

The construct validity of the Ricci-Gagnon questionnaire to assess physical activity level: a prospective study

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ABSTRACT

Background: The physical activity level of individuals has gained interest in the medical field in the last decades. It can be assessed using validated questionnaires. The Ricci-Gagnon questionnaire has been designed for this purpose but has never been validated. The aim of this study was to verify the construct validity of the Ricci-Gagnon questionnaire to assess physical activity level. **Method:** Healthy participants completed the Ricci-Gagnon questionnaire and the International Physical Activity Questionnaire (IPAQ) short form reflecting the physical activity level as the evaluated construct. The questionnaires were scored as recommended. **Results:** Results were analysed for 93 participants. Age was inversely correlated to the Ricci-Gagnon ($\rho = -0.223$, $p = 0.033$) and IPAQ scores ($\rho = -0.206$, $p = 0.049$). Only the score for vigorous intensity activities in the IPAQ was inversely correlated with age ($\rho = -0.412$, $p < 0.001$). Logarithmic regression showed that the Ricci-Gagnon questionnaire predicted the physical activity level determined by the IPAQ short-form whatever the age-group. However, the coefficient of determination indicated that the variability in the dependent variable was explained by the logarithmic relationship with the independent variable, mainly for the 20-39 age-group ($F=40.378$, $R^2=0.582$, $p<0.001$). This relationship was poorly explained for the 40-59 years ($F=4.209$, $R^2=0.123$; $p=0.049$) and the 60-80 years age-groups ($F=11.567$, $R^2=0.300$, $p=0.002$). Agreement between the 2 questionnaires for physical activity level was poor ($K = 0.203$, 95%CI: 0.050 to 0.356, $p=0.001$) and age-group influenced the agreement. **Conclusion:** The Ricci-Gagnon questionnaire has construct validity for the assessment of physical activity level in people under 40 years old.

KEYWORDS: physical activity, assessment, Ricci-Gagnon questionnaire, international physical activity questionnaire short-form, construct validity

Introduction

Physical activity is defined by the World Health Organization (WHO) as “any bodily movement produced by skeletal muscles, that requires energy expenditure” [1]. It includes leisure time, transport, and work. Physical activity level is related to the health-related quality of life of adults [2, 3]. As such, the World Health Organisation has defined a mini-

mal recommended daily physical activity level. Regular physical activity prevents and reduces the risk of various medical conditions affecting quality of life and mortality, such as hypertension, coronary heart disease, stroke, diabetes, breast and colon cancer, and depression [4, 5, 6, 7]. The benefits of physical activity are non-linearly related to the level of physical activity [8]. This means that the reduction in the relative risk of mortality continues to increase with higher volumes of physical activity. All these elements justify the need for tools to assess physical activity level.

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Physical activity level can be assessed using objective or subjective

Table 1 Participant characteristics and test scores

	Total (n=93)	20-39 years (n=31)	40-59 years (n=32)	60-80 years (n=30)	comparison by age-group (p-value)
Characteristic					
Age (years)	56.1 (23.3-87.4)	25.3 (23.3-40.2)	56.3 (44.8-60.2)	73.7 (63.2-87.4)	0.001 ^{a,b,c}
Sex ratio (M/F)	40/50	18/13	8/24	14/16	0.025
30s STST (repetitions)	16.5 (8-30)	21 (9-28)	17.5 (11-30)	12 (8-30)	0.001 ^{b,c}
Ricci-Gagnon Questionnaire					
Total score (points)	25 (11-36)	29 (13-36)	24 (12-35)	23 (11-35)	0.070
Inactive/Active/Very active (n)	18/70/5	3/25/3	8/23/1	7/22/1	0.430
IPAQ Short-Form					
Total score (MET-min/week)	1958 (258-9546)	2265 (370-9546)	2189 (258-7662)	1386 (330-6396)	0.129
Low/Moderate/High level (n)	9/54/30	2/18/11	4/18/10	3/18/9	0.911

^a:20-40 years. vs 40-60 years ; ^b:40-60 years vs 60-80 years; ^c:20-40 years vs 60-80 years

measurements. Objective measurements quantify energy expenditure using physiological parameters (e.g., heart rate or oxygen consumption), or body movement (accelerometry or, multi-sensor measurements). Subjective measures include diaries and self- assessment questionnaires. As with all measurement tools, questionnaires require validation before use. Many questionnaires are available for use in children and adults [9]. Unfortunately, they are not all fully validated. The COnsensus-based Standards for the selection of health status Measurement Instruments (COSMIN) describes the whole process of validation [10], from linguistic validation to the verification of psychometric properties [11].

The International Physical Activity Questionnaires (IPAQ) that includes 4 different questionnaires is the reference questionnaire for physical activity assessment [12]. However, this questionnaire has several disadvantages: the need to rate the overall activity intensity, the difficulty for the individual to quantify the number of hours of physical activity and the complex scoring system [13]. The Ricci-Gagnon questionnaire has been developed in French and is frequently used in French speaking countries. Unfortunately, it has never been validated. Construct validity, which is the degree to which the scores of a questionnaire are consistent with hypotheses based on the assumption that the questionnaire validly measures the construct to be measured, should be evaluated for this questionnaire [11].

The aim of this study was to verify the construct validity of the Ricci-Gagnon questionnaire to assess physical activity level. We assumed that the IPAQ-short form measures physical activity (the evaluated construct).

Method

Subjects

This prospective observational study followed the Statement for Strengthening the Reporting of Observational studies in Epidemiology (STROBE). Participants were prospectively recruited in the street in December 2019. The inclusion criteria were aged over 18 years, native French-speaking, literate, with no chronic disease and not taking any medication (based on self-declaration). The exclusion criteria were any physical incapacity or cognitive disorder. Three groups were constituted by age (20-39, 40-59, and < 60 years) to ensure a homogeneous age distribution in the total sample. All participants performed a 30s sit-to-stand test (STST). This test has been validated to quantify functional lower limb strength in people with COPD [14, 15]. The study was approved by the regional

Ethics Committee from Cliniques universitaires Saint-Luc and Université Catholique de Louvain in Brussels (2018/04JUL/274) and followed the current guidelines for Clinical Good Practice. All participants provided written informed consent for participation.

Design

Participants completed the 2 self-report questionnaires assessing physical activity: the Ricci-Gagnon questionnaire as the evaluated questionnaire and the IPAQ-short form reflecting physical activity level as the evaluated construct.

Ricci-Gagnon questionnaire This questionnaire includes 9 questions assessing habits related to physical activities (Appendix 1). Sedentary behaviour (1 item), leisure activities (including sport) (4 items) and activities of daily life (4 items) are assessed. Scores for each question range from 1 to 5 points and the total score ranges from 9 to 45 points. The higher the total score, the greater the physical activity level. A total score > 18 points is considered as inactive, between 18 and 35 points as active and > 35 points as very active.

IPAQ short-form This questionnaire is valid and reliable in French [12]. It includes 4 sets of questions about the number of days and time spent performing moderate (4 MET) or vigorous intensity (8 MET) physical activity and walking (3.3 MET) for at least 10-min at a time during the last 7 days. The total score is expressed as MET-min per week. Three categories are defined:

- High level if vigorous-intensity activity on at least 3 days and accumulating at least 1500 MET-minutes/week, or 7 or more days of any combination of walking, moderate-intensity or vigorous intensity activities achieving a minimum of at least 3000 MET-minutes/week.
- Moderate level if 3 or more days of vigorous activity of at least 20 minutes per day, 5 or more days of moderate-intensity activity or walking of at least 30 minutes per day, or 5 or more days of any combination of walking, moderate-intensity or vigorous intensity activities achieving a minimum of at least 600 MET-min/week.
- Low level if none of the above categories. The IPAQ short-form was self-completed by all participants using the standardised instructions provided with the questionnaire.

Statistical analysis The sample size was calculated using a correlation coefficient of 0.30 (corresponding to the median value of all the coef-

ficients found in the different IPAQ short-form validation studies [9]), with a power of 80% and an alpha level of 0.05. A 10% missing data rate by group was used. The number of required participants was 33 per group. Data were analysed using SPSS 27.0 for Windows (IBM Software). A descriptive analysis was done for participant characteristics and the results of the 2 questionnaires. Results are described in tables using the median, minimum and maximum, and the 95% confidence interval. A ceiling or floor effect was respectively considered if more than 15% of participants achieved the highest or the lowest possible score [16]. Because of the distribution of the results for the 2 questionnaires, a logarithmic regression was used to verify the construct validity of the Ricci-Gagnon questionnaire to assess overall physical activity level. The coherence between the activity level categories was verified using Cohen's kappa coefficient (k). This was run to determine if there was an agreement between the physical activity levels measured by the 2 questionnaires. The level of agreement was determined according to the guidelines from Altman [17] as follows: 0-0.20 = poor; 0.21-0.40 = fair; 0.41-0.60 = moderate; 0.61-0.80 = substantial; 0.81-1.00 = almost perfect. The percentage of exact agreement was calculated and corresponded to the percentage of participants who were assigned the same physical activity level category by both questionnaires. Data by age-group were compared using an ANOVA or a Chi-squared test. A p -value < 0.05 was considered as statistically significant

Results

Ninety-nine participants were consecutively recruited. Six were subsequently excluded because of physical incapacity ($n = 3$) or incomplete questionnaires ($n = 3$). The characteristics of the sample and the results are shown in (Table 1). Functional lower limb strength was reduced in the 2 older age-groups. No ceiling or floor effect occurred. The total score obtained using the Ricci-Gagnon questionnaire decreased with increasing age-group although the total weekly physical activity level was not different. Age was inversely correlated with the Ricci-Gagnon ($\rho = -0.223$, $p = 0.033$) and IPAQ short-form scores ($\rho = -0.206$, $p = 0.049$). Only the score for vigorous intensity activities in the IPAQ short-form was inversely correlated with age group ($\rho = -0.412$, $p < 0.001$).

The logarithmic regression showed that the Ricci-Gagnon questionnaire predicted the physical activity intensity determined by the IPAQ short-form whatever the age-group (Figure 1). However, the coefficient of determination indicated that the variability in the dependent variable was explained by the logarithmic relationship with the independent variable, mainly for the 20-39 age-group ($F=40.378$, $R^2=0.582$, $p<0.001$). This relationship was poorly explained for both the 40-59 years ($F=4.209$, $R^2=0.123$; $p=0.049$) and the 60-80 years age-groups ($F=11.567$, $R^2=0.300$, $p=0.002$).

Agreement between the 2 questionnaires regarding physical activity level was poor ($K = 0.203$ (95%CI: 0.050 to 0.356) ($p=0.001$)). The percentage of exact agreement was 58%. Disagreement was highest between the active and the high-level categories from the Ricci-Gagnon questionnaire and the IPAQ, respectively (23% disagreement). Age-group influenced agreement. Agreement between the 2 questionnaires for the physical activity level for the two younger age-groups was poor to fair ($K = 0.278$, 95%CI: -0.004 to 0.560, $p=0.017$) and $K = 0.211$ (95%CI: -0.020 to 0.442, $p=0.046$) for 20-39 and 40-59, respectively. There was no agreement for the older age-groups ($K = 0.100$, 95%CI: -0.169 to 0.369, $p=0.382$).

The 30s STST result was correlated with the total Ricci-Gagnon questionnaire score ($\rho=0.348$, $p=0.001$), the total weekly physical activity intensity ($\rho=0.247$, $p=0.018$), and total weekly physical activity with a high intensity ($\rho=0.435$, $p<0.001$). It was not correlated with total weekly physical activity with low ($\rho=0.123$) or moderate ($\rho=0.055$) intensity.

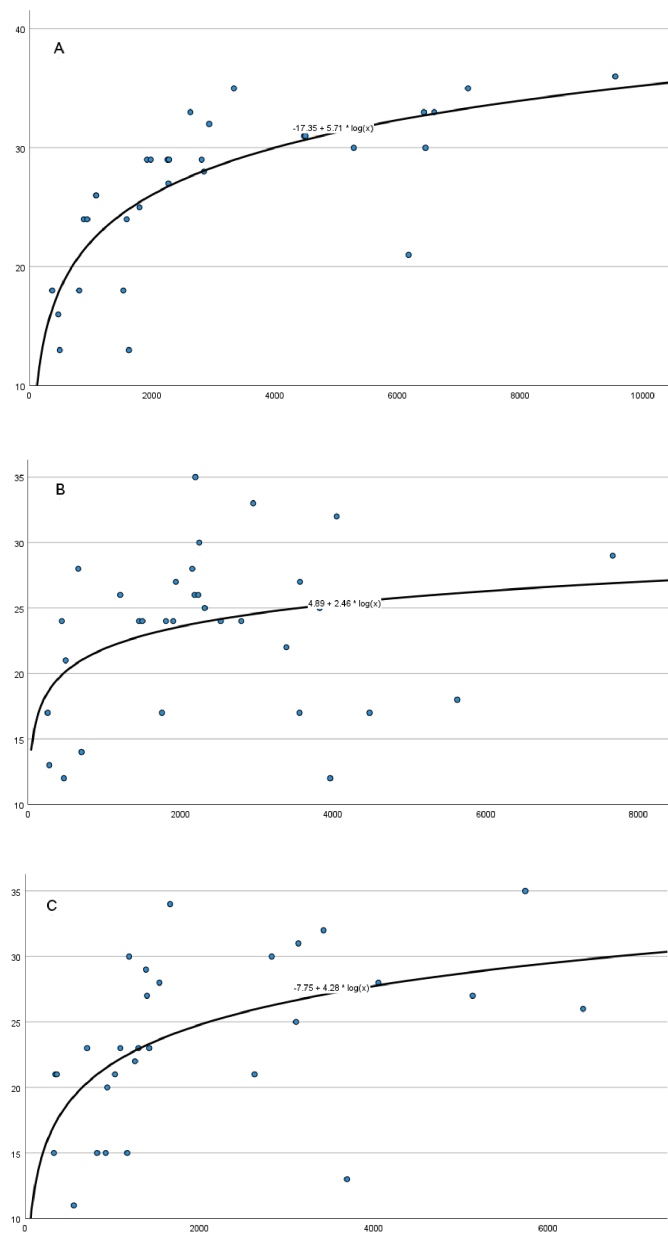


Figure 1 Figure 1: Relationship between the Ricci-Gagnon (X axis) and IPAQ (Y axis) scores for each age group: 20-40 years ($n=31$) (Panel A), 40-60 years ($n=32$) (Panel B), and 60-80 years ($n=30$) (Panel C)

Discussion

This study verified the construct validity of the Ricci-Gagnon questionnaire to assess physical activity level. We found that the questionnaire had construct validity for people under 40 years old.

The logarithmic regression was used to fit the relationship between the results of the 2 questionnaires because the curve for the total weekly physical activity intensity accelerated rapidly then slowed. The model fitted better in the 20-39 age-group, demonstrating the construct validity of the Ricci-Gagnon questionnaire to assess physical activity of different levels determined by the IPAQ short-form in this age-group. Indeed, the coefficient of determination of 0.58 indicated that 58% of the variability in the Ricci-Gagnon questionnaire results could be explained by the

logarithmic relationship with the different total weekly physical activity levels determined by the IPAQ short-form. However, the relationship was not satisfactory for the 2 other age-groups (lower coefficients of determination).

The agreement between the 2 questionnaires for the descriptive categories of physical activity level was poor, as illustrated by the Cohen's kappa value and by the same response category of physical activity level lower than 60%. Substantial disagreement was observed between the active and the high-level categories from the Ricci-Gagnon questionnaire and the IPAQ short-form, respectively. That means that the discriminant validity for physical activity level was low and that the Ricci-Gagnon questionnaire cannot be used as a surrogate for the IPAQ short-form to discriminate between physical activity levels. This is because the descriptions of the different categories by the 2 questionnaires are not substitutable due to differences in the scoring of the categories. The IPAQ short-form focuses more on the intensity of different types of physical activity in the scoring than the Ricci-Gagnon questionnaire. The Ricci-Gagnon questionnaire focuses more on global life activities by summing the different items of the questionnaire, including activities of daily life and physical leisure activities. Agreement between the questionnaires decreased with participant age. This can be explained by the fact older people have expectedly lower scores because older adults generally engage in less vigorous, shorter duration physical activity than younger adults as illustrated by the fact the only correlation between age and the IPAQ short-form score was for vigorous intensity activities. Less than one quarter of older adults engage in regular physical activity [18].

The lack of medical screening of participants could be considered as a limitation with regards to verification of the healthy status of those included. Recruitment was based on self-report. The number of movements performed during the 30s STST was in line with the normative values for older adults in Germany [19] and slightly higher than those for adults in Spain [20]. This indicates that the lower limb strength of the recruited subjects was within normal ranges. This test has been used to discriminate between sufficient and insufficient physical activity levels in adults [21]. Therefore, it was not surprising to find a correlation between the 30s STST, and the total scores obtained with both the Ricci-Gagnon questionnaire and the total weekly physical activity intensity determined by the IPAQ short-form. Indeed, muscle strength is associated with physical activity level [15]. Moreover, the correlation between the 30s STST and the time spent performing vigorous intensity physical activity but not moderate or low activity can be explained by the 30s STST power of discrimination between people with sufficient and insufficient physical activity levels [21] or those who exercise regularly and those who do not [15].

In conclusion, we found that the Ricci-Gagnon questionnaire only had construct validity for people under 40 years old. This easy and quick questionnaire can be used routinely to assess physical activity level in this group. However, the discriminant validity of the Ricci-Gagnon questionnaire was not confirmed for the different categories of physical activity level.

Statement and declaration

Authors' contribution

The authors confirm contribution to the paper as follows: Gregory Reychler: Conceptualization; Methodology, Formal analysis; Investigation; Writing - Original Draft; Supervision Anne-Sophie Petit: Methodology, Formal analysis; Writing - Review and Editing Frank Aboubakar: Methodology, Formal analysis; Writing - Review and Editing Giuseppe Liistro: Methodology, Formal analysis; Writing - Review and Editing Antoine Fremault: Methodology, Formal analysis; Writing - Review and Editing

Gilles Caty: Methodology, Formal analysis; Writing - Review and Editing Marc Beaumont: Methodology; Writing - Review and Editing

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Disclosure statement

All authors declare they have neither financial nor non-financial interests.

Ethics

The study was approved by the regional Ethic Committee in Cliniques universitaires Saint-Luc and Université Catholique de Louvain in Brussels (2018/04JUL/274)

Consent to participate

Informed consent was obtained from all individual participants included in the study

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