

RESEARCH PAPER

High levels of physical activity and obesity co-exist amongst Inuit adults in Arctic CanadaB. N. Hopping,* E. Erber,* E. Mead,* C. Roache[†] & S. Sharma[§]

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Arctic, obesity, chronic disease, Inuit, physical activity.

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Abstract

Background: Existing evidence indicates that Inuit in Arctic Canada are undergoing a lifestyle transition leading to decreased physical activity (PA) and increased body mass index (BMI). Data specific to PA and BMI amongst Inuit in Nunavut, Canada, are currently limited. The present study aimed to characterise current PA and BMI levels in a sample of Inuit adults.

Methods: Inuit adults randomly selected from a cross-sectional survey of three communities in Nunavut, Canada, completed an adapted International Physical Activity Questionnaire (IPAQ) and an anthropometric survey. Data were analysed by gender and age group using standardised IPAQ protocol.

Results: Response rates ranged from 69–93%. Two hundred and eighteen Inuit adults [180 women, 38 men; mean (standard deviation (SD)) ages 42.3 (13.0) and 42.4 (14.8) years respectively; age range 19–89 years] completed the IPAQ. All men and 97% of women allowed height and weight measurements; the remainder were self-reported. Mean (SD) BMI was 27.7 (6.3) kg/m² for males and 30.3 (8.0) kg/m² for females. The largest proportion of women and participants in both age groups had a BMI in the obese category; males were evenly split between the normal and obese categories. Self-reported PA was high, with most men, women and participants ≤50 years in the high category of PA. Participants >50 years were evenly split across the medium and high categories. Most participants (72%) were classified as being overweight or obese, yet reported medium or high levels of PA (89%).

Conclusions: The findings obtained in the present study indicate the co-existence of high BMI and high self-reported PA amongst Inuit adults.

Introduction

Chronic disease risk is lower with adequate dietary intake and physical activity (PA) (Mokdad *et al.*, 2003; Heath, 2009). Inuit of Nunavut, Canada, are a population with historically low prevalence of most noncommunicable diseases, an outcome that is probably a result of the highly physically active nomadic lifestyle and nutrient-dense traditional diet (Kuhnlein *et al.*, 2004; Takano, 2005). During the past 50 years, the nutrition and lifestyle transition of Inuit in the Canadian Arctic has caused a major

shift in both dietary behaviours and PA levels. Overweight and obesity have increased, and several chronic diseases, such as diabetes and cancer, are becoming more prevalent (Circumpolar Inuit Cancer Review Working Group, 2008; Deering *et al.*, 2009; Sarkar *et al.*, 2010). To reverse this health trend before it mirrors that of other Aboriginal populations having undergone a similar transition with negative health effects (Young *et al.*, 2000), measures must be taken to first understand the causes of the trend. Current PA levels and the prevalence of overweight and obesity are two aspects of chronic disease

prevention that should be examined because both are modifiable risk factors for chronic illness (Dyck *et al.*, 1998; Lloyd & Barnett, 2008; Public Health Agency of Canada, 2008a,b).

The health status and related environmental factors facing Inuit in Nunavut have been described elsewhere (Sharma, 2010). With the rising rates of chronic disease, up-to-date anthropometric and PA data are needed to elucidate potential causes of this trend. Data are currently limited for Inuit in Nunavut. The present study aimed to characterise current PA and body mass index (BMI) levels in a sample of Inuit adults.

Materials and methods

Recruitment and data collection

Details on recruitment and data collection are reported elsewhere (Sharma, 2010). In brief, three communities in Nunavut, Canada, were sampled for this study between June and October of 2008. The short form of the International Physical Activity Questionnaire (IPAQ) was adapted for use with Inuit and was used to collect self-reported PA information. Height and weight were measured by trained staff; heights were measured to the nearest centimetre using a stadiometre, and weights were measured to the nearest 1/10 of a pound (50 g) using a digital scale. Institutional Review Board approval was obtained from the Committee on Human Studies at the University of Hawaii and the Office of Human Research Ethics at the University of North Carolina at Chapel Hill, and the Nunavut Research Institute licensed this study.

Statistical analysis

The standard protocol for analysing the IPAQ (IPAQ Research Committee, 2005) was closely followed for this analysis. The protocol suggests truncating minutes of walking as well as minutes of moderate and vigorous PA per day exceeding 180 min (3 h) to be equal to 180 min. Values for 73 participants were truncated. Exclusion criteria were set at a total PA level of more than 960 min (16 h) but, after truncation of the data, no participants fell into this range. Minutes of PA were converted into metabolic equivalents (METs). METs are a measure of PA that relate to the energy expenditure required for each activity, accounting for both duration and intensity. Using established conversions, minutes spent in each level of PA were converted into MET-min per PA level per week. MET-min per week for moderate PA, for example, were calculated using the formula: moderate MET-min per week = 4.0 × moderate-intensity activity min per day × days in which participant engaged in moderate-intensity activities. The constant numbers to determine

MET-min per week for vigorous PA and walking were 8 and 3.3, respectively. Total PA scores were then attributed to each respondent by calculating the sum of MET-min per week spent walking and in moderate and vigorous PA. Finally, PA scores were categorised according to the IPAQ guidelines, which placed individuals with total PA of <600 MET-min per week in the 'low' category, those with scores of 600–2999 in the 'medium' category, and those with ≥3000 MET-min per week in the 'high' category. Participants who declined having their heights (3%) and weights (3%) measured and who self-reported these anthropometric measures instead were included in the study.

BMI (kg/m²) was calculated and adjusted for weight of clothing (1 kg for light clothing, 1.5 kg for medium clothing and 2 kg for heavy clothing). Mean (SD) BMI and MET-min of PA per week were compared by age groups (≤50 years versus >50 years) using Wilcoxon rank sum tests. Additionally, the percentages of participants in each BMI category (underweight/normal = <25 kg/m²; overweight = 25–29.9 kg/m²; obese = ≥30 kg/m²) (World Health Organization, 2000) and each IPAQ PA level (low, moderate, high) (IPAQ Research Committee, 2005) were calculated. The results for men and participants older than 50 years are presented for completion; however, because of the low number of participants in both categories, comparisons across gender and age groups may not be representative. All statistical analyses were performed using SAS statistical software, version 9.1 (SAS Institute, Inc., Cary, NC, USA). All tests and *P*-values were two-sided and were considered statistically significant at $\alpha \leq 0.05$.

Results

Two hundred and eighteen Inuit adults participated in this study; 180 participants (83%) were women, and 38 (17%) were men. The response rates ranged from 69–93% across the three communities. The age range for the study population was 19–89 years; men and women averaged 42.4 (SD = 14.8) and 42.3 (SD = 13.0) years of age, respectively. All men allowed both height and weight measurements, whilst 97% of women allowed both measurements.

Men had an average (SD) BMI of 27.7 (6.3) kg/m², whilst women averaged 30.3 (8.0) kg/m², corresponding to the overweight and obese BMI categories, respectively (Table 1). The mean (SD) BMI of older participants [31.1 (7.9) kg/m²] was also in the obese category, whilst those individuals aged ≤50 years had a mean (SD) BMI categorised as overweight [29.5 (7.7) kg/m²]. The highest percentage of women and participants in both age categories fell into the obese BMI category, whilst the highest

Table 1 Mean (SD) body mass index and frequency (%) of Inuit adults in each body mass index category by gender and age

Body mass index*	Total	Men	Women	P-value	≤50 years	>50 years	P-value
	(n = 218)	(n = 38)	(n = 180)		(n = 169)	(n = 49)	
Mean (SD)	29.9 (7.7)	27.7 (6.3)	30.3 (8.0)	0.10	29.5 (7.7)	31.1 (7.9)	0.17
Normal (<25.0 kg/m ²) [†]	60 (28.2)	13 (34.2)	47 (26.9)		48 (28.7)	12 (26.1)	
Overweight (25.1–29.9 kg/m ²)	60 (28.2)	12 (31.6)	48 (27.4)		51 (30.5)	9 (19.6)	
Obese (≥30 kg/m ²)	93 (43.7)	13 (34.2)	80 (45.7)	0.42	68 (40.7)	25 (54.4)	0.21

*Missing information for five participants.

[†]Only five participants were underweight (≤18.5 kg/m²).

Table 2 Mean (SD) physical activity and frequency (%) of Inuit adults in each physical activity category by gender and age

Physical activity*	Total	Men	Women	P-value	≤50 years	>50 years	P-value
	(n = 218)	(n = 38)	(n = 180)		(n = 169)	(n = 49)	
Mean (SD)	3801 (2256)	5064 (4631)	3525 (2813)	0.16	3995 (3231)	3080 (3283)	0.02
Low [†]	23 (10.9)	2 (5.3)	21 (12.1)		12 (7.2)	11 (24.2)	
Medium [‡]	85 (40.1)	16 (42.1)	69 (39.7)		68 (40.7)	17 (37.8)	
High [§]	104 (49.1)	20 (52.6)	84 (48.3)	0.47	87 (52.1)	17 (37.8)	0.004**

*Missing information for six participants.

[†]Less than 600 metabolic equivalent (MET)-min per week spent walking or in moderate or vigorous physical activity.

[‡]Between 600 and 2999 MET-min per week spent walking or in moderate or vigorous physical activity.

[§]Greater than 2999 MET-min per week spent walking or in moderate or vigorous physical activity.

**Statistically significant at $\alpha \leq 0.05$.

percentages of men were evenly split between the normal and obese categories.

Self-reported PA levels were high in this population of Inuit adults (Table 2). On average, participants spent 3801 (SD = 2256) MET-min walking or in moderate or vigorous PA per week, which corresponds to the highest IPAQ PA level. Participants of both genders and age groups averaged METs in the highest category of PA. The greatest percentages of participants >50 years fell into the medium and high levels of PA, whilst the greatest percentages of younger participants and both genders fell into the high PA category.

Discussion

Amongst Inuit adults who participated in the present study, measured anthropometrics and self-reported PA revealed both high BMI and PA levels. The majority of participants (72%) were classified as being overweight or obese, yet reported medium or high levels of PA (89%).

The results obtained in the present study are in contrast to other reports showing low levels of PA and a lower prevalence of obesity amongst similar Inuit populations. In 2005, 52% of the Nunavut population aged over 12 years reported being physically inactive during leisure

time (Statistics Canada, 2003). Self-reported data collected by the Canadian Community Health (CCH) Survey were used by Sarkar *et al.* (2010) to assess changes in BMI and PA from 2000–2001 to 2005–2006. Study participants in Nunavut, most of whom were Aboriginal, reported an increased prevalence of overweight (28.6–29.8%), obesity (21.4–26.1%) and inactive leisure time (29.0–57.0%). The present study found a similar proportion of overweight but a much greater proportion of obese participants. Self-reported PA as assessed using the IPAQ in the present study yielded greater PA levels than reported in the CCH Survey.

In the present study, BMI was higher than current recommendations (World Health Organization., 2000; Health Canada, 2008a). Statistics Canada compared BMI across the territories and provinces in Canada in 2005 and found that the Northwest Territories and Nunavut, regions with the highest proportion of Inuit inhabitants, had the highest rates of obesity (Human Resources & Social Development Canada, 2008). The strong correlation between BMI and chronic disease (World Health Organization., 2000; Young *et al.*, 2000) indicates that overweight and obesity play a role in chronic disease development in most populations. However, BMI cut-points for 'overweight' (25–29.9 kg/m²) and 'obesity' (≥30 kg/m²) were developed for non-Aboriginal populations and may therefore be unsuitable

for risk assessment amongst Inuit (Charbonneau-Roberts *et al.*, 2005; Young *et al.*, 2007). Body composition, in relation to muscularity and stature, is known to skew BMI calculations and may place individuals in inappropriate BMI categories (Heymsfield *et al.*, 2009). Jørgensen *et al.* (2003) conducted a study comparing metabolic risk factors for obese Greenlandic Inuit and Danes and found that at any given level of obesity, Inuit had lower metabolic disturbances than their European counterparts. Correlations between BMI category and disease risk observed in Caucasian populations may therefore be less applicable to Inuit populations.

Although the IPAQ has been validated in 12 countries, including Canada (Craig *et al.*, 2003), Inuit are a unique population that may not be accurately assessed by this instrument. This hypothesis is supported by the mean reported time spent in PA in the present study being higher than the recommendations for primary chronic disease prevention (CDC, 2008; Public Health Agency of Canada, 2008c). However, the prevalence of chronic disease is rising amongst Inuit (Health Canada, 2008b; Inuit Tapiriit Kanatami, 2008). Although diet and genetics may also play a role in disease development, several factors, including results from other reports (Statistics Canada, 2003), appear to indicate that PA levels may have been over-reported in this study. A validation study of the IPAQ amongst Inuit or the development of a culturally appropriate assessment tool is needed for future PA surveillance in this population.

The primary limitation of the present study was the self-reported nature of the PA data, which may have introduced recall bias. The IPAQ asked participants only about PA in the previous week, which may not be representative of PA throughout all seasons. However, one strength of the present study was the response rate for measuring heights and weights, which was very high (100% and 97% for men and women, respectively) compared with a national survey (Tjepkma, 2006); in the 2004 Canadian Community Health Survey, only 54% of men and 61% of women consented to have their heights and weights directly measured.

In conclusion, the results obtained in the present study indicate a high prevalence of overweight and obesity despite self-reported PA levels in the highest categories. The present study used international instruments and standards for PA and BMI assessment, which may not be appropriate for Inuit. Future studies should therefore investigate methods that may be more suitable for use with Inuit, such as the waist-to-hip ratio as a measure of adiposity and PA monitors as direct measures of PA. There is an additional need to validate the IPAQ for the Inuit population.

Conflict of interests, source of funding and authorship

The authors declare they have no conflicts of interest. The project was supported by American Diabetes Association Clinical Research award 1-08-CR-57, Government of Nunavut Department of Health and Social Services and Health Canada. SS developed the conception and design of the study. CR oversaw all data collection and field activities, and EM was responsible for data collection. BNH and EE contributed to data analysis. All authors were responsible for data interpretation. BNH drafted the manuscript, and all authors critically reviewed its content and have approved the final version submitted for publication.

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