Concurrent Validity of the International Physical Activity Questionnaire (IPAQ) in an Iiyiyiu Aschii (Cree) Community

Grace M. Egeland, PhD¹
Daneen Dénomme, MSc¹

Pierre Lejeune²
Daria Pereg, PhD³

ABSTRACT

Background: Culturally acceptable and validated instruments for assessing physical activity among Indigenous Peoples are lacking. Given the current trends in obesity, health behaviour surveillance tools are needed to evaluate trends and to determine the effectiveness of health promotion efforts aimed at curbing the obesity epidemic.

Objective: To evaluate whether the International Physical Activity Questionnaire (IPAQ) scores correlate with anthropometric indices in an Iiyiyiu Aschii community (Cree Territory of northern Québec, Canada).

Methods: A cross-sectional study was carried out in a Cree community as part of a larger research effort entitled, "Nituuchischaayihitau Aschii: A Multi-Community Environment-and-Health Longitudinal Study in Iiyiyiu Aschii". Randomly selected adult participants (n=161) underwent an anthropometric assessment and answered the IPAQ which was administered by bilingual research assistants. Concurrent validity of the IPAQ was evaluated by the extent to which the physical activity scores were related to anthropometric measures.

Results: Significant inverse correlations were observed between the IPAQ Total MET score and % body fat ($r = -.19$, $p \leq 0.01$) and the IPAQ Vigorous MET score and % body fat ($r = -.26$, $p \leq 0.001$), but not for waist circumference or BMI. Walkers (6-7 days/wk for ≥ 60 minutes/day), however, had a waist circumference that was, on average, 5 cm smaller than non-walkers in age- and sex-adjusted linear regression analyses ($\beta = -4.97$; $SE = 2.5$; $p \leq 0.05$).

Discussion: The results indicate that the IPAQ holds promise as a culturally adaptable questionnaire for the Iiyiyiuch. However, modifications will help improve its acceptability for community members.

Key words: Anthropometry; indigenous populations; motor activity; validity

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

1. Centre for Indigenous Peoples' Nutrition and Environment and School of Dietetics and Human Nutrition, McGill University, Ste. Anne-de-Bellevue, QC

2. Public Health Department, Cree Territory of James Bay, Montreal, QC

3. Unité de recherche en santé publique, Centre Hospitalier Universitaire de Québec, Québec, QC

Correspondence and reprint requests: Grace M. Egeland, Centre for Indigenous Peoples' Nutrition and Environment and School of Dietetics and Human Nutrition, McGill University, Macdonald Campus, 21,111 Lakeshore Rd., Ste. Anne-de-Bellevue, QC H9X 3V9, Tel: 514-398-8642, Fax: 514-398-1020, E-mail: grace.egeland@mcgill.ca

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Physical activity is a protective factor against overweight and obesity,^{1,2} and physical inactivity is associated with increased risk of chronic diseases.³ Culturally validated instruments for assessing physical activity among Indigenous Peoples are needed for health behaviour surveillance and for evaluation of the effectiveness of health promotion efforts. Also, in epidemiologic studies, a valid physical activity instrument can facilitate multidisciplinary research regarding the determinants of health. Because of the lack of internationally comparable physical activity measures that are culturally adaptable, the International Consensus Group developed the International Physical Activity Questionnaire (IPAQ) in 1996.⁴

The primary objective of the current paper was to evaluate the concurrent validity of the IPAQ through evaluating its correlation with anthropometric indices in a Cree population.

METHODS

Study population

A cross-sectional study was conducted in the community of Mistissini, Québec in the summer of 2005 and was coordinated by the Cree Board of Health in collaboration with McMaster, Laval, and McGill universities. A research agreement was developed with the Cree Board of Health and project development and refinements took place in the community. Ethics approval was obtained from participating institutions. Radio announcements and meetings built awareness of the project. Bilingual Iiyiyiuch interviewers conducted recruitment and interviewing. Pregnant women were not eligible to participate. A stratified random sampling design consisting of 4 age strata was used to recruit participants from municipal lists. While the pilot study included children, the current analyses were restricted to adults. A total of 359 adults were randomly selected, of whom 79 were out of town or not able to be reached. Of the resulting 280 potential participants, 62% participated in the study (n=172). Anthropometry and physical activity assessments were available on 161 adults.

IPAQ

There are two versions of the IPAQ: a short and a long version.⁴ The short version of the IPAQ was designed to be used

TABLE I

Means and Standard Deviations (SD) of Anthropometric Indices and Age, and Sex Distribution by Total MET Quartiles and Vigorous MET Tertiles among Adult Iiyiyi Aschii (Cree), Mistissini, 2006

Activity Score	MET Mean (Range)	Age (yrs)	% Female	BMI	% Body Fat	WC
Total MET						
1 (n=35)	1030 (132-1935)	42.2 (18.7)	71.4	33.8 (6.8)	41.1 (10.3)*	108.8 (14.4)
2 (n=42)	3170 (2106-4548)	33.8 (14.2)	66.7	33.4 (6.9)	40.4 (10.0)	107.3 (14.6)
3 (n=42)	6012 (4632-7875)	34.9 (11.0)	61.9	32.2 (6.0)	38.2 (10.5)	106.5 (15.6)
4 (n=42)	11585 (7998-19278)	41.4 (16.6)	47.6	32.9 (6.0)	36.3 (9.7)	108.1 (12.9)
Vigorous MET						
1 (n=72)	0 (0-0)	37.3 (15.8)	73.6 **	33.9 (6.8)	41.6 (10.0)***	108.6 (13.8)
2 (n=48)	1505 (120-3360)	37.8 (15.0)	60.4	32.8 (5.6)	38.7 (8.4)	107.7 (13.1)
3 (n=41)	7152 (3840-10080)	38.9 (16.1)	41.5	31.8 (6.3)	35.0 (11.3)	105.9 (16.5)
Walking						
Non-walkers (n=111)	None to Moderate	40.6 (16.2)*	68.5**	34.1 (6.4)**	41.0 (9.1)**	110.3 (14.5)**
Regular Walkers (n=56)	6-7 days and ≥60 min/day	33.9 (13.5)	46.4	31.4 (6.4)	35.4 (11.0)	104.0 (15.0)

* $p \leq 0.05$; ** $p \leq 0.01$; *** $p \leq 0.001$ from χ^2 test for trend across low to high MET groups or from χ^2 test for differences in proportion between walking and non-walking groups.

in surveillance studies, whereas the long version was designed for research. The long version of the questionnaire was rejected by community members because of concerns regarding the burden of too many questions on participants. Both versions of the IPAQ were designed for culturally appropriate adaptations. Bilingual Iiyiyi research interviewers reviewed the original versions of the IPAQ, suggested culturally appropriate examples of equivalent physical activities which were incorporated into the modified version, translated the questionnaires, conducted all interviews, and provided feedback to the research team regarding their experience administering the survey.

To calculate the volume of types of activities recorded by the IPAQ, respective metabolic equivalent (MET) intensity levels, representing multiples of a resting metabolic rate obtained during quiet sitting at a standard body weight of 60 kg, were taken from the comprehensive compendium of physical activity⁵ and MET minutes/week were calculated based upon published formulas.⁶ All activities and all vigorous intensity activities were summed to provide a total MET and vigorous score, respectively. The questionnaire covered the previous 7 days.

Anthropometric indices

Weight and body fat percentage were measured using a bioelectrical impedance scale (Tanita). Height was measured without shoes to the nearest centimetre with a stadiometer and body mass index (BMI) was calculated (kg/m^2). Waist circumference was measured at the point midway between the iliac crest and the costal margin.

Analyses

Total MET and Vigorous MET scores were evaluated as continuous data and as quartiles for Total METs and as tertiles for Vigorous METs. Due to the distribution of the scores, uneven sample sizes exist in the categories. Also, due to the range of values, MET scores were divided by 100 to facilitate analyses and interpretation. Walking was evaluated as a dichotomous variable indicating a high degree of walking (6-7 days/week for ≥ 60 minutes/day) versus less or no walking activity.

Spearman correlations between the total METs and vigorous METs and BMI, % Body Fat, and waist circumference (WC) were examined. Mean and standard deviations for the anthropometric variables were evaluated by level of total and vigorous METs. Furthermore, because of the potential for differences in the reporting of physical activities by obesity level, analyses were stratified by obesity (BMI < 30 vs. BMI ≥ 30). Multivariable linear regression analyses were conducted to control for age and sex. Interaction terms of sex by activity and obesity by activity level were evaluated. The association between daily walking of 60 minutes or more with the anthropometric variables was evaluated as a means of assessing the validity of the data.

RESULTS

The mean age of adults was 38.4 years ($\text{SD}=15.7$), and 61% of the participants were women. The anthropometric variables all showed a high degree of adiposity in the study population with a mean % body fat of 44.3% ($\text{SD}=6.5$) for women and 30.9% ($\text{SD}=9.3$) for men ($p \leq 0.001$).

Mean BMI was 34.5 ($\text{SD}=6.7$) for women and 31.1 ($\text{SD}=5.7$) for men ($p \leq 0.001$). Central adiposity was also highly prevalent: mean waist circumference was 109.2 cm ($\text{SD}=14.4$) for women and 106.6 cm ($\text{SD}=15.7$) for men.

Total and vigorous MET scores

Significant inverse correlations were observed between the IPAQ Total MET score and % body fat ($r = -.19$, $p \leq 0.01$) and the IPAQ Vigorous MET score and % body fat ($r = -.26$, $p \leq 0.001$). The inverse association between the physical activity scores and % body fat was particularly strong among the 114 individuals with a BMI ≥ 30 kg/m^2 ($r = -0.32$, $p \leq 0.001$ for total MET score; $r = -0.36$, $p \leq 0.001$ for vigorous MET score). Also, total MET and vigorous MET scores were inversely correlated with BMI and WC, but the associations were weak and non-significant ($r < .10$ and $p = 0.10$).

When total MET scores were evaluated as quartiles and vigorous MET scores as tertiles, men were more active and more vigorously active than women, differences which were significant for vigorous activity tertile groups (χ^2 tests for trend for differences in proportion across the three vigorous activity levels, $p \leq 0.01$) (Table I).

Total METs as quartile groups were inversely related to % body fat in univariate analyses based upon χ^2 test for trend across the 4 levels of low to high MET categories ($p \leq 0.01$) (Table I). Similarly, in multivariable analyses adjusting for age, sex, and BMI group (< 30 vs. ≥ 30 kg/m^2), total MET quartiles were significantly and inversely related to % body fat ($\beta = -1.05$; $\text{SE} = .39$; $p \leq 0.01$) (Table II). Total MET

TABLE II

Physical Activity Measures Predict Body Fat % in Multivariable Linear Regression Analyses among Iiyiyiu Aschii (Cree) Adults, Mistissini, 2006

Models	Beta	(SE)
Age (yrs)	.04	(.03)
Sex (Female vs. Male)	11.3	(.91) ***
BMI group (≥ 30 vs. < 30)	11.4	(.92) ***
Total MET Quartiles	-1.05	(.39) **
$R^2 = 0.73$		
Age (yrs)	.04	(.03)
Sex (Female vs. Male)	11.0	(.91) ***
BMI group (≥ 30 vs. < 30)	11.3	(.92) ***
Vigorous MET Tertiles	-1.5	(.54) **
$R^2 = 0.73$		

* $p \leq 0.05$; ** $p \leq 0.01$; *** $p \leq 0.001$

scores evaluated as incremental units of 100 were also inversely related to % body fat adjusting for age, sex, and BMI group ($\beta = -.025$; $SE = .01$; $p \leq 0.01$).

Vigorous METs as tertile groups were significantly inversely related to % body fat in linear regression analyses adjusting for age, sex, and BMI group ($\beta = -1.51$; $SE = .54$; $p \leq 0.01$) (Table II). Vigorous MET scores evaluated as incremental units of 100 were also significantly inversely related to % body fat in multivariable analyses adjusting for age, sex, and BMI group ($\beta = -.033$; $SE = .01$; $p \leq 0.05$).

No significant interaction terms between sex and activity or between BMI group and activity were present. Also, no significant associations between activity scores and BMI or WC were observed in univariate or multivariable analyses.

Walking

A total of 56 individuals (34%) of the adult study population reported a high degree of walking in the previous week (6-7 days/week for 60 minutes or more per day). Walkers were significantly younger, less likely to be female, and had a lower mean BMI, % body fat, and waist circumference (Table I). In multivariable linear regression analyses adjusting for age and sex, walkers had a waist circumference that was 5 cm smaller than non-walkers ($\beta = -4.97$; $SE = 2.5$, $p \leq 0.05$), a non-significantly lower BMI ($\beta = -1.96$; $SE = 1.07$, $p = 0.07$) and lower % body fat ($\beta = -2.5$; $SE = 1.3$, $p = 0.06$) than non-walkers.

Community research assistants' comments on IPAQ

During a debriefing with the research assistants, three points were raised. First, the IPAQ includes the walking questions last and the interviewers felt that the walking

questions should go first to avoid the common occurrence of respondents including walking activities when answering the first part of the questionnaire. Second, many of the activities deemed not intensive enough to make one "out of breath"⁵ were reported as strenuous because obesity makes even light or moderate activities seem strenuous. The third point was that respondents had difficulty quantifying every activity of 10 or more minutes.

DISCUSSION

The IPAQ assesses activity performed in leisure, domestic, and work and transportation-related activities. Studies evaluating the reliability and validity of the IPAQ show that it is comparable to other generally accepted self-reported methods.⁶ Furthermore, the IPAQ has been selected for use in various high-profile studies such as the European Physical Activity Surveillance System, the European Health Interview Survey, the Countrywide Integrated Non-communicable Disease Intervention, and the WHO World Health Survey (WHS).⁴ Furthermore, in an evaluation of construct validity in 2,950 participants from two multiethnic suburban neighbourhoods of Oslo, Norway, significant inverse correlations were observed between IPAQ vigorous, leisure-time, and total PA, and occupational PA in men with waist-to-hip ratio.⁷

Few assessments of validity, however, have been made in high-risk populations. In the Multicenter European obesity project, the short, past 7-day version of the IPAQ was significantly related to the Baecke questionnaire among 757 obese subjects and PA assessed by both tools was inversely related to obesity defined by leptin and % body fat.⁸ However, the IPAQ

did not perform as well as the Baecke in its relationship with abdominal obesity, especially in men. The findings are comparable to the current study among Cree where the IPAQ was significantly inversely related to % body fat but not to waist circumference or BMI. Further evaluation of PA assessment in high-risk populations is warranted and methodology for minimizing misreporting based upon the criteria of being "out of breath" may help improve the validity of PA assessment among obese individuals.

The significant findings associated with walking indicate the quality of the data collected as the benefits of walking are well established. Also, the results indicate that the IPAQ has potential as a surveillance and research tool in Cree communities. The Canadian Population Health Initiative 2004 recommendation for eliciting health benefits from physical activity is to perform greater than 60 minutes of measured physical activity per day.⁹ The IPAQ, however, sums all activities that occurred during the week without considering whether the activities occurred on different days of the week. Modifying the questionnaire to determine whether Canadian guidelines are followed would be worthwhile.

The questions documented activities of 10 or more minutes during the previous week and included all aspects of activities (leisure, domestic, work, transportation). One potential modification to the IPAQ that may make it more acceptable to community members would be to limit the questions to activities of a longer duration of time, such as 20-30 minutes. As activities of longer duration are considered to provide health benefits, this simple modification to the questionnaire would improve acceptability of the instrument while enabling the collection of meaningful data.

Given some of the difficulties experienced in data collection in the Cree community, it is not surprising that among Australian Aboriginals, the IPAQ was poorly received and ultimately abandoned by researchers.¹⁰ More work is needed to ensure the cultural adaptation of the IPAQ for Indigenous Peoples. Cultural adaptation requires conceptual equivalence (i.e., that people attach the same meaning to terms and concepts used⁴); metric equivalence (i.e., that the substitute activities have the same intensity levels as the origi-

nal activities); and linguistic equivalence (i.e., that the meanings rather than the words of the questions are translated appropriately).

In summary, the IPAQ holds promise as a surveillance and research tool for Indigenous Peoples. However, some modifications are warranted.

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RÉSUMÉ

Contexte : On manque d'instruments culturellement acceptables et validés pour analyser l'activité physique chez les peuples indigènes. Il faudrait disposer d'outils de surveillance des habitudes de santé pour évaluer les tendances actuelles de l'obésité et déterminer l'efficacité des mesures de promotion de la santé qui visent à freiner l'épidémie d'obésité.

Objectif : Déterminer si les scores obtenus au questionnaire international d'activité physique (IPAQ) présentent une corrélation avec les indices anthropométriques dans l'Iiyiyu Aschii (un territoire cri du Nord du Québec, au Canada).

Méthode : Nous avons mené une étude transversale dans une communauté crie dans le cadre d'une étude plus vaste intitulée « Nituuchischaayihitaa Aschii: A Multi-Community Environment-and-Health Longitudinal Study in Iiyiyu Aschii ». Des participants d'âge adulte sélectionnés au hasard (n=161) ont fait l'objet d'une évaluation anthropométrique et répondu aux questions de l'IPAQ, lequel a été administré par des adjoints à la recherche bilingues. Pour évaluer la validité concourante de l'IPAQ, nous avons calculé le niveau d'association entre les scores d'activité physique et les mesures anthropométriques.

Résultats : Des corrélations inverses significatives ont été observées entre le score total selon l'IPAQ et le pourcentage d'adiposité ($r=-0,19$, $p\leq 0,01$) et entre le score d'activité physique intense selon l'IPAQ et le pourcentage d'adiposité ($r=-0,26$, $p\leq 0,001$), mais les corrélations observées à l'égard du périmètre ombilical ou de l'IMC n'étaient pas significatives. Cependant, les marcheurs (6 ou 7 jours/sem à ≥ 60 min/jour) avaient un périmètre ombilical qui mesurait en moyenne 5 cm de moins que les non-marcheurs selon les analyses de régression linéaires rajustées selon l'âge et le sexe ($\beta=-4,97$; erreur-type=2,5; $p\leq 0,05$).

Analyse : L'IPAQ est prometteur en tant qu'outil pouvant être adapté à la culture des populations de l'Iiyiyu Aschii. Des modifications contribueraient toutefois à améliorer son acceptabilité pour les résidents.

Mots clés : anthropométrie; populations indigènes; activité motrice; validité