COMMENTARY

Tackling the Obesity Pandemic

A Call for Sedentary Behaviour Research

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ABSTRACT

An emerging threat to public health is seen in the dramatic rise in obesity status of Canadians, especially among young people. In addressing the possible factors responsible for these dramatic increases, this paper outlines the importance of understanding sedentariness as an important health behaviour, distinct from physical activity, and identifying the modifiable determinants of sedentary behaviours.

MeSH terms: Obesity; child; television; video games; exercise

RÉSUMÉ

Une menace grandissante pour la santé publique des Canadiennes et des Canadiens est la hausse spectaculaire de l'obésité, particulièrement parmi les jeunes. En étudiant les facteurs qui pourraient en être responsables, cet article décrit l'importance de considérer la sédentarité comme un comportement significatif pour la santé, distinct de l'activité physique, et de répertorier les déterminants modifiables des comportements sédentaires.

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It seems apparent that in many parts of the world, including Canada, we are in the midst of an obesity pandemic,[1,2] although such claims are not without criticism.[3] Among Canadians, the prevalence of obesity (Body Mass Index [BMI] ≥30.0) in adults increased from 13.8% in 1979 to over 23% in 2004,[4] while the largest increases in prevalence occurred among young people (12-17 years of age), tripling from 3% to 9% over the same time period.[5] These data are particularly important because BMI (derived from body weight/height) was objectively assessed and the designation of adolescent obesity was based on age- and gender-specific centile curves (i.e., adult obesity projections), thus providing a more accurate assessment of the population and further adding to the evidence of an emerging health crisis.[6]

In attempting to understand the dramatic increase in adiposity, it has been suggested that since the rate is so severe and sudden, environmental factors and not genetic factors play a greater role.[7,8] Within the environment, it would then follow that we have increased our caloric consumption and/or expended a much lower amount of calories than previous generations. However, reviews concerning energy expenditure and energy intake show discrepant results in support of either position.[9-11] For example, participation rates of physical activity appear to show modest *increases* in recent years;[2,9,12] while population-level data on trends in calorie consumption over the past several decades show either no changes[10] or only modest increases.[13,14]

Sedentary behaviour

The inconsistency of results could be attributed to a lack of accurate and robust measures of energy intake and energy expenditure. This may suggest that the rise in obesity may be partly influenced by a decrease in energy expenditure not measured by current instruments, such as reduced dependence on walking/cycling for transportation, increased use of labour-saving devices in the home and at work, and increased involvement in sedentary behaviours, such as television watching and video game playing.[15] As such, sedentary behaviour should reflect more than the mere absence of activity alone (i.e., not physically active), but specific behaviours (see also computer usage, motorized transportation) of very low to low intensity and

having an approximate MET (multiple of the resting metabolic rate) value <2.0 (i.e., sitting or lying down) but >0.9 (sleeping).[16]

The importance of studying the influence of sedentary behaviours on health is reflected in the following directives and policy statements. "Physical Activity Guides" provided by Health Canada recommend that children and youth increase their levels of physical activity at least 30 minutes per day, but also decrease time spent in specific sedentary activities such as television watching, playing computer games and surfing the internet by at least 30 minutes per day.[17,18] Similarly, the American Academy of Pediatrics recommends limiting media time for children to less than 2 hours per day of quality programming, while children less than 2 years should be discouraged from any viewing time.[19]

These recommendations reflect a growing concern about the total amount of TV/computer usage reported by children, youth and adults, as well as the impact these behaviours have on health. For example, Canadian data show that for the year 2002, the average amount of television watching was over 3 hours per day and increased relatively with age.[20] Canadian youth are also highly involved in screen-based sedentary behaviours, and especially among boys and young men.[21-23] Furthermore, it is estimated that 20 to 30% of Canadian children (11-15 year olds) are watching 4 or more hours of television per day, while large numbers of children are beginning to watch television at an earlier age and in greater amounts, and more Canadian children report playing video games (>4 hours/week) than children from other countries.[24,25] In addition, using computers to access the Internet has increased dramatically among adults (from 1994 to 2000); however the greatest increases appear to be among youth (15 to 24 years of age), from 16.5% in 1994 to 84.5% for the year 2000.[26]

Reducing sedentary behaviour

Support for the health-enhancing benefit of reducing sedentary behaviour comes from a growing body of research that links specific sedentary behaviours to health and physical activity. For example, it appears that reducing the time spent in behaviours involving screen-based entertainment and motorized transport may help, independent of physical activity, attenuate excessive weight gain and reduce the risk of developing cardiovascular disease and diabetes among children and adults.[27-35]

Additionally, experimental studies by Epstein and colleagues showed that obese children (8 to 12 years old) who were reinforced only for being less sedentary (e.g., watching less television/video, playing less computer games) showed equal or better changes in weight or fitness compared to those who were reinforced only for being more physically active.[36] Furthermore, obese children spent more time being physically active when sedentary behaviours were targeted for reduction, which helped improve weight control along with decreased energy intake.[37,38] Other interventions (i.e., school/ primary care setting) exclusively targeting reductions in sedentary behaviour (television viewing, video games) have also shown promising results in reducing adiposity levels[39] and increasing physical activity among youth.[40]

Call for sedentary behaviour research

With the understanding that behavioural interventions aimed at reducing sedentary leisure activities have been beneficial in reducing weight status and improving fitness and physical activity at the individual level, and that sedentary behaviours may be distinctly related to health, it is somewhat surprising that most behavioural research in exercise science continues to focus on what people are not doing (physical activity) rather than what they are doing (sedentary activities). An analogous process would be trying to understand smoking behaviour by looking at the determinants of non-smoking! In agreement with Owen and colleagues,[41] we would argue that sedentary behaviour should be addressed as a problem for research and public health action, in its own right. This also suggests that the determinants of sedentary behaviour may not necessarily be the same as those for physical activity[42,43] and that our theories and models are possibly inadequate for understanding such behaviour. Specifically, we need to move beyond measuring the correlates of physical activity to understand patterns of sedentariness, and build on original research of sedentary behaviour(s) and its relationship to physical activity.[44,45]

Current status

Research into the determinants of sedentary behaviour has just started to develop with studies primarily examining television viewing. In a recent review of correlates of television/video viewing among children and youth (2 to 18 years), variables consistently associated (in expected directions) with TV/video viewing were ethnicity (non-white), parental socio-economic status, body weight, between-meal snacking, number of parents in the house, parental TV habits, and having a TV in one's bedroom.[46] Importantly, few modifiable correlates were identified. Studies of adults have similarly shown how lower socio-economic status is associated with heavy television watching along with other health indicators (e.g., smoking, alcohol consumption).[29,35,47]

Research examining personal or social-psychological influences on sedentary behaviour is extremely limited, with enjoyment emerging as a main predictor from one study of adults.[48] A second investigation that attempted to examine personal or "psychosocial correlates" of sedentary behaviour, tested concerns regarding fitness/health and television viewing time among grade 7 and 10 students in the United States.[49] Results indicated a weak negative or non-association between fitness/health concerns and television viewing. The authors commented on the absence of research regarding the personal determinants (psycho-social correlates) of sedentary behaviour, and called for quantitative and qualitative inquiries to explore the factors that facilitate, motivate and/or reinforce sedentary behaviour among youth. Additionally, the study of sedentary behaviour should go beyond simply media-based behaviours (i.e., TV viewing) and include such modern pastimes as video-game/computer usage among youth and also motorized transport among adults.

CONCLUSION

There is a strong case to consider sedentary behaviour as an important health behaviour that is distinct from physical activity. We urge greater research attention to what we commonly assume Canadians to be doing more of, i.e., engaging in increasing amounts of sedentary behaviour. Research into sedentary behaviour is at an early stage and we actually know very little about the nature of sedentary behaviour, its dimensions, determinants and relationships to important health outcomes. In particular,

we should ask what it is about certain sedentary behaviours that make them more attractive than active pursuits for males and females, and why this preference increases with age for Canadians.

Addressing sedentary behaviour is conceptually important because our theories and models, which are predominantly social cognitive (of physical activity) in nature, are possibly inadequate for understanding inactivity. It is empirically important because we have so little behavioural data about sedentariness. For example, what are Canadians doing, for how long, with whom, when and why? Finally, it is practically important because we may need to develop interventions that principally reduce sedentary behaviour rather than just target increasing physical activity. A complementary research focus on sedentary behaviour is now needed if we are to effectively tackle the pandemic of obesity among youth.

REFERENCES

1. LeBlanc CMA. The growing epidemic of child and youth obesity – Another twist? *Can J Public Health* 2003;94(5):329-30.
2. World Health Organization. Obesity: Preventing and Managing the Global Epidemic: Report of a WHO Consultation on Obesity. Geneva, Switzerland: World Health Organization, 1998.
3. Campos P. *The Obesity Myth.* New York, NY: Penguin Group Inc., 2004.
4. Statistics Canada. Measured Obesity: Adult Obesity in Canada. Nutrition: Findings from the Canadian Community Health Survey. Issue no. 1. 2005. (Catalogue no. 82-620-MWE). Ottawa, ON.
5. Statistics Canada. Measured Obesity: Overweight Canadian Children and Adolescents. Nutrition: Findings from the Canadian Community Health Survey. Issue no. 1. 2005. (Catalogue no. 82-620-MWE). Ottawa, ON.
6. Heart and Stroke Foundation of Canada. Heart and Stroke Foundation Warns Fat is the New Tobacco. Press release. Feb. 10, 2004.
7. Tremblay MS, Willms JD. Is the Canadian childhood obesity epidemic related to physical inactivity? *Int J Obesity* 2003;27:1100-5.
8. Hill JO, Melanson EL. Overview of the determinants of overweight and obesity: Current evidence and research issues. *Med Sci Sports Exerc* 1999;31(11, Suppl 1):S515-S521.
9. Blair SN, Nichaman MZ. The public health problem of increasing prevalence rates of obesity and what should be done about it. *Mayo Clinic Proceed* 2002;77(2):109-13.
10. Jeffery RW, Utter J. The changing environment and population obesity in the United States. *Obesity Res* 2003;11(Suppl. 1):12S-22S.
11. Slyper AH. The pediatric obesity epidemic: Causes and controversies. *J Clin Endocrin Metabol* 2004;89(6):2540-47.
12. Craig CL, Russell SJ, Cameron C, Bauman A. Twenty-year trends in physical activity among Canadian adults. *Can J Public Health* 2004;95(1):59-63.
13. Nielsen S, Siega-Riz A, Popkin BM. Trends in energy intake in the US between 1977 and 1996: Similar shifts seen across age groups. *Obesity Res* 2002;10:370-78.
14. Statistics Canada. Food Statistics 2003, vol. 3, no.2. 2004; Minister of Industry. (Catalogue no. 21-020-XIE.)
15. Stein CJ, Colditz GA. The epidemic of obesity. *J Clin Endocrin Metabol* 2004;89(6):2522-25.
16. Ainsworth BE, Haskell WL, Whitt MC, Irwin ML, Swartz AM, Strath SJ, et al. Compendium of physical activities: An update of activity codes and MET intensities. *Med Sci Sports Exerc* 2000;32(9 Suppl):S498-504.
17. Health Canada. Canada's physical activity guide to healthy active living: Family guide to physical activity for children (6-9 years of age). Available online at: http://www.phacaspc.gc.ca/pau-uap/paguide/child_youth/children/index.html (Accessed December 2004).
18. Health Canada. Canada's physical activity guide to healthy active living: Family guide to physical activity for youth (10-14 years of age). Available online at: http://www.phac-aspc.gc.ca/pau-uap/paguide/child_youth/youth/index.html (Accessed December 2004).
19. American Academy of Pediatrics. Policy statement: Children, adolescents and television. *Pediatrics* 2001;107(2):423-26.
20. Statistics Canada. Television Viewing, fall 2002. *The Daily* November 21, 2003. (Catalogue no. 11-001XIE).
21. Statistics Canada. Youth in Canada, third edition: Target groups project. (Catalogue no. 89-511-XPE) Ottawa, ON: Ministry of Industry, 2002.
22. Gordon-Larsen P, McMurray RG, Popkin BM. Adolescent physical activity and inactivity vary by ethnicity: The National Longitudinal Study of Adolescent Health. *J Pediatrics* 1999;135(3):301-6.
23. Utter J, Neumark-Sztainer D, Jeffery R, Story M. Couch potatoes or French fries: Are sedentary behaviors associated with body mass index, physical activity, and dietary behaviors among adolescents? *J Am Diet Assoc* 2003;103:1298-305.
24. Certain LK, Kahn RS. Prevalence, correlates and trajectory of television viewing among infants and toddlers. *Pediatrics* 2002;109:634-42.
25. WHO. Health and Health Behaviour Among Young People. WHO Policy Series: Health Policy for Children and Adolescents 1: International Report. WHO: Geneva, 2000.
26. Statistics Canada. General Social Survey: Internet Use. *The Daily* March 26, 2001. (Catalogue no. 56F006XIE).
27. Andersen RE, Crespo CJ, Barlett SJ, Cheskin LJ, Pratt M. Relationship of physical activity and television watching with body weight and level of fatness among children: Results from the Third National Health and Nutrition Examination Survey. *JAMA* 1998;279(12):938-42.
28. Dunstan DW, Salmon J, Owen N, Armstrong T, Zimmet PZ, Welbron TA, et al. Physical activity and television viewing in relation to risk of undiagnosed abnormal glucose metabolism in adults. *Diabetes Care* 2004;27(11):2603-9.
29. Hancox RJ, Milne BJ, Poulton R. Association between child and adolescent televiewing and adult health: Longitudinal birth cohort study. *Lancet* 2004,364:257-62.
30. Jakes RW, Day NE, Khaw KT, Luben R, Oakes S, Welch A, et al. Television viewing and low participation in vigorous recreation are independently associated with obesity and markers of cardiovascular disease risk: EPIC - Norfolk population-based study. *Eur J Clin Nutr* 2003;57:1089-96.
31. Kronenberg F, Pereira MA, Schmitz MKH, Arnett DK, Evenson KR, Crapo RO, et al. Influence of leisure time physical activity and television watching in artherosclerosis risk factors in the NHLBI family heart study. *Artheroscl* 2000;153:433-43.
32. Fotheringham MJ, Wonnacott RL, Owen N. Computer use and physical inactivity in young adults: Public health perils and potentials of new information technologies. *Ann Behav Med* 2000;22(4):269-75.
33. Frank LD, Andersen MA, Schmid TL. Obesity relationship with community design, physical activity, and time spent in cars. *Am J Prev Med* 2004;27(2):87-96.
34. Hu FB, Li TY, Colditz GA, Willet WC, Manson JE. Television watching and other sedentary behaviors in relation to risk of obesity and type 2 diabetes mellitus in women. *JAMA* 2003;289(14):1785-91.
35. Salmon J, Bauman A, Crawford D, Timperio A, Owen N. The association between television viewing and overweight among Australian adults participating in varying levels of leisure-time physical activity. *Int J Obesity* 2000;24:600-6.
36. Epstein LH, Roemmich JN. Reducing sedentary behavior: Role in modifying physical activity. *Exerc Sport Sci Rev* 2001;29(3):103-8.
37. Epstein LH, Paluch RA, Gordy CC, Dorn J. Decreasing sedentary behaviors in treating pediatric obesity. *Arch Pediatr Adol Med* 2000;154(3):220-26.
38. Epstein LH, Valoski AM, Vara LS, McCurley J, Wisniewski L, Kalarchian MA, et al. Effects of decreasing sedentary behaviour and increasing activity on weight change in obese children. *Health Psychol* 1995;14:109-15.
39. Robinson TN. Reducing children's television viewing to prevent obesity: A randomized controlled trial. *JAMA* 1999;282:1561-67.
40. Ford BS, McDonald TE, Owens AS, Robinson TN. Primary care interventions to reduce television viewing in African-American children. *Am J Prev Med* 2002; 22(2):106-9.
41. Owen N, Leslie E, Salmon J, Fotheringham MJ. Environmental determinants of physical activity and sedentary behavior. *Exerc Sport Sci Rev* 2000;28:153-58.
42. Gordon-Larsen P, McMurray RG, Popkin BM. Determinants of adolescent physical and inactivity patterns. *Pediatrics* 2000;105(6):1-8.
43. Schmitz KH, Lytle LA, Phillips GA, Murray DM, Birnbaum AS, Kubik MY. Psychosocial correlates of physical activity and sedentary leisure habits in young adolescence: The teens eating for energy and nutrition at school study. *Prev Med* 2002;34:266-78.
44. Marshall SJ, Biddle SJH, Gorely T, Cameron N, Murdey I. Relationship between media use, fatness and physical activity in children and youth: A meta analysis. *Int J Obesity* 2004;28(10):1238-46.
45. Feldman DE, Barnett T, Shrier I, Rossignol M, Abenhaim L. Is physical activity differentially associated with different types of sedentary pursuits? *Arch Pediatr Adolesc Med* 2003;157(8):797-802.
46. Gorely T, Marshall SJ, Biddle SJH. Couch kids: Correlates of television viewing among youth. *Int J Behav Med* 2004;11(3):152-63.
47. Sidney S, Sternfeld B, Haskell WL, Jacobs DR, Chesney MA, Hulley SB. Television viewing and cardiovascular risk factors in young adults: The CARDIA study. *Ann Epidemiol* 1996;6:154-59.
48. Salmon J, Owen N, Crawford D, Bauman A, Sallis JF. Physical activity and sedentary behavior: A population-based study of barriers, enjoyment, and preference. *Health Psychol* 2003;22(2):178-88.
49. McGuire MT, Neumark-Sztainer DR, Story M. Correlates of time spent in physical activity and television viewing in a multi-racial sample of adolescents. *Pediatr Exerc Sci* 2002;14:75-86.

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