Ontario
Cancer Care Ontario
Action Cancer Ontario

Cancer Risk Factors in Ontario

Body Composition

BODY COMPOSITION

Risk factor/exposure	Cancer	Direction of association	Magnitude of risk*	Strength of evidence[a]
Body fatness	Esophagus[†]	↑	1.55[a]	Convincing
	Colon and rectum	↑	1.10–1.15[a,b]	
	Pancreas	↑	1.14[a]	
	Breast (post-menopausal)	↑	1.13[c]	
	Endometrium	↑	1.52[a]	
	Kidney	↑	1.31[a]	
	Gallbladder[‡]	↑	…	Probable
	Breast (pre-menopausal)	↓	…	
Abdominal fatness	Colon and rectum	↑	1.02[b]	Convincing
	Pancreas	↑	…	Probable
	Breast (post-menopausal)	↑	…	
	Endometrium	↑	…	
Adult weight gain	Breast (post-menopausal)	↑	…	Probable
Adult attained height[§]	Colon and rectum	↑	1.05[b]	Convincing
	Breast (post-menopausal)	↑	1.10[c]	
	Pancreas	↑	…	Probable
	Breast (pre-menopausal)	↑	…	
	Ovary	↑	…	

Sources: [a]WCRF/AICR, 2007; [b]WCRF/AICR, 2011; [c]WCRF/AICR, 2010

* Relative risk (RR) estimate for each: 5 kg/m^2 increase in body mass index (body fatness indicator); 2.5 cm increase in waist circumference (abdominal fatness indicator); 5 cm increase in adult attained height.

…Magnitude of risk not shown in table if strength of evidence is "probable" or "limited."

[†] Adenocarcinoma only.

[‡] Directly, and indirectly through the formation of gallstones.

[§] Unlikely to directly modify cancer risk.

BODY FATNESS

Background

» Body fatness is typically assessed using body mass index (BMI), a measure of weight adjusted for height that is calculated as weight in kilograms divided by height in metres squared (kg/m^2).

» Adult body fatness is frequently classified by the World Health Organization into four broad categories based on the following BMI cut-offs:[46]

Classification	BMI (kg/m^2)
Underweight	< 18.50
Normal range	18.50–24.99
Overweight	≥ 25.00
Obese	≥ 30.00

» Fat is not equally distributed around the body, but rather accumulates subcutaneously in certain parts of the body such as the abdomen. Intra-abdominal fat stores may be a better predictor of chronic disease risk than overall body fatness.[24]

- The evidence is convincing that greater body fatness increases the risk of cancers of the esophagus (adenocarcinoma), colon and rectum, pancreas, breast (post-menopausal), endometrium and kidney, and probable that it increases the risk of gallbladder cancer.[24,38,47] Greater body fatness probably reduces the risk of pre-menopausal breast cancer.[47]
- A positive dose-response relationship is generally apparent for cancers associated with body fatness in adults, even within the range usually considered healthy.
    - For every 5 kg/m^2 increase in BMI within the range considered "normal" and above, risk increases by 50%–55% for esophageal adenocarcinoma and endometrial cancer, roughly 30% for kidney cancer, and 10%–15% for colorectal, post-menopausal breast and pancreatic cancer.[24,38,47]
- For certain cancers, existing evidence suggests that the relationship with body fatness differs by subtype. For example:
    - Cancer of the esophagus: an association is apparent for adenocarcinoma only, while evidence for all types of esophageal cancer combined or squamous cell carcinoma is inconsistent.[24]
    - Cancer of the colon and rectum: the evidence is more consistent and shows a larger increase in risk for colon cancer than for rectal cancer.[38,48,49]
    - Cancer of the breast (pre- and post-menopausal): results from a large meta-analysis[50] and subsequent prospective studies[51–53] suggest that the relationship with body fatness depends on the hormone receptor (estrogen and progesterone) status of the tumour.
- For some cancer sites there is some evidence to suggest that associations with body fatness may differ by sex. For example, a stronger association with BMI for colon and rectal cancers is apparent in men.[38,48] The association between BMI and kidney cancer, on the other hand, appears to be stronger in women.[48,54]
- Evidence suggests that hormone replacement therapy (HRT) used during and/or following menopause modifies the association between body fatness and both post-menopausal breast cancer and endometrial cancer; greater body fatness increases the risk of cancer of the breast (post-menopausal) and endometrium among women who have never used HRT, but the association is generally weaker or null among ever-users.[47,55]

ABDOMINAL FATNESS

- According to the comprehensive World Cancer Research Fund/American Institute for Cancer Research (WCRF/AICR) review, abdominal fatness is a cause of colorectal cancer and probably causes cancers of the pancreas, breast (post-menopausal) and endometrium.[24,38,47]
- For colorectal cancer, a consistent and clear dose-response relationship is observed with both measures of abdominal obesity (waist circumference and waist-to-hip ratio). Colorectal cancer risk is estimated to increase by approximately 2% for every 2.5 cm (1 inch) increase in waist circumference and by roughly 17% for every 0.1 increase in waist-to-hip ratio.[38]

ADULT WEIGHT GAIN

- Existing epidemiologic evidence suggests that weight gain during adulthood is a probable cause of post-menopausal breast cancer.[47]
- There is consistent evidence of a dose-response relationship such that the risk of post-menopausal breast cancer rises with increases in the amount of weight gained during adulthood.[24]

ADULT ATTAINED HEIGHT

- Greater adult attained height is a convincing cause of cancers of the colon and rectum, as well as breast cancer (post-menopausal). It is also probably a cause of cancer of the pancreas, breast (pre-menopausal) and ovary.[24,38,47]
- For cancer sites that have a convincing association with adult attained height, abundant and consistent evidence demonstrates a positive dose-response; each 5 cm (approximately 2 inches) increase in adult attained height increases colorectal cancer risk by 5%[38] and post-menopausal breast cancer risk by 10%.[47]
- The relationship with attained height is stronger for colon cancer than rectal cancer. It is also stronger in men than in women.[38]

BIOLOGIC MECHANISMS

- Several potential mechanisms have been proposed to explain the relationship between body composition and increased cancer risk:[24]
    - Abdominal fatness and obesity are associated with insulin resistance, resulting in excess circulating insulin (hyperinsulinemia) and insulin-like growth factor-1 (IGF-1), which can promote the development of certain cancers.
    - Adipose cells produce hormones, known as adipokines, such as leptin and adiponectin, which may stimulate cell growth.
    - Adipose tissue is the main site of estrogen synthesis in men and post-menopausal women. Excess sex steroids are strongly associated with risk of endometrial and post-menopausal breast cancer.
    - Obesity is characterized by low-grade chronic inflammation, which can promote the growth of cancer cells.
- The biologic mechanisms responsible for a decreased risk of pre-menopausal breast cancer with increasing body fatness are unclear, although various explanations, mostly focusing on endogenous hormone levels, have been proposed.[24]
- Adult attained height is unlikely to directly modify cancer risk. Instead, it is probably a marker for genetic, environmental, hormonal, and/or nutritional factors that affect growth from preconception until adulthood.[24]