

Validity and reliability of the Baecke questionnaire for the evaluation of habitual physical activity among people living with HIV/AIDS

Validade e reprodutibilidade do questionário Baecke para avaliação da atividade física habitual em pessoas vivendo com HIV/AIDS

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Abstract

This study evaluates the validity and reliability of the Baecke questionnaire on habitual physical activity when applied to a population of HIV/AIDS subjects. Validity was determined by comparing measurements for 30 subjects of peak oxygen uptake, peak workload, and energy expenditure with scores for occupational physical activity (OPA), physical exercise in leisure (PEL), leisure and locomotion activities (LLA), and total score (TS). Reliability was determined by testing and retesting 29 subjects at intervals of 15-30 days. Validity was evaluated with the Pearson correlation and reliability analyses were done using the intraclass correlation, paired Student t-test, and Bland-Altman methods. Peak VO₂ and peak workload had significant correlation with PEL (r = 0.41; r = 0.43; respectively). Energy expenditure had a significant correlation with OPA (r = 0.64). The intraclass coefficients were 0.70 or more for OPA, PEL and TS. There was no difference in OPA, PEL, LLA and TS between the two evaluations. The Bland-Altman methods showed that there was good agreement between the measurements for all habitual physical activities scores. Results show that the Baecke questionnaire is valid for the evaluation of habitual physical activity among people living with HIV/AIDS.

HIV; Acquired Immunodeficiency Syndrome; Antiretroviral Therapy; Validation Studies; Physical Fitness

The use of highly active antiretroviral therapy has brought about a significant increase in survival among people living with HIV/AIDS. However, long-term use of highly active antiretroviral therapy has been associated with morphological body changes including central fat gain, particularly in the abdomen, and peripheral fat loss and with metabolic abnormalities such as hypercholesterolemia, hypertriglyceridemia and glucose intolerance ¹. These disturbances may not only impair the quality of life of these individuals and induce psychological distress, but also represent an important medical concern in regard to the increased risk of cardiovascular disease development. Physical activity is known to be a protective factor against cardiovascular diseases and may contribute towards reducing obesity and fat metabolism disturbances in the population at large ².

Even though several methods for assessing habitual physical activity are available, standardized questionnaires are the most feasible in epidemiological studies ³. Various questionnaires have been proposed in the literature with this purpose ⁴, but so far there is no evidence that these tools might be specifically useful for the evaluation of physical activity in people living with HIV/AIDS. Given that this type of investigation may be helpful in the long-term monitoring of side effects in the clinical follow-up of patients under highly active anti-

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retroviral therapy, it is therefore necessary to determine viable methods for assessing habitual physical activity within this group, taking their lifestyle characteristics into consideration.

The Baecke questionnaire⁵ is an instrument that evaluates habitual physical activity over the previous 12 months. It is easily applied and understood, making use of qualitative and quantitative scales to assess the magnitude of occupational physical activity, physical exercise in leisure, and leisure and locomotion activities. This questionnaire has already been validated and used in an epidemiological study in Brazil^{6,7}. The aim of the present study was to assess the validity and reliability of the Baecke questionnaire for the evaluation of habitual physical activity among people living with HIV/AIDS.

Methods

The study was conducted from October 2001 to June 2002 at the Casa da AIDS (AIDS Clinic), a health unit linked to the Departamento de Doenças Infecciosas e Parasitárias, Faculdade de Medicina, Universidade de São Paulo (Department of Infectious Diseases of the School of Medicine, University of São Paulo). This center for multidisciplinary healthcare and research is located in the central region of the city of São Paulo, Brazil and provides care for 4,000 registered outpatients with HIV/AIDS. Sample size was 25 subjects and was estimated assuming a 0.5 correlation coefficient, $\alpha = 5\%$ and $\beta = 20\%$. This value (0.5) is the mean of the correlation coefficients reported for several studies that correlated the maximum oxygen uptake with Baecke habitual physical activities scores^{8,9,10}.

The subjects were selected with a consecutive sampling strategy. The first six patients who attended the clinic in each period (morning, afternoon and evening) were invited to take part in the study and were interviewed by two specifically trained students, to obtain responses for the Baecke questionnaire and a questionnaire concerning sociodemographic variables (on the same day). Following this, weight and height measurements of all patients were performed by a physical education professional. In addition, an energy expenditure diary was given to participants, who were instructed to fill it out over the subsequent week. Cardiopulmonary exercise testing (ergospirometry) was scheduled for the week following physical evaluation. Fifty-three subjects were invited to participate in the study, with 30 of them participating in the validation and 23 not

participating in the validation but returning after 15 to 30 days to participate in the reliability assessment. These 23 individuals did not take part in both the validation and the reliability assessment for lack of time and interest. From the 30 subjects participating in the validation, 15 filled out the diary and performed the ergospirometry, 9 just performed the ergospirometry, and 6 just filled out the diary. Because of this, the sample size for validation using the diary was 21 (15+6) and the sample size for the validation using the fitness test was 24 (15+9). From the 30 subjects in the validation, 6 returned after 15 to 30 days and answered the Baecke questionnaire again. Because of this, the sample size for reliability was 29 (23+6).

The present study was approved by the Research Ethics Committees of all the institutions involved in the study, and informed consent was obtained from all subjects before admission to the study.

Habitual physical activity questionnaire

The Baecke questionnaire consists of 16 questions involving three habitual physical activity scores relating to the previous 12 months: (1) occupational physical activity, consisting of eight questions, (2) physical exercise in leisure, consisting of four questions, and (3) leisure and locomotion activities, consisting of four questions. The total score for habitual physical activity is obtained by adding occupational physical activity + physical exercise in leisure + leisure and locomotion activity scores. The instrument had already been translated into Portuguese and applied to a Brazilian population^{6,7}.

Cardiopulmonary exercise testing

Maximum exercise capacity was determined with a ramped protocol using an electromagnetically braked cycle ergometer (Cardio Control Ergometer EGT 1500), with work rate increments of 15 watts every minutes at 60 rotations per minute until exhaustion. Oxygen uptake (VO_2) and carbon dioxide production were determined by means of gas exchange on a breath-by-breath basis in a computerized system (CAD/Net 2001, Medical Graphics Corporation, St. Paul, USA). Peak VO_2 was defined as the maximum attained oxygen uptake at the end of the exercise period in which the subject could no longer maintain the cycle ergometer velocity at 60 rotations per minute. High values of peak VO_2 and of peak workload are indicative of good physical fitness and are correlated with the level of leisure activities^{3,4,11}.

Anthropometry

Weight was measured using a Filizola electronic scale and height was measured using a tape attached to the wall of the physical evaluation room. A single measurement was made for weight, and three measurements were made for height with the adoption of the mean value.

Energy expenditure diary

The Bouchard three-day energy expenditure diary¹² was used as the physical activity index. Diaries were kept for two weekdays and one weekend day. The mean weekly energy expenditure was calculated as kilocalories per week. The energy expenditure is determined by all the activities that one does during the day (occupational and leisure)^{3,4,12}.

Statistical analysis

The Pearson correlation coefficient (r) was calculated between habitual physical activity scores and peak VO_2 , peak workload and energy expenditure. All variables were evaluated regarding goodness-of-fit for normal distribution (Kolmogorov-Smirnov test). The intraclass correlation coefficient (r_{icc}), the paired Student t -test and the Bland-Altman methods were used to determine reliability.

Results

The mean age was 37.2 years (range: 26.0-49.5 years) and the mean education level was 14.4 years (range: 6.5-26.0 years).

The physical exercise in leisure score showed a correlation with peak VO_2 and with peak workload (Table 1), but there was no significant correlation between leisure and locomotion activities,

occupational physical activity, or total score with peak VO_2 .

There was a significant correlation between occupational physical activity score and energy expenditure. There were no correlations between energy expenditure with physical exercise in leisure, leisure and locomotion activities, or total score.

The intraclass correlation coefficients were significant for test and retest for all habitual physical activities scores, and the highest magnitudes were observed for occupational physical activity, total score, and physical exercise in leisure (Table 2). No differences in the means were observed between test and retest among the habitual physical activities scores. The Bland-Altman methods showed that there was good agreement between the measurements for all habitual physical activities scores (Figures 1 and 2).

Discussion

There is still no gold standard for the validation of habitual physical activity questionnaires.

Table 1

Pearson correlation coefficients as validation measures between habitual physical activity scores and physical fitness and physical activity variables.

Scores	Peak VO_2 (ml/kg/min)	Peak workload (watts)	Energy expenditure (kcal/week)
	$r(p)$	$r(p)$	$r(p)$
Occupational physical activity	-0.14 (0.521)	0.02 (0.938)	0.64 (0.002)*
Physical exercise in leisure	0.41 (0.045)*	0.43 (0.036)*	-0.11 (0.627)
Leisure and locomotion activities	0.19 (0.362)	0.13 (0.553)	-0.06 (0.785)
Total score	0.27 (0.227)	0.30 (0.148)	0.24 (0.293)

* Significant correlation at $p < 0.05$.

Table 2

Paired t -test and intraclass correlation coefficients as reliability measures between mean (\pm SD) physical activity scores.

	Measure 1	Measure 2	T-test (P)	Correlation (r_{icc})
Occupational physical activity	2.62 \pm 0.53	2.71 \pm 0.56	0.128	0.85*
Physical exercise in leisure	2.27 \pm 0.68	2.38 \pm 0.58	0.227	0.70*
Leisure and locomotion activities	2.60 \pm 0.55	2.65 \pm 0.46	0.672	0.44*
Total score	7.27 \pm 1.18	7.50 \pm 1.27	0.178	0.72*

* Significant correlation at $p < 0.05$.

Figure 1

Analysis of reliability of occupational physical activity score and leisure and locomotion score for the Bland Altman method.

Figure 1a

Occupational physical activity score

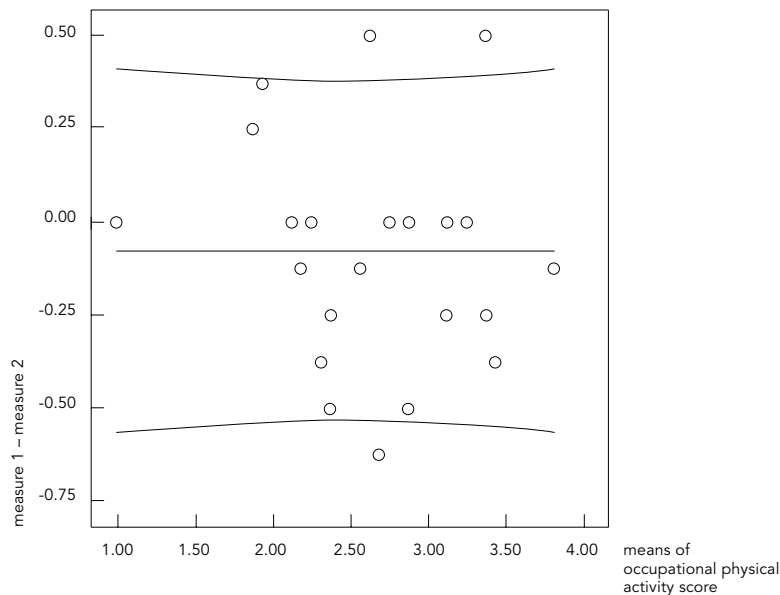
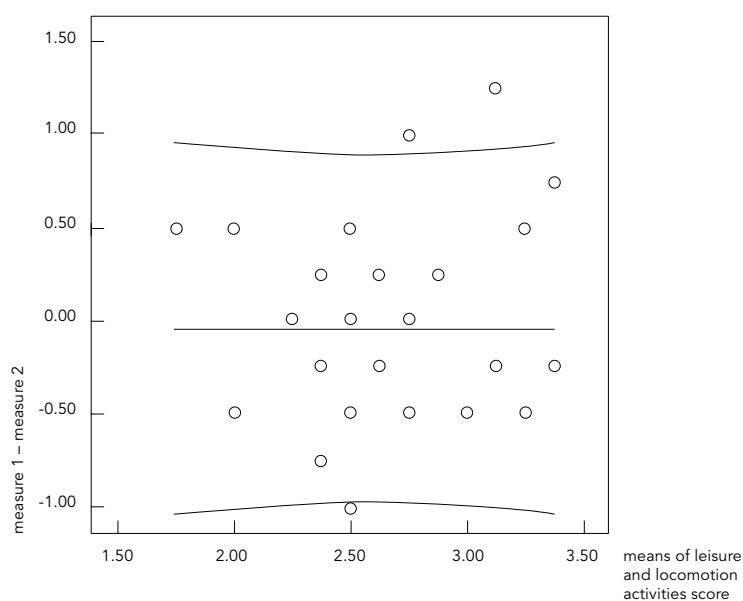


Figure 1b

Leisure and locomotion score



Methods such as the measurement of energy expenditure using doubly labeled water or an accelerometer have been used in validation studies. However, these techniques are not always feasible, since the former method is extremely expensive and the latter requires optimal patient cooperation in the use, handling, and return of the devices. The Bouchard three-day energy expenditure diary serves as an adequate alternative for measuring current physical activity, as subjects simply record their activities over a short period of time (two weekdays and one weekend day).

Maximum oxygen uptake has been used for physical fitness measurement among HIV/AIDS subjects in Brazil¹³ and also as a standard measurement for the validation of habitual physical activity questionnaires⁴. This measurement is closely related to energy expenditure¹¹ and collection of such data is not time-consuming, as the subject is asked to come to the laboratory just once to perform the test.

In our study, the physical exercise in leisure score had a significant correlation with peak VO_2 ($r = 0.41$). Similar results were obtained in relation to the correlation of physical exercise in leisure with peak VO_2 ($r = 0.47$) in a study among Belgian men⁸, and with maximum oxygen uptake ($r = 0.52$) in a study among American women and men⁹. In an analysis of a modified Baecke questionnaire, correlation coefficients of 0.45 and 0.67 were obtained for American women and men, respectively¹⁰.

In contrast, we were not able to demonstrate significant correlation between peak VO_2 and leisure and locomotion activities, occupational physical activity, or the total score ($r = 0.19$, $r = 0.14$ and $r = 0.27$, respectively). There is general agreement that peak VO_2 , as a measurement of physical fitness, is a better discriminator of physical exercise than of other types of physical activity. Indeed, previous studies have found low correlations between leisure and locomotion activities and occupational physical activity or maximum oxygen uptake^{8,9,14}.

In our study, the correlation between peak workload and physical exercise in leisure was significant ($r = 0.43$), in contrast to occupational physical activity, leisure and locomotion activities, or the total score ($r = 0.02$, $r = 0.13$ and $r = 0.30$, respectively). These results are similar to those obtained for peak VO_2 . Likewise, Jacobs et al.⁹ studied maximum workload in treadmill exercise testing and its relation with Baecke scores among American adults, obtaining a correlation coefficient of $r = 0.57$ with regard to the physical exercise score and of $r = 0.33$

as far as the leisure and locomotion activities score is concerned.

Using the analysis of the energy expenditure diary as the standard, we observed a significant correlation between energy expenditure and the occupational physical activity score. It is interesting to point out that the magnitude of such a correlation still remains controversial in the literature. Ainsworth et al.¹⁵ did not detect a significant correlation between energy expenditure recorded in a 48-hour diary and the occupational physical activity score of the modified Baecke questionnaire. However, a significant correlation with the occupational physical activity score was obtained among Belgian men when doubly labeled water ($r = 0.52$)¹⁶ and movement sensors ($r = 0.42$)⁸ were used as standards.

In the present study, physical exercise in leisure, leisure and locomotion activities, and the total score were not correlated with the 72-hour diary instrument that was used as the standard. Other investigators, however, obtained a significant correlation between the energy expenditure diary and the leisure and locomotion activities score for American women ($r = 0.42$) and men ($r = 0.37$)¹⁰ and the total score for Dutch women and men ($r = 0.52$)¹⁴. Significant correlation between leisure and locomotion activities and movement sensors ($r = 0.28$)⁸ and doubly labeled water ($r = 0.50$)¹⁶ were obtained among Belgian men.

We speculate that the low correlation found in our study might reflect the fact that information collected by the 3-day diary may not be fully representative of the habitual physical activities in the previous 12-month period. Ideally an instrument could be used to measure the physical activity at different time points along the year, as done by Pols et al.¹⁴ in a study with adult and elderly Dutch women.

In the reliability assessment we found strong correlation, especially for occupational physical activity ($r_{icc} = 0.85$), physical exercise in leisure ($r_{icc} = 0.70$), and the total score ($r_{icc} = 0.72$), but not for leisure and locomotion activities ($r_{icc} = 0.44$). Several previous studies have shown good reliability for Baecke scores. Test and retest after a 30-day interval yielded $r = 0.74$ for the occupational physical activity score among American women and men¹⁵ and $r_{icc} = 0.95$ for Belgian men¹⁷. As for the physical exercise in leisure score, age-adjusted values of $r = 0.92$ and $r = 0.88$ were obtained for American men and women, respectively¹⁰, and $r = 0.93$ was obtained for Belgian men¹⁷. The total score yielded $r_{icc} = 0.93$ for American women and men⁹ and $r_{icc} = 0.86$ for Belgian men¹⁷.

Figure 2

Analysis of reliability of physical exercise in leisure score and total score for the Bland Altman method.

Figure 2a

Physical exercise in leisure score

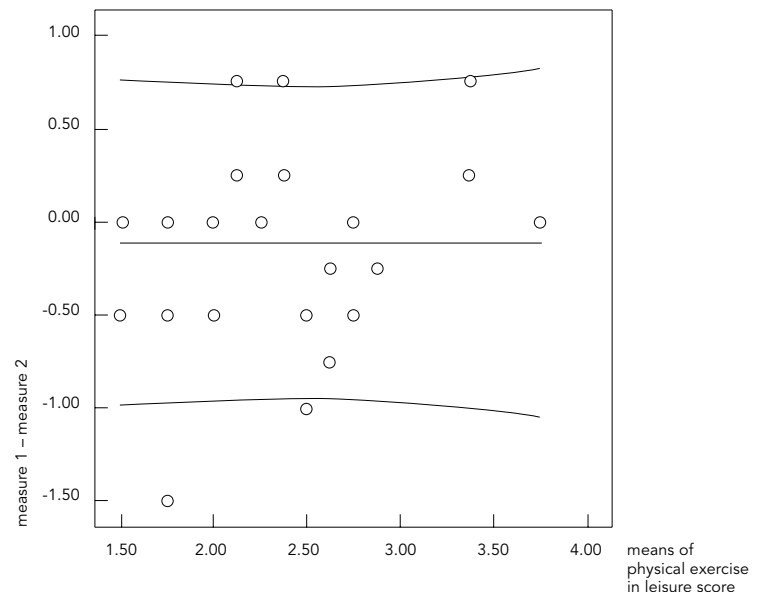
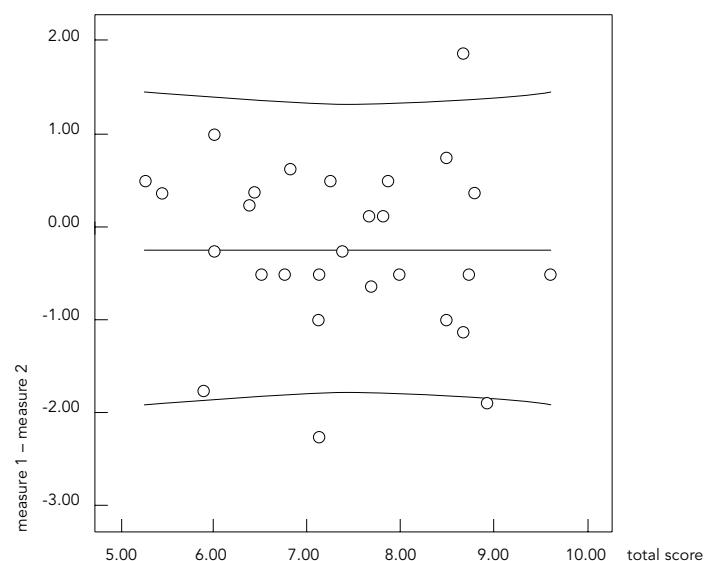


Figure 2b

Total score



Scores analyzed after an interval of 15 days did not present marked changes, as shown for Belgian men, with values of $r_{icc} = 0.88$ for occupational physical activity, $r_{icc} = 0.79$ for physical exercise in leisure, and $r_{icc} = 0.74$ for the total score¹⁶. These results regarding the reliability of occupational physical activity, physical exercise scores, and the total score are similar to those obtained in our study of men and women living with HIV/AIDS.

The leisure and locomotion activities scores obtained for these individuals were low and differed from those published for other studies. This low reliability may be due to the fact

that activities such as walking, bicycling for leisure, and locomotion may vary daily, depending on a number of variables, such as weather conditions, traffic, and other infra-structural elements¹⁸. However, the Bland-Altman methods showed the leisure and locomotion score had a good agreement.

We conclude that even though certain differences were found between results obtained from the Baecke questionnaire in comparison with reference methods, these discrepancies do not hamper the validity of this questionnaire for the evaluation of habitual physical activity among people living with HIV/AIDS.

Resumo

Verificar a validade e reprodutibilidade do questionário Baecke de avaliação da atividade física habitual para portadores do HIV/AIDS. Foram estudadas trinta pessoas na análise da validação. Os escores de atividade física ocupacional (AFO), exercício físico no lazer (EFL), atividades de lazer e locomoção (ALL) e escore total (ET) foram comparados com o consumo de oxigênio de pico, carga de pico e gasto energético. Na análise da reprodutibilidade, foram estudadas 29 pessoas (intervalo entre 15-30 dias). O coeficiente de correlação de Pearson foi utilizado para validação. O coeficiente de correlação intraclasse, teste t-pareado e Bland-Altman foram utilizados para reprodutibilidade. O VO_2 pico e a carga de pico foram correlacionados, significativamente com o EFL ($r = 0,41$; $r = 0,43$, respectivamente). O gasto energético foi correlacionado, significativamente, com o AFO ($r = 0,64$). Os coeficientes de correlação intraclasse foram de 0,70 ou superiores para AFO, EFL e ET. Não houve diferenças significativas nas médias dos escores entre as duas medidas, e o método de Bland-Altman mostrou boa concordância para todos os escores. O questionário Baecke mostrou-se válido para avaliação da atividade física habitual em portadores do HIV/AIDS.

HIV; Síndrome de Imunodeficiência Adquirida; Terapia Anti-retroviral; Estudos de Validação; Aptidão Física

Collaborators

A. A. Florindo wrote the present work; M. R. D. O. Latorre contributed to statistical analyses and validation terminologies; E. C. M. Santos contributed to discussions about measures of physical activity and energy expenditure (Baecke questionnaire of physical activity and Bouchard diary of energy expenditure); C. E. Negrão and L. F. Azevedo contributed to discussions of physiological measures (ergospirometry); A. A. C. Segurado contributed to specific discussions about the HIV/AIDS disease.

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