PERFORMANCE BASED ASSESSMENT AND ITS ASSOCIATION WITH PAIN AND DISABILITY IN PATIENTS WITH CHRONIC LOW BACK PAIN.

Dr. Sai Iyer (Assistant Professor, Balaji College of Physiotherapy)[1], Dr. Arwa Bookseller (B.P.T)[2], Dr. Parth Choksi (B.P.T)[3]

ABSTRACT

BACKGROUND:

The global Burden of disability associated with LBP has been increasing since 1990. Disability associated with LBP increased in all age group between 1990 and 2019 and was greatest in the age 50-54 in 2019. Approximately 70% of years lost through disability were in working aged people (20-65 years). There have been increases in both the number of people living with LBP and the prevalence of LBP increases with increase in age until 80-89 years the greatest number of people with LBP globally are currently in the 50-54 year age group. Global Burden of Disease studies have defined LBP as "pain in the posterior aspect of the body from the lower margin of the twelve ribs to the lower gluteal folds with or without pain referred into one of the lower limbs that last for at least one day. Definition of chronic low back pain is established by the persistence of pain beyond 3 months of symptoms. The need for developing appropriate tools for measuring mobility and activities of daily living was recently characterized as a priority for research by an international task force on back pain. Timed tests of activities such as walking, the sit-to stand task, and repeated trunk flexion have been examined in patients with back pain and shown to have what we consider acceptable reliability, and to be sensitive to change over time. Decreased mobility of the trunk often is considered a manifestation of back pain, and activities such as bending, twisting, stooping, crouching, lifting, dressing, and picking up objects often are limited. Research states that performance tests used in patients with low back pain should be useful to elucidate such key aspects of functioning and activity limitations. The most common outcome measure used in chronic low back pain is ODI, a self-reported questionnaire.

AIM AND OBJECTIVES:

- To determine the level of physical activity in Low back pain patient.
- To determine the association of physical performance assessment with pain and disability in patient with chronic low back pain.

METHODOLOGY:

The scales were handed over to the patients suffering from chronic Low back pain consisting of all the 3 questionnaires. Low back Disability level was assessed by ODI – Oswestry Disability Scale, Back Performance was assessed by PSQI – Back Performance scale, and Pain was measured by NPRS – Numerical Pain Rating Scale. The consent was taken from the patients and the details of the study were also explained to them initially. All the data were analysed. ($p<0.05$).

OUTCOME MEASURES:

Back Performance assessment, Pain, Low back disability Level.

RESULTS:

A total of 100 data were collected and were analyzed. It was seen that there is a negative correlation of back performance with pain and disability. With increase in pain and disability there is reduction in performance. Also there is altered perception in individuals with chronic low back pain, which was analyzed in the study with the reports of all the 3 scales.

CONCLUSION:

There is overall reduction in performance based assessment of patients with chronic low back pain. There is alteration in perception and execution in patients with chronic low back pain. Outcome measures should be performance based rather than selfreported, so as to assess the real picture of patients prognosis and outcome of any treatment.

Keywords: Chronic Low back Pain, Pain and Disability

INTRODUCTION

Global Burden of Disease studies have defined low back pain (LBP) as "pain in the posterior aspect of the body from the lower margin of the twelfth ribs to the lower gluteal folds with or without pain referred into one or both lower limbs that lasts for at least one

day.[1] The definition of the chronic lower back pain is established by the persistence of pain beyond 3 months of symptoms.[2] Common conditions causing low back pain are Herniated disk, degenerative disk disease, facet joint dysfunction, Sacroiliac joint dysfunction, Spinal stenosis, Spondylolisthesis, osteoarthritis and deformity.[1] The main factors inducing the pain to become chronic are individual factors, psychological factors or socio-professional factors. The socio-professional factors are often much more influential than the physical factors.[2]

The fact is attributed to the chronic nature of diseases that lead to an increase in physical disabilities such as decline in health, decreased strength, reduced muscle endurance, flexibility, and mobility, as well as deterioration in motor control, causing postural instability in a variety of situations in daily life.[1] The incidence of chronic degenerative diseases, namely chronic musculoskeletal pain, particularly in the lumbar region, is one of the most common complaints in individuals over age 60, and leads to functional limitation and greater physical dependence.[3]

The global burden of disability associated with LBP has been increasing since 1990. Disability associated with LBP increased in all age groups between 1990 and 2019 and was greatest in the 50-54 age group in 2019. Approximately 70% of years lost through disability were in working aged people (20-65 years). There have been increases in both the number of people living with LBP and the prevalence of LBP in all age groups from 1990 to 2017. Although the prevalence of LBP increases with increasing age until 80-89 years, the greatest number of people with LBP globally are currently in the 50-54 year age group. The overall increase in the burden of LBP is likely to be driven by ageing and an increasing population, however there may be other contributing factors. It is estimated that fewer than 1 in 3 people living with chronic LBP have associated substantial restriction of participation in work, social activities, and self-care activities for 6 months or more (high-impact

LBP). Although less than 28% of people with LBP have severe disability, they account for 77% of all disability caused by low back pain.[1]

There are many factors associated with LBP and disability, including biological, psychological, social and societal factors. These factors seem to be important in low- and high-income societies. Factors that are consistently reported to be associated with disability and high societal costs of chronic LBP include older age, poor general health, increased psychological or psychosocial stress, worse baseline functional disability, sciatica, and the presence of compensation. Social determinants of health with moderate to large effects on poor LBP disability outcomes include "socioeconomic deprivation," low income, unemployment, and occupational factors (manual lifting, working overtime, and lack of supporting staff).[4]

Literature suggests that patients with chronic low back pain reduced quality of life which is determined by different socio-demographic parameters. [5]

Reduction in Pain and improvement in ADLS are one of the most common expectations of patients with chronic low back pain and the indicators of successful treatment outcomes. Bodily pain, limitation of physical activities, and role limitation due to physical health are frequently occurring problems in this group of patient.[6] Such areas of health should be assessed by the use of measurement tools.[7]

A multitude of self-report questionnaires have been developed to assess pain and daily functioning in patients with back problems. Pain is a symptom that depends on the response of the person experiencing it and can be assessed by self-report measures. Such measures are also important because they indicate how patients perceive their daily functioning, and the measures can be used to examine perceived change over time. Self-report measurements also

are simple to obtain. Observation, however, is often considered the most replicable method of assessing functional performance.[7]

The impact of back pain on physical performance may be classified according to the World Health Organization's International Classification of Functioning and Disability (ICF) into dimensions of impairment, activity (limitation), and participation (restriction). Traditional physical tests tend to address impairments. Impairment measures such as those of postural aberrations, decreased muscle force, and range of motion may not be good indicators of musculoskeletal dysfunction and disability.[7]

The need for developing appropriate tools for measuring mobility and activities of daily living was recently characterized as a priority for research by an international task force on back pain. Timed tests of activities such as walking, the sit-to-stand task, and repeated trunk flexion have been examined in patients with back pain and shown to have what we consider acceptable reliability, and to be sensitive to change over time. Decreased mobility of the trunk often is considered a manifestation of back pain, and activities such as bending, twisting, stooping, crouching, lifting, dressing, and picking up objects often are limited. Research states that performance tests used in patients with low back pain should be useful to elucidate such key aspects of functioning and activity limitations.[7]

Patients with back pain often experience difficulties in daily functioning, and these problems are commonly assessed by self-report instruments. The information yielded by these instruments is, however, based on the patient's cognition, influenced by experience and lifestyle, and may not necessarily reflect capability or how well the patient actually performs. There is often a mismatch between objective observation and self-assessment of function.

The most common outcome measure used in chronic low back pain is ODI, a self-reported questionnaire.[8] But the most important fact here is the perception of an individual

with chronic low back pain. Is the perception i.e. what they perceive is what they can actually perform or achieve, that's a gap to be fulfilled. This may help us is coming up with developing more of performance based questionnaires to assess the outcome in patients with chronic low back pain. The need for performance based tool is very important because patients presents with movement loss and except to regain so that they can be independent in their ADLS. In case of self-reported tools another factor which may lead to false prognosis to the patients and therapists is the cognitive level of the patient, language, understanding etc.

Till the best of my knowledge, very few studies have been done to find this association. So this study will focus on physical performance assessment with its association on disability and pain in patients with chronic low back pain.

Many literatures have stated about the big burden of chronic Low back pain on the health care system. Millions of money is been spend on it either in form of surgery or in form of rehabilitation. The most common outcome measure used in chronic low back pain is ODI. It is a self-reported questionnaire and is used to predict the condition by time. But it is also important to know the actual potential of the patient, by using performance based scale to determine whether the perception of the patient is true or false. So this study will focus on performance based assessment and find it association with disability and pain in patients with chronic low back pain. The aim of the study was to study the Physical Performance assessment in patients with chronic low back pain. The objective of the study was to determine the association of Physical Performance assessment with pain and disability in patients with chronic Low back pain.

METHODOLOGY

STUDY DESIGN- Cross-sectional study design

SAMPLE SIZE- 100.

SAMPLING METHOD- Convenient Sampling

SETTINGS- Data would be collected from various hospital and outpatient clinics in Vadodara.

INCLUSION CRITERIA:

- Pain at low back region for more than 3 months.
- Age - 20-60 years.
- Both Males and Females.
- Participants diagnosed any low back pain conditions with no contraindication with Flexion and Extension movement as decided by the orthopaedic surgeon.
- Herniated disk
- Degenerative disk disease
- Facet joint dysfunction
- Sacroiliac joint dysfunction.
- Spinal stenosis
- Spondylolisthesis
- Osteoarthritis and deformity

EXCLUSION CRITERIA:

- Not willing to participate.
- Acute Low back pain or disorder.
- Having contraindication in flexion and extension movement as decided by the orthopaedic surgeon.

PROCEDURE

After getting approval from the ethical committee from the concerned institution participants were recruited from various hospitals and out patient's clinics of Vadodara. Participants diagnosed with any chronic low back disorder listed in the inclusion criteria diagnosed by the surgeon, was included in the study. He/she was explained about the study and informed consent was taken. Then the participants were asked to fill up the questionnaire of Oswestry Disability index (ODI), Numerical Pain rating Scale (NPRS) and will be asked some to fill the demographic details. Then the Participants were asked to perform certain tests (back performance scale) and how the participant performs, scoring was be done accordingly by the therapist. ODI scale is available in both English and Gujarati language. The advantage of this would be that participant will be reading the questionnaire and filling up the responses. If the participants are illiterate then the therapist will read it and ask the response from the participant.

All the scales used in the present study have good psychometric properties.[14,15,16,17,18,19,20]

STATISTICAL ANALYSIS

- Data analysis was done using SPSS version 23.0.
- Descriptive analysis was used to analyse the demographic and Sociodemographic variables.
- Shapiro-Wilk test was used to determine Normality of data.
- Spearmans Correlation analysis was used to determine the association of back performance assessment with disability and pain.
- 95% confidence interval was taken, significance level $p<0.05$.

RESULTS

- A total of 100 samples were collected from various clinics, hospitals across Vadodara.
- The demographic and Sociodemographic details are mentioned in table1

Table 1: Demographic and Socio- Demographic characteristics of Participants

Variables		**N (%)**	**Mean ± SD**
Gender	Males	44 (44)	
	Females	56 (56)	
Age	20-30	23 (23)	25.54 ± 3.25
	31-50	55 (55)	41.72 ± 5.97
	51-60	22(22)	55.95 ± 3.42
BMI	<18.5	3 (3)	
	18.5-24.9	52 (52)	
	25-29.9	36 (36)	
	>30	09 (9)	
Occupation	Working	69 (69)	
	Non- Working	31 (31)	
Duration			7.14 ± 3.87

(N- No of Participants, SD- Standard deviation, BMI- Body mass Index, % Frequency, Duration- months)

- In age group we have classified it as **20-30 as young adults**

  31-50 as middle age adults

  And 51-60 as old adults.[21]

- Analysis was done accordingly to the age group also.
- The **minimum age** participants from our study was of **21 years** and **maximum age was 60 years.**
- The **minimum BMI was 15.6** and the **maximum BMI was 33.41 kg/m^2 .**
- The **minimum duration of symptoms was 3 months** and the **maximum duration was 18 months.**

Graph 1: Gender distribution

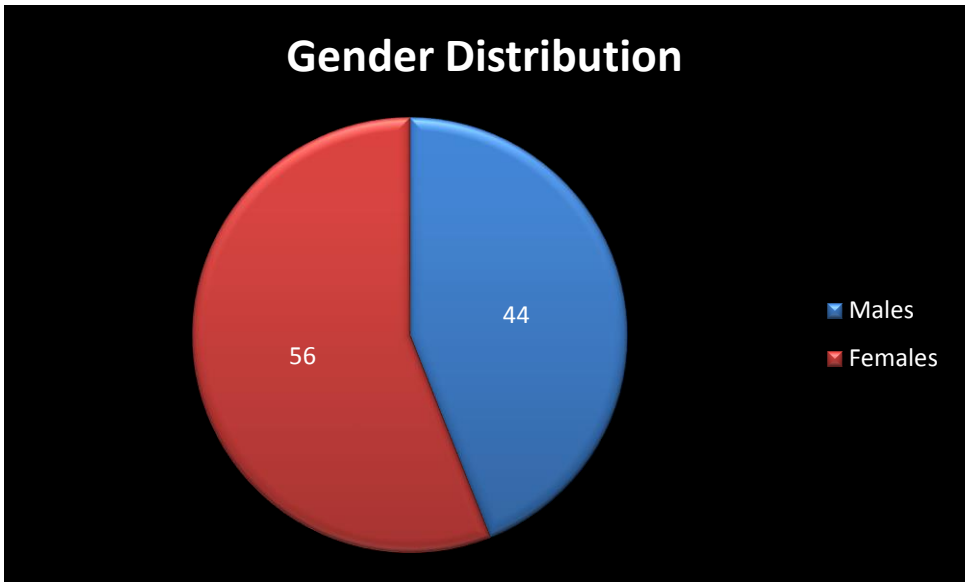

Table 2: Different low back pain conditions and Number of participants in each Condition.

Categories	Frequency	Percentage
Lumbar Spondylosis	15	15%
Lumbar Disk Prolapse	50	50%
Lumbar Spondylolisthesis	10	10 %
Mechanical Low back Pain	15	15 %
Lower Cross Syndrome	10	10%

Table 3: Analysis of outcome measures

Variables	Min	Max	Mean $\pm$ SD
NPRS on Activity	1	10	5.63 ± 2.13
ODI	26.90	90	70.81 ± 10.40
BPS	0	15	8.03 ± 3.78

(NPRS- Numerical pain rating Scale, ODI- Oswestry disability index, BPS- Back performance scale).

- In NPRS, higher the score worse is the pain of the patient.
- In ODI, higher the score percentage, more the disability and pain and wore the condition of patient.
- In BPS, higher the score worse is the condition of patients or performance related to back.
- The aim of the study is to determine performance based assessment in patients with chronic Low back pain.

Table 4: Summary of BPS scores

BPS SCORE	No: of Individual
0	3
1	3
2	3
3	7
4	3
5	6
6	5
7	5
8	11
9	7
10	7
11	10
12	10
13	10
14	5

15	5

Table 4 states that there are more no of individual in worse conditions of back pain in terms of back performance and few individuals having good back performance.

Table 5: Interpretation of ODI Scores

Scores	Interpretations	No: of Individuals
0-20%	Minimal Disability	37
21-40%	Moderate Disability	34
41-60%	Severe Disability	20
61-80%	Crippled Disability	9
81-100%	Bed Ridden	0

So when we analyse table 5, it is seen that majority of individuals are having minimal to moderate disability (37+34=71). 71 individuals are having only mild to moderate disability .29 individuals are having severe to crippled disability.

Now to analyse the perception of individuals of chronic low back pain we compared table 4 and 5 (the ODI scores and BPS scores).

Table 6: Comparison of scores of BPS and ODI

BPS SCORE	No: of Individual	Scores	No: of Individuals
0	3	0-20% Minimal Disability	37
1	3	21-40% Moderate Disability	34
2	3	41-60% Severe Disability	20
3	7	61-80% Crippled Disability	9
4	3	81-100% Bed Ridden	0
5	6	-	-
6	5	-	-
7	5	-	-
8	11	-	-
9	7	-	-
10	7	-	-
11	10	-	-
12	10	-	-
13	10	-	-
14	5	-	-
15	5	-	-

- From the table it is seen that (low BPS score means better is the mobility of back and performance and in ODI less percentage of scores means minimal disability).
- In ODI which is a self-reported questionnaire there are more individuals in minimal and moderate disability and in BPS there are more individuals in more score means less mobility and back performance.
- So the Response has an Inverse relationship of ODI with BPS. So there is a difference in perception of individual which can be proved by performance based outcome.
- Performance based outcomes can lead to a better prognostic factor and can better assess outcomes when compared with self- reported questionnaires.
- The objective of the study was to compare BPS scores with pain and disability.
- Shapiro-Wilk test was used to assess the distribution of data and the results came as Skew distribution of data.
- So to determine the association of BPS with pain and disability Spearmans correlation analysis was used.

Table 7: Spearmans Correlation of Back Performance scale with Pain (NPRS).

Spearmans correlations		
		NPRS (Pain)
Back Performance scale	**Correlation coefficient**	**-0.891**
	Significance Value	**0.00***

(P<0.05) *

Table 8: Spearmans Correlation of Back Performance scale with Disability (ODI).

Spearmans correlations		
		ODI (Disability)
Back Performance scale	**Correlation coefficient**	**-0.711**
	Significance Value	**0.00***

(P<0.05) *

- The association of BPS with pain (NPRS) showed a strong negative correlation and the data were statistically significant. As the pain intensity increases, the performance related measurement of back reduces. Pain affects movement and thereby reduces the mobility of back.
- There was a moderate negative correlation between ODI and BPS and the data were statistically significant.
- When compared the BPS with age there was a weak to moderate negative correlation and the data were not statistically significant.

Table 9: Spearmans Correlation of Back Performance scale with Age.

Spearmans correlations		
		Age
Back Performance scale	**Correlation coefficient**	**-0.56**
	Significance Value	**0.627**

(P<0.05) *

Table 10: Back Performance Scale in different age groups

Age Group	Min	Max	Mean ± SD
20-30	0	14	7.68 ± 4.20
31-50	1	15	8.17 ± 3.83
51-60	3	15	8 ± 3.2

Table 11: Back Performance assessment in different age groups and its association with pain and disability.

Variable	NPRS (21-30)	ODI (21-30)
Back Performance Scale		
Correlation coefficient	-0.75	-0.50
Significance Value	0.04*	0.918
	NPRS (31-50)	**ODI (31-50)**
Back Performance Scale		
Correlation coefficient	-0.81	-0.82
Significance Value	0.00*	0.04*
	NPRS (51-60)	**ODI (51-60)**
Back Performance Scale		
Correlation coefficient	-0.91	-0.50
Significance Value	0.00*	0.00*

(P<0.05)*

DISCUSSION

The study aimed to assess the performance based assessment in patients with chronic low back pain and the objective was to find the association of the performance based assessment with Pain and disability. A total of 100 samples were collected and the data were analysed.

The participants were asked to perform certain task which checked the mobility of back through a scale called back performance scale. They were asked to report the pain through NPRS scale. The disability was measured by Oswestry disability index. It was seen from the data that there were more individual's who's score in ODI were showing minimal to moderate disability. But when the scores were compared with BPS it showed worse. So these data suggested an inverse relationship between the scores of ODI and BPS. So there might be an alteration in perception of individuals with chronic low back pain.

A study done by Benedict Martin Wand[22] et al stated that there is distorted in body perception in individuals with chronic low back pain. The level of perceptual disturbance is positively correlated with pain and disability. The disturbed perception is also responsible for increase in pain, psychological distress, fear avoidance and tissue sensitivity. This could be a reason because of which the patients can think of performing an action but not execute it.

The objective of the study was to compare the performance based assessment with and disability. When comparing pain with BPS there was a strong negative correlation between them and the data were statistically significant. Pain always has an inverse relationship with movement. More the pain less the movement. Strand LI[7] et al in his

study concluded that pain in low back is responsible for reduction in mobility and which in turn reduces the performance of low back.

When BPS was compared with ODI there was a moderate negative correlation and the data were statistically significant. Pain leads to mobility deficits and vica versa. Thus a viscous cycle is initiated and that leads to alteration in performance assessment of low back pain.[7]

When BPS was correlated with age there was a moderate negative correlation and the data were not statistically significant. One reason could be no any assessment of home and work environment was taken and another any pre-existing condition assessment was also not included. Studies states with increase in age do the mobility deficit and thus affects the performance.[23]

BPS when compared with pain and disability by the age groups, there was a strong negative correlation with pain and a moderate negative correlation with ODI in young age group. But one thing which is important to note here is the unequal distribution of participants in the different age groups. More the pain less the movement and more the disability. But one thing which should be considered is ODI is a self-reported questionnaire while BPS is performance based outcome. What the patients plans or thinks (Cognitive functions) will not exactly match the perception or the reality or the execution.[(7,23)]

When BPS was compared with pain and ODI in middle adult and older adult age group (31-50) - (51-60), there was a strong negative correlation. The possible explanation could be pain in inversely associated with mobility impairment and the pain tolerance level reduces with age and pain is directly proportional with disability. The healing

power, reduces with age, degenerative changes starts and there by further increasing pain leading to mobility deficit and thereby limiting performance of low back.[7,23]

CONCLUSION

There is overall reduction in performance based assessment of patients with chronic low back pain. There is alteration in perception and execution in patients with chronic low back pain. Outcome measures should be performance based rather than self-reported, so as to assess the real picture of patient's prognosis and outcome of any treatment.

LIMITATIONS

- Smaller sample size.
- Occupational analysis, home environment analysis and assessment of pre-existing comorbidities could be taken.

FUTURE RECOMMENDATIONS

- Study with a larger sample size.
- Assessment of work environment, home environment and any other pre-existing comorbidity shall be taken into consideration.

REFERENCES

1. IASP: Global burden of low back Pain, 2021.
2. Rozenberg S. Chronic low back pain: definition and treatment. La Revue du praticien. 2008 Feb 1;58(3):265-72.

3. Rodrigues CP, Silva RA, Nasrala E, Andraus RA, Fernandes MT, Fernandes KB. Analysis of functional capacity in individuals with and without chronic lower back pain. Acta ortopedica brasileira. 2017 Jul;25:143-6.
4. Benz T, Lehmann S, Elfering A, Sandor PS, Angst F. Comprehensiveness and validity of a multidimensional assessment in patients with chronic low back pain: a prospective cohort study. BMC Musculoskeletal Disorders. 2021 Dec;22(1):1-3.
5. Járomi M, Szilágyi B, Velényi A, Leidecker E, Raposa BL, Hock M, Baumann P, Ács P, Makai A. Assessment of health-related quality of life and patient's knowledge in chronic non-specific low back pain. BMC Public Health. 2021 Apr;21(1):1-8.
6. Blanpied PR, Gross AR, Elliott JM, Devaney LL, Clewley D, Walton DM, Sparks C, Robertson EK, Altman RD, Beattie P, Boeglin E. Neck pain: revision 2017: clinical practice guidelines linked to the international classification of functioning, disability and health from the orthopaedic section of the American Physical Therapy Association. Journal of Orthopaedic & Sports Physical Therapy. 2017 Jul;47(7):A1-83.
7. Strand LI, Moe-Nilssen R, Ljunggren AE. Back Performance Scale for the assessment of mobility-related activities in people with back pain. Physical therapy. 2002 Dec 1;82(12):1213-23.
8. Maughan EF, Lewis JS. Outcome measures in chronic low back pain. European Spine Journal. 2010 Sep;19(9):1484-94.
9. Strand LI, Moe-Nilssen R, Ljunggren AE. Back Performance Scale for the assessment of mobility-related activities in people with back pain. Physical therapy. 2002 Dec 1;82(12):1213-23.

10. Andersson EI, Lin CC, Smeets RJ. Performance tests in people with chronic low back pain: responsiveness and minimal clinically important change. Spine. 2010 Dec 15;35(26):E1559-63.
11. Coyle PC, Velasco T, Sions JM, Hicks GE. Lumbar mobility and performance-based function: an investigation in older adults with and without chronic low back pain. Pain medicine. 2017 Jan 1;18(1):161-8.
12. Pfingsten M, Lueder S, Luedtke K, Petzke F, Hildebrandt J. Significance of physical performance tests for patients with low back pain. Pain Medicine. 2014 Jul 1;15(7):1211-21.
13. Lee CP, Fu TS, Liu CY, Hung CI. Psychometric evaluation of the Oswestry Disability Index in patients with chronic low back pain: factor and Mokken analyses. Health and quality of life outcomes. 2017 Dec;15(1):1-7.
14. Magnussen L, Strand LI, Lygren H. Reliability and validity of the back performance scale: observing activity limitation in patients with back pain. Spine. 2004 Apr 15;29(8):903-7.
15. Vianin M. Psychometric properties and clinical usefulness of the Oswestry Disability Index. Journal of chiropractic medicine. 2008 Dec 1;7(4):161-3.
16. Shah S, Balaganapathy M. Reliability and validity study of the Gujarati version of the Oswestry Disability Index 2.1 a. Journal of back and musculoskeletal rehabilitation. 2017 Jan 1;30(5):1103-9.
17. Jensen, M.P. and Karoly, P. (2011). "Self-report scales and procedures for assessing pain in adults", in Turk, D.C. and Melzack, R. (eds). Handbook of pain assessment, 3rd edition. New York, Guilford Press, 19-44.

18. Ferraz MB, Quaresma MR, Aquino LR, Atra E, Tugwell P, Goldsmith CH. “Reliability of pain scales in the assessment of literate and illiterate patients with rheumatoid arthritis”. J Rheumatol. 1990 Aug;17(8):1022–4.
19. Childs JD, Piva SR, Fritz JM. “Responsiveness of the Numeric Pain Rating Scale in Patients with Low Back Pain”. Spine. 2005 Jun 1;30(11):1331–4.
20. Williamson A, Hoggart B. “Pain: a review of three commonly used pain rating scales”, Journal of Clinical Nursing, Wiley/Blackwell (10.1111); 2005 Aug 1;14(7):798–804.
21. Yarlagadda A, Murthy JV, Prasad MK. A novel method for human age group classification based on correlation fractal dimension of facial edges. Journal of King Saud University-Computer and Information Sciences. 2015 Oct 1;27(4):468-76.
22. Wand BM, James M, Abbaszadeh S, George PJ, Formby PM, Smith AJ, O'Connell NE. Assessing self-perception in patients with chronic low back pain: development of a back-specific body-perception questionnaire. Journal of back and musculoskeletal rehabilitation. 2014 Jan 1;27(4):463-73.
23. González-Roldán AM, Terrasa JL, Sitges C, van der Meulen M, Anton F, Montoya P. Age-related changes in pain perception are associated with altered functional connectivity during resting state. Frontiers in aging neuroscience. 2020 May 7;12:116.