public's worry about food safety. Seventy-five percent of soaps sold in Canada contain antibacterial ingredients. Triclosan is an antibacterial compound that is used in plastic toys, socks, cutting boards, mops, phone guards and sponges. The presence of such materials can give a false sense of security so parents and caregivers may dispense with regular hygiene.



The Danger Zone for Infants

Of particular concern to infants, are juices, honey and eggs. Since there have been several outbreaks of food borne illness from unpasteurized cider and juices, Health Canada and the FDA have policies on labelling of these unpasteurized products. They are most commonly sold at roadside stands, country fairs and sometimes on ice in the produce department. Pasteurized beverages include all products packaged in cans, bottles and juice boxes that are found in unrefrigerated sections of the grocery store. Concentrated juice and juice from concentrate is also pasteurized. Parents should choose only pasteurized products for their infants and toddlers.

Health Canada recommends that honey should not be fed to children under one year of age due to the risk of infant botulism from spores that may be present in the honey.¹¹

Because Salmonella bacteria can be transmitted from infected hens directly into the eggs before the shells are formed, infants should not be served raw eggs or products made with raw eggs (eggnog).¹²

Person to person is an important route of infection in the home and in day care, in the spread of E.coli organisms. Eating uncooked hot dogs, cookie dough and licking the spoon when baking are all situations where food borne illness can occur in the pediatric population. Parents of infants are encouraged to avoid soft cheeses, raw milk, raw sprouts, unpasteurized juices and cider, oysters, undercooked chicken and undercooked ground meat.

Making Food Safer

The food industry has implemented changes to increase the safety of the food supply. The USDA Pathogen Reduction/Hazard Analysis and Critical Control Points (HACCP) program has resulted in a decline in the percentage of meat and poultry products testing positive for Salmonella. HACCP is a seven step, written plan to identify where chemical, physical or microbial problems are most likely to occur in a food processing plant. It is a science-based process control system to prevent food safety hazards, set performance standards and establish testing programs to ensure that those standards are met. On-farm food safety programs are also being implemented to reduce the risk of food borne illness from produce and livestock at the first step of production.

Food Safety Information for Consumers

Consumers can extend the precautions taken by industry by learning to buy, prepare and store food safely. There are two partnerships in North America that bring together the food industry, consumer interests, and various levels of government to inform citizens about proper food handling practices. Their resources include educational campaigns aimed at grocers, community groups, K-3 classes and other partners. A logo, mascot, refrigerator stickers, brochures, bookmarks etc. have been developed. The four steps to preventing food borne illness are:

- 1 Separate raw meats and poultry from other foods during storage and preparation.
- 2 Chill all foods within two hours. One bacterium can double in 20 minutes and become 2 million in seven hours. As few as 100 E.coli can cause illness. Refrigerator temperature should be 4°C (40°F) and freezers should be kept at -18°C (0°F).
- 3 Clean hands, utensils and all surfaces before, during and after preparing foods. Wash all produce before eating or cooking.
- 4 Cook thoroughly until proper internal temperatures have been reached and serve immediately.

More information is available at their websites.

The Canadian Partnership in Consumer Food Safety Education: www.canfightbac.org

Partnership in Food Safety Education: www.fightbac.org

The government agencies responsible for the safety of the food supply also have information for consumers on their websites.

Canadian Food Inspection Agency: www.cfia-acia.agr.ca

Health Canada: www.hc-sc.gc.ca

USDA Food Safety and Inspection Service: www.fsis.usda.gov

FDA Center for Food Safety and Applied Nutrition: www.cfsan.fda.gov/list.html

Thermy Campaign to promote the use of thermometers in safe food preparation: www.fsis.usda.gov/thermy/index.htm

Clearly, research has shown a gap in knowledge about safe food handling and every year, thousands suffer needlessly. Health care workers and educators can help by discussing these issues with patients and students and linking consumers to reliable, sound information.

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New American Growth Charts

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Revisions to the 1977 National Center for Health Statistics (NCHS) growth charts have been completed. Sixteen new growth charts (see Table 1) were launched May 30, 2000 by the Centers for Disease Control and Prevention (CDC), of which the NCHS is now a part.¹ These charts represent revisions to the 14 existing NCHS charts from 1977, plus the introduction of two new body mass index (BMI)-for-age charts for boys and girls ages two to 20 years. Authorities with expertise in child growth and growth charts, biostatistics, pediatric practice, and applied public health nutrition were consulted throughout the revision process.² The CDC growth charts have incorporated newer data from five national health examination surveys collected from 1963 to 1994, plus five supplementary data sources. Improved statistical procedures were used for smoothing curves and generating z-scores.

Table 1. Available CDC growth charts for females and males

CHART	AGE OR HEIGHT RANGE
Weight-for-age	birth to 36 months
Weight-for-age	2 to 20 years
Length-for-age	birth to 36 months
Stature-for-age	2 to 20 years
Head circumference-for-age	birth to 36 months
Weight-for-length	45-103 cm
Weight-for-stature	77-121 cm
BMI-for-age	2 to 20 years

Major features of the revised charts include:

- 1 – incorporation of data from 5 national surveys
- 2 – development of BMI-for-age charts
- 3 – addition of 3rd and 97th smoothed percentiles for all charts
- 4 – addition of the 85th percentile for the weight-for-stature and BMI-for-age charts. The 85th percentile has been recommended as a cut-off threshold to identify children and adolescents at risk for overweight.
- 5 – extension of all charts for children and adolescents to age 20 years
- 6 – data from the Fels Longitudinal Study (1929-75) that were used in the 1977 NCHS growth charts were replaced with national survey data plus supplementary data from two state birth registries
- 7 – elimination of discontinuity between curves for infants and older children. There is an observed average biological difference of 0.8 cm between recumbent length and stature measurements now. The previous charts reflected a difference of between 0.7-1.5 cm at 24-36 months.

Differences Between Revised and Original Charts

Some minor differences occur in the percentile lines. Most of the differences are found in the charts for infants, where national data were previously not available. There are also some differences at the outer percentiles (i.e. smallest and largest children).

a) Charts for infants and small children

Because a national information base was lacking, the source of data for the previous charts for infants came from a single longitudinal study (Fels Institute, 1929-1975) of primarily formula-fed, white, middle-class infants in a limited geographic area of southwestern Ohio. Over the years a number of concerns have arisen regarding the Fels data (Table 2); therefore, weight and length data from the Fels Longitudinal Study were replaced with nationally representative data from the U.S. Health Examination Surveys and supplemented with birth data from Wisconsin and Missouri state birth registries (1989-94). Use of national data for the new charts better represents the American racial and ethnic diversity, as well as the size and growth patterns of combined breast- and formula-fed infants. National data also ensure a smoother transition for monitoring length/height from the charts for infants to charts for older children. An ongoing World Health Organization multi-centre growth reference study, designed to be completed in 2002, will result in a new set of international growth charts for infants and pre-schoolers through five years of age. These charts will be based on the growth of exclusively or predominantly breastfed infants.

Below age 24 months, the revised weight-for-age curves are generally higher than in the 1977 charts. After approximately six months, the revised length-for-age curves tend to be lower than in 1977, with the magnitude of change slightly larger for girls than for boys. The revised head circumference charts also show some differences with the curves being higher from birth to 4-6 months and after this age, lower than the 1977 percentiles.

Table 2. Concerns with relevancy of Fels data to today's infants

- 1 In the Fels research, measurements of recumbent length and weight were done at three-month intervals between three and 12 months of age. A three-month interval is now considered too lengthy for presenting reference data at one-month intervals as used in the growth charts.
- 2 Birth weights from 1929-1975 do not match recent national birth weights. Birth weights on the new CDC charts are higher than the birth weights on the previous 1979 NCHS charts.
- 3 Differences between recumbent length and stature were thought to be too large. It is felt that the recumbent length data may have been less accurate.
- 4 The size and growth of breast- and formula-fed infants are different.
- 5 Over the past two decades, the timing of introducing solids to an infant has shown a secular trend towards older ages. Additionally, the composition of infant formulas has evolved to become more similar to human milk. These changes to feeding patterns and formula content have altered intake of specific nutrients and perhaps impacted on growth.

b) Charts for children and adolescents

Children are now heavier than when the initial charts were produced. To avoid the influence of an increase in body weight and BMI that occurred between NHANES III and previous national surveys, data for NHANES III subjects six years and older were excluded from the revised weight and BMI charts. This was done to avoid an upward shift of the weight and BMI curves. Without this exclusion, the 85th and 95th percentile curves would have been higher and fewer children and adolescents would have been classified at risk of overweight or overweight. As a result, from age two to approximately 14 years, the revised weight-for-age percentiles are quite similar to the 1977 percentiles for boys and girls.

Height has remained virtually unchanged; therefore, the revised stature-for-age percentiles are remarkably similar.

Body Mass Index charts

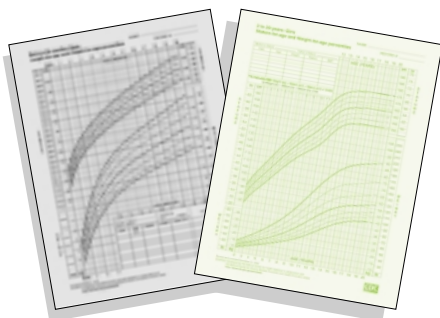
The new sex-specific BMI-for-age charts are appropriate for clinical use starting at two years of age, when stature can be accurately obtained. The BMI-for-age charts were created to replace the 1977 weight-for-stature charts, as BMI is considered a more accurate tool. In addition, the weight-for-stature charts were limited to prepubescent boys under 11.5 years of age and shorter than 145 cm, and to prepubescent girls under 10.0 years of age and shorter than 137 cm. The new BMI-for-age charts can be used to identify children and adolescents who are either overweight (BMI-for-age (95th percentile) or at risk for overweight (> 85th BMI-for-age < 95th percentile). It is suggested that children and adolescents be considered underweight when BMI-for-age is below the 5th percentile.

Future Plans

Graphical presentation of the charts in a condensed format with two charts per page is being developed and when completed will be available on the Internet. The National Center for Chronic Disease Prevention and Health Promotion will take the lead in developing and promoting educational materials associated with the revised charts. Additional information on the new charts, including copies of the charts and the full data files, is available on the National Center for Health Statistics web site (www.cdc.gov/growthcharts).

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Assessing and Planning Diets for Healthy People

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In December 1995, the Food and Nutrition Board of the National Academy of Sciences began a close collaboration with the government of Canada to develop a harmonization of nutrient-based dietary standards¹. A Dietary Reference Intakes (DRI) Committee including scientists from the United States and Canada was appointed to oversee this project. The project involves the work of expert groups who are charged with reviewing the scientific literature on specific nutrient needs during the lifespan, assessing of the role the nutrients play in decreasing the risk of disease, and interpreting data on nutrient intakes in North America. So far, three reports on reference values for dietary nutrient intakes have been issued; these are listed in Table 1. In this issue of In Touch, definitions of terminology used in the reports are presented. In future issues, highlights of the reports will be covered.

Table 1. Dietary Reference Intake Reports Available

Dietary Reference Intakes for Calcium, Phosphorus, Magnesium, Vitamin D, and Fluoride

Dietary Reference Intakes for Thiamin, Riboflavin, Niacin, Vitamin B6, Folate, Vitamin B12, Pantothenic Acid, Biotin, and Choline

Dietary Reference Intakes for Vitamin C, Vitamin E, Selenium, and Carotenoids

These reports can be reviewed online at <http://books.nap.edu>.

Definition of Terms

The nutrient recommendations that can be used for planning and assessing diets in healthy populations are named “Dietary Reference Intakes².” An umbrella term, DRIs include four types of reference values: the Estimated Average Requirement (EAR), the Recommended Dietary Allowance (RDA), the Adequate Intake (AI), and the Tolerable Upper Intake Level (UL). In the past, only one set of values, the RDAs in the United States and the Recommended Nutrient Intakes (RNIs) in Canada, was used to assess and plan diets. The more complete set of reference values now available allows health professionals to use the value that most suits what they need to accomplish.

The Estimated Average Requirement (EAR) is the value for intake of a nutrient that is estimated to meet the requirement of 50 percent of individuals in a gender and age group². It is expressed as a daily value averaged over time. EARs take into account not only prevention of nutrient deficiencies but also disease risk reduction. The EAR is used to set the RDA. EARs can be used to assess the prevalence of inadequate intakes in a group or to set goals for the mean intake of a specific population. Using EARs for groups is preferred over the use of RDAs for statistical reasons.

The Recommended Dietary Allowance (RDA) is the average daily dietary intake level needed to meet the nutrient requirements of nearly all individuals (97 to 98 percent) in a gender and age group². The RDA applies to individuals and not groups². The RDA is set at two standard deviations above the EAR. It is recommended that individuals aim for the intakes specified by RDAs.

The Adequate Intake (AI) is used instead of the RDA if there is a lack of scientific evidence available to derive an EAR². AIs are based on estimates of average nutrient intakes by groups of healthy people. AIs are particularly relevant for healthy infants. During the first four to six months of age, the AIs are based on the estimated mean daily nutrient intake supplied by breast milk in exclusively breastfed infants. If RDAs are not available, individuals should aim to achieve AIs for nutrients.

The Tolerable Upper Intake Level (UL) is the highest chronic daily intake of a nutrient that will most likely result in no risk of adverse health effects for almost all healthy individuals². Importantly, it does not infer that intakes greater than the RDA are beneficial to individuals. Normally, the UL refers to intake from food, fortified food, water and supplements. ULs can be used to assess the proportion of the population that has excessive intakes of specific nutrients. The model used for deriving the ULs is risk assessment.

The process of risk assessment involves four steps: hazard identification, dose-response assessment, exposure assessment, and risk characterization². During the hazard identification step, information about the toxic properties of a given nutrient are collected, organized and evaluated. Human and animal studies are evaluated by addressing the evidence of adverse effects in humans, causality, relevance, mechanisms of toxic action, quality of the database, and identification of sensitive subpopulations.

The second step in risk assessment, dose-response assessment, determines the relationship between the dose and adverse effect. It is in this step that an estimate of the UL is identified. Data must be evaluated to identify the most appropriate data sets to be used for deriving the UL. The no-observed-adverse-effect level (NOAEL) or lowest-observed-adverse-effect level (LOAEL) when a NOAEL does not exist is identified. Uncertainty factors such as interindividual variation in sensitivity and extrapolation from animal data to humans are applied, resulting in a value for the UL that is less than the NOAEL. Larger uncertainties result in smaller ULs.

Exposure assessment, the third step, is an evaluation of the population's intake of the nutrient under question and a determination of the portion of the population that exceeds the UL. The final step in the risk assessment process, risk characterization, summarizes the conclusions and evaluates the risk.

The ULs represent a major contribution of the Food and Nutrition Board³. These values will be of enormous help when counseling individuals who take dietary supplements, because they provide evidence-based guidance.

Life Stage Categories

Nutrient needs and sensitivities change throughout life, and the DRIs have taken into account differences based on life stages. The life stage categories chosen for all nutrients are listed in Table 2. Additional subdivisions are added when evidence indicates changing nutrient needs. In addition, differences in reference values by gender are included when the evidence warrants it.

Table 2. Life Stage Categories²

0 through 6 months 7 through 12 months 1 through 3 years 4 through 8 years 9 through 13 years 14 through 18 years 19 through 30 years 31 through 50 years 51 through 70 years > 70 years	PREGNANCY < 18 years 19 through 50 years LACTATION < 18 years 19 through 50 years
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The DRIs are a tool with broader applicability than the former nutrient recommendations. Health professionals can better plan and assess diets for individuals and groups, using the most appropriate value for the given circumstance. In addition, the collaboration evidenced in the development of these reports will help the scientific community achieve harmonization of nutrient recommendations.

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