Job Requirements and Physical Demands (JRPD) Questionnaire: Cross-Cultural Adaptation and Psychometric Evaluation in Iranian Army Personnel with Chronic Low Back Pain

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Research Article

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Abstract

**Background:** Biomechanical risk factors have been identified as the main predisposing factor of Chronic Low Back Pain (CLBP), especially in Army personnel. The Job Requirements and Physical Demands (JRPD) questionnaire has been developed to assess the biomechanical exposures related to CLBP. Examining the biomechanical risk factors could prevent CLBP. This research was designed to cross-cultural adaptation and the psychometric properties of the Persian version of the Job Requirements and Physical Demands (JRPD) questionnaire among Iranian Army personnel with Chronic Low Back Pain (CLBP).

**Methods:** In this non-experimental and methodological designed study, the content validation of the JRPD was performed after translating to Persian. The Persian JRPD was administered to 198 Army personnel with CLBP, with an interval of seven days, to assess test-retest reliability. Scores of the Visual Analog Scale (VAS), Borg's Category-Ratio (CR10) scale, General Health Questionnaire-28 (GHQ-28), and two Physical Functioning (PF₁ and PF₂) items of the 12-item Short Form survey (SF-12) were recorded to estimate the correlation with the Persian JRPD.

**Results:** After content validation, the number of items in the Persian JRPD remained unchanged. Persian JRPD was correlated with VAS ($r = .27; p < .001$), Borg's scale ($r = .19; p < .009$), GHQ-28 ($r = .31; p < .001$), PF₁ ($r = -.35; p < .001$), and PF₂ ($r = -.27; p < .001$). Also, test-retest reliability and internal consistency values were found to be .80 and .91, respectively.

**Conclusion:** The Persian version of the JRPD is a valid questionnaire with good reliability when applied to Iranian Army personnel with CLBP.

**Background**

Low Back Pain (LBP) is the most common disorder among Army personnel, defined as pain localized below the costal margin and above the inferior gluteal folds, with or without leg pain [1, 2]. In the Armed forces, LBP impacts troop readiness and leads to ambulatory care, work duty limitation, lost days, and disability [2–6]. The LBP prevalence is rising, and the LBP-related costs have increased substantially over the past decades [7]. 4–19% of patients with LBP feel the pain for three months or longer, called Chronic LBP (CLBP) [7, 8]. CLBP is a multifactorial disorder, and previous studies have been confirmed the roles of individual factors, health behaviors, work organization, psychosocial, and biomechanical risk factors in the back pain onset and its exacerbation [4, 5, 9]. Among these, biomechanical risk factors, for instance, heavy lifting, static work postures, frequent twisting and bending, forceful exertions, and whole-body vibration have been identified as the main predisposing factor of CLBP, especially in Army personnel [2, 4, 5]. Examining the biomechanical risk factors could prevent CLBP [5, 10], and the primary prevention programs would enhance the performance and quality of life in the Army personnel [2, 11, 12].

Self-report questionnaires, as an examining method to measure biomechanical exposures, are efficacious in reducing the resources of time and costs [5]. Various self-report questionnaires are currently available.
for the evaluation of LBP, such as Job Requirements and Physical Demands (JRPD) [1, 2, 5], Roland-Morris disability questionnaire and its variants [13, 14], Oswestry disability index and its several versions [14, 15], the Quebec back pain disability scale [16], the Waddell disability index [17], the low back outcome score [18], and many other scales (see further information in Longo et al. [14]). All these questionnaires, except JRPD, estimate the degree of patients’ disabilities in physical and mental functions during daily living, productivity, and work quality. However, the JRPD questionnaire has been particularly developed to assess the biomechanical exposures related to LBP.

The JRPD questionnaire was originally developed by the US Air Force (1997), both the military and civilian populations, for preventing work-related musculoskeletal illnesses through ergonomics [19]. The Job Factors section of the JRPD is generally called JRPD and consists of 38 items [19]. Daniels and colleagues (2005) have specifically examined the measurement properties of the JRPD in relation to LBP [5]. They had confirmed that the JRPD is a validated measure for assessing biomechanical exposures for back pain [1, 2, 5, 20]. The JRPD questionnaire has been developed to assess biomechanical exposure in a variety of occupational groups [5, 19]. Its items contain questions about the frequency of certain work-related movements such as bending, twisting, lifting, sitting, and postures; which are consistently found to be related to LBP [1, 2, 5, 20].

Based on our best knowledge, the JRPD questionnaire has not been translated and cross-culturally adapted to other languages. Concerning the high prevalence of CLBP in Iranian populations [1, 2, 21], in the current study, we aimed to translate the original JRPD questionnaire to the Persian language, perform the cross-culturally adaptation, and evaluate the validity, reliability, and responsiveness of the questionnaire in a sample of Iranian Army personnel who suffered from CLBP.

Methods

Study design and participants

This non-experimental and methodological designed study was performed using a convenient sampling method [22]. Of selected Iranian Army centers in Tehran province, 198 patients with CLBP have participated in the current study from February 2013 to August 2018. Patients with LBP, as pain between T12 and buttock crease, with or without associated lower limb symptoms [23], the persisted pain for longer than three months [1, 2, 7], at least one episode of LBP within the past 12 months [1, 2, 5], aged 18 years or older [1, 24], and fluency in the Persian language included to the current study. Exclusion criteria were previous or scheduled surgery to the lumbosacral spine, malignancy, trauma, psychological conditions, specific conditions such as spondylolisthesis, spinal stenosis, and osteoporosis, and presence of medical “red flags” that indicate the potentially serious medical and pathological conditions in the spine, such as disc herniation, fractures, tumors, nerve compression, and structural deformity [1, 5, 24, 25]. Participants who answered the questionnaires incompletely in the test or retest phase were also excluded.

Translation procedure
Before the study, we have received permission from the original JRPD developers for this cross-cultural adaptation study. The cross-cultural adaptation process was adjusted according to the guideline proposed by Beaton et al. [26], in order to provide a linguistically and culturally equivalence between the original and the translated versions (Fig. 1). The first step of the cross-cultural adaptation was the forward translation, in which the questionnaire was translated from the English language to Persian. Two bilingual Persian-native expert translators produced two independent translations. Item content, response options, and instructions were all translated. One of the translators was aware of the concepts being examined, whereas the other translator has not informed of the concepts being quantified and had no clinical background. They provided written reports, which included additional comments to highlight challenging phrases or uncertainties and their rationale for choices. In the second step, translators and research administrators synthesized the translations and formulated an initial version of Persian JRPD by comparing the translated texts and solving all the discrepancies.

Two bilingual English-native expert translators translated the initial version of Persian JRPD back into the original language, in the third (backward translation) step. They were blinded to the original version and have not informed of the concepts explored, and had no clinical background. In the fourth step, the expert committee consisting of all translators, research administrators, and three occupational therapists, reviewed all the versions and reached a consensus about all the discrepancies, and eventually provided the prefinal version of Persian JRPD. Next, in the pilot study, the prefinal version was tested on 70 Army personnel with CLBP (see further details at [2]) to find any difficult, ambiguous, or confusing items in order to determine the qualitative face validity [27]. Participants reported no difficulty in completing the prefinal Persian version of JRPD during the pilot study (good face validity) [2]. Ultimately, the final version of Persian JRPD was provided to assess the psychometric properties.

**Assessment of psychometric properties**

To assess the psychometric properties of Persian JRPD, content and convergent validity, floor/ceiling effects, test-retest relative and absolute reliability, internal consistency, and Minimal Detectable Change (MDC), with 95% Confidence Interval (CI), were determined.

**Validity**

**Content validity**

Following translation, content experts were invited to participate in the study for assessing Persian JRPD content validation. Although there is no clear idea on the ideal number of content experts needed in a validation study [28], three occupational therapists and four physiotherapists, with the same language and culture of our participants, reviewed all items of the questionnaire for relevancy, simplicity, clarity, and the necessity of each item [29]. After receiving a questionnaire that included items related to content validity, they had seven days to respond to the questions [28]. For assessing the quantitative content validity of each item of the questionnaire, the Content Validity Index (CVI) and Content Validity Ratio (CVR) were calculated based on the Lawsheis model [29]. Content experts were asked to declare their
level of agreement for relevancy, simplicity, clarity (CVI), and the necessity of each item (CVR), as to which items should be included in the final Persian JRPD. Content experts had to rate each item of the questionnaire on a Likert-like scale of 1 to 4 [30]. Acceptable values for CVI and CVR were considered higher than .70 and .59, respectively [29, 31].

**Convergent validity**

convergent validity of the Persian JRPD was explored by correlation, using Spearman correlation coefficient and comparing the Persian JRPD with pain Visual Analog Scale (VAS), Borg's Category-Ratio (CR10) scale, General Health Questionnaire (GHQ-28), and two Physical Functioning (PF) items (PF$_1$ and PF$_2$) of the 12-item Short Form (SF-12) survey. Sizes of correlation .90 to 1.00, .70 to .90, .50 to .70, .30 to .50, and .00 to .30 are interpreted as very high, high, moderate, low, and negligible correlation, respectively [32].

**Floor/ceiling effects**

we were used floor/ceiling effects (percentages) to determine the acceptability of the Persian JRPD. When floor/ceiling effects occur, more than 10% of the participants achieve the lowest or the highest possible score on the scale [22].

**Reliability**

**Test-retest reliability**

the Intra-Class Correlation Coefficient (ICC) and the Standard Error of Measurement (SEM) were used to calculate the relative and absolute reliability, respectively. Since the Persian JRPD is a self-report questionnaire, the effect of the observer/rater in answering the items is minimum. Accordingly, the test-retest relative reliability of the questionnaire was estimated based on a mean-rating (k = 3), absolute-agreement, 2-way mixed-effects model (ICC$_{3,1}$), with 95% CI [33]. Values less than .5, .5 to .75, .75 to .9, and greater than .90 are indicative of poor, moderate, good, and excellent reliability, respectively [33]. Also, the SEM was calculated using the formula of $SD_{pooled} \times \sqrt{1-ICC}$. The $SD_{pooled}$ is the standard deviation of the total score of the questionnaire for all participants [34]. An SEM value of less than half of $SD_{pooled}$ is considered acceptable [35]. By considering participants were not aware of the completion of the questionnaire again, they responded to the questions with a seven-day interval [36]. Participants were asked to complete the questionnaire without the rater's assist.

**Internal consistency**

internal consistency was estimated through Cronbach's alpha. Value of alpha more than 9, 8, 7, 6, and 5 is indicative of an excellent, good, acceptable, questionable, and poor inter-item reliability, respectively.
Also, alpha less than 5 is unacceptable [37].

**Clinometric property**

$MDC_{95\%}$ of the questionnaire was calculated using the formula of $\pm 1.96 \times \sqrt{2 \times SEM}$ [38]. The value of 1.96 is a $z$ score associated with 95% CI [34, 38]. $MDC_{95\%}$ determines the minimal amount of change that can be considered as a real change in the behavior of each participant. A questionnaire with a smaller $MDC_{95\%}$ is sufficiently sensitive [38].

**Instruments**

We have used a self-administered questionnaire to gather participants' demographic data. Furthermore, the self-report scales, including the Persian JRPD, VAS, Borg CR10 scale, GHQ-28, and PF$_1$ and PF$_2$ items of the SF-12 survey, were used to collect data.

**JRPD:** As mentioned previously, the JRPD questionnaire has 38 items, which use to examine both types of exposure and duration of biomechanical exposures related to LBP [1, 2, 5, 20]. Each item has five-point Likert-type scales: 1 (never), 1 ($\leq$ 5 hours/week), 2 ($\leq$ 2 hours/day), 3 (2 to 4 hours/day), and 4 ($\geq$ 4 hours/day) [1, 2, 5]. The total score of JRPD computes by summing the total of the 38 items and ranging from 38 to 152. A higher score means a higher level of biomechanical exposure and a greater likelihood of a subject has LBP within the past 12 months [5, 20].

**VAS:** VAS, as a valid and reliable measure of pain intensity that has been used widely in various adult study populations, was used to assess the correlation of Persian JRPD with pain intensity [39, 40]. It is a continuous scale comprised of a horizontal 100-mm length line, of which 0-mm means no pain and 100-mm means pain as bad as it could or worst imaginable pain [40]. We have not utilized the numbers or verbal descriptors at intermediate points to avoid clustering of scores around a preferred numeric value [40]. Participants were asked to put a line perpendicular to the VAS line. Then, the distance between 0-mm and the patient's mark was measured by a ruler to determine the participant's score [40]. The cut-points for VAS have been recommended: no pain (0–4 mm), mild pain (5–44 mm), moderate pain (45–74 mm), and severe pain (75–100 mm) [41]. Therefore, individuals with a VAS score of 4 or less than were considered as without CLBP and were not entered into the study.

**Borg's CR10 scale:** Borg's CR10 scale is a valid way to rating the levels of physical or muscular fatigue and whole body exertion due to work. A high score on this scale indicates the high load of both cardiovascular and muscular work [20, 42]. Participants were asked to put a mark on a 10-cm horizontal line where their physical intensity presented [20]. The scores were defined as: 0 (no exertion at all), .5 (very, very slight (just noticeable)), 1 (very slight), 2 (slight), 3 (moderate), 4 (somewhat severe), 5 (severe), 6 and 7 (very severe), 8 and 9 (very, very severe (almost maximal)), and 10 (maximal exertion) [42].

**GHQ-28**
GHQ-28 is a valid scale, which has been developed to identify minor psychiatric and psychological disorders. Persian GHQ-28 was applied in the current study [43], which contains 28-items in domains of somatic symptoms (items 1–7), anxiety/insomnia (items 8–14), social dysfunction (items 15–21), and severe depression (items 22–28). A higher score of the GHQ-28 implies a higher unfavorable psychological status. Subjects indicated which each symptom is true of themselves on a 4-point Likert scale [43, 44].

**SF-12**

SF-12 survey was used to assess the correlation of Persian JRPD with the patients' functional abilities in physical activities. Persian SF-12 is a validated and reliable measure of function [45]. It has a focus on overall physical and mental health outcomes and is used in various medical studies on patients with chronic conditions [45]. In the current study, we have selected two PF items of SF-12 included PF$_1$ (limitations in moderate physical activities) and PF$_2$ (limitations in climbing several flights of stairs). Also, instead of mental health items of the SF-12, we have used GHQ-28 for well considering mental aspects.

**Statistical analysis**

The mean (SD) of the quantitative variables and the frequency (%) of the qualitative variables were reported. The normal distribution of data was tested using the Shapiro Wilk test [46]. All analyses were performed using Statistical Package for the Social Sciences (SPSS 21.0, Chicago, IL) with the statistical significance level of $p < .05$ and 95% CI.

**Results**

One hundred and ninety-eight participants with a mean (SD) age of 32 (10.40) years participated in the present study. Despite recruiting three females into the study, their data were excluded from the analyses because of minor effects on statistical outcomes. All 198 participants, therefore, were male. The demographic and clinical characteristics of participants are indicative in Table 1.
| Characteristics                        | Mean (SD)  | Range (min-max) |
|---------------------------------------|------------|-----------------|
| Age (yr)                              | 32 (10.40) | 19–66           |
| Height (cm)                           | 175 (6.80) | 157–192         |
| Weight (kg)                           | 74 (1.10)  | 47–116          |
| Pain intensity (VAS)                  | 36 (25.30) | 6–99            |
| Frequency (%)                         |            |                 |
| Mild pain (5–44 mm)                   | 128 (64.60)|                 |
| Moderate pain (45–74 mm)              | 49 (24.70) |                 |
| Severe pain (75–100 mm)               | 21 (10.60) |                 |
| Educational status                    |            |                 |
| Academic                              | 151 (76.30)|                 |
| Non-academic                          | 47 (23.70) |                 |
| Marital status                        |            |                 |
| Single                                | 82 (41.40) |                 |
| Married                               | 116 (58.60)|                 |
| Employment status                     |            |                 |
| Employed                              | 128 (64.60)|                 |
| Unemployed                            | 70 (35.40) |                 |
| Service status                        |            |                 |
| Military                              | 139 (70.20)|                 |
| Non-military                          | 59 (29.80) |                 |
| Military ranks                        |            |                 |
| Colonel                               | 6 (3.00)   |                 |
| Major                                 | 10 (5.10)  |                 |
| Captain                               | 15 (7.60)  |                 |
| Lieutenant                            | 126 (64.70)|                 |
| Master sergeant                       | 11 (5.50)  |                 |
| Sergeant                              | 5 (2.50)   |                 |
The CVI for items of the Persian JRPD ranged from .76 to 1.00. All 38 items had CVI higher than .7, which implies a good content validity for these items. Twelve out of 38 items had a CVI of 1, which represented a complete agreement among the content experts. The CVR for items of the Persian JRPD ranged from .60 to 1.00, and 14 out of 38 items had a CVR of 1, a complete agreement among the content experts. Content validation outcomes of the Persian JRPD questionnaire are presented in Table 2.
Table 2
Content validation outcomes of the Persian JRPD questionnaire (N = 7).

| Item | Description                                                                                                                                                                                                 | CVI  | CVR  |
|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|
| 1    | I work with my hands at or above chest level                                                                                                                                  | .93  | 1.00 |
| 2    | To get to or do my work, I must lay on my back or side and work with my arm up                                                                                                  | .93  | .90  |
| 3    | I must hold or carry materials (or large stacks of files) during the course of my work                                                                                              | 1.00 | 1.00 |
| 4    | I force or yank components of work objects in order to complete a task                                                                                                            | .90  | .90  |
| 5    | I reach / hold my arms in front of or behind my body (e.g. Using keyboard, filing, handling parts, perform inspection tasks, pushing/ pulling carts, etc.)                                                | 1.00 | .90  |
| 6    | My neck is tipped forward or backward when I work                                                                                                                               | .96  | 1.00 |
| 7    | I cradle a phone or other device between my neck and shoulder                                                                                                                      | 1.00 | .70  |
| 8    | My wrists are bent (up, down, to the thumb, or little finger side) while I work                                                                                                   | .93  | 1.00 |
| 9    | I apply pressure or hold an item /material /tool (e.g., screwdriver, spray gun, mouse, etc. in my hand for longer than 10 seconds at a time)                                                      | .96  | .90  |
| 10   | My work requires me to use my hands in a way that is similar to wringing out clothes                                                                                               | 1.00 | .90  |
| 11   | I perform a series of repetitive tasks/ movement during the normal course of my work (e.g. using keyboard, tightening fastener, cutting meat, etc.)                                                                 | .93  | 1.00 |
| 12   | The work surface (e.g., desk, bench, etc.) or tool(s) that I use presses into my palm(s) /wrist(s), or against the sides of my fingers leaving red marks on or beneath the skin                                | .93  | 1.00 |
| 13   | I use my hand/ palm like a hammer to do aspects of my work                                                                                                                      | .96  | 1.00 |
| 14   | My hands and fingers are cold when I work                                                                                                                                   | .90  | .80  |
| 15   | I work at a fast pace to keep up with the machine production quota or performance incentive                                                                                          | .83  | .80  |
| 16   | The tool(s) that I use vibrates and/ or jerks my hand(s)/arm(s)                                                                                                                 | 1.00 | 1.00 |
| 17   | My work requires that I repeatedly throw or toss items                                                                                                                          | .96  | .90  |
| 18   | My work requires me to twist my forearms, such as turning a screwdriver                                                                                                           | 1.00 | 1.00 |
| 19   | I wear gloves that are bulky, or reduce my ability to grip                                                                                                                       | .96  | .70  |
| 20   | I squeeze or pinch work objects with a force similar to that which is required to open a lid on a new jar                                                                      | .90  | .80  |
| 21   | I grip work objects or tools as if I am griping tightly onto a pencil                                                                                                            | .86  | .80  |
| Item | Description                                                                 | CVI | CVR |
|------|-----------------------------------------------------------------------------|-----|-----|
| 22   | When I lift, move components, or do other aspects of my work, my hands are lower than my knees | .83 | 1.00 |
| 23   | I lean forward continually when I work (e.g., when sitting, when standing, when pushing carts, etc.) | .93 | .90 |
| 24   | The personal protective equipment or clothing that I wear limits or restricts my movement | 1.00 | .80 |
| 25   | I repeatedly bend my back (e.g., forward, backward, to the side, or twist) in the course of my work | 1.00 | 1.00 |
| 26   | When I lift, my body is twisted and/ or I lift quickly | .96 | .80 |
| 27   | I can feel vibration through the surface that I stand on, or through my seat | .90 | .90 |
| 28   | I lift and/ or carry items with my hand | 1.00 | .90 |
| 29   | I lift or handle bulky items | 1.00 | 1.00 |
| 30   | I lift materials that weigh more than 25 pounds | .96 | .90 |
| 31   | My work requires that I kneel or squat | 1.00 | 1.00 |
| 32   | I must constantly move or apply pressure with one or both feet (e.g. using foot pedals, driving, etc.) | .96 | .90 |
| 33   | When I’m sitting, I cannot rest both feet flat on the floor | .80 | 1.00 |
| 34   | I stand on hard surface | 1.00 | .90 |
| 35   | I can see glare on my computer screen or work surface | .76 | .60 |
| 36   | It is difficult to hear a person on the phone or to concentrate because of other activity, voices, or noise in/ near my work area | .83 | .60 |
| 37   | I must look at the monitor screen constantly so that I do not miss important information (e.g. radar scope) | .93 | .60 |
| 38   | It is difficult to see what I am working with (monitor, paper, parts, etc.) | .76 | .60 |

Abbreviations: JRPD; Job requirements and physical demands, CVI; content validity index, CVR; content validity ratio.

The normality hypothesis was rejected for Persian JRPD total scores ($p < .05$). Hence, the Spearman was used to measure the degree of correlation between the Persian JRPD total scores and other variables. The Spearman correlation analyses indicated a significant correlation between the total score of Persian JRPD and VAS ($r = .27; p < .001$), Borg's CR10 scale ($r = .19; p < .009$), and total score of GHQ-28 ($r = .31; p < .001$). Negatively significant correlations between the Persian JRPD total score and PF$_1$ ($r = -.35; p < .001$) and PF$_2$ ($r = -.27; p < .001$) were also estimated (Table 3).
Table 3  
Correlation of the Persian JRPD total score with other scales (N = 198).

| Variable                                           | Spearman | p-value |
|----------------------------------------------------|----------|---------|
| VAS                                                | .27      | .001    |
| SF-12                                              |          |         |
| PF<sub>1</sub>                                      | -.35     | .001    |
| PF<sub>2</sub>                                      | -.27     | .001    |
| GHQ-28 (N = 151)                                   |          |         |
| Total score                                        | .31      | .001    |
| Somatic symptoms (1–7 items total score)           | .22      | .007    |
| Anxiety/insomnia (8–14 items total score)          | .33      | .001    |
| Social dysfunction (15–21 items total score)       | .28      | .001    |
| Severe depression (22–28 items total score)        | .21      | .009    |
| Borg CR10 scale                                    | .19      | .006    |

Abbreviations: JRPD; job requirements and physical demands, VAS; visual analog scale, SF-12; standard short form health survey, PF1; physical functioning-1 (limitations in moderate physical activities), PF2; physical functioning-2 (limitations in climbing several flights of stairs), GHQ; general health questionnaire. Bolded values present significant difference (p < .01).

The mean (SD) of the Persian JRPD total score of all participants was obtained 56.00 (17.00), ranged from 38 to 117. Eighty-four out of 198 (42.40%) participants had a minimum (floored) total score, and no one had a maximum (ceiling) total score. ICC<sub>(3, 1)</sub> value for Persian JRPD total score was found to be .80. Amounts of SEM and MDC<sub>95%</sub> were calculated at 7.91 and 21.32, respectively. Cronbach’s alpha was also obtained at .91 (Table 4).
Table 4
Reliability outcomes of the Persian JRPD questionnaire (N = 198).

| Items | Mean (SD) | Sig  | Cronbach's Alpha Coefficient | ICC 3,1 (95 % CI) | SEM  | MDC |
|-------|-----------|------|------------------------------|-------------------|------|-----|
| 38    | 57.08 (17.51) | .001 | .91                          | .80 (.73 − .84)   | 7.91 | 21.32 |

Abbreviations: JRPD; job requirements and physical demands, SD; standard deviation, Sig; significance, ICC; intraclass correlation coefficient, CI; confidence interval, SEM; standard error measurement, MDC; minimal detectable change. Bolded value presents significant difference (p < .05).

Discussion

This is the first study for the cross-cultural adaptation of the JRPD questionnaire. The main aim of the current study was to translate the JRPD to Persian and evaluate the psychometric properties of the Persian version of JRPD in a sample of Iranian Army personnel with CLBP. We have found that the Persian JRPD is a valid and reliable questionnaire among this population.

All 38 items of the Persian JRPD questionnaire had an accepted CVI and CVR values. Consequently, the number of items in the Persian JRPD remained unchanged. Therefore, all items of the questionnaire were relevant to the assessment of biomechanical exposures, which would lead to CLBP in Iranian Army personnel.

Convergent validity refers to the correlation between measures [47]. When two measures have a strong correlation, it implies that two measures capture equivalent information (strong convergent validity) [47]. For estimating the convergent validity, we have found a low correlation of the total score of the Persian JRPD with the total score of the GHQ-28, the total score of the anxiety/insomnia domain of GHQ-28, and PF₁ of the SF-12. We have also found a negligible correlation between Persian JRPD total score and other measures. In line with our results, Daniels and colleagues [5] have reported a negligible correlation of the original JRPD with pain intensity and physical/mental dysfunctions tested by SF-12. These results confirmed that the JRPD questionnaire would not strongly capture the same information as the selected measures. It has been concluded that the JRPD questionnaire, as a measure of CLBP-related biomechanical exposures, cannot be suggested to use instead of VAS, SF-12, GHQ-28, or Borg CR10 scale. As a suggestion for future studies, it should be examined further convergent validation of the JRPD and low back outcomes, using different observational measurements of biomechanical exposures.

The flooring effect was observed (42.40 %) for Persian JRPD. It represents a possible measuring limitation for the Persian JRPD. The flooring effect may reduce the sensitivity of the scale and distorts the ability of the questionnaire to detect any real changes after interventions. Moreover, the flooring effect can be an
indicator of weak content validity [48]. However, in our study, an acceptable content validation was obtained. Hence, it seems the obtained flooring effect stemmed from the existence of various items in the questionnaire. Observing many items of the JRPD during a certain work is impossible. In other words, just 1 out of 38 items of the questionnaire, as the physical requirements for work, would be enough to suffer back pain. Hence, we suggest developing a short-form of the Persian JRPD in different jobs.

Our findings showed that the Persian JRPD had good relative reliability, acceptable absolute reliability, and excellent internal consistency. In line with our results, Daniels and colleagues had confirmed that the original JRPD questionnaire had high internal consistency [5]. However, they had not examined the relative and absolute test-retest reliability of the JRPD. Overall, our findings have confirmed that the Persian JRPD is a reliable scale for assessing CLBP-related biomechanical exposures in Army personnel.

MDC$_{95\%}$ indicates the responsiveness of a questionnaire [38] and explains truly and validly (not randomly) changes in the total score of the questionnaire to determine whether a patient’s clinical outcome is getting better or getting worse [49]. Our findings indicated the MDC$_{95\%}$ of 21.32 for Persian JRPD. Therefore, researchers and clinicians should note that changes in the total score of Persian JRPD should exceed this amount to indicate a real change in the health status. In other words, the test-retest difference less than this amount can be considered as a measurement error and should be ignored [50].

According to the literature, this is the first cross-cultural adaptation study of the JRPD questionnaire. Hence, we have not compared our results with versions of other languages. Furthermore, the current study had some limitations, such as the convenient sampling method. We have not analyzed the factor structure of the Persian JRPD questionnaire because of the inadequate sample size, which was recommended for factor analysis [51]. However, the authors suggest future studies for factor analyzing and developing short-forms of the JRPD in different occupations and populations. Another limitation of the present study was that all data were collected by self-reported measures. It would be suggested that, in future studies, other methods of measuring biomechanical exposures will be considered to examine the convergent validity.

**Conclusion**

The JRPD was translated to the Persian language, and the psychometric properties of the Persian JRPD were investigated. In conclusion, the Persian version of the JRPD is a valid and reliable questionnaire to assess the CLBP-related biomechanical exposures in Iranian Army personnel.

**List Of Abbreviations**

LBP; Low Back Pain, CLBP; Chronic Low Back Pain, JRPD; Job Requirements and Physical Demands, MDC; Minimal Detectable Change, CI; Confidence Interval, CVI; Content Validity Index, CVR; Content Validity Ratio, VAS; Visual Analog Scale, Borg’s CR10; Borg’s Category-Ratio scale, GHQ-28; General Health
Declarations

Ethics approval and consent to participate

Informed consent was obtained from all eligible participants. This study followed the principles of the Declaration of Helsinki, and its protocol was approved by the Research Board and the Committee of Medical Ethics of Tehran University of Medical Sciences and Health Services, Iran (Ethics Code: 9011355008.206.957).

Consent for publication

Not applicable.

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

M.R. and G.T. designed the study. M.R. collected and analyzed the data, and interpreted the results, and provided the manuscript. E.P. was a contributor in collecting data and writing the manuscript. All authors read and approved the final manuscript.

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**Figures**
Figure 1

A flow chart illustrating the procedure of translating the English-version of Job Requirements and Physical Demands (JRPD) questionnaire to the Persian language.