

# Measured Weights in PEI Adults Reveal Higher Than Expected Obesity Rates

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## ABSTRACT

**Background:** The increasing prevalence of obesity and overweight in Canada is a significant health concern. Unfortunately, we know very little about the actual weight status and associated health risks in our population since most surveys use only self-reported body weights and heights and typically do not include a measure of body fat distribution. This paper summarizes the findings of the Prince Edward Island Nutrition Survey.

**Methods:** A random sample of 1,995 adults aged 18-74 were interviewed in their homes and weights, heights and waist circumference measurements were obtained. Relative health risks, population proportions and their corresponding 95% confidence intervals were calculated.

**Results:** Overall, almost one third of PEI adults are obese (BMI  $\geq$  30). This is almost double that reported in the 1995 National Population Health Survey using self-reported heights and weights. More women were classified as being very severely obese (Class III) than men, but for both men and women there appears to be a trend of increased mild obesity with age. Based on BMI and waist circumference, over one third of the population is considered to be at high to extremely high risk for health problems.

**Conclusion:** Self-reported height and weight data appear to result in significant underestimation of the problem of obesity. Given the serious health consequences associated with this condition, it is critical that measured heights and weights be collected in future population-based surveys to ensure that public health interventions are based on accurate prevalence data.

*La traduction du résumé se trouve à la fin de l'article.*

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The marked increase in the prevalence of obesity internationally has been labelled the "obesity epidemic."<sup>1</sup> In Canada, it has been estimated that the prevalence of obesity and overweight has more than doubled during the past two decades.<sup>2</sup> This is a concern, given that obesity is a risk factor for many chronic diseases, including cardiovascular disease, diabetes mellitus and some cancers.<sup>3</sup>

The most commonly used indicator of obesity is body mass index (BMI) because of its ease of measurement and reasonable relation to body fatness in the general population.<sup>4</sup> It is used to evaluate weight independent of height and has been found to correlate with mortality and morbidity and total body fat.<sup>5,6</sup> In addition to the degree of overall fatness, the distribution of adipose tissue within the body is an important predictor of disease risk. Measurement of the waist hip ratio (WHR) has been used to characterize regional fat distribution, which has been associated with cardiovascular disease risk and diabetes.<sup>1,7,8</sup> Recent research, however, has suggested that waist circumference (WC), which is an indicator of both subcutaneous and visceral fat in the abdomen, is a better predictor of health risks. Specifically, high levels of visceral fat have been shown to be associated with several risk factors that include the development of diabetes and coronary heart disease.<sup>9-11</sup> It is recommended that measures of both BMI and WC be used as part of a comprehensive health assessment.<sup>12</sup>

In Canada, we know relatively little about the actual weight status and fat distribution of our population. The National Population Health Survey,<sup>13</sup> and the more recent Canadian Community Health Survey,<sup>14</sup> the Physical Activity Monitor,<sup>15</sup> and the Food Habits of Canadians survey<sup>16</sup> provided only self-reported body weights and heights and did not include a measure of body fat distribution. Studies have shown that men and women tend to misreport their height and weight, which can lead to inaccurate calculations of BMI and misclassification of overweight and obesity.<sup>17</sup> To address the need for more Canadian data, all provinces completed nutrition surveys using similar protocols during the 1990s. This paper summarizes the body measure findings of the Prince Edward Island Nutrition Survey.

## METHODS

The PEI Nutrition Survey was a province-wide survey of 1,995 adult Prince Edward Islanders (aged 18-74 years) designed to describe dietary practices, nutrient intakes, weight status and fat distribution. A peer-reviewed standardized protocol, described elsewhere in more detail,<sup>18</sup> was used.

Weight was assessed without heavy clothing using portable spring scales which were calibrated weekly using a 20-pound weight. Standing height was measured after removal of shoes using a standard measuring tape with a lock and a stainless steel footplate. Height and weight measures were used to derive the BMI as weight (kg)/ height<sup>2</sup> (m<sup>2</sup>). BMIs were classified into four categories with cut-off points established to define a range of BMI values for each category (see Figure 1).<sup>12</sup> Waist circumference was measured using a Lufkin Executive Diameter Tape at the point of noticeable waist narrowing or between the ribs and iliac crest.<sup>19</sup> Two measurements were taken and the mean was recorded; if there was more than 0.4 cm difference, a third measure was taken and the mean of the two closest measures was recorded.

Waist circumference and BMI values were used to assess relative health risk (see Figure 1). Study participants were classified into one of the five health risk categories as identified in the new Canadian weight guidelines.<sup>12</sup>

Population proportions and their corresponding 95% confidence intervals were calculated using Stata6 (StataCorp, College Station, Texas). Survey estimates were calculated taking into account the clustering and stratification of the sample, as well as adjustments for non-response. These adjustments provide unbiased estimates with adequately wide confidence intervals that account for the survey design effect.<sup>20</sup> Estimates where confidence intervals did not overlap were considered significantly different between ages and sex groups ( $p < 0.05$ ).

## RESULTS

A total of 1,995 interviews were conducted with Islanders aged 18 to 74 years (50.1% males and 49.9% females), with a 71% response rate of located and eligible indi-

**TABLE I**  
Body Mass Index Categories

Sex and Age Group	Underweight	BMI Categories <sup>†</sup>		
		% of Population [95% Confidence Interval]	Normal	Overweight
M 18-34	*	36.9 [31.3,42.8]	43.2 [37.4,49.2]	19.9 [15.4,25.2]
M 35-49	*	20.5 [16,25.8]	44.8 [38.8,50.9]	34.7 [29.2,40.7]
M 50-64	*	21.0 [16.6,26.1]	44.2 [38.4,50.1]	34.8 [29.5,40.6]
M 65-74	*	26.5 [20.4,33.5]	39.6 [32.6,47]	33.2 [26.6,40.6]
F 18-34	2.39 [1.08,5.21]	44.0 [38,50.1]	24.4 [19.5,30]	29.2 [24,35.1]
F 35-49	0.442 [.062,3.08]	40.9 [35.2,46.8]	29.1 [24.1,34.7]	29.5 [24.4,35.3]
F 50-64	1.08 [.345,3.33]	22.5 [18,27.7]	38.8 [33.3,44.6]	37.6 [32.2,43.4]
F 65-74	3.12 [1.3,7.33]	24.7 [18.7,31.9]	32.2 [25.5,39.7]	40.0 [32.8,47.5]

<sup>†</sup> Underweight = BMI < 18.5, Normal = BMI 18.5-24.9, Overweight = BMI 25.0-29.9, Obese = BMI ≥ 30

\* Insufficient number of underweight men to produce population estimates

**TABLE II**  
PEI Obesity Rates

Sex and Age Group	Obesity Categories <sup>†</sup>			
	% of Population [95% Confidence Interval]	Class I	Class II	Class III
M 18-34	13.8 [10.1,18.7]	2.85 [1.35,5.93]	3.2 [1.65,6.09]	
M 50-64	24.3 [19.6,29.7]	5.36 [3.25,8.73]	5.17 [3.08,8.55]	
M 65-74	22.5 [16.9,29.4]	5.88 [3.16,10.7]	4.82 [2.58,8.82]	
F 18-34	10.7 [7.5,15.1]	6.59 [4.13,10.4]	11.9 [8.49,16.4]	
F 35-49	14.1 [10.4,18.8]	5.23 [3.14,8.57]	10.2 [7.12,14.5]	
F 50-64	20.1 [15.9,25.1]	6.69 [4.28,10.3]	10.8 [7.64,15.1]	
F 65-74	24.5 [18.5,31.6]	5.79 [3.13,10.5]	9.69 [6.01,15.3]	

<sup>†</sup> Class I Obesity = BMI 30.0-34.9, Class II = BMI 35.0-39.9, Class III = BMI ≥ 40.0

**TABLE III**  
PEI Waist Circumference

Sex and Age Group	Waist Circumference	High Waist Circumference <sup>†</sup>
	mean (cm) [95% Confidence Interval]	% of Population [95% Confidence Interval]
M 18-34	88.7 [87.2, 90.1]	14.7 [10.7,19.9]
M 35-49	95.4 [94.0, 96.8]	24.0 [18.9,30]
M 50-64	98.4 [97.0, 99.8]	35.5 [29.7,41.8]
M 65-74	100.0 [98.1, 101.8]	39.1 [31.6,47.1]
F 18-34	79.6 [77.6, 81.5]	23.6 [18.4,29.7]
F 35-49	81.2 [79.6, 82.8]	25.3 [20.2,31.2]
F 50-64	86.9 [85.2, 88.6]	39.1 [33.3,45.2]
F 65-74	87.6 [85.4, 89.9]	42.9 [35.2,51]

<sup>†</sup> ≥102 cm for males, ≥88 cm for females<sup>12</sup>

viduals. Height and weight measures were performed on 95% of participants and used to derive the BMI. Waist circumference was assessed on 87% of participants.

The proportion of participants classified as underweight, normal weight, overweight or obese by age and sex, are described in Table I. Overall, almost one third of adults

(30.5%) are considered obese (BMI ≥ 30), with 29% of males and 32% of females falling into this category. Men were more likely to be considered overweight compared to women (44% vs. 30% respectively). There was a very low prevalence of underweight (BMI < 18.5). Younger men (age 18 to 34) were more likely to be of normal weight compared to men in older age groups. Younger men were also less likely to be obese than older men. Similarly, younger women (aged 18 to 49) were more likely to be of normal weight than women aged 50 or over.

Table II further categorizes obesity into three classes of obesity.<sup>13</sup> A higher proportion of men had mild obesity (Class I) compared to women. More women had “very severe” obesity (Class III) compared to men (11% vs. 5%, respectively). For

**TABLE IV**  
**Health Risk\* Using Both BMI and Waist Circumference**

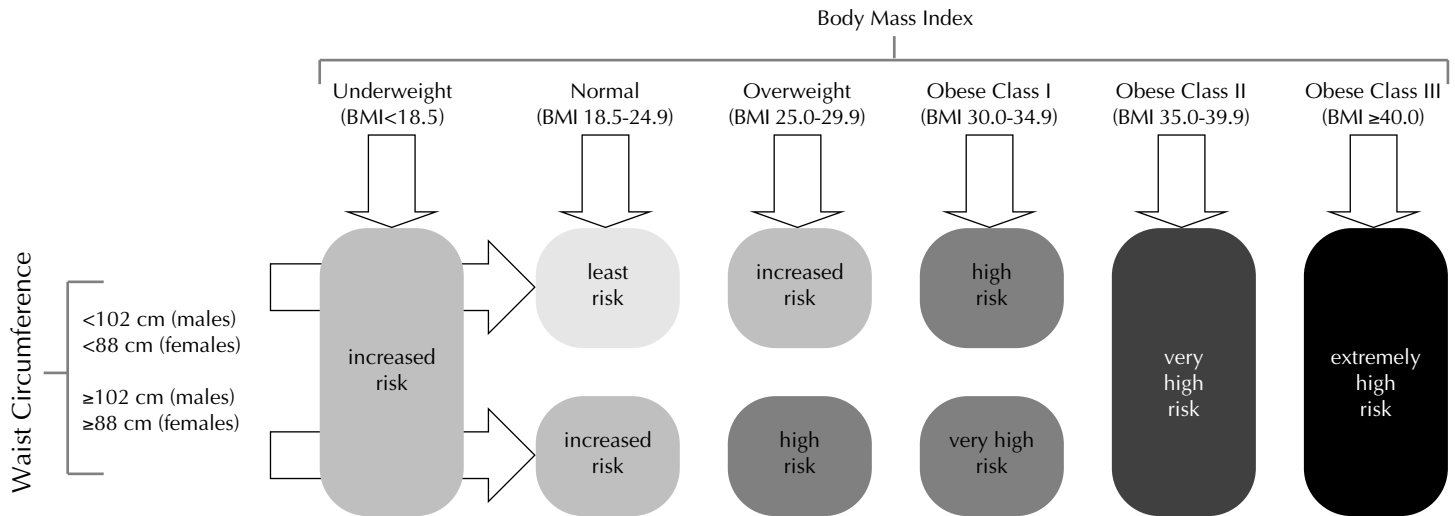
Sex and Age Group	Health Risk Classification % of Population [95% Confidence Interval]				
	Least Risk	Increased Risk	High Risk	Very High Risk	Extremely High Risk
M 18-34	37.4 [31.6,43.6]	38.3 [32.5,44.5]	11.5 [8.04,16.3]	9.31 [6.17,13.8]	3.44 [1.78,6.56]
M 35-49	19.7 [15.1,25.2]	41.9 [35.8,48.2]	14.1 [10.2,19.1]	17.8 [13.5,23.2]	6.59 [4.07,10.5]
M 50-64	20.0 [15.6,25.4]	36.7 [31.0,42.8]	12.9 [9.27,17.7]	24.7 [19.7,30.4]	5.70 [3.4,9.41]
M 65-74	23.0 [17.1,30.2]	31.3 [24.5,39.0]	15.1 [10.4,21.4]	25.3 [19,32.7]	5.30 [2.84,9.7]
F 18-34	43.4 [37.2,49.8]	23.3 [18.4,29.2]	6.81 [4.2,10.8]	13.5 [9.67,18.4]	13.0 [9.29,17.9]
F 35-49	39.5 [33.8,45.6]	23.0 [18.4,28.5]	12.8 [9.26,17.5]	14.0 [10.3,18.7]	10.7 [7.43,15.1]
F 50-64	22.8 [18.2,28.1]	29.9 [24.7,35.6]	13.3 [9.78,17.9]	22.6 [18.1,28]	11.3 [8.02,15.8]
F 65-74	22.5 [16.6,29.8]	29.1 [22.4,36.8]	12.1 [7.8,18.2]	26.0 [19.7,33.4]	10.4 [6.43,16.3]

\* Canadian Guidelines for Body Weight Classification in Adults, 2003<sup>12</sup>

**TABLE V**  
**1995 PEI Population Estimates**

	Sex and Age Group	National Population Health Survey, PEI (n=705)		PEI Nutrition Survey (n=1,995)	
		%	[95%CI]	%	[95%CI]
Less than secondary school education	M&F 20-74	29.0	[25.5, 32.9]	30.4	[28.5, 32.5]
	M 20-34	21.1	[14.0, 30.5]	25.7	[20.5, 31.5]
	M 35-49	32.6	[23.3, 43.5]	34.0	[28.5, 40.1]
	M 50-64	49.1	[37.1, 61.1]	53.3	[47.4, 59.1]
	M 65-74	75.0	[58.7, 86.3]	66.9	[59.5, 73.5]
	F 20-34	10.7	[6.3, 17.6]	10.4	[7.2, 14.7]
	F 35-49	17.7	[11.4, 26.5]	17.3	[13.3, 22.3]
	F 50-64	36.7	[24.8, 50.5]	37.8	[32.4, 43.6]
	F 65-74	46.1	[31.4, 61.6]	56.8	[49.1, 64.2]
	M&F 20-74	17.2	[14.3, 20.6]	17.4	[15.7, 19.4]
Low income adequacy*	M 20-34	18.7	[11.7, 28.7]	15.6	[11.4, 21.0]
	M 35-49	8.2	[4.1, 15.6]	12.7	[9.0, 17.6]
	M 50-64	15.6	[8.6, 26.6]	15.2	[11.2, 20.3]
	M 65-74	29.3	[16.9, 46.0]	26.4	[19.9, 34.1]
	F 20-34	24.3	[16.5, 34.2]	23.3	[18.2, 29.3]
	F 35-49	14.1	[8.6, 22.2]	12.2	[8.6, 17.0]
	F 50-64	14.2	[7.7, 24.8]	18.8	[14.4, 24.3]
	F 65-74	26.5	[15.9, 40.9]	33.4	[25.8, 42.0]
	M&F 20-74	29.7	[26.2, 33.4]	27.9	[25.8, 30.1]
	M 20-34	44.8	[34.9, 55.1]	37.3	[31.4, 43.5]
Daily smoking	M 35-49	43.6	[33.0, 54.8]	34.2	[28.7, 40.2]
	M 50-64	38.5	[27.6, 50.7]	25.6	[20.8, 31.1]
	M 65-74	18.0	[9.0, 32.6]	23.0	[17.3, 30.0]
	F 20-34	26.4	[18.9, 35.6]	28.2	[23.0, 34.0]
	F 35-49	19.8	[13.5, 27.9]	24.2	[19.4, 29.7]
	F 50-64	27.9	[17.5, 41.5]	20.4	[16.1, 25.5]
	F 65-74	8.0	[2.9, 20.4]	11.2	[7.2, 16.9]
	M&F 20-74	63.2	[59.6, 66.4]	58.3	[56.0, 60.7]
	M 20-34	74.1	[64.3, 81.9]	57.8	[51.8, 63.6]
	M 35-49	64.1	[52.7, 74.1]	52.0	[45.9, 58.0]
Very good or excellent self-reported health	M 50-64	59.3	[46.8, 70.6]	52.7	[46.8, 58.5]
	M 65-74	54.3	[38.8, 69.0]	59.2	[51.6, 66.3]
	F 20-34	72.3	[64.8, 78.0]	55.7	[49.5, 61.7]
	F 35-49	73.1	[63.9, 80.7]	67.4	[61.5, 72.7]
	F 50-64	59.4	[45.6, 71.9]	58.9	[53.0, 64.5]
	F 65-74	49.1	[33.9, 64.4]	58.4	[50.6, 65.7]
	M&F 20-74	16.6	[13.7, 20.1]	30.5	[28.5, 32.7]
	M 20-34	13.4	[7.9, 21.8]	18.5	[14.0, 24.0]
	M 35-49	16.5	[10.3, 25.5]	34.7	[29.2, 40.7]
	M 50-64	14.6	[7.5, 26.4]	34.8	[29.5, 40.6]
Obesity (BMI ≥ 30)	M 65-74	15.0	[6.5, 31.0]	33.2	[26.6, 40.6]
	F 20-34	18.0	[11.2, 27.6]	29.2	[24.0, 35.1]
	F 35-49	20.4	[13.2, 30.0]	29.5	[24.4, 35.3]
	F 50-64	13.3	[6.0, 27.1]	37.6	[32.2, 43.4]
	F 65-74	22.1	[11.7, 37.6]	40.0	[32.8, 47.5]

\* defined by Statistics Canada<sup>13</sup> as household income <\$15,000 for <3 persons, <\$20,000 for 3-4 persons, <\$30,000 for 5+ persons



**Figure 1.** Health risk classification using body measures

Source: Canadian Guidelines for Body Weight Classification in Adults, 2003

both men and women, there appears to be a trend of increased mild obesity with age.

Mean waist circumference and the proportion of respondents with high waist circumference values are shown in Table III by age and sex. For both men and women, waist circumference is greater for persons over age 50 as compared to those under age 50. Overall, 26.8% of the adult population had a high waist circumference.

The level of health risk based on BMI and waist circumference data is shown in Table IV. Over one third of the population (37%) is considered to be at high to extremely high risk for health problems. Among men, there was a large increase in the proportion classified in the three high health risk groupings at age 35. Among women, this increase occurred later, at age 50. More women (12%) than men (5%) were classified in the extremely high risk category with no difference by age. In the high risk and very high risk categories, there was no difference in the percentage of individuals by age or sex. More younger men (18-34 yrs) than older men (>35) were classified in the lowest health risk category (37% vs. 20%). Similarly, more younger women (18-34 yrs) than older women (50+) were classified in the lowest health risk category (42% vs. 23%).

Table V compares the population estimates of obesity using self-reported data from the 1995 PEI sample of the National Population Health Survey (NPHS)<sup>13</sup> and physical measures of height and weight from the PEI Nutrition Survey. Both surveys provide PEI estimates for a variety of

health-related variables, using similar questions. There were no significant differences for all variables assessed, except for the rate of obesity, which was almost double in the PEI Nutrition Survey. Physical measures compared to self-report provide double the estimate of obesity for all age-sex categories except young men aged 20 to 34 years.

## DISCUSSION

Obesity is a serious health problem in Prince Edward Island, affecting almost one third of the adult population. Further, our analysis suggests that self-reported weight and height data result in significant underestimation of the problem of obesity. Although self-reported data on height and weight are commonly used in epidemiological studies, past studies have indicated that both men and women misreport their height and weight,<sup>17,21</sup> leading to a misclassification of the percentage of overweight and obese individuals in the population.

Comparisons of obesity rates with other provincial surveys suggest that the PEI adult population is at considerably higher risk for health-related problems than other Canadians. In Nova Scotia, 22% of the population had a BMI ≥ 30,<sup>22</sup> while in Quebec only 12% of the population was considered to be obese.<sup>23</sup> It is unclear whether these discrepancies reflect provincial differences in food consumption patterns, genetics, and/or physical activity rates, or a temporal shift in obesity rates, since both of these surveys were conducted five years prior to the PEI survey.

There are some limitations to consider when using BMI to assess body fatness and associated health risks. The BMI does not distinguish between body weight from fat and weight from lean body mass<sup>4</sup> and the relationship between BMI and body fat varies with body proportions.<sup>12</sup> This relationship may also vary with age in that the decrease in lean body mass with age may result in lower BMI values for older individuals compared to younger individuals with similar levels of body fat.<sup>12</sup> Finally, misclassification is likely to occur among those with increased weight due to high levels of muscle mass.<sup>17</sup>

When the proportion of the population with elevated waist circumference and BMI was examined to assess health risk, it was found that almost 2 out of every 5 adult Prince Edward Islanders are at "high to extremely high" risk of developing obesity-related health conditions. Thus, the application of the health risk classification categories recommended in the latest Canadian weight guidelines<sup>12</sup> in a population-based sample resulted in the highest prevalence (37%) of health-related risk compared to the use of a single indicators such as BMI alone (31%) or waist circumference (27%). This suggests that past studies using single indicators may have underestimated obesity-related health risk.

Our findings are consistent with PEI's high prevalence of cardiovascular diseases<sup>13</sup> and is likely to be a harbinger of increasing chronic disease burden in the future. This study underscores the need for public health interventions designed to reduce

obesity in adulthood. It has also identified population groups that appear to be at increased health risk, particularly men aged 35 to 49 years. Although more younger men and women are classified in the least health risk category, the finding that almost 25% of men and 33% of women are already at "high to extremely high" health risk by the age of 18 indicates the need for preventive efforts targeting school-aged children. Finally, these findings also highlight the need to collect measured, rather than self-reported, weights and heights in the population, along with actual waist circumference measures, to avoid significant underestimation of the prevalence of obesity in Canada.

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## RÉSUMÉ

**Contexte :** Le taux croissant d'obésité et d'embonpoint constaté au Canada est préoccupant. Malheureusement, nous en savons très peu sur la véritable catégorie de poids des Canadiens et Canadiennes et les risques connexes pour leur santé. En effet, pour la plupart des enquêtes, on n'a recours qu'à des données autodéclarées sur le poids et la taille qui n'incluent généralement pas de mesure de la distribution de la masse adipeuse. Le présent document résume les conclusions de l'enquête sur la nutrition à l'Île-du-Prince-Édouard.

**Méthode :** Nous avons interviewé un échantillon aléatoire de 1 995 adultes âgés de 18 à 74 ans, à leur domicile, et mesuré leur poids, leur taille et leur tour de taille. Nous avons calculé les risques relatifs, les proportions de la population et les intervalles de confiance de 95 % correspondants.

**Résultats :** Globalement, près du tiers des adultes de l'Île sont obèses (IMC  $\geq 30$ ). C'est presque le double des résultats obtenus lors de l'Enquête nationale sur la santé de la population (1995), dont les données sur le poids et la taille étaient autodéclarées. Plus de femmes que d'hommes étaient considérées comme très gravement obèses, bien que, chez les deux sexes, il semble y avoir une tendance à une légère obésité avec l'âge. Lorsqu'on tient compte des mesures de l'IMC et du tour de taille, plus du tiers de la population est jugé à risque élevé ou extrêmement élevé de commencer à avoir des problèmes de santé.

**Conclusions :** Notre analyse suggère que l'utilisation de données autodéclarées sur la taille et le poids entraîne une importante sous-estimation du problème de l'obésité. Étant donné les graves conséquences sur la santé associées à l'obésité, il sera essentiel, dans le cadre des prochaines enquêtes auprès de la population, de mesurer la taille et le poids afin de nous assurer que les interventions en santé publique sont fondées sur des données exactes.