

# Preventive Nutrition: The Impact on the Future Health of Canadians

A key concept of “Building on Values: The Future of Health Care in Canada” or the Romanow Report is the integration of disease prevention and health promotion initiatives. One component missing from the report, which largely focused on smoking, physical activity and obesity, was the potential benefit of preventive nutrition in improving the future health of Canadians. In October 2005, Wyeth Consumer Healthcare Inc. sponsored a seminar that gave an overview of the potential benefit of preventive nutrition.

While there are gaps in the knowledge about what Canadians eat, all indications are that they do not meet their basic needs for micronutrients on a daily basis. The 2000/2001 Canadian Community Health Survey indicated that only about one-third of Canadians reported eating fruits and vegetables five to ten times per day. This means that many Canadians do not have an optimal diet that can improve health and reduce disease risk.

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## Assessment of the Canadian Diet Study

*Susan Whiting, PhD is a professor in the College of Pharmacy and Nutrition at the University of Saskatchewan in Saskatoon.*

Health Canada has not reported data from a nationwide survey of dietary intakes since the Nutrition Canada data in 1972, however in 2004 new dietary data were collected but are not yet available. In the absence of a national sample, Wyeth Consumer Healthcare funded an unrestricted research grant to Dr. Susan Whiting to combine data from the eight currently available provincial nutrition surveys conducted from 1990 to 1999, to provide a comprehensive view of the Canadian diet. Dr. Whiting provided some interesting insights from her comprehensive review. Canadians have been making poor food choices which has resulted in several micronutrient inadequacies and growing rates of obesity.

Fat intakes were 33% of total energy, lower than those reported in Nutrition Canada, but still above 30% of energy, which is considered to be the upper level for heart health. Overweight and obesity rates in all provinces have increased. Newfoundland and Labrador’s rates have increased the most since 1972. Although no substantial increase in obesity was seen in British Columbia, the percentage of overweight people did increase. It was noted that reported energy intakes declined with age, which is a normal response to lower metabolism and less activity.

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Thus it is not practical to recommend people increase food intakes to improve nutritional status as the overweight/obesity data show.

Despite differences in survey design and timing of surveys, Dr. Whiting made some interesting observations regarding vitamin and mineral intakes of Canadians.

### Canadian Dietary Intakes Inadequacies of Vitamins & Minerals

| Vitamin Inadequacies Identified |             |
|---------------------------------|-------------|
| 1970 to 1972                    | 1990s       |
| Folate                          | Folate      |
| Vitamin C                       | Vitamin C   |
| Thiamin                         | Vitamin B12 |
| Vitamin D                       | Vitamin B6  |
|                                 | Vitamin D*  |
| Mineral Inadequacies Identified |             |
| 1970 to 1972                    | 1990s       |
| Iron                            | Iron        |
| Calcium                         | Calcium     |
|                                 | Magnesium   |
|                                 | Potassium   |
|                                 | Zinc        |

*\* not tested in the 1990s but found inadequate in other studies.*

Folate and vitamin C intakes have remained inadequate and B12 and B6 were notable additions to concerns about micronutrient inadequacies. Prior to fortification with folic acid in January 1998, 90% or more of Canadians were inadequate in their folate; this was remedied somewhat, yet, 30% of Canadians, especially older women, may be at risk for deficiency today. Vitamin D intakes were not measured by any provincial survey in the 1990s, and vitamin D has recently been shown to be a critical factor in

not only bone health, but in other areas such as cancer and autoimmune disease. Calcium status of Canadians may be improving today because of the availability of calcium-fortified beverages in the marketplace, but in the 1990s, women, especially, in the provinces examined, failed to meet calcium recommendations.



*Dr. Susan Whiting*

A diet consisting of fruits and vegetables, whole grains and only minimally processed foods will provide most nutrient needs, but supplements can improve the nutritional health of those whose diets fall short. Some provinces analyzed the health impact of supplement use. For example, in the British Columbia nutrition survey, supplement use significantly reduced inadequacy for folate, vitamin B12, and vitamin C.

Dr. Whiting suggests that the intake of potassium may be a useful “new” indicator of diet quality because of its prevalence in fruits and vegetables. When potassium intakes are low, then there has been a lack of healthy foods, resulting in micronutrient inadequacies. This situation is relatively common. The potassium recommendation (4,700 mg) from the new Dietary Reference Intake means that Canadians need at least 8-10 servings of fruits and vegetables, rather than just the five-a-day which is currently promoted. The alkalinity from potassium is a benefit to bone health, and also helps to alleviate the impact of sodium on blood pressure. As well, fruits and vegetables contain many micronutrients and dietary fibre.

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The Canadian Community Health Survey collected dietary data in 2004, but in a separate survey to be conducted in 2006, biochemical data via blood sampling will be collected. This should provide further guidance in assessing the benefits of optimal nutrition in disease risk reduction. When this survey is completed, the dietary information collected in the 1990s can be used as an important time point in gauging dietary trends of Canadians.



*Dr. David Hanley*

### **The Role of Nutrition in Osteoporosis Prevention**

*David Hanley, MD, FRCPC is a professor in the Departments of Medicine and Oncology, Division of Endocrinology and Metabolism, at the University of Calgary.*

Prevention of fractures due to osteoporosis will be a significant factor in controlling health care costs in the coming decades. The hip fracture is the most feared complication of osteoporosis. Osteoporosis and Alzheimer’s disease are the two most common causes of seniors’ loss of independence. Current osteoporosis rates, in conjunction with the increasing number of older Canadians, suggest that by 2041, hip fractures

will outstrip the availability of surgeons and facilities to care for patients, and health care costs will increase. The estimated number of hip fractures in Canada in 2041 will be 88,124 when 29% of the population is 65 years of age or older. In 1993, only 13% of the population was 65 years of age or older. Hip fractures are the most obvious disability caused by osteoporosis. However, vertebral and wrist fractures have major disability consequences, although these costs are not as easily measured.

We reach our peak bone mass before the age of 20, and then it probably begins to decline in our late 20’s. Our skeletons are constantly being restored and remodeled, but as we age, we do not completely replace the bone that is lost, and we tend to lose bone gradually. However, osteoporosis should never be considered a normal part of aging. There is a major role for nutrition in osteoporosis prevention, to separate chronology from biology, that is, to prevent or slow down much of the age related bone loss.

Calcium and vitamin D should be considered together when making recommendations about how to prevent or slow bone loss. In the typical Canadian diet, dairy products provide the bulk of calcium, and if an individual does not consume dairy foods, then supplementation is a reasonable solution because meeting calcium needs without dairy products is very difficult. Optimizing calcium intakes can increase bone mass levels in the young, and prevent age-related bone loss in older individuals. A recent meta-analysis (Shea et al., 2002) determined that lumbar spine and hipbone density increases of just over 1.5% are observed with calcium administration.

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Calcium supplements often contain vitamin D, but some brands may have insufficient vitamin D levels for those with the highest need. A recent meta-analysis indicates, however, that vitamin D doses between 400 and 800 IU/day reduce the risk for hip and nonvertebral fractures (Bischoff-Ferrari et al., 2005). Originally, insufficient vitamin D was defined as a blood concentration of 25-OH vitamin D between 25-40 nmol/L, but researchers now believe the lowest acceptable level to be 50 or even 80 nmol/L. If 80 nmol/L is the correct level for defining inadequate vitamin D, a recent study showed that most of the people living in Calgary have suboptimal levels of vitamin D, despite living in the Canadian city with the most hours of sunshine per year. It is therefore likely that people residing in other parts of Canada have blood concentrations well below the optimal

level most of the time. Currently, vitamin D recommendations are being reviewed and will likely be revised upward by the Standing Committee on Dietary Reference Intakes.

Dr. Hanley also dispelled some common myths about calcium and vitamin D. Protein, sodium and caffeine all cause hypercalciuria, but adequate calcium intake can correct this disturbance. Although no one would recommend very high intakes of vitamin D, toxicity that causes hypercalcemia and kidney damage, probably requires an intake of over 30-40,000 IU daily. Finally, although some studies suggest an association between magnesium intake and the occurrence of osteoporosis, there is no evidence that magnesium is required in the management of osteoporosis.



*Dr. John Scott*

### **The Role of Nutrition in Prevention of Birth Defects and on Pregnancy Outcome**

*John Scott, PhD, ScD is a professor in the Department of Biochemistry at Trinity College, Dublin, Ireland.*

A good, mixed diet can prevent overt folate deficiency, but cannot optimally reduce the risks of neural tube defects (NTDs) for two reasons. First, natural folates have poor bioavailability and stability, hence are limited in their efficacy in preventing NTDs. Second, wheat and vegetables have been bred to improve agronomic benefits, and though the plants are able to meet their own folate needs, meeting the folate needs for humans is purely an accident.

Dr. Scott believes that protecting against NTDs means balancing the equation between effective dose and risk. The scientific evidence suggests that increasing red blood cell folate levels to 400 µg/L would be highly protective against NTDs. Virtually all the studies to date indicate that adequate folate levels reduce NTDs. In general,

the risk of NTDs when red blood cell folate levels are 150 µg/L is 7 per 1,000 births, and when red blood cell folate levels are 500 µg/L the risk is 1 per 1,000 births.

Fortification of flour has partly corrected some of the most severe deficiencies, but the true benefit of folic acid has not been optimized. In the U.S., a 20% reduction in NTDs was noted post-fortification, and in Nova Scotia and Ontario, the number of NTDs was cut by about 50% with fortification. Supplements are effective if taken at the right time; therefore, all women of childbearing age should take a supplement containing folic acid.

Unlike Canada and the U.S., the United Kingdom (UK) has made no progress on implementing a fortification policy. Initially, UK policymakers wanted to add folic acid at levels that would increase intakes by 250 µg, rather than the 100 µg that fortification schemes in Canada and the U.S. provide. A survey of dietary intakes would help to alleviate concerns about the masking of vitamin B12 deficiency, but none has been planned to date.

The masking of vitamin B12 deficiency by the addition of folic acid has been a principle concern that some have suggested could be eliminated by the addition of vitamin B12 to flour as well. However, Dr. Scott noted that adding vitamin B12 to flour to increase passive absorption would require very large amounts of vitamin B12, and most scientists are not comfortable with this measure.

Still, there are good reasons to ensure that individuals are maintaining adequate levels of folate from food intake, fortification and supplementation. The MTHFR (methylene tetrahydrofolate reductase, a key enzyme in the homocysteine metabolic pathway) genetic polymorphism may increase the folate requirement by 30-40%. For homozygotes with this single polynucleotide polymorphism (SNP) the individual risk for hyperhomocysteinemia is very high, but even in heterozygotes, folate needs are increased, and the population risk is high because of the number of individuals who are heterozygous for this SNP.

Failing to consume enough food folate could have serious implications beyond the risk of NTDs. Some studies have shown a relationship between folate, homocysteine and birth defects such as orofacial clefts and other congenital defects; recent research also indicates that adverse pregnancy outcomes may result from poor folate

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nutrition. High plasma homocysteine levels (> 10 µmol/L at 14 weeks gestation) are associated with a significantly increased risk of severe pre-eclampsia, and abruptio placentae is influenced by folate status. Additional studies about folic acid and other birth defects are necessary.

Dr. Scott concluded that folic acid has many critical roles in nutrition and that optimum nutrition is about "tipping the physiological balance" rather than taking mega-doses of folic acid.

## Nutrition and Cardiovascular Disease Prevention

*J. David Spence M.D. is Director of the Stroke Prevention and Atherosclerosis Research Centre at the Robarts Research Institute in London, Ontario.*

Fasting lipids are the "carrot in the snowman" because medicine has for too long focused on fasting blood lipid samples to provide a picture of how an individual responds to diet. Dietary recommendations should be based on other factors which give a more complete picture, and Dr. Spence made several suggestions.

Dietary advice should be based on the effect of diet on postprandial fats. One can have an egg for breakfast, a tuna sandwich for lunch, and chicken for dinner, and have a stable fasting lipids measurement. Postprandial fat and oxidative stress, however, impair endothelial function, and contribute to cardiovascular disease. In fact, Dr. Spence recommends that his vascular patients consume no egg yolks because although an egg raises low density lipoprotein levels (LDL) by only 10%, it raises oxidized LDL by 34%. In clinical trials, the Mediterranean Diet is the only diet to show reduction of cardiovascular disease (CVD); therefore, Dr. Spence also recommends that his patients eat only 4 ounces of meat from any animal every other day.

Vitamins E and C can reduce the effect of postprandial fats on endothelial function, but vitamin E has been the subject of much scientific criticism recently. Rather than stopping vitamin E supplementation, Dr. Spence notes that a Finnish study showed that 400-800 IU vitamin E, taken with a slow release vitamin C supplement of 250 mg slowed progression of arterial thickening.

Another factor to consider is homocysteine levels, which have been largely neglected by the medical community. Homocysteine has a steep dose-response curve, meaning that the higher plasma homocysteine levels rise, the more dramatic the mortality risk. Homocysteine acts in several ways to increase CVD risk: homocysteine

is a clotting factor because it increases fibrinogen, it oxidizes LDL, and it consumes nitric oxide which relaxes the smooth muscle cells of blood vessels. Folic acid supplementation has been shown to reduce homocysteine levels in numerous studies. Since folate fortification, vitamin B12 has become the main nutritional determinant of homocysteine status; therefore, vitamin B12 levels and dosing must also be taken into consideration. An example of how these interactions can alter the results of clinical trials is the Vitamin Intervention for Stroke Prevention (VISP) trial that examined the impact of folic acid and vitamins B6 and B12. In both groups under study, the vitamin B12 deficiency was corrected, and folate fortification probably negated the effect of folate supplementation. So, in effect, what the VISP trial really showed was that vitamin B6 does not prevent stroke events. Dr. Spence's research group conducted an efficacy analysis by selecting a subgroup within the VISP trial that was capable of responding to vitamin therapy. This subgroup consisted of individuals with adequate vitamin B12 absorption. The analysis consisted of 63% males and 37% females (n = 2,155) with a mean age of 66 ± 10.7 years. A 21% reduction in the risk of stroke events was observed in the high-dose supplement group compared to the low-dose group.

Dr. Spence concluded that doses of vitamin B12 in clinical trials need to be higher to effectively lower total homocysteine, and that lower total homocysteine levels will reduce stroke or coronary events and death in high-risk patients.

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*Dr. J. David Spence*



Dr. John A. Baron

## Nutritional Prevention of Colorectal Cancer

John A. Baron, M.D. is a Professor of Medicine at the Centre for the Evaluative Clinical Sciences of Dartmouth Medical School in New Hampshire.

Current evidence regarding the association of dietary fibre with risk of colorectal cancer is conflicting. Indeed, the evidence that fibre protects against colorectal cancer is actually relatively weak. Dr. Baron believes the hypothesis that fiber is protective may have been maintained as long as it has because of the heterogeneity of fibres and confounding with other nutrients.

Several micronutrients have been studied for their possible effect on cancer prevention. In some cases, such as beta-carotene, these may have adverse effects. Lung cancer trials showed disturbing results with beta-carotene supplementation for both lung cancer and cardiovascular events. Folic acid supplements have been proposed for cancer prevention, but dietary associations are weak and inconsistent, and clinical trial data to date have been negative.

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Another micronutrient under investigation is calcium. Epidemiological results have been suggestive and in adenoma prevention trials there have been benefits. In the Calcium Polyp Prevention Study, the beneficial effect of calcium was observed mainly in those individuals who had vitamin D levels above the median, suggesting a role for vitamin D in colorectal chemo prevention. Other observational research indicates that vitamin D may reduce the risk for colorectal cancer, and the possible interaction between calcium and vitamin D needs to be examined further. Several lines of research indicate that vitamin D inhibits proliferation,

induces differentiation and promotes apoptosis of cancer cells.

Other possibilities for the nutritional prevention of colorectal cancer include zinc, soy protease inhibitors, tea, omega-3 fatty acids and curcumin. There are relatively little data available regarding these nutrients.

## Summary

Jeffrey Blumberg, PhD, FACN, CNS is at the Friedman School of Nutrition Science and Policy and the Jean Mayer USDA Human Nutrition Research Centre on Aging at Tufts University.

Dr. Blumberg explained that, although there are some conflicting data, there is a consistent and growing trend toward recommending food fortification and dietary supplementation in conjunction with nutrition education to realize fully the potential of preventive nutrition. In Canada and the United States, many professional and public organizations recommend dietary supplementation i.e.: folic acid for the prevention of neural tube birth defects; calcium in osteoporosis prevention, particularly for those who seldom or never eat dairy products; vitamin D for those with little exposure to sunlight or dark skin; vitamin B12 for some adults over age 50 and vegetarians; and iron for pregnant women.

While noting that no dietary supplement serves as a substitute for healthy eating, Dr. Blumberg stated there is a role for multivitamin/mineral products for most adults. At a minimum, these help "fill the gap" between usual nutrient intakes and daily allowances for micronutrients. Recent data indicate that only 3% of Americans meet four of the five recommendations for intake among food groups like dairy, fruits, vegetables, and whole grains. Based on national nutrition monitoring data, Dr. Gladys Block at the University of California at Berkeley has suggested the epidemic of overweight and obesity in North America is accompanied by an epidemic of under-nutrition of essential nutrients.

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As we face the challenge to find ways to increase the intake of essential nutrients without increasing calorie intake, Dr. Blumberg notes that nutrient supplementation, particularly with multivitamins, appears to be an effective tool to help ensure adequate nutritional status and promote health.

To achieve optimal nutrition status, Dr. Blumberg recommends a diet that follows *Canada's Food Guide to Healthy Eating* complemented by a multivitamin. However, it is important to appreciate that the benefits of multivitamins in reducing the risk for chronic disease found in observational studies are associated with long-term use.

### These studies suggest several potential benefits from multivitamin use including:

- Lower mortality from cardiovascular disease
- Reduced risk of coronary heart disease, peripheral artery disease, and myocardial infarction
- Lower prevalence of hypertension
- Reduced risk of colorectal cancer, reoccurrence of colonic adenomas, breast cancer, and benign breast disease
- Lower incidence of infectious disease episodes in diabetics
- Lower prevalence of cataracts
- Reduced risk of arthritis and multiple sclerosis
- Prevention of preterm labor and several types of birth defects

While observational evidence cannot be considered as definitive, it can provide compelling reasons for healthcare professionals to consider multivitamins in their practice. Randomized clinical trials provide a higher degree of evidence and have demonstrated that multivitamins can reduce the risk of neural tube defects, lower total plasma homocysteine, improve immune responses and lower infectious disease episodes in older adults. These and other studies have been cited as a basis for broadening recommendations for multivitamin supplementation to the general population to help meet micronutrient requirements, promote health, and reduce the risk of chronic disease.



Dr. Jeffrey Blumberg