Sedentary Behaviour, Visceral Fat Accumulation and Cardiometabolic Risk: A 6-Year Longitudinal Study from the Quebec Family Study

Travis J. Saunders, Mark S. Tremblay, Jean-Pierre Després, Claude Bouchard, Angelo Tremblay, Jean-Philippe Chaput Healthy Active Living and Obesity Research Group, Children's Hospital of Eastern Ontario Research Institute

Abstract

To determine whether sedentary behaviour was associated with increased accumulation of visceral fat or other deleterious cha over a 6-year follow-up period among adult participants in the Quebec Family Study.

Methods: A 6-year retrospective longitudinal study of the Quebec Family Study. Total sedentary time and physical activity were assessed while visceral fat and other markers of cardiometabolic disease risk were directly measured. All variables of interest were collected at bo

Results: Baseline sedentary behaviour was not associated with changes in visceral adiposity or any other marker of cardiometabolic risk entary behaviour were positively associated with changes in waist circumference (p < 0.05). However, there was no association between iour and changes in visceral adiposity or other markers of cardiometabolic risk (p > 0.05).

Conclusion: These results suggest that neither baseline sedentary behaviour nor changes in sedentary behaviour are associated with long adiposity in adult men and women. With the exception of waist circumference, the present study did not find evidence of a relationship betw and any marker of cardiometabolic risk in this population.

Introduction

Sedentary behaviour is consistently associated with increased risk of both obesity an cess sedentary time has also been associated with increased accumulation of centra other markers of cardiometabolic risk [1]. One factor that may link sedentary behaviour with increased morbidity and mortality is the accumulation of visceral adipose tissue, which is prospectively associated with mortality and increased cardiometabolic risk [2].

The purpose of the present study was to determine whether sedentary behaviour was associated with increased accumulation of visceral fat or other deleterious changes in cardiometabolic risk among adult participants in the Quebec Family Study.

Methods

The current study included 123 men and 153 women between the ages of 18 and 65. Total sedentary time and physical activity were assessed using the Bouchard 3-Day Physical Activity Questionnaire [3]. Cross-sectional areas of visceral and subcutaneous abdominal adipose tissue were assessed using computed tomography. Cardiometabolic biomarkers including fasting insulin, glucose, blood lipids, HOMA-Insulin Resistance, and oral glucose tolerance were also measured. All variables of interest were collected at both baseline and follow-up.



Figure 1. Assessment of visceral and subcutaneous abdominal adiposity via computer tomography.

des in cardiometabolic risk
geo in our dono non
ov self-report questionnaire
asolino and follow un
o > 0.05). Changes in sed-
hanges in sedentary behav-
hangee in eedentary seriav
itudinal changes in visceral
veen sedentary behaviour
na mortality. Ex-
al adipacity and
a auposity and

Categorical value	Examples of antipiding	Energy cost in mets from various studies		Median energy cost used	
	Examples of activities	Minimum	Maximum	METS	hcsl/kg/I
1	Sleeping Resting in bed	1.0		1.0	0.26
2	Sitting: eating, listening, writing, etc	1.0	2.0	1.5	0.38
3	Light activity standing: washing, shaving, combing, cooking, etc	2.0	3.0	2.3	0.57
4	Slow walk (<4 km/h), driving, to dress, to shower, etc	2.0	4.0	2.8	0.69
5	Light manual work: floor sweeping, window washing, driving a truck, painting, waiting on tables, nursing chores, several house chores, electrician, barman, walking at 4 to 6 km/h	2.3	5.0	3.3	0.84
6	Leisure activities and sports in a recreational environment: baseball, golf, volleyball, can- oeing or rowing, archery, bowling, cycling (<10 km/h), table tennis, etc	3.0	8.0	4.8	1.2
7	Manual work at moderate pace: mining, car- pentry, house building, lumbering and wood cutting, snow shoveling, loading and unloading goods, etc	4.0	8.0	5.6	1.4
8	Leisure and sport activities of higher intensity (not competitive): canoeing (5 to 8 km/h), bicycling (>15 km/h), dancing, skiing, bad- minton, gymnastic, swimming, tennis, horse riding, walking, (>6 km/h), etc	5.0	н	6.0	1.5
9	Intense manual work, high intensity sport ac- tivities or sport competition: tree cutting, carrying heavy loads, jogging and running (>9 km/h), racquetball, badminton, swim- ming, tennis, cross country skiing (>8 km/ h), hiking and mountain climbing, etc	6.0	~15	7.8	2.0

Figure 2. Activity categories (left) and sample form (right) of the Bouchard 3-Day Physical Activity Questionnaire [3]. For the purposes of this paper, only activities in Category 2 were considered sedentary behaviour.



Figure 3. Changes in visceral adipose tissue cross-sectional area across tertiles of baseline sedentary behaviour (Figure 3A) or change in sedentary behaviour (Figure 3B) were compared by analysis of covariance with adjustment for age, sex, baseline BMI, energy intake, moderate-to-vigorous physical activity, educational level, income, smoking and menopausal status. Data are presented as mean ± standard error. There were no significant differences across tertiles of sedentary behaviour in either analysis.

Results







Table 1. Associations (95% confidence interval) of baseline sedentary behaviour with 6-year change in markers of cardiometabolic disease risk

ľ	Model	LDL-C	
	1	-0.01 (-0.01, 0.01) -	(
	2	-0.01 (-0.01, -0.01)* -	(
	0		
	3	-0.01 (-0.03, 0.01) -	

Model 1: unadjusted. Model 2: adjusted for age and sex. Model 3: adjusted for age, sex, BMI, energy intake, moderate-to-vigorous physical activity, educational level, income, smoking and menopausal status.

After adjustment for age, sex, baseline BMI, physical activity, energy intake, smoking, education, income and menopausal status, baseline sedentary behaviour was not associated with changes in visceral adiposity or any other marker of cardiometabolic risk (p > 0.05). In the model which adjusted for all studied covariates, changes in sedentary behaviour were positively associated with changes in waist circumference (p < 0.05). However, there was no association between changes in sedentary behaviour and changes in visceral adiposity or other markers of cardiometabolic risk (p > 0.05).

Conclusions

These results suggest that neither baseline sedentary behaviour nor changes in sedentary behaviour are associated with longitudinal changes in visceral adiposity in adult men and women. With the exception of waist circumference, sedentary behaviour does not appear to be associated with longitudinal changes in any marker of cardiometabolic risk in this population. These findings suggest that the development of cardiometabolic risk may be due primarily to factors other than self-reported sedentary behaviour.

References

- in children and adults. Am J Clin Nutr 37: 461–467.

Acknowledgements

Financial support for this study and presentation was provided by the Canadian Institutes of Health Research, the Canadian Diabetes Association, the University of Ottawa Faculties of Health Science and Graduate & Postdoctoral Studies, as well as the Healthy Active Living and Obesity Research Group at the Children's Hospital of Eastern Ontario Research Institute.





TG	HOMA-IR	Glucose AUC	Insulin AUC	
0.01 (-0.03, 0.02)	0.02 (-0.01, 0.05)	-0.58 (-4.07, 2.92)	-8.53 (-579.88, 562.82)	

-0.01(-0.03, 0.02)0.03(0.01, 0.05)*0.06(-3.45, 3.57)65.56(-524.90, 656.02)

-0.01 (-0.02, 0.02) 0.01 (-0.07, 0.07) -2.63 (-12.51, 7.25) -1252.36 (-2527.59, 22.86)

1. Wijndaele K, Healy GN, Dunstan DW, Barnett AG, Salmon J, et al. (2010) Increased cardiometabolic risk is associated with increased TV viewing time. Med Sci Sports Exerc 42: 1511.

2. Kuk JL, Katzmarzyk PT, Nichaman MZ, Church TS, Blair SN, et al. (2006) Visceral fat is an independent pre dictor of all-cause mortality in men. Obesity (Silver Spring) 14: 336–341. doi:10.1038/oby.2006.43

3. Bouchard C, Tremblay A, Leblanc C, Lortie G, Savard R, et al. (1983) A method to assess energy expenditure

