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Development of the postural habits and awareness scale: a reliability and validity study

Banu Bayar [a], Asalet Aybüke Güp[a], Dilara Özen Oruk[a], Özge İpek Dongaz[a], Eralp Doğu[b] and Kılıçhan Bayar[a]

[a]Department of Physiotherapy and Rehabilitation, Muğla Sıtkı Koçman University, Turkey; [b]Department of Statistics, Muğla Sıtkı Koçman University, Turkey

ABSTRACT

Objectives. The aim of this study was to develop a scale that assesses postural awareness and habits, as well as to establish the validity and reliability thereof. *Methods*. The 19-item postural habits and awareness scale (PHAS) was developed. The scale has a score range of 0–95, with a higher score indicating good posture and awareness. A total of 278 healthy adults with an age range of 18–65 years were included in the study. The sociodemographic form, short form 36 health survey (SF-36) and body awareness questionnaire (BAQ) were used to test the validity and reliability of this newly developed scale. *Results*. From factor analyses, it was observed that the items clustered into four factors, which explained 55.99% of the variance. Cronbach's α for each factor of the scale varied between 0.619 and 0.832. A high correlation was observed regarding test–retest reliability of the scale ($r = 0.905$). *Conclusion*. This newly developed self-reported scale allows for the comprehensive determination of both postural habits and awareness together. The PHAS is a valid and reliable scale that can be used by professionals who are interested in posture.

KEYWORDS

healthy; posture; ergonomic; awareness; habits

1. Introduction

Posture, which is classified as good and poor, refers to the position of a human body in space, and the alignment of body parts in relationship to each other [1,2]. Good posture is the position in which minimum stress is placed on each joint [3]. Otherwise, poor posture consists of incorrect alignment between body segments and increases stress on joints [4]. Postural awareness, which is one of the fundamental components of being conscious of distinguishing between good and poor posture, has gained popularity in the health sciences recently. Cramer et al. [5] defined postural awareness as (pp. 1) 'the subjective conscious awareness of body posture that is mainly based on proprioceptive feedback from the body periphery to the central nervous system'.

Body posture can be influenced by various factors such as physical, physiological, emotional and environmental [6,7]. Daily and behavioral habits are often adopted which may disregard the optimal body position and lead to postural changes, because these postural habits are also an important concept that affects posture [8]. Bad postural habits may result in changing the muscle tone and body alignment, eventually causing poor posture patterns and body asymmetry in general. To prevent any musculoskeletal impairment associated with poor posture, it is important to know about better ergonomics. Being aware of posture could serve as a support for a change in postural habits.

Body awareness concerns caution regarding bodily sensations and implies access to proprioceptive consciousness. It is also parallel to the construct of postural awareness and strongly associated with it. When self-report instruments for the measurement of body awareness in the literature were reviewed, there were numerous questionnaires evaluating body awareness which were affected by interoceptive factors such as perceiving pain, cognition and emotional status. The body awareness questionnaire (BAQ), the body awareness measure (BAM), the body awareness scale – health (BAS-H), the body awareness rating scale (BARS), the questionnaire on body awareness of postural habits in young people (Q-BAPHYP), the scale of body connection (SBC), the body responsiveness scale (BRS) and the scale of body awareness (SBA) are some of them [9–16]. In addition to these, body region-specific awareness questionnaires such as the Fremantle back awareness questionnaire [17], the Fremantle knee awareness questionnaire [18] and the Fremantle neck awareness questionnaire [19] are available.

Unlike body awareness, postural awareness focuses on the individual's ability to be aware of postural changes in daily life. Postural awareness is required for maintaining healthy postural habits in daily life, and furthermore postural habits of individuals are a factor that affects the level of postural awareness, so assessments including these habits are needed to guide professionals working in the health sciences with regard to treatment options and lifestyle modification. To achieve this, an assessment scale capable of evaluating both postural habits and postural awareness is required. The only questionnaire is the postural awareness scale (PAS) which was developed by Cramer et al. [5] in this field.

The primary aim of this study was to develop a scale that evaluates both postural habits and awareness in healthy adults. A second purpose was to determine the relationship between postural habits and postural awareness. The research question of the present study was determined as follows: is the

CONTACT Banu Bayar bbayar@mu.edu.tr

newly developed scale valid and reliable for the assessment of postural habits and awareness in healthy adults?

2. Methods

2.1. Participants

A total of 278 healthy adults with an age range of 18–65 years were included in this study. Data were collected through Google Forms. Sociodemographic characteristics of the subjects including age, gender, height (cm), weight (kg), body mass index (BMI), dominant side, occupational working condition and regular physical activity were recorded. The case flow diagram is shown in Figure 1 and the exclusion criteria for the study were as follows: having cognitive, mental and psychological problems, answering the trap question (which is the seventh question of the new scale) wrongly and experiencing body awareness/perception training [20]. All participants gave written informed consent prior to enrollment. The study was performed by the ethical standards in the World Medical Association Declaration of Helsinki. Ethical approval was obtained from the Human Research Ethics Committee affiliated with the Muğla Sıtkı Koçman University (Protocol Number: 180030, Decision No: 16, date: February 26, 2018).

2.2. Development of the postural habits and awareness scale

The objective of this scale was to identify the self-perception of healthy adults concerning their postural habits and awareness. The final version of the postural habits and awareness scale (PHAS) contains 19 items measured on a 5-point Likert scale. Each item of the scale is scored between 1 = *strongly disagree* and 5 = *strongly agree*. Seven items are reverse coded. The maximum score of postural habits is 35 and of postural awareness is 60, and the total is 95 at maximum. A high score indicates good posture and awareness. Postural habits items include expressions about the posture that the individual prefers in daily life activities such as standing, sitting, lying, shopping and carrying some things. On the other hand, the postural awareness items contain expressions about the subjective conscious awareness of body posture. The PHAS was developed based on the scale development stages described by Boateng et al. [21] in nine stages (Figure 2) as follows:

- Stage 1: after reviewing the literature about scales/questionnaires used to evaluate the postural habits and/or awareness, the content of the scale was grouped as postural habits and postural awareness, and the first draft of the scale was produced.
- Stage 2: the draft was analyzed by an expert panel including a physiatrist, six physiotherapists and a non-domain specialist, and revised several times following recommendations. After the content validity index (CVI) was calculated, the items that had a coefficient value below 0.75 were deleted [22]. The revised first draft with 31 items was administered to 28 participants (the pilot study). Based on the results obtained, the first version of the scale was changed four times and restructured to form the fifth iteration, which was resubmitted to the same expert panel.
- Stage 3: cognitive interviews that ensure the questions and answers are meaningful were made during the pilot study. In accordance with this purpose, opinions of participants about the scale were asked.
- Stage 4: guidelines for the respondent–to–item ratio is in a wide range. We used 10:1 (i.e., 50 respondents for a five-item questionnaire) criteria as the respondent-to-item ratio range. For this reason, it was aimed to have a minimum of 210 participants for the 19-item PHAS [23]. Following the approximately 2-year revision process, the final version of the 19-item PHAS was developed and applied to 278 participants.
- Stage 5: item reduction analysis was used to combine items that had an internal consistency and had the same

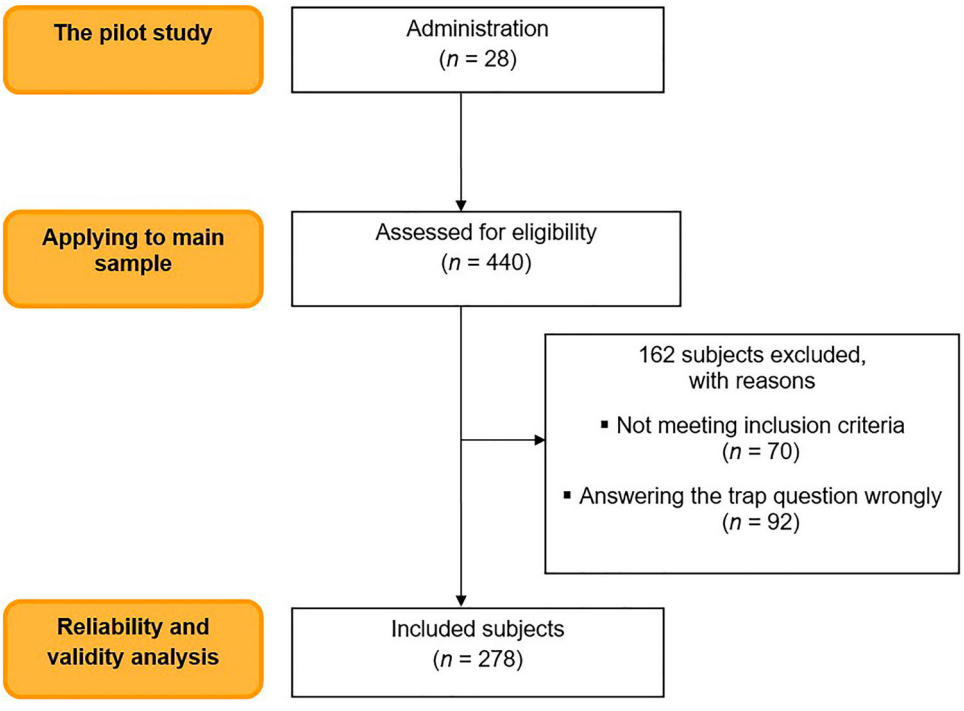

Figure 1. Flow diagram.

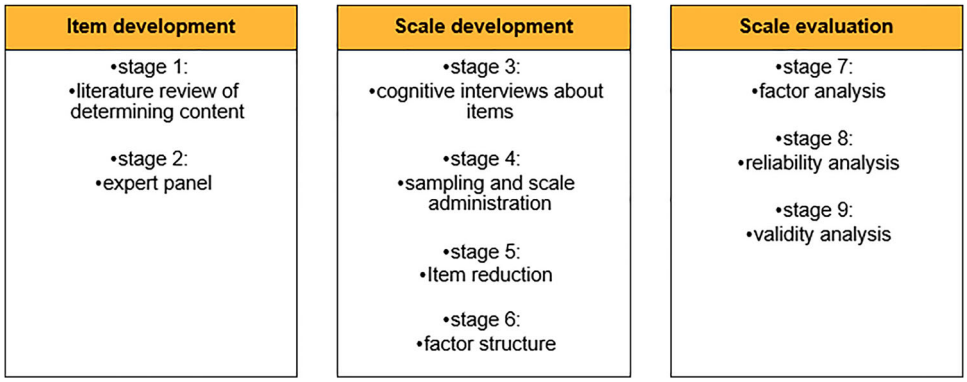

Figure 2. Scale development stages diagram.

meaning. According to the results obtained from the analyses, all of the items whose construct validity was ensured were included in the final version of the PHAS. The Cronbach α internal consistency coefficients of the entire scale and its separate sub-factors were calculated by performing factor analysis. Exploratory factor analysis (EFA) was applied to the data to evaluate the structural validity and to determine the factor structure of the scale [24]. Data were analyzed with the Kaiser–Meyer–Olkin (KMO) test and Bartlett's test of sphericity (BTS) for eligibility for EFA. After the missing and extreme values were excluded, the data of 278 participants were analyzed.

- Stage 6: EFA was used to determine the factor structure of the PHAS. The number of factors was analyzed based on the eigenvalue > 1 rule via varimax rotation for 70 participants.
- Stage 7: confirmatory factor analysis (CFA) was used to confirm the number and structure of factors. It was applied to 208 people out of 70 people who were applied EFA.
- Stage 8: test–retest correlation and Spearman's correlation coefficient were used to report the reliability of the PHAS. Cronbach's α was calculated for the PHAS for each item.
- Stage 9: the correlations of the PHAS with the short form-36 health survey (SF-36) and BAQ were analyzed by Spearman's correlation coefficient. The significance level for all analyses was set at $p < 0.05$.

2.3. Outcome tools

The SF-36 and BAQ were used for the validity analysis of the PHAS.

The SF-36 is used to assess self-perception of health-related quality of life in eight subscales and 36 items. There are two different summaries in the SF-36. While the physical component summary (PCS) includes physical function (10 items), physical role limitations (four items), energy/vitality (four items), pain (two items) and general health (five items), the mental component summary (MCS) includes emotional role limitations (three items), social function (two items) and mental health (five items) [25]. SF-36 score calculation was computed by the algebraic sum of the corresponding item values and then using the formula of scale to a score. Finally, the PCS and MCS were obtained by appointing a pre-described particular load to each of the eight scale scores [26]. The score range of each subscale is 0–100. A higher score indicates a better health condition [27]. The Turkish version of the SF-36 was made by Koçyiğit et al. [28].

The BAQ is a scale that includes psychosocial elements about the sensitivity of a person to normal or abnormal body conditions and measures the sensitivity to physical reactions. The BAQ consists of 18 items and four subgroups: prediction of body responses; sleep–wake cycle; prediction at the onset of disease; and attention to changes and reactions in the body process. Each item of the questionnaire is scored between 1 and 7 (1 $=$ *not at all true of me* to 7 $=$ *very true of me*). The total score of the BAQ is a sum of the values of all items. This score can range from 18 to 126. According to the BAQ, a higher score indicates a better body awareness level [9]. Karaca and Bayar [29] translated the scale into Turkish.

2.4. Statistical analysis

Statistical analysis was carried out using R version 4.1.0. Construct validity of the PHAS was confirmed with factor analysis. The number of factors was determined based on the eigenvalue > 1 rule via varimax rotation for the principal component of factors. Cronbach's α coefficient was used to determine the internal consistency of the PHAS. The reliability of the PHAS was shown as the test–retest correlation coefficient, and Spearman's correlation coefficient was used. The correlations of the PHAS with other scales were presented as Spearman's correlation coefficient. The statistical significance level was defined as $p < 0.05$.

3. Results

Demographic data of the participants are presented in Table 1. Based on Lawshe's content validity ratio, the CVI should be at least 0.750 if the number of experts is eight [30]. The CVI was found to be 0.870 for the current study.

KMO and BTS values were used to determine whether the data are sufficient before proceeding to factor analysis and principal component analysis and varimax rotation are calculated. The KMO value was found to be 0.833 in the analysis. The KMO value should be between 0.60 and 0.90, and a higher score indicates toward perfect [31]. Also, approximately the value for BTS was calculated as $\chi^2(171) = 2658.704$; $p < 0.001$.

In the literature, the limit for factor loading is reported should be between 0.30 and 0.40 [32], and 0.30 is taken as the limit of this study. According to the results of EFA, items attending to similar parameters were clustered into four factors. The percentage of variance for factors is found as 55.9%. The factor loading and total variance percentage are presented in Table 2. As a result of CFA, it was found that fit indices

Table 1. Sociodemographic characteristics of subjects ($N = 278$).

Characteristic	Total
Age (mean ± *SD*)	28.72 ± 11.87
Gender (%)	
Female	74.8
Male	25.2
Dominant side (%)	
Right	89.2
Left	10.8
BMI (mean ± *SD*)	24.11 ± 5.09
Occupational working condition (%)	
Unemployed	27.77
Requiring physical exertion	7.40
Requiring sitting	41.97
Requiring standing	15.43
Requiring walking	7.41
Regular physical activity (%)	
Yes	24.8
No	75.2

Note: BMI = body mass index.

were within acceptable limits ($\chi^2(527)/df\ (164) = 3.21$, comparative fit index [CFI] = 0.861, root mean square error of approximation [rmsea] = 0.0893).

The structure validity factor analysis of the scale and internal consistency reliability test are examined by Cronbach's α coefficient. The mean and standard deviation that were obtained by factor analysis of the values obtained for the participants for all items of the scale are presented in Table 3. The factor correlations of test–retest were more than 0.85 ($p < 0.05$) per factor.

Table 3. Mean values and test–retest correlations of the scale.

Factor of PHAS	Mean ± *SD*	Correlation	*p*
Postural habits and awareness	27.64 ± 5.75	0.897	< 0.001*
Awareness of factors disrupting posture	17.00 ± 2.49	0.970	< 0.001*
Positional awareness	14.82 ± 3.38	0.915	< 0.001*
Ergonomic awareness	8.46 ± 2.76	0.856	< 0.001*
Total	67.93 ± 11.26	0.905	< 0.001*

*$p < 0.05$.
Note: PHAS = postural habits and awareness scale.

Table 4. Correlations between the PHAS, BAQ and SF-36.

Outcome tool	Subgroup of SF-36	PHAS	*p*
BAQ	–	0.409	< 0.05*
SF-36	PCS	0.273	< 0.05*
–	MCS	0.146	< 0.05*

*$p < 0.05$.
Note: BAQ = body awareness questionnaire; MCS = mental component summary; PCS = physical component summary; PHAS = postural habits and awareness scale; SF-36 = short form 36 health survey.

The correlation of the current scale with other scales is presented in Table 4. The total score of the PHAS correlated significantly with the BAQ ($r = 0.409$, $p < 0.05$). Positive correlations were also observed based on factor-summary pairs such as the PCS and MCS summaries of SF-36 scores and this newly developed scale in total scores, respectively ($r_1 = 0.273$, $r_2 = 0.146$, $p < 0.05$).

4. Discussion

There are many instruments that can be used to assess body and posture such as awareness, perception, connection and

Table 2. Factor loadings.

	Factor			
Item of PHAS	Postural habits and awareness	Awareness of factors disrupting posture	Positional awareness	Ergonomic awareness
I usually stand upright	0.814	–	–	–
I usually sit upright	0.916	–	–	–
I usually sit hunched	0.846	–	–	–
I usually have trouble sitting upright	0.792	–	–	–
I usually have trouble standing upright	0.785	–	–	–
I usually notice that my sitting is disrupted after a short time	–0.456	–	–	–
I usually try to be upright in daily life	0.463	–	–	–
I usually need the advice of others to correct my posture	0.606	–	–	–
My mood usually changes my posture	–	0.605	–	–
My health condition usually changes my posture	–	0.728	–	–
Being tired usually changes my posture	–	0.746	–	–
I usually need to change my posture when I feel pain	–	0.639	–	–
I am usually aware of my posture while resting	–	–	0.436	–
I am usually aware of my posture while doing something	–	–	0.754	–
I usually bend my knees while picking up an item from the floor	–	–	0.776	–
I usually make an effort for correct posture while sitting or standing	–	–	0.307	–
I usually stand by bearing load on my dominant leg for longer	–	–	–	0.348
I usually carry the shopping bags in my dominant hand	–	–	–	0.957
I usually carry the bag in my dominant arm	–	–	–	0.749
Variance (%)	27.08	11.22	9.17	8.52
Internal consistency	0.832	0.779	0.619	0.702

Note: PHAS = postural habits and awareness scale.

responsiveness; but most of them focus on psychological/emotional conditions [6]. At present, we developed the PHAS based on supporting the close link between the physical and mental aspects. The PHAS is easy to administer and score and is suitable for a wide range of the population.

The present study showed that the PHAS is a valid and reliable tool. The Cronbach α value of the PHAS was 0.73 for internal consistency. The results obtained with EFA supported a four-factor structure, as confirmed by CFA. The Cronbach α values of factors were 'postural habits and awareness' (0.832), 'awareness of factors disrupting posture' (0.779), 'positional awareness' (0.619) and 'ergonomic awareness' (0.702) in the PHAS. Test–retest correlation indicates consistency between two evaluations over time. The PHAS was applied again 2 weeks later for test–retest reliability. The test–retest value was determined as 0.905 in the PHAS.

The BAQ is a self-reported, valid and reliable instrument for assessing awareness of normal body processes. While it focuses on sensitivity to somatic responses, it does not aim to assess the physical components of body awareness. The PAS, which is developed to evaluate the postural awareness of patients with chronic pain, is a 7-point Likert scale consisting of 12 items. The first factor of the PAS is 'ease/familiarity with postural awareness', which refers to an effortless awareness and connectedness; the second factor is 'need for attention regulation with postural awareness' and indicates a forced awareness. In addition to these instruments, the newly developed scale for a healthy population integrates postural habits with awareness.

The PHAS has a four-factor structure: postural habits and awareness; awareness of factors disrupting posture; positional awareness; and ergonomic awareness. Based on the included items, factors might be interpreted as four different aspects of awareness and habits about posture. The factor 'postural habits and awareness' showed significant correlations with the BAQ and physical and mental components of the SF-36 as expected. The second factor 'awareness of factors disrupting posture', however, is slightly correlated to both components of the SF-36, but not the BAQ, surprisingly. Like the BAQ, this factor also evaluates the effect of somatic responses such as pain, illness and mood on postural awareness. The 'positional awareness' factor correlated with the BAQ and PCS. The last factor, 'ergonomic awareness', showed significant correlations with only the PCS. Since positional and ergonomic awareness is interpreted mostly from a physical point of view, it can be interpreted as an expected result that does not show a relationship with the mental component. On the other hand, the total score of the PHAS has a relationship to both the BAQ and SF-36.

Unlike other body awareness questionnaires in the literature, the PHAS questions ergonomic awareness. Ergonomic factors are physical factors such as awkward posture that have the potential to cause injury while an individual is performing a job task [33]. An awkward posture is the deviation of the body from its neutral position while work activities are being performed, which may include sitting hunched, kneeling, reaching behind and twisting [34]. From this point of view, we asked about the habits that might cause bad posture in the daily lives of individuals, such as standing and dominancy habits.

We suggest that the validity study of this scale, which was developed for healthy individuals, will also be carried out in different populations/situations such as pregnancy, obesity, older people, scoliosis, fibromyalgia and patients with chronic pain. These will be effective in the rehabilitation of lots of musculoskeletal disorders (MSDs). Determination of postural awareness and habits of individuals is crucial for preparing a personalized rehabilitation program. In line with the data obtained with this study, minor postural modifications to be made in individuals' activities of daily living or their postural habits will help to form a good posture perception by affecting their postural awareness.

Posture is affected by gravitational forces and body position [35,36]. Therefore, the PHAS assess postural habits and awareness during various activities in both sitting and standing positions. Additionally, posture is controlled and modified by internal factors [37]. Hence, the effect of mood and health conditions on postural awareness is questioned in the PHAS. Thus, the PHAS might be a comprehensive assessment tool to assess postural habits and awareness. On the other hand, there are some limitations of our study. The lack of a valid and reliable posture-specific awareness scale made comparison analysis of the present scale difficult. Although the PAS is the only published scale that assesses postural awareness, a Turkish validation of the PAS is not yet published. Hence, we used the BAQ and SF-36 for the content validity of the PHAS. In addition, since our data collection process overlapped with the COVID-19 pandemic, we had to reach the participants online. We hesitate whether part of the data might be collected better and eventually results could profoundly reflect the population. Lastly, performance-based measures during actual tasks could be used to compare perceptions of individuals.

5. Conclusions

It was established that the PHAS is a valid and reliable assessment scale for determining the postural habits and postural, positional and ergonomic awareness of the healthy population in the present study. Further research is needed for validation on different health conditions and cultural adaptation to different populations.

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No potential conflict of interest was reported by the authors.

ORCID

Banu Bayar http://orcid.org/0000-0001-6369-8416

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