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Original Article

Physiotherapy Section

Hindi Translation, Validation and Test-retest Reliability of the Anterior Knee Pain Scale in Individuals with Patellofemoral Pain Syndrome: A Cross-sectional Study

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ABSTRACT

Introduction: Patellofemoral Pain Syndrome (PFPS) is a common musculoskeletal condition characterised by anterior knee pain aggravated by activities such as stair climbing, squatting, running, and prolonged sitting. The Anterior Knee Pain Scale (AKPS) is a widely used patient-reported outcome measure for assessing symptoms and functional limitations in individuals with PFPS. However, a validated Hindi version of the AKPS is unavailable.

Aim: To translate the AKPS into Hindi and evaluate its content validity, internal consistency, and test-retest reliability among individuals with PFPS.

Materials and Methods: This cross-sectional study was conducted at MM Superspeciality Tertiary care Hospital, Mullana, Ambala, Haryana, India, from March 2025 to January 2026. The AKPS was translated into Hindi following standardised procedures, including forward translation, synthesis, back translation, expert evaluation using the Delphi method, and pre-testing. Content validity was assessed using the Item-Level Content Validity Index (I-CVI) and Scale-Level Content Validity Index (S-CVI/Ave). Test-retest reliability and internal consistency were evaluated in 51 individuals with PFPS using the Intraclass Correlation Coefficient (ICC), Cronbach's alpha, and Bland-Altman agreement analysis.

Results: The Hindi version of the AKPS demonstrated excellent content validity, with an S-CVI/Ave of 0.977. Most items achieved complete expert agreement (I-CVI=1.00), while two items demonstrated acceptable agreement (I-CVI=0.85). Internal consistency was excellent, with Cronbach's alpha was 0.977. Test-retest reliability showed an ICC for single measures of 0.955 (95% CI: 0.923-0.974, $p<0.001$), indicating excellent reliability. Bland-Altman analysis revealed a mean difference of -0.44±1.896, with 95% Level Of Agreement (LOA) ranging from -4.16 to 3.28, indicating good agreement between repeated measurements.

Conclusion: The Hindi version of the AKPS is a valid, reliable, and reproducible tool for assessing symptom severity and functional limitations in Hindi-speaking individuals with PFPS, and it can be effectively utilised in both clinical practice and research settings.

Keywords: Delphi technique, Patient-reported outcomes measures, Questionnaires, Stair climbing

INTRODUCTION

Patellofemoral Pain Syndrome (PFPS) is a common musculoskeletal condition of the knee, characterised by pain around or behind the patella that is exacerbated by functional activities such as running, jumping, squatting, stair climbing and prolonged sitting [1]. PFPS is diagnosed more frequently in females than in males and occurs most often in adolescents and physically active individuals [2]. Its chronic and recurrent nature substantially impairs functional performance and overall well-being.

The causes of PFPS are multifactorial and vary between individuals. The primary underlying mechanism is thought to be abnormal patellar tracking within the femoral groove. Additional contributing factors include weakness of the quadriceps and hip musculature, abnormal knee movement patterns and excessive mechanical stress on the knee joint. Assessment of symptom severity and functional limitations is essential to guide appropriate clinical decision-making and to evaluate treatment effectiveness in individuals with PFPS [3].

The Kujala score, also known as the Anterior Knee Pain Scale (AKPS), is a widely used questionnaire for assessing pain and disability in individuals with PFPS. The AKPS consists of 13 items with a maximum score of 100, where higher scores reflect better knee function [4]. The original version demonstrated excellent test–retest reliability, with Watson CJ et al. reporting an intraclass correlation coefficient (ICC) of 0.95 for the AKPS [5]. The scale has been translated and validated in several languages and countries, including Chinese [6], Spanish [7], Brazilian Portuguese [8] and Arabic [9].

Hindi is one of the most widely spoken languages in India, yet no validated Hindi version of the AKPS is currently available. Therefore, translation and validation of the instrument are necessary for clinical and research use among Hindi-speaking individuals with PFPS. The present research aimed to translate the AKPS into Hindi and to assess its content validity and test–retest reliability in individuals with PFPS. The protocol for this study has already been published [10].

MATERIALS AND METHODS

A cross-sectional observational study was conducted at MM Super Speciality Tertiary Care Hospital, Mullana, Ambala, Haryana, India, from March 2025 to January 2026 among individuals with PFPS. Ethical approval was obtained from the Institutional Ethics Committee of Maharishi Markandeshwar Institute of Medical Sciences and Research, Mullana, Ambala (IEC-3445), and the study was registered under the Clinical Trial Registry of India (CTRI No: CTRI/2025/09/094675). All procedures adhered to the Indian Council of Medical Research (ICMR) Guidelines (2017) and the Declaration of Helsinki (2013) for research involving human

participants. Written informed consent was obtained from all participants prior to enrollment in the study.

Inclusion criteria: Participants aged 19-55 years with clinically confirmed PFPS who were able to read and understand Hindi were included in the study [3]. The ability to comprehend the questionnaire and to provide informed consent was also required for eligibility.

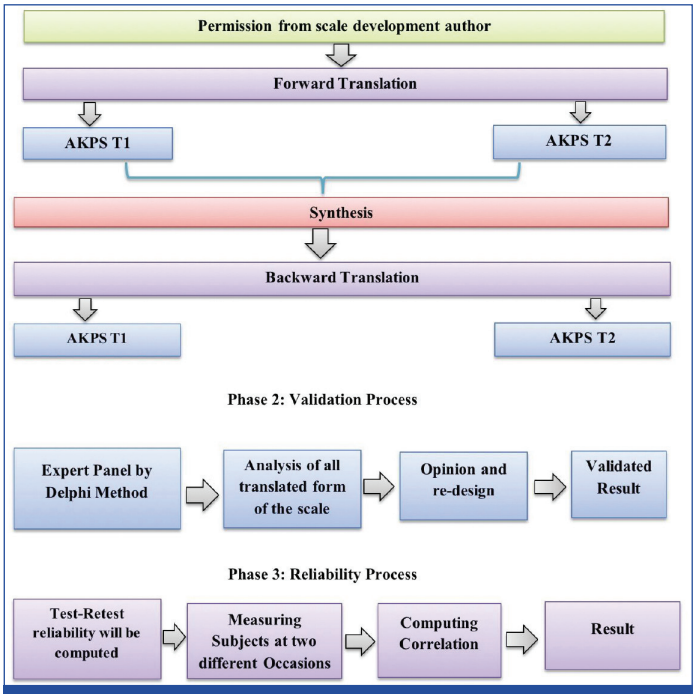
Exclusion criteria: Individuals with a history of Total Knee Replacement (TKR), previous knee surgery, acute knee injury, or any other significant lower limb pathology were excluded. Participants who were unable to understand Hindi or who were uncooperative during the assessment procedure were also excluded.

Sample size estimation: A total of 51 participants with PFPS were recruited from a super-speciality tertiary care hospital for validation of the Hindi version of the AKPS. The study evaluated the content validity and test-retest reliability of the instrument. The sample size was determined based on established recommendations for validation studies reported in the literature [11,12].

Study Procedure

The Hindi version of the AKPS was evaluated for content validity, internal consistency, and test-retest reliability. Content validity was assessed using the Delphi method with expert evaluation. Internal consistency was examined using Cronbach's alpha, while reliability was evaluated using the ICC [13]. Bland-Altman analysis was performed to assess agreement between repeated measurements [14]. The normality of the study variables was assessed using the Kolmogorov-Smirnov test [15].

The AKPS was translated from the original English version into Hindi in accordance with the standardised procedure described by Beaton DE et al., for the translation and adaptation of self-reported measures [12]. The complete translation and validation process was conducted in six stages [Table/Fig-1].



[Table/Fig-1]: Process of translation, validation and reliability [12].

Outcome measure

Anterior Knee Pain Scale (AKPS): The AKPS, also referred to as the Kujala Score, is a self-report questionnaire specifically designed to evaluate symptoms and functional impairments associated with PFPS. This 13-item in this measure yield a total score, with lower score, indicating a greater pain severity and functional limitation [4]. The original AKPS has demonstrated excellent test-retest reliability; Watson CJ et al., reported an ICC value of 0.95 in individuals with AKP [5].

Stage 1: Forward translation: Two translators worked independently on the forward translation of the instrument, and both were fluent in English and Hindi.

Translator one: He was a healthcare professional with prior knowledge of the PFPS, and the AKPS.

Translator two: The second translator was a native Hindi speaker with no medical background and was blinded to the objectives of the study, thereby ensuring an unbiased linguistic translation. The translator held qualification of MA (Hindi), B.Ed., and M.Phil. Both translators independently translated the original AKPS into Hindi, and their translations were designated as T1 and T2 [12].

Stage 2: Synthesis: A single consolidated version (T1-T2) was produced by comparing the two translated version (T1 and T2) and synthesising them into the most appropriate version. Discussions were held between the two translators and the principal investigators to resolve any discrepancies and to ensure that the synthesized version maintained the same meaning and concepts as the original scale [12].

Stage 3: Back translation: Two translators, without a medical background, who were blinded to the original AKPS back-translated the synthesised Hindi versions (T1-2) into English. The purpose of this step was to verify consistency and determine whether the translated version accurately reflected the original questionnaire. Back translation is an important component of validating translations [12].

Stage 4: Delphi survey for content validity: The content validity of the translated Hindi AKPS using the Delphi method was evaluated. A panel of seven multidisciplinary clinicians and academicians experienced in musculoskeletal rehabilitation reviewed each item of the questionnaire in its entirety. Each item was rated on a 3-point scale (agree, neutral, disagree). Content validity was assessed using the I-CVI and the Scale-Level Content Validity index based on Universal Agreement (S-CVI/UA), following the recommendations of Lynn (1986) and Polit & Beck (2006), as summarised by Yusoff MS (2019) [16]. An individual item was considered acceptable if it achieved a minimum I-CVI score of 0.78 when evaluated by 6-10 experts, and the scale was considered to demonstrate adequate content validity if the S-CVI/Ave was at least 0.90 [16].

Stage 5: Pre-testing and reliability assessment: A pre-final version of the AKPS questionnaire for Hindi speakers was administered to a sample of 51 individuals with PFPS during the pre-testing and reliability assessment stage [11,12]. Participants completed the questionnaire independently. The test-retest reliability of the questionnaire was established by administering it twice under similar conditions, with a 48-hour interval between assessments, consistent with previous reliability studies [5]. Reliability was evaluated using the ICC, as suggested by Shrout PE and Fleiss JL [17]. Cronbach's alpha was used to determine the internal consistency of the questionnaire [18]. Bland-Altman analysis was performed to assess absolute reliability by evaluating the agreement between repeated measurements of the questionnaire [14].

Stage 6: Submission of documents: The completed documentation of the translation, validation and reliability testing process was submitted to the Institutional Ethics Committee for audit and approval of the final Hindi version [ANNEXURE 1].

STATISTICAL ANALYSIS

Data analysis was conducted using descriptive statistical methods for demographic variables, including age, height, weight, BMI, and AKPS scores. Descriptive statistics included the calculation of the mean, median, standard deviation, minimum, and maximum values to summarise the data and its variability. The Kolmogorov-Smirnov test was used to assess the normality of the study variables, and the data were found to be not normally distributed ($p<0.05$) [15].

The test-retest reliability of the Hindi version of the AKPS was assessed using the Intraclass Correlation Coefficient (ICC) based on a two-way mixed-effects model with absolute agreement according to Shrout PE and Fleiss JL [17]. Both single-measure and average-measure ICCs were calculated, and 95% confidence intervals were reported. Internal consistency was evaluated using Cronbach's alpha coefficient [18]. ICC values were interpreted according to established criteria as poor (0.00-0.49), moderate (0.50-0.74), good (0.75-0.89), and excellent (0.90-1.00) [13]. Statistical significance was set at $p<0.05$. All statistical analyses were performed using Statistical Package for the Social Sciences (SPSS) version 26.0 (IBM Corp., Armonk, NY, USA). The absolute reliability of the AKPS instrument was evaluated using the Bland-Altman method of agreement analysis [14]. The mean variation between the test and retest measurements was calculated and the Level Of Agreement (LOA) was determined as the mean difference±1.96 ×SD of the difference. In addition to calculating the mean differences, the relationship between the test and retest AKPS scores was examined using correlation analysis. The correlation coefficient (r) was used to evaluate the association between the test and retest AKPS scores [19]. Statistical significance was set at a p-value of less than 0.05. All analyses were conducted using Statistical Package for Social Sciences (SPSS) statistical software version 26.0.

RESULTS

In the present study, the Hindi version of the AKPS demonstrated excellent internal consistency with a Cronbach's alpha (α) of 0.977, along with very high test-retest reliability (ICC=0.955).

Content validation of Hindi version of the AKPS was completed was conducted using the Delphi method, with expert ratings displayed in [Table/Fig-2]. Of the 13 items, there was total agreement among experts for 11 items (Q2-Q11 and Q13) yeiding an I-CVI of 1.00 for these items. For Q1 and Q12, six out of seven experts agreed, resulting in an I-CVI of 0.85. The S-CVI/Ave, obtained based on universal agreement among all specialists, exceeded the recommended threshold of 0.90, indicating acceptable content validity [16]. The S-CVI/UA was calculated as 0.85, further reflecting good content validity. These findings support the conclusion that the Hindi version of the AKPS has excellent content validity and did not require a second round of the Delphi survey.

The demographic characteristics of the study participants are shown in [Table/Fig-3]. A total of 51 individuals with PFPS were included, with a mean age of 45.88±10.00 years; the sample comprised 15 males and 36 females. All data were complete, and no participants were excluded from the final analysis of the results. The mean height, weight, and BMI were 161.23±7.31 cm, 60.92±8.66 kg, and 23.33±2.66 kg/m^2, respectively. The mean AKPS test score at baseline was 80.20±12.99, while the mean test score after 48 hours was 80.88±12.35, indicating minimal variation between repeated assessments. The normality of AKPS scores was assessed using the Kolmogorov-Smirnov test, which showed that the data were not normally distributed ($p<0.05$). Results for internal consistency and reliability are summarised in [Table/Fig-4] with a Cronbach's alpha coefficient of 0.977, indicating excellent internal consistency.

The LOA were calculated using Bland-Altman plot depicted one outlier as shown in [Table/Fig-5] rest all agreement were within the range of mean difference for the two consecutive reading for AKPS [14]. This pattern indicates good agreement and the absence of significant systematic bias, thereby confirming the stability and reliability of the questionnaire over repeated assessments. Although a single potential outlier was located above the upper LOA, the overall distribution of the data still demonstrated acceptable agreement between the two assessments [Table/Fig-5].

DISCUSSION

The present study aimed to translate and evaluate the psychometric properties of the Hindi version of the AKPS in individuals with PFPS. The demonstrated that the Hindi version of the AKPS is a valid, reliable, and reproducible instrument for assessing anterior knee pain and associated functional limitations among Hindi-speaking individuals with PFPS.

Based on the guidelines proposed by Lynn (1986), the content validity of the Hindi version of the AKPS was found to be excellent [16]. The S-CVI/Ave exceeded the recommended threshold of 0.90, indicating strong agreement among the expert panel regarding the relevance, clarity, and cultural appropriateness of the translated items. The S-CVI/UA also demonstrated acceptable agreement. These findings indicate that the Hindi version successfully retained the conceptual meaning and clinical relevance of the original AKPS. Similar observations have been reported in previous cross-cultural adaptation studies of the AKPS in Greek, Persian, Thai, French, German, Dutch and Italian populations [20-25].

The Hindi version of the AKPS demonstrated excellent relative reliability, with Cronbach's alpha of 0.977. According to Portney LG and Watkins MP, Cronbach's alpha values greater than 0.90 indicate excellent internal consistency [26]. These findings suggest

	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Expert 6	Expert 7	Experts in Agreement	I-CVI	UA
Items										
Q1	1	1	1	0	1	1	1	06	0.85	0
Q2	1	1	1	1	1	1	1	07	1	1
Q3	1	1	1	1	1	1	1	07	1	1
Q4	1	1	1	1	1	1	1	07	1	1
Q5	1	1	1	1	1	1	1	07	1	1
Q6	1	1	1	1	1	1	1	07	1	1
Q7	1	1	1	1	1	1	1	07	1	1
Q8	1	1	1	1	1	1	1	07	1	1
Q9	1	1	1	1	1	1	1	07	1	1
Q10	1	1	1	1	1	1	1	07	1	1
Q11	1	1	1	1	1	1	1	07	1	1
Q12	1	1	1	1	1	0	1	06	0.85	0
Q13	1	1	1	1	1	1	1	07	1	1
								SCVI/Ave	0.977	0.85
	Proportion of items judged as relevant across the seven experts								S-CVI/Ave	
									0.977	

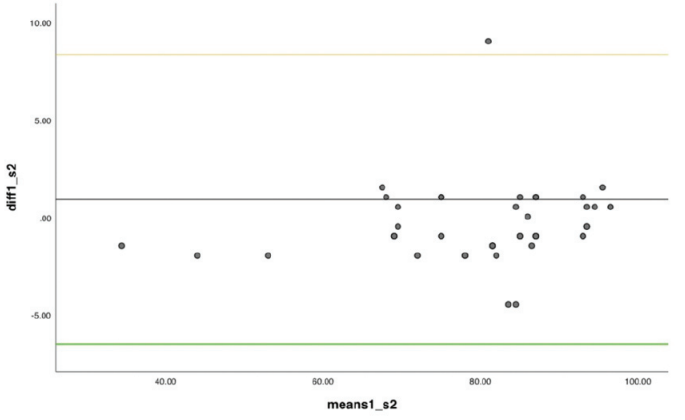
[Table/Fig-2]: Responses gathered by the expert review panel through the Delphi survey.

Variables	Mean±SD	Minimum	Maximum
Age (Years)	45.88±10.00	19	55
Height (cm)	161.23±7.31	149.3	182.8
Weight (kg)	60.92±8.66	40	76
BMI (kg/m^2)	23.33±2.66	16.60	29.80
AKPS test score	80.20±12.99	34.50	96.50
AKPS retest score	80.88±12.35	34.50	96.50

[Table/Fig-3]: Demographic characteristics of participants (N=51).

Parameters	Value	95% Confidence Interval	p-value
Cronbach's Alpha	0.977	-	-
ICC (Single Measures)	0.955	0.923-0.974	<0.001
ICC (Average Measures)	0.977	0.960-0.987	<0.001
Correlation coefficient (r)	0.956	-	<0.001

[Table/Fig-4]: Reliability statistics of Hindi version of AKPS.



[Table/Fig-5]: Bland-Altman plot.

strong homogeneity among the translated items and indicate that the Hindi AKPS reliably measures the construct of anterior knee pain and functional limitation. The Hindi version of the AKPS also demonstrated excellent test–retest reliability, with ICC values of 0.955 for single measures and 0.977 for average measures. According to Shrout PE and Fleiss JL, ICC values above 0.90 indicate excellent reliability [17]. These findings indicate high temporal stability and reproducibility of the Hindi AKPS over repeated measurements. The reliability estimates observed in the present study were comparable to those reported in previously translated versions. Earlier studies reported Cronbach's alpha values of 0.92 in the Arabic version [9], 0.92 in the Persian version [21], 0.89 in the French version [22], 0.87 in the German version [23], 0.78 in the Dutch version [24], 0.91 in the Italian version [25], 0.90 in the Thai version [27], and 0.90 in the Indonesian version [28]. Similarly, ICC values in previous translated versions ranged from 0.93 to 0.99, including Chinese version validated by Cheung RT et al., also demonstrated ICC values exceeding 0.90 [6], 0.96 in the Arabic version [9], 0.94 in the Persian version [21], 0.97 in the French version [22], 0.93 in the German version [23], 0.95 in the Dutch version [24], 0.96 in the Italian version [25], 0.98 in the Thai version [27], and 0.99 in the Indonesian version [28]. These findings indicate that the Hindi AKPS possesses reliability and reproducibility comparable to internationally validated versions of the AKPS.

The Hindi version of the AKPS demonstrated acceptable absolute reliability through Bland-Altman analysis, which showed good agreement between test and retest measurements with minimal systematic bias [14]. The LOA were within acceptable ranges, indicating consistency and stability of the Hindi AKPS over repeated measurements. These findings suggest that the Hindi version possesses satisfactory reproducibility and agreement between repeated assessments.

The findings of the present study are consistent with the psychometric properties reported for the original English AKPS and its translated versions across multiple countries and languages. The Hindi version demonstrated excellent internal consistency and high test-retest reliability comparable to the Chinese versions of the AKPS [6], Arabic [9], Persian [21], French [22], German [23], Dutch [24], Italian [25], Thai [27] and Indonesian [28]. These findings suggest that the Hindi version maintains satisfactory conceptual equivalence, reliability, and reproducibility comparable to internationally validated AKPS versions.

The availability of a valid and reliable Hindi version of the AKPS may facilitate improved clinical assessment and outcome evaluation in Hindi-speaking individuals with PFPS. The translated questionnaire may also support physiotherapy research and evidence-based clinical practice in the Indian population.

Limitation(s)

Despite these strengths, certain limitations should be acknowledged. The study was conducted at a single tertiary care center with a relatively limited sample size, which may affect the generalisability of the findings. The ability of the Hindi AKPS to detect clinical changes over time and its long-term follow-up performance were not assessed in the present study.

Future multicentre studies with larger sample sizes are recommended to further evaluate the ability of the Hindi AKPS to detect clinical changes over time, construct validity, and clinical applicability in broader populations.

CONCLUSION(S)

The Hindi version of the AKPS demonstrated excellent content validity, internal consistency, test-retest reliability, and measurement agreement. It may be used for assessment of symptoms and functional limitations among Hindi-speaking individuals with PFPS in clinical and research settings.

Authors' contribution: All authors contributed equally to the study design, methodology, data collection, analysis, and manuscript preparation.

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ANNEXURE 1

परिशिष्ट

घुटने के अगले भाग में दर्द (शीट कोड: _____)

नाम_____तारीख: _____

आयु: _____

घुटना: बाएँ/दाएँ

लक्षणों की अविध: _____ साल_____ महीने

प्रत्येक प्रश्न के लिए, अपने घुटने के लक्षणों के अनुसार सही विकल्प (अक्षर) पर गोला करें।

1. लंगड़ाना
(a) नहीं (5)
(b) हल्का या कभी-कभी (3)
(c) लगातार (0)

2. सहारा
(a) बिना दर्द के पूरा सहारा (5)
(b) दर्द के साथ (3)
(c) भार सहन करना असंभव (0)

3. चलना
(a) असीमित (5)
(b) 2 किमी से अधिक (3)
(c) 1-2 किमी (2)
(d) असमर्थ (0)

4. सीढ़ियाँ
(a) कोई कठिनाई नहीं (10)
(b) उतरते समय हल्का दर्द (8)
(c) नीचे उतरते और ऊपर चढ़ते समय दोनों में दर्द (5)
(d) असमर्थ (0)

5. उकड़ू बैठना
(a) कोई कठिनाई नहीं (5)
(b) बार-बार उकड़ू बैठने पर दर्द (4)
(c) हर बार दर्द (3)
(d) आंशिक भार सहन के साथ संभव (2)
(e) असमर्थ (0)

6. दौड़ना
(a) कोई कठिनाई नहीं (10)
(b) 2 किमी से अधिक के बाद दर्द (8)
(c) शुरुआत से ही हल्का दर्द (6)
(d) गंभीर दर्द (3)
(e) असमर्थ (0)

7. कूदना
(a) कोई कठिनाई नहीं (10)
(b) हल्की कठिनाई (7)
(c) लगातार दर्द (2)
(d) असमर्थ (0)

8. घुटनों को मोड़कर लंबे समय तक बैठना
(a) कोई कठिनाई नहीं (10)
(b) व्यायाम के बाद दर्द (8)
(c) लगातार दर्द (6)
(d) दर्द के कारण अस्थायी रूप से घुटनों को सीधा करना पड़ता है (4)
(e) असमर्थ (0)

9. दर्द
(a) नहीं (10)
(b) हल्का और कभी-कभी (8)
(c) नींद में बाधा (6)
(d) कभी-कभी गंभीर (3)
(e) लगातार और गंभीर (0)

10. सूजन
(a) नहीं (10)
(b) अत्यधिक मेहनत के बाद (8)
(c) दैनिक गतिविधियों के बाद (6)
(d) हर शाम (4)
(e) लगातार (0)

11. असामान्य और दर्दनाक घुटने की हड्डी (पटेला) की हरकतें (आंशिक अव्यवस्था)
(a) नहीं (10)
(b) खेल गतिविधियों में कभी-कभी (6)
(c) दैनिक गतिविधियों में कभी-कभी (4)
(d) कम से कम एक बार दर्ज किया गया अव्यवस्था (2)
(e) दो से अधिक बार अव्यवस्था (0)

12. जांघ की मांसपेशियों का शोष
(a) नहीं (5)
(b) हल्का (3)
(c) गंभीर (0)

13. घुटने मोड़ने की कमी
(a) नहीं (5)
(b) हल्की (3)
(c) गंभीर (0)