

NIN Review

National Institute of Nutrition

No. 33 2002

Preventing Type 2 Diabetes – A National Priority

Part II – Defining a key target group for diabetes prevention strategies

Diabetes is a significant and growing health concern. It is the seventh leading cause of death in Canada. More than two million Canadians are estimated to have diabetes and more than 60,000 new cases are diagnosed each year.¹ The estimated cost in Canada of treating diabetes and its debilitating complications, including heart and kidney disease, nerve damage, blindness and amputation, is at least US\$9 billion.²

Type 2 diabetes, the most common type (90%), is largely preventable through healthy lifestyle habits such as eating well, keeping active and maintaining a healthy weight.¹ However, the Canadian population is becoming increasingly overweight and inactive. If action is not taken to improve their lifestyle habits, more Canadians will be at risk of developing type 2 diabetes and its associated health problems. Moreover, our nation will face even higher health care costs associated with type 2 diabetes and other lifestyle-related diseases.

This article describes a population group considered to be a key target for strategies aimed at preventing type 2 diabetes in Canada: adults 35 to 55 years of age, with a Body Mass Index (BMI) of 25 to 29.9, who are physically active <30 min/day.

Defining the Key Target Group

The incidence of type 2 diabetes increases markedly with increasing age, affecting more men than women, particularly those who are overweight. Diabetes also affects some ethnic population groups more than others.

Age, Gender and Ethnicity

The majority (68%) of people with diabetes have been diagnosed after the age of 40. Diabetes is three times more common among Canadians 65 years of age or older than among those 35 to 64 (10.4% vs. 3.2%).²

Data on prevalence of diabetes in Canadians and contributing lifestyle trends such as overweight and inactivity are presented in a previous NIN Review No. 32, 2002, “Preventing Type 2 Diabetes – A National Priority, Part I.”

Prevalence of diagnosed diabetes is significantly higher among males than females over 12 years of age (3.5% vs. 2.9%, respectively),² due to a higher prevalence in the 35- to 64-year age group (3.7% men vs. 2.7% women) and a similar but more distinct pattern in those 65 years or older (12.1% men vs. 9.1% women).² Projections of mortality trends into the year 2016 show an exponential increase in the number of diabetes-related deaths among men and a more linear increase among women.³

Diabetes is more common among some racial/ethnic groups, particularly Aboriginal peoples not living on reserves (5.4% of those 12 or older vs. 3.2% whites, 3.8% blacks).² Health Canada’s Aboriginal Diabetes Initiative is addressing this issue.⁴

Overweight and Obesity

Overweight and obese Canadians are at increased risk of mortality compared to those who are of normal weight. This is confirmed by a 13-year follow-up study⁵ of 10,725 adults 20 to 69 years of age which looked at the risk of all-cause mortality in the Canadian population across the new WHO⁶/NIH⁷ BMI categories. Obese individuals are at increased risk for serious health concerns,



including type 2 diabetes.⁶ The majority of people (59%) aged 35 to 64 with diabetes are overweight.²

The rate of overweight and obesity among Canadians is high and mounting, particularly among men and older Canadians. Data from the Canadian Community Health Survey (CCHS)⁸ show that the number of adults aged 20 to 64 considered obese (BMI >30) increased 24% (by about 532,000) between 1994/95 and 2000/01. Men accounted for two thirds of the increase (32% among men vs. 15% among women). In the 1998/99 National Population Health Survey (NPHS),⁹ almost half (48%) of men 35 to 54 years of age were overweight (BMI 25–29.9) compared with 23% of 35- to 44-year-old women and 31% of 45- to 54-year-old women.

Obesity appears to be on the rise for all age and sex groups, except women 20 to 34 years of age.⁸ The greatest increase is among men and women aged 45 to 54, who account for one quarter of all obese adults in Canada.⁸ Obesity rates increase with age, being highest among those 55 to 64 years (19%) and 45 to 54 years (18%).⁸

Abdominal Obesity

Abdominal obesity, an independent risk factor for diabetes that should be considered in addition to BMI, also increases with age. A waist circumference (WC) measurement ≥ 94 cm for men and ≥ 80 cm for women indicates that the individual is “at risk” of metabolic complications associated with obesity.⁶ A WC ≥ 102 cm for men and ≥ 88 cm for women pushes these individuals to the “critical level” category.^{6,7}

According to measurements from the Canadian Heart Health Surveys (1986–1992),¹⁰ 39% of men and 34% of women in the 35 to 44 age category were “at risk” of metabolic complications due to their WC. This jumped to 53% of men and 50% of women in the 45 to 54 age group and 61% of men and 64% of women in the 55 to 64 age category.¹⁰

A recent review of data from the Third National Health and Nutrition Examination Survey (NHANES III)¹¹ found that high WC increases likelihood of type 2 diabetes independently of BMI (Table 1). Among those

Table 1: Classification of Overweight and Obesity by BMI, WC and Associated Disease Risk⁷

Weight Category	BMI (kg/m ²)	Obesity Class	Disease Risk ^a (Relative to Normal Weight and WC)	
			WC Men ≤ 102 cm Women ≤ 88 cm	WC Men > 102 cm Women > 88 cm
Underweight	<18.5	–	–	–
Normal ^b	18.5–24.9	–	–	–
Overweight	25.0–29.9	–	increased	high
Obesity	30.0–34.9	I	high	very high
	35.0–39.9	II	very high	very high
Extreme Obesity	≥ 40	III	extremely high	extremely high

^aDisease risk for type 2 diabetes, hypertension and cardiovascular disease

^bIncreased WC can be a marker of increased risk even in people of normal weight
Adapted from Preventing and Managing the Global Epidemic of Obesity. Report of the World Health Organization Consultation on Obesity, WHO, Geneva, 1997

who were of normal weight, overweight or obese, those with a high WC had an increased risk of diabetes, hypertension, dyslipidemia and the metabolic syndrome in comparison to those with normal WC values.¹¹

Weight Loss

A 10% weight loss in overweight individuals is associated with a substantial reduction in abdominal obesity (WC, ≥ 6 cm) and related insulin resistance, independent of whether the weight loss was induced by energy restriction or exercise.¹² Women (40%) are more likely than men (23%) to report recent attempts at weight loss, including many women who are already within a healthy weight range.¹³ The 1998/99 NPHS¹⁴ found that 59% of women considered their weight when selecting foods, compared to only 41% of men. Also, overweight women (BMI ≥ 25) were more likely than overweight men (68% vs. 49%, respectively) to be concerned about food selection and its effects on weight.¹⁴

In the most recent Tracking Nutrition Trends (TNT) study,¹⁵ Canadians indicated being more motivated to change or improve their eating habits to maintain health (58%) than to lose weight (22%). When asked about specific issues influencing their food choices, 95% considered “maintaining good health” as influential compared to 72% (women 74% vs. men 69%) who indicated “weight loss/maintenance”.

Although many overweight people claim they want to shed excess pounds, most do little to achieve this goal. In a study of 1,224 adults in Minnesota,¹⁶ about 73% of the men and 85% of the women said they were

currently trying to lose weight or to avoid gaining weight, the average goal being about 23 pounds for men and 28 pounds for women. However, only one third of those trying to lose weight and one fifth of those trying to avoid gaining weight actually cut their food intake or reported exercising for ≥ 150 min/week.

Investigators of long-term maintenance of weight loss¹⁷ find that people lose weight when taught new eating and exercise behaviours, but regain when they stray from those behaviours. Whether failure to maintain behaviour changes was due to loss of knowledge and skills, loss of motivation, adverse side effects of behaviour change (e.g. hunger, psychological stress, social pressure), or other variables was not clear. Weight loss/maintenance interventions that extended the length of treatment and that placed greater emphasis on exercise at least delayed weight regain.

Activity and Healthy Lifestyle Habits

Research consistently reports that physically active individuals are less likely to develop type 2 diabetes in comparison with sedentary individuals.^{18–20} An active lifestyle is important for maintaining a healthy weight and preventing weight gain leading to obesity.^{21,22} A sedentary lifestyle may contribute to the progression from normal fasting glucose to impaired fasting glucose and diabetes.²³ Regular exercise has been shown to improve control of lipid abnormalities, diabetes, hypertension and obesity, with the greatest benefits realized by sedentary individuals who begin to exercise.²⁴

Several studies^{25–28} have shown that healthy lifestyle behaviours can help prevent or delay the onset of type 2 diabetes. One study²⁵ involving 577 adults with impaired glucose tolerance found that over a 6-year period the incidence of diabetes was decreased by exercise interventions (46% reduction), diet-plus-exercise (42%) and diet only (31%). In another study²⁶ that followed $\geq 85,000$ nurses 30 to 55 years of age for 16 years with no interventions, there were 3,300 new cases of type 2 diabetes. Overweight or obesity was the single most important predictor of diabetes. Even after adjustment for BMI, 91% of the diabetes cases were attributed to behaviours that did not conform to the low-risk pattern (diet high in cereal fibre and polyunsaturated fat and low in *trans* fat and glycemic load, and ≥ 30 min/day of moderate physical activity). A Finnish diabetes prevention study²⁷ involved 522 overweight men (172) and women (350) with a mean age of 55 years, mean BMI of 31 and impaired glucose tolerance. During the 4-year trial, the risk of diabetes was reduced by 58% in the diet and exercise group (11% vs. 23% control), despite a very modest weight loss of 3.5 kg or 5% of body weight. Another study²⁸ suggests that a prudent dietary pattern is associated with a substantially reduced risk of diabetes in men, based on 42,504 male health professionals,

40 to 75 years of age, without diagnosed diabetes, cardiovascular disease, or cancer at baseline. A high score for the western dietary pattern (higher consumption of red meat, processed meat, French fries, high-fat dairy products, refined grains, sweets, desserts) combined with low physical activity level or obesity was associated with a particularly high risk of diabetes compared with the prudent diet (higher intake of vegetables, fruit, fish, poultry, whole grains).

The US Diabetes Prevention Program Research Group²⁹ found that lifestyle intervention was more effective than metformin in reducing the incidence of diabetes in individuals at high risk. This study involved 3,234 non-diabetic persons (average age 51 years; 68% women, 45% minorities; mean BMI of 34) with elevated fasting and post-load plasma glucose concentrations. After a follow-up of an average of 2.8 years, lifestyle intervention (goals of $\geq 7\%$ weight loss, ≥ 150 min/week of physical activity) reduced incidence of diabetes by 58%, and metformin by 31%, as compared with placebo.

Implications: Type 2 diabetes can be prevented or delayed with positive lifestyle habits. Prevention strategies must reach Canadians before the age when diabetes is generally diagnosed, diabetes and obesity prevalence rates rise dramatically, and activity levels plummet. To reduce the impact on personal health as well as costs to the health system, interventions should be targeted to Canadians 35 to 55 years of age, who are overweight (BMI 25–29.9), who have a high WC (men ≥ 94 ; women ≥ 80 cm), and who are active < 30 min/day.

Healthy weight strategies should be developed, aimed particularly at men. Men are more likely to have diabetes and to be overweight than women. Education strategies should increase awareness at an early age about the health benefits of maintaining a healthy weight and—a less familiar concept to consumers—a healthy waist size. For adults who are already overweight, the focus should be on preventing additional weight gain that could put them in the higher risk obese category. To maintain or lose weight, they need support in making long-term changes toward both healthy eating and increased activity.

Changes in Body Composition and Activity with Aging

Further rationale for targeting 35- to 55-year-olds is provided by their significant changes in body composition, physical activity and energy expenditure, which all contribute to gradual increases in weight and WC.

Body Composition Changes

Body fat content increases with age and is stored preferentially in abdominal rather than peripheral tissues, with maximum rates of overweight and obesity attained between 55 and 65 years of age.³⁰ Concurrently, lean body mass decreases.³¹ These deleterious changes are thought to be due to a small positive energy imbalance, caused by an increasingly sedentary lifestyle without concomitant decreases in energy intake.³²

Menopause is a particularly high-risk time for weight gain in women (average gain 1.8 kg to 2.3 kg).^{33,34} It also results in a hormonally driven shift in body fat distribution from the peripheral to the abdominal region.³⁴ However, these changes are not inevitable.^{35–37} One study³⁵ found that weight gain and increased WC, along with elevations in lipid levels and other risk factors for heart disease, are preventable through lifestyle intervention in healthy menopausal women. Another study³⁶ revealed that behavioural factors—particularly exercise and alcohol consumption—were more strongly related to weight than menopause transition. A third study³⁷ showed that decreased energy and fat intake and increased physical activity prevented increase in weight during menopausal years.

Between the ages of 20 and 80, adults lose $\geq 20\%$ to 30% of their skeletal muscle mass;³⁸ a noticeable decrease is not observed until the end of the fifth decade.³⁹ This trend contributes to loss of muscular strength, higher rates of disability and a general decline in quality of life.⁴⁰ Aging is associated with a preferential decrease in muscle mass in the lower body, with men retaining a higher muscle mass than women.³⁹

Physical Activity and Energy Expenditure Changes

Physical activity and daily energy expenditure both decline with age and are thought to be important contributors to weight gain and the negative changes in body composition seen in older adults. As physical activity declines, a loss of fat-free mass (specifically, skeletal muscle mass) and increase in fat mass is frequently observed.³² The age-related decline in lean body mass can be corrected with continued activity or initiation of a strength-training program.⁴¹

Part of the decline in energy expenditure with age is due to decreasing body cell mass. Basal metabolism drops 1% to 2% per decade between 20 and 75 years of age. At age 75, men and women require a much lower daily energy intake to maintain their weight compared

to when they were 20, even if they remain equally physically active.⁴² Women have lower resting metabolic rates than men because for a given height they have more body fat and less lean body mass.⁴²

Follow-up data on women with a mean age of 46 years from the NHANES I study⁴³ indicate that subjects with a low physical activity level were 3.8 times more likely to have gained >13 kg during the preceding 10 years.

Implications: Both men and women need to be aware that significant body composition changes occur with aging, beginning as early as the third decade of life. Strategies to counteract these changes are required. Increasing the activity level, especially weight-bearing and strength-training exercises, tends to improve or maintain muscle mass and strength. Increasing energy expenditure through physical activity and activities of daily living, along with appropriate energy intakes, continue to be important measures to prevent excess gains in weight and abdominal fat with age. Women need encouragement to continue healthy practices that can prevent weight gain during the critical menopausal years.

Eating Patterns of Adult Canadians

Investigating the eating patterns of Canadians can provide insights into the most effective strategies for reducing obesity and risk of diabetes. The last major national nutrition survey, Nutrition Canada, was conducted a generation ago (1970/72). Canadian Heart Health Surveys completed more recently in Ontario, Manitoba, Nova Scotia and Quebec^{44–47} indicate that total fat intakes have declined but remain above the recommended 30% of energy. The national Food Habits of Canadians (FHC) survey⁴⁸ conducted in 1997/98 indicates that, among those 35 to 65 years of age, fat intake was down $\geq 10\%$. Energy intake decreased somewhat for men but rose slightly for women 40 to 64 years of age compared to 30 years ago.⁴⁸

The FHC survey⁴⁸ found that energy intake was lower among older Canadians (Table 2). The percent of energy from carbohydrate was slightly higher for women than men and was close to the recommended 55% of energy. Protein intake was consistent across both age and sex groups. The percent of energy from fat and saturated fat were similar for both age and sex groups and were close to the recommended 30% and 10% of energy, respectively. Cholesterol intakes were higher for men than women. Total fibre intake was highest for men 35 to 49 years of age, lowest for women 35 to 49 and the same for men and women 50 to 65.

Table 2: Weighted Mean Nutrient Intake of Canadians 35–65 Years of Age⁴⁸

	35–49 Years		50–65 Years	
	Men (n=266)	Women (n=459)	Men (n=181)	Women (n=306)
Energy (kcal)	2,696	1,789	2,440	1,756
Protein (%E)	17.1	17.1	17.1	17.7
Carbohydrate (%E)	51.6	53.0	50.1	54.0
Total fat (%E)	30.2	29.7	30.6	28.9
Saturated fat (%E)	9.6	9.7	9.8	9.5
Cholesterol (mg)	340	224	343	230
Total fibre (g)	18	14	16	16

The FHC survey⁴⁸ also considered average number of servings consumed from each of the four food groups in *Canada's Food Guide to Healthy Eating* among adults 35 to 65 years of age. Intake of Grain Products declined with age; but all groups, except women 50 to 65 years of age, ate ≥ 5 servings/day. Vegetables & Fruit intake was below the minimum target of 5 servings/day for women 35 to 49 years of age and men 50 to 65. The average number of servings of Milk Products was below the recommended 2 servings/day for men and women in all age groups. Intake of Meat & Alternatives was at or above the recommended intake of 2 to 3 servings/day for men and women in all age groups. A diet that lacks foods from any of the four food groups can compromise intakes of specific nutrients, particularly calcium, iron and folate in some adult groups.^{44–48} Foods from the Other Foods category may be replacing more nutrient-dense foods in the diet: they provided 26% to 29% of the energy and 24% to 34% of the fat intake in the different age and sex groups but only very small amounts of protein and micronutrients.⁴⁸

Food Preparation, Meal Skipping, Snacking

The majority of meals (70%) in Canada are eaten at home.⁴⁹ Of these, 86% are made from scratch or near scratch, 6% are fresh/frozen packaged meals, 6% are ready-to-eat meals from a restaurant, and 2% are ready-to-eat meals from retail.⁴⁹ Most Canadian adults (59%) skip at least one meal a week, most often lunch (45%), followed by breakfast (29%) and dinner (17%).⁵⁰ Snacking is a popular habit, with 9 out of 10 Canadians reporting snacking at least once a week; the majority (62%) in the home.⁵¹ Top snack choices include fresh fruit, potato chips, chocolate candy, cookies, crackers, yogurt, candy, granola or cereal bars, ice cream and gum.⁵¹ Key reasons indicated for their choices are taste (52%) and hunger (39%).⁵²

Alcohol Intake

Alcohol can add significantly to energy intake although consumers may not always consider this. In the 1998/99 NPHS,¹⁴ 51% of men and 25% of women in the 25- to 44-year age group had an alcoholic drink at least once a week, compared to 50% of men and 29% of women 45 to 65 years of age. Binge drinking (≥ 5 alcoholic drinks at one sitting) was far more common among men than women (24% vs. 7% binge drink ≥ 1 /month), and decreased with age.¹⁴

Attitudes and Actions Toward Healthy Eating

Knowledge and attitudes are important underpinnings to action. Some gender and age differences can be seen in reported nutrition knowledge, importance of nutrition, nutrients of concern and food choices. For example, in the 2001 TNT study¹⁵ women were significantly more likely than men to rate their knowledge of nutrition highly (94% very or somewhat knowledgeable vs. 90% of men).

Nutrition continued to be significantly more important for women (92%) than men (85%) in 2001.¹⁵ However, that gap is narrowing: men reported a higher perceived importance of nutrition than in previous years, up from 76% in 1989. In 2001, 55% of adults 35 to 54 years of age indicated nutrition was extremely or very important; this relative importance declined from a peak of 73% in 1994.¹⁵ The most significant decline was observed among younger consumers 18 to 34 years of age.

Fat remained at the top of the list of concerns in 2001, presenting some level of concern to 82% of consumers.¹⁵ The level of concern for many topics increased over 1997. Vitamins now present the same level of concern as fat (82%), followed by saturated fat (80%), fibre (78%), calcium (77%), protein (76%) and cholesterol (74%). Women were generally more concerned about specific nutrients than men, particularly calcium and iron but also dietary fat. However, consumers do not always choose food according to their concerns. The likelihood of selecting foods based on the amount of a specific nutrient directly correlates with, but is lower than, the reported level of concern about that nutrient.

According to the 1998/99 NPHS,¹⁴ women are more concerned about maintaining or improving health through food choice than men (80% vs. 63%, respectively). Women were more likely than men to report that they choose foods because of lower fat, fibre, other vitamins or minerals, calcium and iron. Women were more likely than men to avoid foods because of fat content, types of fat, calories, cholesterol, sugar, salt and iron.



In the 2001 TNT study,¹⁵ 92% of Canadians believed they were currently making an effort to eat well. Eating more vegetables and fruits, consuming less fat and eating a balanced diet were the most popular actions cited. Women were more likely than men to put an emphasis on eating more fruits and vegetables and on reducing sugar intake. Men were more likely than women to attempt reducing energy intake or eating less. Men and women appear to be equally concerned about consuming less fat, eating a balanced diet, watching what they eat and eating less red meat. Furthermore, 62% of Canadians indicated having made changes over the past year to improve their eating habits; changes cited most frequently were consuming less fat (34%), eating more fruit and vegetables (26%), and reducing sugar intake (14%). No statistically significant differences between men and women were reported.

Barriers to Healthy Eating

The most frequently mentioned barriers to healthy eating concern time and taste factors. Healthy eating is typically described as being a challenge due to a shortage of time or busy lifestyles.^{15,53} In the most recent TNT study,¹⁵ almost half (46%) of Canadians mentioned that they frequently sacrifice proper nutrition because of the everyday pressures of life.

A Spanish study⁵⁴ that is part of a pan-European survey found the main barriers to healthy eating were irregular work hours, willpower and food-related factors (unappealing food and cost), while preventing disease was the most frequently selected benefit to healthy eating. About 20% of the subjects said they had no difficulty eating in a healthier manner. In a larger study involving the 15 member states of the European Union (EU),⁵⁵ the most common perceived barriers to healthy eating were time and taste factors. A lack of knowledge about healthy eating was not selected by many as an important barrier.

Results of several surveys^{55,56} suggest that a significant barrier may be that many consumers think they are already eating well. For example, 70% of the EU subjects believed their diets to be healthy already.⁵⁵ The 1998 Ontario Food Survey⁵⁶ also found that 73% of respondents did not desire to make any changes to their present intake of seven food groupings because they believed they were already eating well. There was a greater tendency for men compared to women to want to maintain their present intake. The major barrier to changing intake found in that survey was preference for a food, followed by habit (time of day, associations with

other foods [i.e. milk consumed only at breakfast], influence of friends and social activities, religious reasons) and preparation (family meal preferences, preparation skills, time available to prepare foods). Other factors such as knowledge, cost, health and availability were not identified as major factors in changing consumption of most of the food groupings.

Social influences can be important barriers; patients report difficulties following nutrition advice when eating in social situations.⁵⁷ Environmental factors such as access to healthy food choices also need to be explored further.

Implications: *Canadians believe that nutrition is important and feel that they are quite knowledgeable about nutrition; yet nutrition surveys indicate a need for improved nutrient intakes and food choices. Consumers in the 35- to 55-year target group may need additional motivations to eat well to recapture their waning interest. This group needs messages focused on the “benefits” of healthy eating related to maintenance of a healthy weight and prevention of diseases such as type 2 diabetes. Men specifically need to be targeted to help increase their concern about healthy eating and desire to make healthier food and alcohol decisions for the sake of their health and weight.*

Canadians need assistance overcoming barriers to healthy eating, and creative solutions to help them eat well despite busy lifestyles. Although consumers seem to be aware of the changes required to improve their eating habits (i.e. consuming less fat, eating more vegetables and fruit), they may need some assistance in assessing their own eating habits and making specific improvements. Practical advice about meal planning, food preparation and healthy snack choices would be beneficial. In developing healthy eating strategies, the focus could be geared more toward consuming appropriate amounts of energy to balance intakes with expenditure and less toward dietary fat. One important consideration for some adults 35 to 65 years of age would be to ensure that Other Foods are not displacing choices from the four food groups of Canada’s Food Guide to Healthy Eating, which can compromise intakes of specific nutrients.

Activity Patterns of Middle-Aged Canadians

Physical activity levels decline with age, as does the time spent in active leisure and sports. Canadians in middle life, particularly women, are an inactive group. According to the 1998 Time Use of Canadians survey,⁵⁸ adults 35 to 55 years of age spend more time working and have less free time than the average Canadian 15 years or older (Table 3). They invest less time in socializing, watching television and active leisure activities. Men spend more time in active leisure than women. Women 35 to 44 years of age spend the least amount of time in active leisure compared to all other age and sex groups.

Leisure time accounts for only part of a person's total energy output, as paid work or household chores can also be physically demanding. However, in the 1998/99 NPHS survey¹⁴ almost one quarter of people aged 12 or older reported that "sitting" best described their usual daily non-leisure activity. Just under half reported that their time was usually spent standing or walking, and 20% mentioned lifting and carrying light loads. A small minority (6%) reported that they typically did heavy labour, significantly higher among men than women (5% vs. 2%, respectively). Even among people whose usual daily routine involved mostly sitting, a higher percentage of men than women had vigorously active leisure time.

Canada's Physical Activity Guide to Healthy Active Living recommends that Canadians work toward 60 min/day of physical activity for optimal health benefits.⁵⁹ But many Canadians are not achieving that goal. Roughly four in ten Canadians 25 to 64 years of age, particularly women, are active <30 min/day on average (32% of men vs. 39% of women 25 to 44; 36% of men vs. 41% of women 45 to 64).⁶⁰ According to the 2001 Physical Activity Monitor,⁶¹ 57% of Canadians are inactive (spending <3 kcal/kg body weight/day, equivalent to walking ≥ 1 hour/day). Inactivity increases with age: 43% of 20 to 24 year olds, 56% of 25 to 44 year olds, 62% of 45 to 64 year olds, and 69% of adults 65 years or older are inactive.⁶¹

More men than women tend to be vigorously active (47% of men vs. 34% of women 25 to 44; 37% of men vs. 29% of women 45 to 64).⁶⁰ About 60% of men and women 35 to 54 years of age exercise ≥ 3 times/week (Table 4).⁶² Exercise includes vigorous activities such as calisthenics, jogging or racquet sports, team sports, dance classes or brisk walking for a period of ≥ 15 min.

In the general population, activity increases with education level and household income.⁶⁰ Of those who are active <30 min/day, 50% have less than secondary school education compared to 39% with secondary

Table 3: Average Time Spent on Various Activities for Adults Aged 35–44 and 45–54⁵⁸

Activity Group	Average Time Spent (hours/day) ^a					
	35–44 years		45–54 years		General population ≥ 15 years	
	Men	Women	Men	Women	Men	Women
Total work ^b	9.4	9.3	8.8	8.5	7.8	7.8
–paid work/related activities	6.2	3.8	5.8	3.8	4.5	2.8
–unpaid work ^c	3.1	5.4	2.9	4.6	2.7	4.4
Personal care	9.8	10.2	10.0	10.5	10.2	10.6
Free time	4.8	4.5	5.2	5.0	6.0	5.6
–socializing (incl. restaurant)	1.5	1.7	1.5	1.7	1.9	2.0
–television, reading, passive leisure	2.3	2.0	2.8	2.3	2.9	2.6
–sports, movies, entertainment events	0.1*	0.2	0.2*	0.2*	0.2	0.2
Active leisure	0.9	0.6	0.8	0.8	1.1	0.8
–active sports	0.6	0.3	0.4	0.4	0.6	0.4
–other active leisure	0.4	0.3	0.4	0.4	0.5	0.5

^a Averaged over a 7-day week

^b Includes paid work and related activities, household work and related activities, civic and voluntary activity, and education and related activities

^c Includes household work and related activities, and civic and voluntary activity

*Figures to be used with caution. The coefficient of variation of the estimate is between 16.6% and 33.3%

Table 4: Exercise Frequency in 35- to 54-Year-Old Canadians, 1998/99⁶²

Age	Three or more times weekly (%)	Once or twice weekly (%)	Less than once weekly or never (%)
Total 35–44 years	60	19	19
Men	60	19	18
Women	60	19	21
Total 45–54 years	61	18	19
Men	62	19	17
Women	61	17	20

Note: Components may not add to total as frequency was not stated for up to 1% of respondents

school, 32% with college and 29% with university education. Forty-eight percent of Canadians who have a household income <\$20,000 are active <30 min/day compared to 21% of Canadians with a household income >\$100,000. Activity levels are highest for students and lowest for those who are unemployed. Individuals who were never married are the most active.

Actions Toward Active Living

Walking is the most popular leisure-time physical activity for Canadians 18 years of age or older, followed by gardening and yard work, home exercise, swimming, social dancing and bicycling.⁶⁰ Women are more likely than men to participate in exercise classes, exercise at home, participate in social dancing, walk for exercise, and take part in yoga or tai chi. Conversely, men are more likely than women to report activities such as hockey, baseball or softball, soccer, bicycling, weight training, basketball, volleyball, football, jogging and running, golf, tennis, skating and inline skating.

Home is the most frequently cited place for exercise, followed by public facilities, work, and private facilities.⁶³ Women are more likely than men to participate in activities at home. Home is also the top-ranked location for men to exercise, but they are more likely than women to do activities at work and in public and private facilities. About half of employed Canadians report that they do activities at work. Homemakers and retired adults are the least likely to use public facilities. The proportion of adults who are active only at home increases with age; adults 45 to 64 years of age are 1.6 times as likely as younger adults 25 to 44 to do activities only at home. The most frequently reported activities among the groups that exercise only at home are walking, gardening, home exercise, social dancing, bicycling and swimming.

Barriers to Active Living

Adults are more likely to remain active if they engage in activities that they feel competent doing, find enjoyable, can easily access and fit into their daily schedules and that they feel yield a net benefit.⁶⁴

The 1999 Physical Activity Monitor⁶⁵ identified some barriers to active living. Lack of skill and ability was seen as a barrier to becoming more active for 17% of adults 18 years of age or older, particularly for women (19% of women vs. 11% of men 25 to 44) and older adults (23% of women vs. 18% of men 45 to 64).

The cost of physical activity is another barrier, particularly for women (36% women vs. 17% of men 25 to 44;

24% women vs. 18% of men 45 to 64) and individuals who are active <30 min/day (60%).⁶⁵

One third of Canadians 25 to 64 years of age say there is not enough information available on local physical activity opportunities.⁶⁵ About one quarter of those 25 to 64 years of age indicate that they lack awareness of how to build physical activity into their daily lifestyle, particularly women 45 to 64 and those who are active <30 min/day. Unsuitable hours and class times offered by their local centres hinder 37% of 25- to 44-year-olds and 33% of 45- to 64-year-olds. This is also an important deterrent to those who are active <30 min/day.

Women are more concerned about safety issues than men, making it important to find safe places and friends to exercise with.⁶⁵ They are more likely than men to strongly agree that it is hard to find other people to be active with (42% women vs. 34% men 25 to 44) and places where you can take children. Finding places to be active with the whole family is more of a concern with women 25 to 44 than with women 45 to 64.

Activity limitations or handicaps, which increase with age, are another potential barrier. In 1998/99, 14% of adults 35 to 44 years and 21% of 45- to 54-year-olds had an activity limitation or handicap. This jumped to 42% of seniors aged 75 or older.⁹

Implications: Roughly 40% of Canadians in the target group between 35 and 55 years of age are active <30 min/day. Women, particularly those aged 35 to 44 years, are less active than men. Physical activity is declining at the same time as physiological changes promote weight gain and loss of skeletal muscle mass. Canadians should be made aware of the contribution of a healthy level of physical activity throughout adulthood in maintaining a healthy body weight and skeletal muscle mass and preventing diseases such as type 2 diabetes. More attention should be focused on providing practical suggestions to overcome barriers and reverse the trend toward sedentary activities at work and during leisure time. Strategies should emphasize getting Canadians moving in their usual daily activities, promoting popular activities such as walking and home exercise, and directing them to helpful tools such as Canada's Physical Activity Guide to Healthy Active Living.

Conclusion

Lifestyle choices that promote healthy weights, such as healthy eating and active living, play a primary role in preventing type 2 diabetes. Helping Canadians surmount common barriers to healthy eating and active living is tantamount to success. To have a far-reaching impact, a concerted effort is required among professionals working in the medical, nutrition, fitness and health fields to promote and support positive lifestyle choices in the target group.

Acknowledgements

This review was written for NIN by **Lynn Roblin, M.Sc., RD**, Nutrition Consultant. It is Part II of a summary of a larger literature review entitled *The Changing Physiology, Eating and Activity Patterns, and Obstacles and Barriers to Healthy Eating and Active Living in Canadians 35–55 Years of Age*. The literature review was prepared for “Food and Fitness in Focus”, a joint project of the National Institute of Nutrition, the Canadian Fitness and Lifestyle Research Institute, Dietitians of Canada, and ParticipACTION. That 3-year project is funded under the Canadian Diabetes Strategy—Prevention and Promotion Contribution Program, Health Canada.

NIN gratefully acknowledges the contributions of:

- the **NIN Scientific Advisory Council**;
- the **NIN Communications Advisory Council**; and
- the advisory committee appointed for the “Food and Fitness in Focus” project: **Louise Aubrey**, Office of Nutrition Policy and Promotion, Health Canada; **Heidi Bates**, representing Dietitians of Canada; **Cora Lynn Craig**, Canadian Fitness and Lifestyle Research Institute; **Philippe Dussault**, Fitness and Active Living Unit, Health Canada; **Mary Flynn**, Calgary Regional Health Authority; **Anne Kennedy**, National Institute of Nutrition; **Linda McCargar**, Department of Agricultural, Food and Nutritional Science, University of Alberta; **Robert Ross**, School of Physical and Health Education, Queen’s University; **Art Salmon**, ParticipACTION; **Stefa Katamay** and **Ellen Lakusiak**, Project Managers; and **Sheryl Conrad**, Editor.

References

1. Health Canada, Health Promotion and Programs Branch: *Don't Turn Your Back on Diabetes: Facts and Figures* www.hc-sc.gc.ca/hppb/ahi/diabetes/english/facts/index.html
2. Health Canada, Laboratory Centre for Disease Control, Bureau of Cardio-Respiratory Diseases and Diabetes: *Diabetes in Canada: National Statistics and Opportunities for Improved Surveillance, Prevention, and Control*. Ottawa: Minister of Public Works and Government Services Canada, August 1999 www.hc-sc.gc.ca/hpb/lcdc/publicat/diabet99/d02_e.html
3. Idem: *Mortality* www.hc-sc.gc.ca/hpb/lcdc/bcrdd/diabetes/facts/dia_e.html
4. Health Canada, First Nations and Inuit Health Branch, Aboriginal Diabetes Initiative www.hc-sc.gc.ca/fnihb/chp/adi/index.htm
5. Katzmarzyk P, Craig CL, Bouchard C: Underweight, overweight and obesity: relationships with mortality in the 13-year follow-up of the Canada Fitness Survey. *J Clin Epidemiol* 2001; 54:916–920
6. World Health Organization: *Obesity: Preventing and Managing the Global Epidemic*. WHO Technical Report Series 894, 2000
7. National Institutes of Health, National Heart, Lung, and Blood Institute: The practical guide—identification, evaluation, and treatment of overweight and obesity in adults. Publication 00-4084, October 2000 www.nhlbi.nih.gov/guidelines/obesity/prctgd_b.pdf
8. Statistics Canada: Canadian Community Health Survey: a first look 2000/01. *The Daily*, May 8, 2002 www.statcan.ca/Daily/English/020508/d020508a.htm
9. Idem: National Population Health Survey 1998/99. *Health Indicators*. Ottawa: April 2001. Cat No 82-221-XIE www.statcan.ca/english/freepub/82-221-XIE/00401/stat2.htm
10. MacDonald SM, Reeder BA, Chen Y et al: Obesity in Canada: a descriptive analysis. *Can Med Assoc J* 1997; 145:S39–S45
11. Janssen I, Katzmarzyk PT, Ross R: Body mass index, waist circumference, and health risk; evidence in support of current NIH guidelines. *Archives Intern Med* 2002 (accepted February 26)
12. Ross R, Dagnone D, Jones PJ et al: Reduction in obesity and related comorbid conditions after diet-induced weight loss or exercise-induced weight loss in men. A randomized, controlled trial. *Ann Intern Med* 2000; 133(2):92–103
13. Health Canada: *Toward a Healthy Future – Second Report on the Health of Canadians*. Ottawa: Sept 1999 www.hc-sc.gc.ca/hppb/phdd/report/toward/eng/report.html
14. Statistics Canada: How healthy are Canadians, 2001 annual report. *Health Reports* 2001; 12(3). Cat No 82-003-X1B www.statcan.ca/english/ads/82-003-X1B/sum2001.pdf
15. National Institute of Nutrition: *Tracking Nutrition Trends IV: An Update on Canadians' Nutrition-Related Attitudes, Knowledge and Actions, 2001*. Ottawa: April 2002
16. Kottke T: Self-reported weight, weight goals, and weight control strategies of a mid-western population. *Mayo Clinic Proceedings* 2002; 77:114–121
17. Jeffery R, Epstein L, Wilson G et al: Long-term maintenance of weight loss: current status. *Health Psychology* 2000; 19(1):S5–S16
18. Mayer-Davis EJ, D'Agostino R Jr, Karter AJ et al: Intensity and amount of physical activity in relation to insulin sensitivity: the Insulin Resistance Atherosclerosis Study. *JAMA* 1998; 279(9):669–674
19. Hu FB, Sigal RD, Rich-Edwards JW et al: Walking compared with vigorous physical activity and risk of type 2 diabetes in women: a prospective study. *JAMA* 1999; 282(15):1433–1439
20. Wei M, Gibbons LW, Kampert JB et al: Low cardiorespiratory fitness and physical inactivity as predictors of mortality in men with type 2 diabetes. *Ann Intern Med* 2000; 132:605–611
21. Ross R, Janssen I, Tremblay A: Obesity reduction through lifestyle modification. *Can J Appl Physiol* 2002; 25(1):1–18
22. Grundy S, Blackburn G, Higgins M et al: Physical activity in the prevention and treatment of obesity and its co-morbidities; evidence report of independent panel to assess the role of physical activity in the treatment of obesity and its co-morbidities. *Med Sci Sports Exerc* 1999; 31(11):S502–S508
23. Wei M, Gibbons LW, Mitchell TL et al: The association between cardiorespiratory fitness and impaired fasting glucose and type 2 diabetes mellitus in men. *Ann Intern Med* 1999; 130(2):89–96
24. Bray M: Genomics, genes, and environmental interaction: the role of exercise. *J Appl Physiol* 2000; 88:788–792
25. Pan XR, Li GW, Hu YH et al: Effects of diet and exercise in preventing NIDDM in people with impaired glucose tolerance. The Da Qing IGT and Diabetes Study. *Diabetes Care* 1997; 20:537–544
26. Hu FB, Manson JE, Stampfer MJ et al: Diet, lifestyle, and the risk of type 2 diabetes mellitus in women. *N Engl J Med* 2001; 345:790–797
27. Tuomilehto J, Lindstrom J, Eriksson J et al: Prevention of type 2 diabetes mellitus by changes in lifestyle among subjects with impaired glucose tolerance. *New Engl J Med* 2001; 344:1343–1350
28. van Dam RM, Rimm EB, Willett W et al: Dietary patterns and risk for type 2 diabetes mellitus in U.S. men. *Ann Intern Med* 2002; 136:201–209
29. Diabetes Prevention Program Research Group: Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. *New Engl J Med* 2002; 346:393–403
30. Bouchard C: The obesity epidemic [Introduction]. Cited in Bouchard C (ed): *Physical Activity and Obesity*. Champaign, IL: Human Kinetics, 2000; 8



31. Poehlman E: Physical activity level and weight control in older adults. *Cited in Bouchard C (ed): Physical Activity and Obesity*. Champaign, IL: Human Kinetics, 2000; 264
32. Toth J, Beckett T, Poehlman ET: Physical activity and the progressive change in body composition with aging: current evidence and research issues. *Med Sci Sports Exerc* 1999; 31(11):S590-S596
33. Schwartz RS: Obesity in the elderly. *Cited in Bray GA, Bouchard C, James WPT (eds): Handbook of Obesity*. New York: Marcel Dekker, 1998; 103-114
34. Lovejoy JC: The influence of sex hormones on obesity across the female life span. *J Women's Health* 1998; 7(10):1247-1256
35. Simkin-Silverman LR, Wing RR: Weight gain during menopause. Is it inevitable or can it be prevented? *Postgrad Med* 2000; 108(3):47-50
36. Crawford SL, Casey VA, Avis NE et al: A longitudinal study of weight and the menopause transition: results from the Massachusetts Women's Health Study. *Menopause* 2000; 7(2):96-104
37. Kuller LH, Simkin-Silverman LR, Wing RR et al: Women's Healthy Lifestyle Project: a randomized clinical trial; results at 54 months. *Circulation* 2001; 103(1):32-37
38. Carmeli F, Coleman R, Reznick AZ et al: The biochemistry of aging muscle. *Exp Gerontol* 2002; 37(4):477-489
39. Janssen I, Heymsfield SB, Wang Z et al: Skeletal muscle mass and distribution in 468 men and women aged 18-88 yr. *J Appl Physiol* 2000; 89:81-88
40. Forbes GB, Reina JC: Adult lean body mass declines with age: some longitudinal considerations. *Metabolism* 1970; 19:653-656. *Cited in Bouchard C (ed): Physical Activity and Obesity*. Champaign, IL: Human Kinetics, 2000; 12
41. Nichols JF, Omizo DK, Peterson KK et al: Efficacy of heavy-resistance training for active women over sixty: muscular strength, body composition, and program adherence. *J Am Geriatr Soc* 1993; 41(3):205-210
42. Pi-Sunyer FX: Overnutrition and undernutrition as modifiers of metabolic processes in disease states. *Am J Clin Nutr* 2000; 72(suppl):533S-537S
43. Williamson DF, Madans RF, Andra JC et al: Recreational physical activity and 10 year weight changes in US national cohort. *Int J Obes* 1993; 17:279-286. *Cited in Astrup A: Physical activity and weight gain and fat distribution changes with menopause: current evidence and research issues. Med Sci Sports Exerc* 1999; 31(11):S564-S567
44. Pomerleau J, Ostbye T, Bright-See E: Place of birth and dietary intake in Ontario: energy, fat, cholesterol, carbohydrate, fiber and alcohol. *Prev Med* 1998; 27:32-40
45. Sevenhuysen GP, Gelensky D, Macdonald S: *The Manitoba Heart Health Project: Nutrition Survey Technical Report*. Winnipeg: Department of Community Health Sciences, Faculty of Medicine, U Manitoba, 1991
46. Nova Scotia Department of Health: *Report of the Nova Scotia Nutrition Survey*. Halifax: 1993
47. Bertrand L (ed): *Les Québécoises et les Québécois mangent-ils mieux?* Montréal: Gouvernement du Québec, 1995
48. Gray-Donald K, Jacobs-Starkey L, Johnson-Down L: Food Habits of Canadians: reduction in fat intake over a generation. *Can J Public Health* 2000; 91(5):381-385
49. NPD Group Canada Inc: *Eating Patterns in Canada Report 2001*. *Cited in Canadian Restaurant and Foodservices Association, Foodservice Facts*. Toronto: 2001
50. Idem: *The Canadian Eating Experience*. *Cited in Canadian Restaurant and Foodservices Association, Foodservice Facts*. Toronto: 2000
51. Idem: *SnackTrack 2000* (based on market research conducted by NPD Canada Inc.)
52. Idem: *NPD National Eating Trends 2000* (based on market research conducted by NPD Canada Inc.)
53. Canadian Foundation for Dietetic Research, Dietitians of Canada, Kraft Canada Inc: *Speaking of Food and Eating: A Consumer Perspective*. Toronto: 1997
54. Lopez-Azpiazu I, Martinez-Gonzalez MA, Kearney J et al: Perceived barriers of, and benefits to, healthy eating reported by a Spanish national sample. *Public Health Nutr* 1999; June 2(2):209-215
55. Kearney JM, McElhone S: Perceived barriers in trying to eat healthier—results of a pan-EU consumer attitudinal survey. *Br J Nutr* 1999; 81(suppl 2):S133-S137
56. Mendelson R, Anderson H, Brown H et al: Barriers to changing food selection. *In Anderson GH, Blundell J, Chavez M (eds): Food Selection*. Paris, ON: Danone Institute, 2002 (in press)
57. Koikkalainen M, Mykkanen H, Erkkila A et al: Difficulties in changing the diet in relation to dietary fat intake among patients with coronary heart disease. *Eur J Clin Nutr* 1999; 53(2):120-125
58. Statistics Canada: *Overview of the time use of Canadians in 1998*. *General Social Survey*. Ottawa: 1999. Cat No 12F0080XIE www.statcan.ca/english/freepub/12F0080XIE/12F0080XIE.pdf
59. Health Canada, Canadian Society for Exercise Physiology: *Canada's Physical Activity Guide to Healthy Active Living* www.hc-sc.gc.ca/hppb/paguide/activity_enough.html
60. Canadian Fitness and Lifestyle Research Institute: *2000 Physical Activity Monitor* www.cflri.ca/cflri/pa/index.html
61. Idem: *2001 Physical Activity Monitor* www.cflri.ca/pdf/e/2001pamrep.pdf
62. Statistics Canada: *National Population Health Survey 1998/99; Public use microdata files; Household component*. Ottawa: December 2000. Cat No 82M0009XCB www.statcan.ca/english/Pgdb/People/Health/health19b.htm
63. Canadian Fitness and Lifestyle Research Institute: *1995 Physical Activity Monitor* www.cflri.ca/cflri/pa/index.html
64. Idem: *1997 Physical Activity Monitor* www.cflri.ca/cflri/pa/index.html
65. Idem: *1999 Physical Activity Monitor* www.cflri.ca/cflri/pa/index.html

A series of concise statements on nutrition, *NIN Review* articles are written for NIN by Canadian experts and reviewed by both NIN's Scientific Advisory Council and external specialists.

© National Institute of Nutrition, 2002. All rights reserved.

No portion of this publication may be reprinted without the prior written consent of the Institute. ISSN 0840-5085.

NATIONAL INSTITUTE OF NUTRITION

265 Carling Avenue, Suite 302, Ottawa, Ontario CANADA K1S 2E1

Phone (613) 235-3355 Fax (613) 235-7032 E-mail nin@nin.ca Website www.nin.ca

