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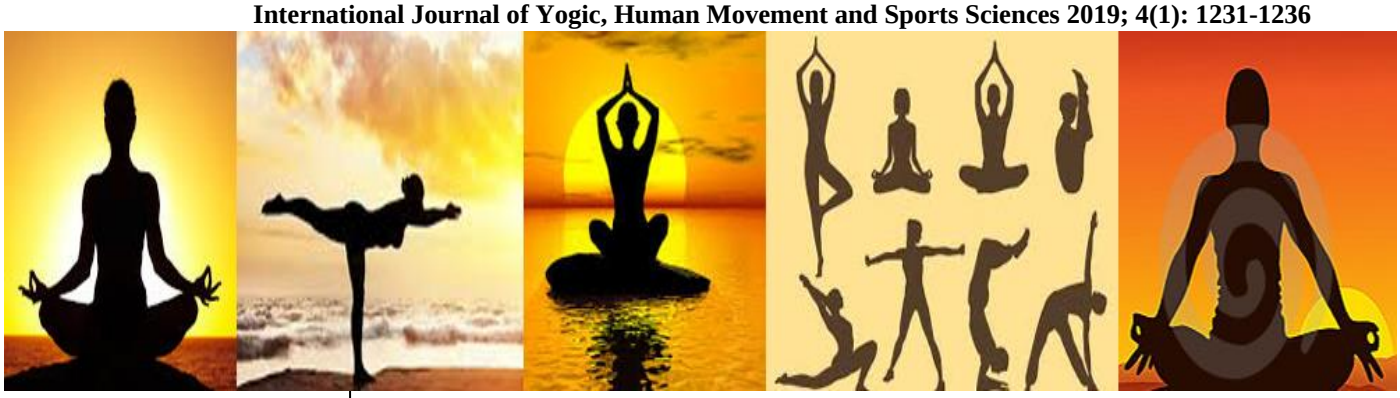

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Reliability and validity of shoulder pain and disability index (Spadi) in sweepers of Surat city

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Abstract
Background: Shoulder Pain is the most common problem in workers exposed to repetitive shoulder activity in their occupation. The risk factors for shoulder pain among sweepers are used upper limb frequently for sweeping and prolonged duration of sweeping with the long handled heavy brooms, which increases the demand on the muscles, ligaments and soft tissues around shoulder joint. The Shoulder Pain and Disability Index (SPADI) is a valid and reliable questionnaire used in shoulder disorders. The purpose of this study was to test the convergent validity and the reliability of the SPADI
Aim and Objectives of the study: Rule out reliability and validity of SPADI
Materials and Methods: A total of 200 Sweepers with shoulder pain were enrolled in the study. The SPADI and the Health Assessment Questionnaire (HAQ) were completed by all the participants. Pain was measured using the Visual Analogue Scale (VAS) during the active range of motion. Reliability was measured by internal consistency and test-retest reliability. Internal consistency was determined by calculating Cronbach's alpha value. Convergent validity was examined by correlating the SPADI questionnaire with the VAS and HAQ scales
Results: Prevalence of shoulder pain among sweepers of Surat and Bardoli city was 49%. Cronbach's alpha value for the SPADI was found to be 0.77. The item - total correlation of the SPADI was 0.841-0.971. The ICC for the SPADI was 0.064, which is towards stability. r=0.734 for SPADI and HAQ (TOTAL). r=0.718 for SPADI and VAS.
Conclusion: The study shows the sweepers have shoulder pain but low back pain and knee pain are more prevalent than shoulder pain**.** The results of the present study suggest that the SPADI is a valid and reliable instrument to assess shoulder pain in Surat Patients.

Keywords: SPADI, VAS, HAQ, shoulder pain, sweepers, disability

Introduction
Shoulder pain is a very prevalent musculoskeletal disorder. After low back pain and neck pain it ranks as third most prevalent musculoskeletal problem [1]. People at high risk of shoulder pain include sweepers, cashiers, garment workers, welders, and bricklayers and those who work with pneumatic tools or in the meat industry. Hairdressers, plasterers, assembly workers, packers, and people who work for long hours at computers, such as secretaries and programmer, are also at high risk. Woman seems to have more problem than men and frequency of shoulder pain increase with age, smoking and previous trauma [2].
The prevalence and incidence of shoulder pain varies largely across age and population. The incidence of shoulder pain has been reported between 0.9-2.5% and prevalence reported by various studies varies from 6.9-26% for point prevalence to 6.7–66.7% for life time prevalence [3].
Improper posture and repetitive activity of shoulder while working can cause excessive stress on the shoulder and scapular muscles which can be one of the reasons for shoulder pain [4]. Shoulder pain arises in or around the shoulder from its joints or surrounding soft tissues, rotator cuff disorders, referred from cervical spine, impingement and adhesive capsulitis [6].
Occupational risks for shoulder pain; risks were divided into physical factors (such as carrying or lifting heavy loads, working in awkward postures, engaging in repetitive movements, and being exposed to vibration) and psychological factors related to work [7]. Several reviews indicate the risk factors including working with arms above shoulder level and other awkward postures (e.g. with trunk flexed laterally), hand- arm vibrations, repetitive movements, pushing

and pulling, and carrying load supported by shoulder [8].

The occupation of sweeping is a vigorous task that involves sweeping of assigned areas such as roads, footpaths, parks, markets and open settlements with the help of long handled broom sand wheel barrows and deposition of waste in nearby community dustbins. These whole processes requires continuous physical tasks such as manually sweeping in the standing posture for long durations, bending while collecting the swept waste, pushing and pulling the wheel barrow, and manually lifting the baskets to deposit waste [9-11].

The quantification of pain is necessary not only for the evaluation of novel therapies, but also for the evaluation of outcome measures of impairment and disability [12]. There is increasing interest in questionnaires or functional measurements among investigators with regard to the ability of these tools to measure the impact of a disease on the performance of daily activities [13]. There are several valid and reliable shoulder disability questionnaires such as Disability of Arm, Shoulder, and Hand Questionnaire (DASH) [14], Shoulder Rating Questionnaire [15], Shoulder Pain And Disability Index (SPADI) [16], Western Ontario Rotator Cuff Index (WORC) [17], Rotator Cuff Quality of Life Measure,[18] Oxford Shoulder Scale [19], and the Dutch version of the Shoulder Disability Questionnaire [20].

SPADI was developed by Roach *et al.*, and has been found to be the quickest (within five minutes) and easiest to complete, as well as being more responsive to change [21, 22]. Generally, validity is established by correlating either the SPADI scores with generic questionnaires using Short Form 36 (SF-36) and Sickness Impact Profile (SIP), or another shoulder-specific instrument (e.g. DASH), and is defined as the convergent validity [23-26]. However, the Health Assessment Questionnaire (HAQ) and the Analogue Scale (VAS) have been used less frequently in validation studies of the SPADI. The original HAQ is one of the main instruments to assess the upper and lower extremity physical functions in musculoskeletal disorders. The HAQ was developed to evaluate the global physical function in patients with rheumatoid arthritis [27]. The Visual Analogue Scale (VAS) is a validated, subjective measure for acute and chronic pain. Scores are recorded by making a handwritten mark on a 10 cm line that represents a continuum between "no pain" and "worst pain" [28]. The Health Assessment Questionnaire (HAQ) is of the instruments deliberately designed to capture prospectively and by protocol the long term influence of multiple chronic illnesses and to allow supplementation by additional measure for particular studies. HAQ Disability Index (HAQ DI) and HAQ Visual Analogue Scale (HAQ VAS pain scale) [29]. They are common instrument used worldwide with tested validity and reliability. [30] The aims of the study to rule out reliability and validity of SPADI in relationship with VAS and HAQ in terms of the convergent validity, as well as to test the reliability of the SPADI by calculating its internal consistency and test-retest reliability..

Materials and Methods:

Study Design, setting and population: The study design was an observational survey study. A total of 200 participants were selected for the study from S.M.C. ward Office of Surat by convenience sampling method on the basis of inclusion and exclusion criteria.

Inclusion Criteria: We included the individuals more than 20 years of age, both male and female who are working as sweepers more than 6 months

Exclusion Criteria: We excluded the individuals those having previous musculoskeletal injury of shoulder, Neurological disorders, cardiovascular disorders and Diabetes mellitus

Outcome Measures: The Shoulder Pain and Disability Index (SPADI) is a self-administered questionnaire designed to measure the pain and disability associated with shoulder pathology in the outpatient setting [16]. It consists of 13 items in 2 domains; pain (5 items) and disability (8 items), scored on a visual analog scales, ranging from 0 to 100 (0 = no pain/ no difficulty and 10 = worst pain imaginable/ so difficult) required help. Each item score is equally weighted, then added for a total percentage score from 0 to 100 (0 = best and 100 = worst). The SPADI was developed by Roach and colleagues in 1991 and initially validated in a sample of 37 male patients with shoulder pathology recruited from an ambulatory care clinic [16]. since then, the SPADI has been validated in other groups including those with adhesive capsulitis and patients recruited from primary care with shoulder pain and shoulder arthroplasty [30-32]. It has also been demonstrated to be responsive to change in a variety of clinical setting such as shoulder arthroplasty, treatment for adhesive capsulitis and sub acromial impingement [31-37]. The SPADI is self-administered with completion time documented to be generally between 2 to 5 minutes, with relative ease of scoring [16]. The use of the SPADI in both clinical and research setting. However, it is known that the clinometric properties of questionnaire may vary among different setting and population [38]. Shoulder Pain And Disability Index (SPADI) (Test-Retest Reliability: 0.92, convergent Validity: 0.65) [22, 23, 39]

The Visual Analogue Scale (VAS) is a validated, subjective measure for acute and chronic pain. Scores are recorded by making a handwritten mark on a 10 cm line that represents a continuum between "no pain" and "worst pain" [28]. (Reliability: 0.99) [40]

The Health Assessment Questionnaire (HAQ) is of the instruments deliberately designed to capture prospectively and by protocol the long term influence of multiple chronic illnesses and to allow supplementation by additional measure for particular studies. HAQ Disability Index (HAQ DI) and HAQ Visual Analogue Scale (HAQ VAS pain scale) [29]. (Reliability: 0.97) [41]

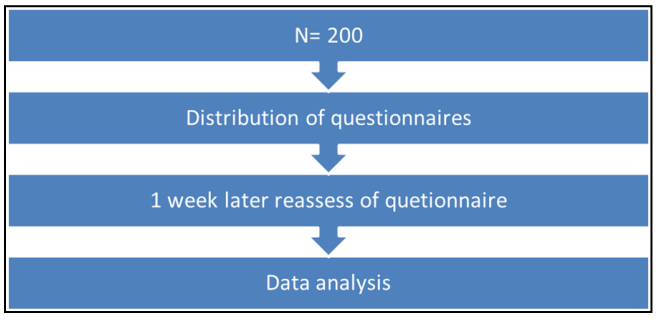

Fig 1: Showing the flow Chart for the procedure.

All statistical analyses were performed using the Statistical Package for the Social Sciences version 20.0 for windows (SPSS, IBM). A p-value <0.05 was considered statistically significant. Descriptive statistics was reported as mean ± standard deviation (SD) for the demographic and clinical characteristics of the study group. Reliability determines whether the questionnaire is able to measure in a consistent and reproducible way, and refers to the extent to which the measured variance in a score reflects the true score. In this study, the reliability of the SPADI was tested by internal consistency and test-retest reliability.

Internal consistency is the ability of a scale to measure a single coherent concept [42]. It was assessed by calculating Cronbach's coefficient alpha value. A value of 0.7 was assessed as the lower limit and a value of 0.8 represented a good value. A value of 0.8–0.95 was regarded as excellent [43]. We also tested the internal consistency by correlating the individual item scores to the total score, defined as item-total correlation. The item-total correlation of SPADI was calculated by Spearman correlation coefficient. A correlation of at least 0.4 was assumed as the standard for supporting scale internal consistency [44]. The test-retest reliability, which is a measure of stability or reproducibility, shows the capability of a scale to give the same result when administered on separate occasions [42]. The test-retest reliability of the SPADI was measured by using intraclass correlation coefficient (ICC). In this study, 60 randomly selected patients completed the SPADI twice within a time interval of 5–7 days before the final evaluation of the patients. Values of ICC vary from 0 (no stability) to 1 (perfect stability).

In the absence of a true "gold standard" against which to assess the criterion validity of the SPADI [45], we compared the SPADI questionnaire with external measures to reflect the impact of shoulder pain. Convergent validity is concerned with the extent to which a particular measure relates to other measures, with theoretically derived hypotheses for the constructs that are being measured [43]. To test the convergent validity, correlations between the SPADI questionnaire and the VAS scores, the total score of the HAQ scale were measured. The Spearman correlation coefficient was used to test the convergent validity of the SPADI scale. Correlation values ≥ 0.4 were considered satisfactory ($r \geq 0.81$–1.0 was considered excellent, 0.61–0.80 very good, 0.41–0.60 good, 0.21–0.40 fair and 0.00–0.20 poor).

Result

The main demographic and clinical characteristics of the sweepers and their categorical characteristics are presented in Table 1 & 2, respectively. Acceptability of the SPADI was satisfactory, with a completion time of about 5 minutes. Prevalence of shoulder pain among sweepers of Surat city was 49%.

The Cronbach's alpha value for SPADI total score was 0.77. The item - total correlation of the SPADI varied from 0.841-0.971 (Table 3). Both findings indicated good internal consistency of the SPADI. The ICC for the SPADI was 0.064, which is towards stability. The convergent validity of the SPADI was tested by spearmen's correlation coefficient. The correlation coefficient between the SPADI and HAQ (TOTAL) was very good (r=0.734), and this correlation was statistically significant (p value= < 0.001). Similarly, the correlation between the SPADI and VAS score was very good (r=0.718), and statistically significant (p= < 0.001) (Table 4.

Table 1: Demographic and clinical characteristics of the patients (n = 200)

Characteristic	Mean ± SD (range)
AGE	39.54 ± 12.08 (21-75)
SPADI total score (range 0–130)	65.109± 378.481
VAS (range 0–10)	5.17 ± 1.927
HAQ(TOTAL) total score (range 0–3)	76.19 ± 34.484

Table 2: Categorical Characteristics of the Patients (N= 200).

Characteristic	No. (%)
Gender F M	149 (74.5%)
	51 (25.5%)
Work of Experience <20 Year	193 (96.5%)
>20 Year	7 (3.5%)
Musculoskeletal with Shoulder Pain Condition	76 (Unilateral) (38%)
	22 (Bilateral) (11%)
Without Shoulder Pain	102 (51%)

Table 3: Correlations between the shoulder pain and disability index (Spadi) questionnaire and the sum score of the spadi (N = 200).

Item No	Correlation Coefficient(r)	P Value
Spadi (Pain)	.937	< 0.001
Spadi (Disability)	.958	< 0.001
Spadi	1.000	< 0.001

Table 4: convergent validity of spadi of surat city:

	Mean± Standard Deviation	Spadi		Vas		Haq (Total)	
		R	P Value	R	P Value	R	P Value
Spadi	65.109± 378.481	1.000		.718	.000	.734	.000
Vas	5.17 ± 1.927	.718	.000	1.000		.778	.000
Haq (Total)	76.19 ± 34.484	.734	.000	.778	.000	1.000	

(SPADI - Shoulder Pain and Disability Index, VAS- Visual Analogue Scale, HAQ- Health Assessment Questionnaire)

Discussion

Among the musculoskeletal disorders, shoulder pain is a common cause of morbidity and disability in the general population. [46, 47] As most of the population suffers from shoulder pain and the prevalence of shoulder pain varies between 2%–26% in various countries [48-52], where in our studies it shows the prevalence of shoulder pain to be 49% (Surat city). In which 38% of sweepers were having unilateral shoulder pain (Dominant > non dominant). Another 11% sweepers were found to have bilateral shoulder pain. Intensity of pain in most of the sweepers was found 4 to 6 on Visual Analogue Scale (VAS). The purpose of the present study was to test the convergent validity of the SPADI scale by correlating the questionnaire with the VAS and HAQ scales. Our findings demonstrated that the convergent validity of the SPADI is good, and that the SPADI questionnaire is a reliable instrument, as indicated by its internal consistency, and test retest reliability. However, the less participation of male

patients (51 (25.5%)) in the study group is a major limitation and impedes the generalizability of our findings. Therefore, the findings of this study should only be applicable to female patients.

Cronbach's correlation alpha value (0.777) is suggesting average value for scale internal consistency but it shows SPADI has less internal consistency in Surat city in compression of previous study. Where, The Spearman's correlation coefficient was found (0.939), which is more than 0.4 and the test-retest reliability (0.7) values for SPADI in the present study, which yielded strong correlations that, were consistent with previous reports. High coefficient alpha values (0.86–0.95) and moderate test-retest reliability (0.65) were found in the initial validation of the original SPADI questionnaire [16]. Ali Bicer and Handan Ankaral revalidated the SPADI questionnaire, and found a high coefficient alpha value (0.94) of the total SPADI score with a test-retest reliability analysis (0.92). Internal consistency was good (0.83), both in the Turkish and Slovene (0.92) validation studies, as was in our study its average (0.777) [23, 24, 39]. In Ali Bicer studies they not analyse the subscales of the SPADI, and their study revealed a coefficient only for the SPADI total score, the lack of coefficient values for the subscales is limitation of their study, where in our study we revealed coefficient values for the subscales of SPADI, as the SPADI is generally accepted as a bi-dimensional scale involving pain and disability [39]. A.J. Jeldi *et al*. validated Tamil SPADI in Tamil population; founded internal consistency of the Tamil SPADI was slightly higher than the English and the German version, where in our study we have used English version of SPADI, which is our biggest limitation of the study [53].

The convergent validity was tested by comparing the SPADI score with the VAS and the HAQ overall scores. The correlation coefficients between the SPADI and VAS during AROM, and the overall HAQ scores were good. Similar results were found when compared to the data with the original and translated versions of the SPADI [22-24]. Currently, there is only one validation study in the literature where the convergent validity was determined by comparing the SPADI with the HAQ scale, and the authors found that the SPADI correlated substantially with the HAQ overall score ($r = 0.61$), where in India SPADI validation was determined with the VAS and this was consistent with our result [53-54]. However, despite the good correlation, there is a major limitation in that the extent of the relationship between the subscales of the SPADI and the HAQ questionnaires is still unclear, as subscale correlations of the questionnaires were not analysed in this study.

Instruments measuring functional status should also reflect their psychometric properties [55]. Since SPADI concentrates more on restricted functional activities, limited information is available involving the psychometric properties of the SPADI. Previous reports revealed that depression was the strongest determinant of nonspecific shoulder pain in women [47]. Our findings concerning the SPADI questionnaire seem to support the results of previous studies. Further reliability and validity trials with more heterogenic groups and using different questionnaires related to psychological status are essential in order to reveal the psychometric properties of the SPADI questionnaires [47].

Conclusion

In conclusion, although it is difficult to draw definite conclusions due to the major limitations of the study, our findings concerning the SPADI questionnaire seem to support the results of previous studies, where the SPADI has been established as a reliable and valid measurement, and the SPADI scale, as a useful for patient having shoulder disorders.

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