Research Paper

Hong Kong Physiotherapy Journal
Vol. 43, No. 1 (2023) 33–41
DOI: 10.1142/S1013702523500026

Hong Kong Physiotherapy Journal
https://www.worldscientific.com/worldscinet/hkpj

Reliability and validity of the Hindi version of international physical activity questionnaire-long-form (IPAQ-LF)

Sukhada S. Prabhu* and Anuprita M. Thakur

School of Physiotherapy, D.Y. Patil University Nerul, Navi Mumbai, India

**sukhadaprabhu@dypatil.edu*

Received 15 June 2021; Accepted 20 October 2022; Published 23 December 2022

Background: IPAQ-LF is a widely used tool for subjective assessment of physical activity. It has been translated, cross-culturally adapted into many languages and tested in many countries around the world. However, no Hindi version of the long-form of this questionnaire exists till date.
Objective: To cross-culturally adapt the IPAQ-LF from English to Hindi language and to evaluate its reliability and validity.
Methods: The guidelines by IPAQ Committee were followed for cross-cultural adaptation process. The Test–retest reliability was assessed on 60 participants by administering Hindi IPAQ-LF twice within two-week time frame. The construct validity was assessed by comparing with seven-day pedometer recording.
Results: Excellent reliability was observed between total physical activity scores on repeated Hindi IPAQ-LF administrations, with interclass correlation coefficient of 0.963 at 95% confidence interval. The ICC for job, transport, Housework and Leisure domain was calculated to be 0.923, 0.839, 0.862 and 0.939, respectively, suggesting excellent reliability. The Cronbach's alpha computed (0.82) suggests good internal consistency. The Hindi Version of IPAQ-LF also demonstrated good construct validity with Spearman correlation coefficient of 0.783. Bland–Altman analyses were performed to evaluate the level of agreement between two constructs.
Conclusion: The study demonstrates that Hindi version of IPAQ-LF is a reliable and valid tool for assessing physical activity levels for Hindi speaking population.

Keywords: Hindi version of International physical activity questionnaire; long-form; cross-cultural adaptation; reliability; validity.

*Corresponding author.

Introduction

Physical activity is defined as any bodily movement produced by skeletal muscles that require energy expenditure. Physical inactivity (lack of physical activity) ranks as the fourth leading risk factor for global mortality. Moreover, physical inactivity is estimated to be the main cause for approximately 27% of diabetes, 21–25% of breast and colon cancers, and approximately 30% of ischaemic heart disease burden.[1] Physical activity (PA) has been proved to be effective in preventing numerous lifestyle-related chronic disorders such as cardiovascular diseases, diabetes, and hypertension.[2] To improve the fitness and endurance levels and to reduce the risk of non-communicable diseases, the World Health Organization (WHO) recommends practicing at least 150 min of moderate-intensity or 75 min of vigorous-intensity aerobic PA throughout the week, or an equal combination of both.[1] Physical activity is generally classified as Low, Moderate and High levels of Physical activity and is measured in METs.

According to Ainsworth,[3] there are various objectives and subjective methods used for PA assessment. Objective methods consist of motion sensors like accelerometers, pedometers, heart rate monitors, oxygen consumption meters, wearable monitors or other measures of energy expenditure like doubly labelled water, direct calorimetry whereas the subjective methods include PA diaries and questionnaires which are the most broadly adopted tracking tools.[4] In the epidemiological studies, the questionnaires are often used as they are cost-effective and can be easy to administer on large population. There are various scales for assessing the PA such as International Physical activity questionnaire (IPAQ), Global Physical Activity Questionnaire (GPAQ) and Physical Activity readiness (PAR), Duke's.

An international consensus group formulated the IPAQ in 1998 for young to middle-aged adults.[5–7] It is a self-administered questionnaire which has acceptable validity and reliability when evaluating the levels and patterns of physical activity in healthy adults ranging from 15 to 69 years of age. There are two forms of IPAQ—long-form and short-form with a reference period of either "the last seven days" or "the usual week."[5,6] There are seven questions in short form and 27 questions in long-form. The IPAQ long-form provides specific details on PA intensity levels in the four domains like occupational/job (related to work), domestic (household chores), transportation (walking, public transportation) and leisure time (recreational activities). It also differentiates between usual sitting time on a week day and a weekend day.[8]

The IPAQ has been translated and cross-culturally adapted into many languages and assessed in many countries around the world. Hindi is a widely spoken in India as it is the prime and official language. About 41% of total population of India are Hindi speakers. However, no Hindi version of the long-form of this questionnaire exists to this date. Thus, in order to make the IPAQ applicable for research among non-English speaking populations in India, it needs to be translated, culturally adapted and properly evaluated for psychometric properties. In India, the sociocultural and physical environment differs from other parts of world so; mere translation of the IPAQ may be insufficient to maintain content validity. Hence to maintain the conceptual equivalence, a cross cultural adaptation of a questionnaire is necessary.

Hence, the purpose of this study was to translate and cross-culturally adapt the English IPAQ-LF, and to evaluate aspects of the reliability and validity of the Hindi-translated and culturally adapted version of the IPAQ-LF.

Subjects and Methods

The study was approved by Institutional Ethics Committee for Biomedical and Health Research. The sample size estimation was done at 95% of confidence interval considering large magnitude of effect size (0.631) which was derived from our pilot study and accordingly 60 participants for reliability and validity analysis within the age group of 20–69 years were randomly selected.

The informed consent was taken from participants for study. Participants who were able to move independently, willing to participate in the study and were well versed in Hindi language were included in the study, whereas individuals with severe chronic diseases likely to hinder physical activities, individuals diagnosed with psychiatry or cognitive diseases, individuals undergone recent surgery were excluded from the study.

Methods

The translation and cultural adaptation of the IPAQ-LF were performed in several steps following

the guidelines prescribed by the IPAQ core group and WHO which consists of forward translation of questionnaire followed by its backward translation.[9] A pilot testing of pre-final synthesised Hindi Version of IPAQ-LF was done and final version of Hindi IPAQ-LF was obtained (Fig. 1).

Forward Translation into Hindi

After obtaining permission from the original author of English IPAQ-LF, the English version of IPAQ-LF was forward translated into Hindi language by two bilingual translators who were familiar with the concept of physical activity and were fluent in both the languages. The main focus of this phase was to achieve sematic equivalence. The translated questionnaire was reviewed by an expert panel committee which consisted of the principal investigator, original translator, a healthcare professional knowledgeable about the concept of physical activity and a lay person. The goal of this expert panel was to retain the conceptual, lingual and metric equivalence between the two questionnaires and to obtain a synthesised Hindi version of IPAQ-LF.

Backward Translation into English

The synthesised Hindi version of IPAQ-LF was then backward translated into English language by two different translators. The synthesised Hindi version of IPAQ-LF and two back translations had been merged into one pre-final Hindi version of IPAQ-LF. The pre-final Hindi version was then reviewed by the expert panel for conceptual, lingual and metric equivalence.

Pilot Testing

The pilot testing of pre-final Hindi version of IPAQ-LF was carried out on 64 participants who could read, write and understand Hindi language. The following questions were asked to them by principal investigator:

(1) Did you understand all words?
(2) How clear was the intent of questionnaire?
(3) Do you have any questions about it?
(4) How could wordings be clearer?
(5) Did any question make you feel uncomfortable?
(6) Were there activities that we missed?

Based on pilot testing, the appropriate and necessary changes were made in the questionnaire and final Hindi version of IPAQ-LF was obtained.

Test– retest reliability: Sixty participants were asked to complete the Hindi version of IPAQ-LF on two occasions within time frame of two weeks (Day 1 and Day 14). Data obtained from these two administrations was analysed by 2-way mixed model interclass correlation coefficient.

Internal consistency: It was done by correlating items with each other by using Cronbach's alpha value.

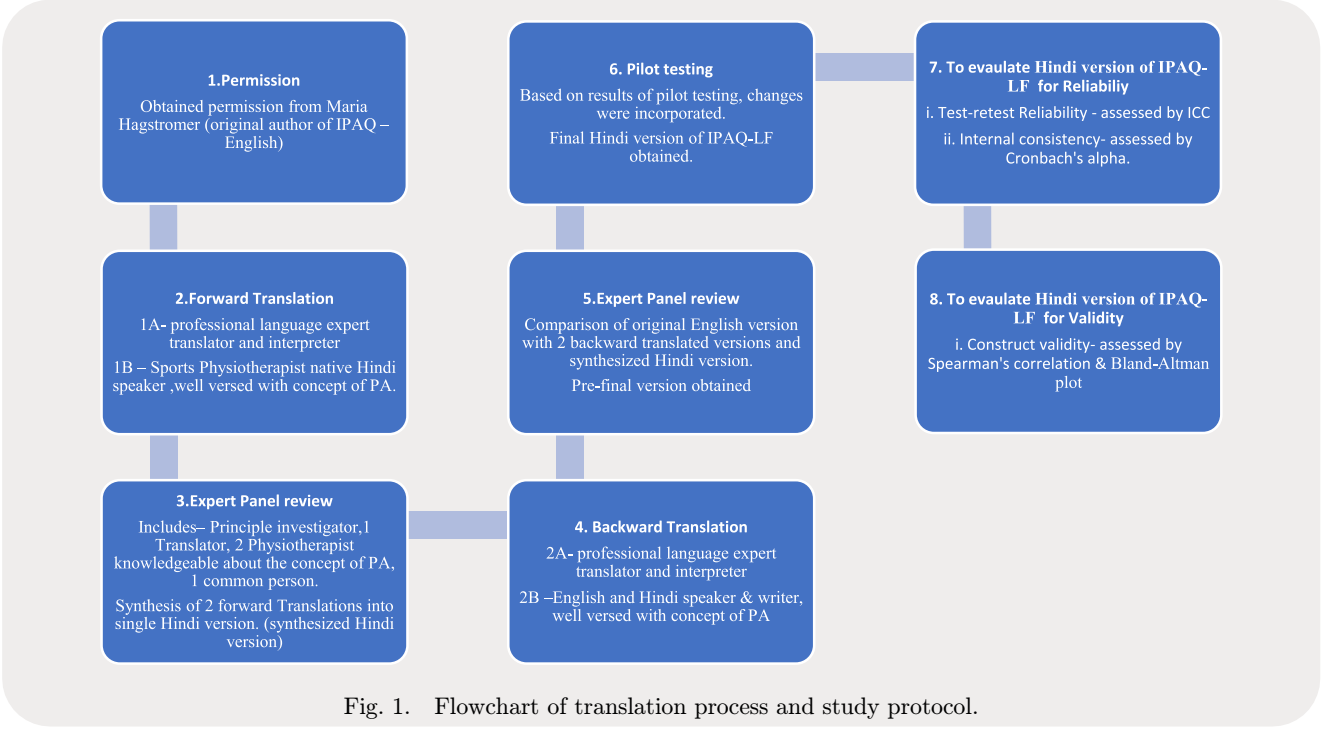

Fig. 1. Flowchart of translation process and study protocol.

Construct validity: Omron HJ-325 Pedometer was allocated to all participants. They were instructed how to wear the pedometer and to remove it only during sleeping and bathing. They were also instructed to record the daily step counts for seven-day period (Day 1-Tuesday to Day 7-Monday). On eighth day, participants submitted the pedometers to researchers, and were advised to complete Hindi version of IPAQ-LF. The average of daily steps walked for seven days was counted and this count was correlated with total physical activity score recorded on Hindi version of IPAQ-LF. Data obtained was analysed using Spearman correlation coefficient test of statistical analysis.

Results

Pilot study of Pre-Final Hindi IPAQ-LF

A total of 64 participants (43.7% males, 56.2% females) with mean age of 40.89 ± 13.79 years and BMI of $26.8 \pm 4.79\,kg/m^2$ participated in the study. 93.7% of participants could understand all words whereas intent of questionnaire was very clear to 95.26%. All the participants agreed that no questions made them feel uncomfortable. Various suggestions on activities to be added/deleted were given. These activities (Fig. 2) were computed for its MET values based on "Compendium of Physical Activities 2011" and were incorporated to prepare the final Hindi version of IPAQ-LF.

Domain	Question Number	Activities/Words added	Activities/Words removed
Job - related PA	6, 7	खड़े रहे (standing)	
Transportation - related PA	8, 9	मेट्रो, बस, कार, ऑटो रिक्शा, या स्कूटर	Tram
	10, 11	सीढ़ीयाँ चढ़े (stair climbing)	
	12	खड़े रहे (standing)	
Housework, House Maintenance, & Caring for Family	14	फावड़ा चलाना, सीढ़ीयाँ चढ़ना कपड़े या बर्तन धोने, खाना पकाना पानी भरना	Snow shovelling
	18		
Recreation, Sports & Leisure-Time PA	22	नृत्य करना, जिम या घर में भारी कसरत करना	
	24	क्रिकेट, बैडमिंटन, जिम में हलके कसरत करना, पॉवर योगा या सूर्यनमस्कार करना	
Time Spent Sitting	26	सोमवार से शुक्रवार/ शनिवार	

Fig. 2. Activities added/removed in Hindi Version of IPAQ-LF based on pilot testing.

Table 1. Characteristics of study population.

Characteristics	Mean ± SD
Age	40.22 ± 14.15 years
Height	157.97 ± 8.58 cm
Weight	66.66 ± 10.58 kg
BMI	26.79 ± 4.42 kg/m^2

Test–retest Reliability

A total 60 participants (46.7% males, 53.3% females) with mean age of 40.22 ± 14.15 years took part in Test–retest reliability study. Their characteristics are described in Table 1. The statistical analysis was performed by using IBM SPSS version 23 software. For total physical activity scores, excellent reliability was observed between

Table 2. Test–retest reliability of the Hindi version of IPAQ-LF.

Hindi-IPAQ-LF domains	First administration (Mean ± SD)	Second administration (Mean ± SD)	Interclass correlation coefficient (ICC) (95% CI)
Total PA	6930.48 ± 7650.01	7363.28 ± 7147.24	0.985
Job-related PA	2795.19 ± 6403.71	3205.49 ± 6140.28	0.988
Transportation-related PA	757.21 ± 1376.76	988.83 ± 1475.45	0.955
Housework, House maintenance-related PA	1886.28 ± 2261	1611.75 ± 1730.10	0.946
Leisure-related PA	1492.31 ± 2493.25	1557.22 ± 2242.28	0.949
Time spent in sitting	2502.69 ± 1414.12	2443.46 ± 1375.91	0.962

Table 3. Internal consistency using Cronbach's alpha.

Hindi-IPAQ-LF domains	Cronbach's alpha	Level of agreement	No. of items	Cronbach's alpha if item deleted
Job-related PA (7 items)	0.994	Excellent	Q1	0.034
			Q2	0.583
			Q3	0.578
			Q4	0.383
			Q5	0.577
			Q6	0.352
			Q7	0.577
Transportation-related PA (6 items)	0.496	Poor	Q8	0.492
			Q9	0.454
			Q10	0.251
			Q11	0.453
			Q12	0.196
			Q13	0.369
Housework, House maintenance-related PA (6 items)	0.518	Poor	Q14	0.458
			Q15	0.026
			Q16	0.188
			Q17	0.026
			Q18	0.184
			Q19	0.398
Leisure-related PA (6 items)	0.7	Fair	Q20	0.440
			Q21	0.480
			Q22	0.433
			Q23	0.269
			Q24	0.430
			Q25	0.184
Time spent in sitting (2 items)	0.849	Good	Q26	0.016
			Q27	0.022
Total PA	0.820	Good	—	

repeated administrations of Hindi IPAQ-LF, with interclass correlation coefficient (ICC) of 0.963 at 95% confidence interval (Table 2). The ICC for job, transport, Housework and Leisure domain was calculated to be 0.923, 0.839, 0.862 and 0.939, respectively, suggesting excellent reliability.

Internal consistency reliability

The Cronbach's alpha computed for internal consistency was 0.82, suggesting good internal consistency among items of questionnaire (Table 3). Also, the excellent agreement was found in internal consistency of job domain with Cronbach's alpha value of 0.994 whereas poor to fair agreement was noted in transport, housework and leisure-related domains (Cronbach's alpha value ranging between 0.4 to 0.8).

Construct Validity

The Spearman Rho value of 0.783 was computed (Table 4), indicating strong positive correlation between total physical activity levels and daily steps walked. The Bland–Altman plot in Fig. 3 demonstrates a satisfactory level of agreement between two constructs (mean = 126.12, 95% limits of agreement = 5128.25; −4876). Furthermore, a regression analysis was performed and confirmed the absence of statistical bias (0.410; $p > 0.05$).

Table 4. Spearman correlation between the Hindi version of IPAQ-LF and pedometer.

			Pedometer average steps	IPAQ-H total score
Spearman's rho	Pedometer average steps	Correlation Coefficient	1.000	0.783**
		Sig. (2-tailed)	—	0.000
		N	60	60
	IPAQ-H total score	Correlation Coefficient	0.783**	1.000
		Sig. (2-tailed)	0.000	—
		N	60	60

Note: **Correlation is significant at the 0.01 level (2-tailed).

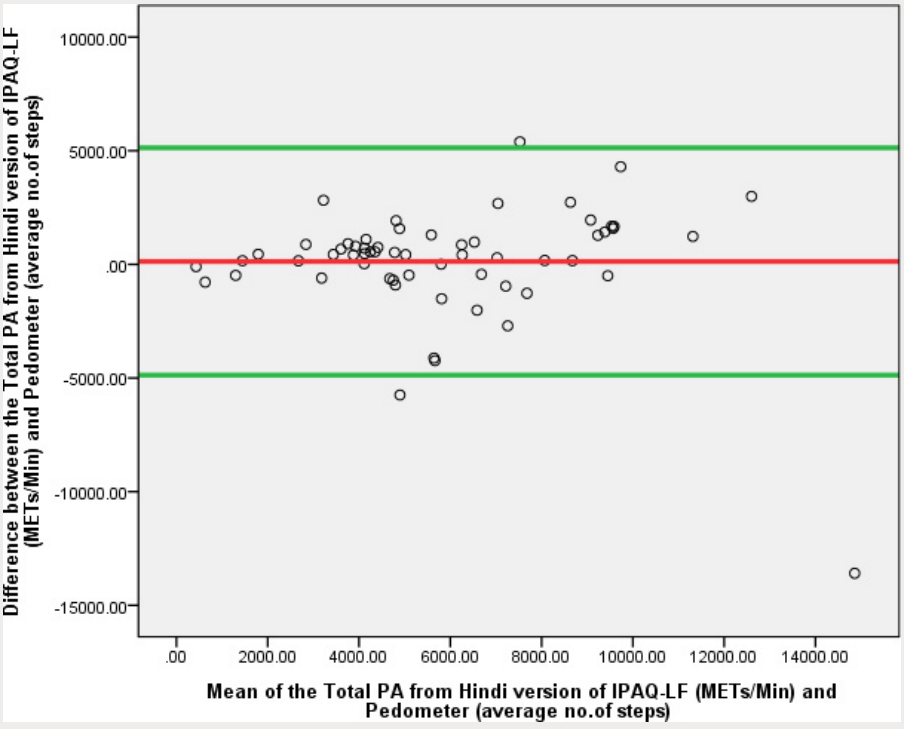

Fig. 3. Bland–Altman plot of the total PA measured on Hindi version of IPAQ-LF and average pedometer steps count.

Discussion

To our best knowledge, this is the first study to translate and cross-culturally adapt the English IPAQ-LF to Hindi IPAQ-LF, and to evaluate its reliability and validity in Hindi speaking population. The guidelines recommended by IPAQ core group were used for translation and adaptation process.[9] This method is cost efficient and widely applied in small budget studies. The pre-final version of Hindi IPAQ-LF was tested on 64 volunteers, which allowed the researcher to detect the discrepancies and to make necessary changes to the adapted questionnaire. For instance, transportation by tram is invalid for Indians, so this word was replaced by most frequently used modes of transport like metro, bus, car, autorickshaw and scooter. Also, the activity of snow shoveling is uncommon in this population, hence it was suggested to be replaced by other activities with similar MET values like washing clothes and utensils, cooking, filling of water. Stair climbing activity was added in job domain as this was more common than use of elevators and escalators which may be unavailable at all work places and thus population may take to walking and stair climbing rather than waiting for elevators to move around at workplace. Recreational activities like dancing, playing sports like cricket, badminton, doing power yoga or suryanamaskar were some of the commonly performed physical activities in domain of recreation, sports and leisure time. In the last domain which is time spent in sitting, words like Monday to Friday/ Saturday were added to clarify the terms weekdays and weekends.

The Hindi version of IPAQ-LF was tested for test–retest and internal consistency reliability. The ICC computed for total PA, job, transport, housework and leisure domain was high, ranging from 0.83 to 0.96 suggesting excellent reliability. The least reliability was established in transport domain (0.83) and the most reliability in the leisure domain (0.93). Our results are in accordance to other studies indicating that various adapted versions of IPAQ-LF have good excellent reliability. The Belgium and Chinese versions of IPAQ-LF showed good to excellent reliability of the adapted versions on test–retest reliability testing with ICC ranging from 0.52–0.81 and 0.74 to 0.97, respectively.[10,11] Whereas the Serbian versions of IPAQ-LF demonstrated moderate to excellent reliability with ICC from 0.53 to 0.91.[12] In the previous researches, Craig *et al.* demonstrated reliability of IPAQ in 12 countries with ICC of 0.8 indicating very good repeatability.[13] The reliability studies undertaken in Norway and Switzerland showed lowest ICC ranging from 0.30–0.62.[14,15] As the above-mentioned studies demonstrated great variability in reliability results, the reason for this can be attributed to difference in intervals between first administration and second administration of the tests. A period shorter than eight days is associated with a higher reliability coefficient whereas a period of three weeks significantly reduces the reliability. In this study, a time frame of two weeks between first administration and second administration was decided. This time frame was considered to be the sufficient period to eliminate the influences of the first response on the results and too short period for any substantial changes to occur in PA.[16]

The internal consistency value analysed was 0.82 indicating high agreement within questionnaire. This result goes in accordance with study done by Khalil *et al.* which shows high internal consistency reliability with Cronbach's alpha ranging from 0.76 to 1.00 in an adapted Arabic version of IPAQ-LF.[17] The Cronbach's alpha if item deleted represents the scale's Cronbach alpha reliability co-efficient for internal consistency if individual item is removed from the scale.[18] The scale's Cronbach alpha is noted if a particular item is deleted. This value is then compared to alpha co-efficient value to see if item wants to be deleted.[18] The Hindi version of IPAQ-LF has seven items clustered under job-related PA domain, two items under time spent in sitting domain and six items each under transportation, Housework- and Leisure-related PA domains. In this study, it is seen that Cronbach's alpha if item deleted for each item is lower than its corresponding overall Alpha value for that particular domain. For job-related domain, the Cronbach's alpha if item deleted ranges from 0.034 to 0.583 which is less than overall Cronbach's alpha for this domain which is 0.994 (Table 3). Similar results can be noted for other domains as well like for transportation-related PA, Housework-related PA, Leisure-related PA and time spent in sitting (Table 3). Hence, the Cronbach's alpha if item deleted for all these items cluster under particular domain is lower than overall Cronbach's alpha value, it can be interpreted that all these items should be retained and cannot be deleted from the domain of the scale in which the item belongs to.

Pedometers are effective body motion sensors that respond to vertical movement created by activities such as walking, jogging and running.[19] They provide precise, convenient, low cost, and objective measure of physical activity.[19] Pedometers have proven to have sufficient evidence with other sophisticated measures of PA.[20] They are utilised as an objective measure of physical activity and have been used in validation of self-report measures including the IPAQ.[21,22] The Omron HJ-325 pedometer used in this study is most reliable and valid for counting the number of steps.[23] A strong positive correlation coefficient ($r = 0.783$) was obtained between total PA from Hindi version of IPAQ-LF and pedometer step count in this study. Streiner *et al.* suggested that for a validity result, the correlation coefficient should be situated between 0.4–0.8 for it to accept.[24] Our study findings are similar to other researchers who used pedometer values to validate IPAQ, for instance Bassett *et al.* ($r = 0.47$),[21] Deng *et al.* ($r = 0.33$),[22] Craig *et al.* ($r = 0.33$)[7] and Vandelanotte *et al.* ($r = 0.38$).[25] The Bland–Altman plots, plotted in this study, show more than 95% of the point lying between upper and lower limits of agreement which leads to the conclusion that Hindi Version of IPAQ-LF should be considered as interchangeable with the Pedometer and thus the two scales exhibited alternate form of validity.

This study has provided some preliminary evidence for reliability of Hindi version of IPAQ-LF.

In conclusion, our analysis results demonstrate good to excellent reliability and strong evidence on validity of Hindi version of IPAQ-LF that can be used for assessing physical activity levels in Hindi speaking population.

Conflict of Interest

The authors have no conflict of interest relevant to this paper.

Funding/Support

This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

Author Contributions

Prabhu S. Sukhada and Thakur M. Anuprita were responsible for research conception and design of the study. Prabhu S. Sukhada was involved with analysis/interpretation of data whereas Thakur M. Anuprita was involved with critical revision of manuscript for important intellectual content. All authors were involved in the acquisition of data, drafting of manuscript, and approval of manuscript to be published.

References

1. World Health Organization. Global recommendations on physical activity for health. 2010.
2. Warburton DE, Nicol CW, Bredin SSD. Health benefits of physical activity: The evidence. Can Med Assoc J 2006;174:801–9.
3. Ainsworth BE, Bassett DR, Strath SJ. Comparison of three methods for measuring the time spent in physical activity. Med Sci Sports Exerc 2000;32(9): S457–S464.
4. Strath SJ, Kaminsky LA, Ainsworth BE, Ekelund U, Freedson PS, Gary RA, et al. Guide to the assessment of physical activity: Clinical and research. BMC Publ Health 2018;18:49.
5. Kim Y, Park I, Kang M. Convergent validity of the international physical activity questionnaire (IPAQ): Meta-analysis. Publ Health Nutr 2013;16:440–52.
6. Hagstromer M, Oja P, Sjostrom M. The international physical activity questionnaire (IPAQ): A study of concurrent and construct validity. Publ Health Nutr 2006;9(6):755–62.
7. Craig CL, Marshall AL, Sjostrom M, Bauman AE, Booth ML, Ainsworth BE, et al. International physical activity questionnaire: 12-country reliability and validity. Med Sci Sports Exerc 2003;35:1381–95.
8. The IPAQ group. Guidelines for data processing and analysis of the international physical activity questionnaire (IPAQ)—short and long forms. 2005.
9. International Physical Activity Questionnaire [Internet]. Cultural Adaptation. Available at https://sites.google.com/site/theipaq/cultural-adaptation.
10. Van Holle V, et al. Assessment of physical activity in older Belgian adults: Validity and reliability of an adapted interview version of the long International Physical Activity Questionnaire (IPAQ-L). BMC Public Health 2015;15:433.
11. Macfarlane D, et al. Examining the validity and reliability of the Chinese version of the International Physical Activity Questionnaire, long form (IPAQ-LC). Publ Health Nutr 2015;14(3): 443–50.
12. Milanović Z. Reliability of the Serbian version of the International Physical Activity Questionnaire for older adults. Clin Interv Aging 2014;9:581–87.

13. Craig CL et al. International Physical Activity Questionnaire: 12-Country Reliability and Validity. Med Sci Sports Exerc 2003;35(8):1381–95.
14. Kurtze N, Rangul V, Hustvedt B-E. Reliability and validity of the international physical activity questionnaire in the Nord-Trøndelag health study (HUNT) population of men. BMC Med Res Methodol 2008;8:63.
15. Sember V, Meh K, Sorić M, Starc G, Rocha P, Jurak G. Validity and Reliability of International Physical Activity Questionnaires for Adults across EU Countries: Systematic Review and Meta-Analysis. Int J Environ Res Publ Health 2020; 17(19):7161.
16. Prot F, Sporiš G, Bosnar K. Research methods in kinesiology. Res Methodology 2009; 9:581–587.
17. Khalil H. Validity and reliability of an adapted Arabic version of the long international physical activity questionnaire. BMC Publ Health 2018;18:49.
18. Glient JA, Rosemary GR. Calculating, Interpreting & Reporting Cronbach's alpha Reliability Coefficient for Likert-type scales. Midwest Research to Practice Conference in Adult, Continuing & Community Education. 2003.
19. Tudor-Locke C, Bassett DR. How Many Steps/Day Are Enough? Preliminary pedometer indices for public health. Sports Med 2004;34(1):1–8.
20. Tudor-Locke C, Williams JE, Reis JP, Pluto D. Utility of pedometers for assessing physical activity: Convergent validity. Sports Med 2002; 32(12):795–08.
21. Bassett DR, Schneider PL, Huntington GE. Physical activity in a old order Amish community. Med Sci Sports Exerc 2004;36(1):79–85.
22. Deng HB, MacFarlane DJ, Thomas GN, et al. Reliability and validity of the IPAQ-Chinese: The Guangzhou Biobank cohort study. Med Sci Sports Exerc 2008;40(2):303–7.
23. Lee JA, Williams SM, Brown DD, Laurson KR. Concurrent validation of the Actigraph gt3x+, Polar Active accelerometer, Omron HJ-720 and Yamax Digiwalker SW-701 pedometer step counts in lab-based and free-living settings. J Sports Sci 2015;33(10):991–1000.
24. Streiner DL, Norman GR. In: Health Measurement Scales: A Practical Guide to their Development and Use. 2nd ed. Oxford, England: Oxford University Press, 1996.
25. Vandelanotte C, De Bourdeaudhuij I, Philippaerts R, Sjöström M, Sallis J. Reliability and validity of a computerized and Dutch version of the International Physical Activity Questionnaire (IPAQ). J Phys Act Health 2005;2:63–75.