Received: 16 December 2024/ Revised: 29 January 2025/ Accepted: 19 February 2025

ORIGINAL ARTICLE

Journal of Hacettepe University
Physical Therapy and Rehabilitation

Comparison of Physiotherapy and Engineering Students in Terms of Posture and Body Awareness

Aleyna GOKDENIZ[1*], Gamze COBANOGLU[2], Ebrar Rana BARDAKCI[1], Bünyamin ERTUS[3], Nevin A. GUZEL[4]

[1]Department of Physiotherapy and Rehabilitation, Institute of Health Sciences, Kırıkkale University, Kırıkkale, Türkiye
[2]Güneysu Vocational School of Physical Therapy and Rehabilitation, Recep Tayyip Erdoğan University, Rize, Türkiye
[3]Independent Researcher, Türkiye
[4]Department of Physiotherapy and Rehabilitation, Faculty of Health Sciences, Gazi University, Ankara, Türkiye
*Corresponding author e-mail: gokdenizaleyna111@gmail.com

ABSTRACT

Purpose: This study aimed to compare Physiotherapy and Rehabilitation (PTR) students who received education on posture, body awareness, and exercise with Engineering students who did not receive such education regarding head-neck posture and body awareness.

Method: The study involved 30 PTR students (10 females, 20 males; age: 21.73±1.08 years; Body Mass Index (BMI): 22.73±2.86 kg/m²) and 30 Engineering students (8 females, 22 males; age: 21.67±1.56 years; BMI: 24.36±3.58 kg/m²). Postural assessments were conducted using photographic measurements, which recorded the sagittal head angle (SHA), sagittal shoulder angle (SSA), and craniovertebral angle (CVA). Body awareness was evaluated using the Body Awareness Questionnaire (BAQ).

Results: There was a significant difference in BMI between the PTR and Engineering students ($p=0.022$), but no significant differences were observed in age, weight, or height ($p>0.05$). No significant differences between the two groups were found in the SHA, SSA, or CVA ($p>0.05$). However, the postural angles of the PTR students were closer to normative values. Additionally, PTR students exhibited significantly higher BAQ scores than Engineering students ($p=0.005$), indicating better body awareness.

Discussion: Although no significant differences were observed in postural angles, the head-neck posture of PTR students was closer to normative values, and their body awareness was significantly higher than that of Engineering students. These findings suggest that PTR education emphasizing posture and body awareness can be an effective preventive strategy to improve individual and community health. Considering the benefits, it is recommended that such education be spread to other disciplines.

Key Words: Physical Therapy Specialty, Engineering, Posture, Awareness, Body Image

INTRODUCTION

Correct posture is a key indicator of a healthy musculoskeletal system. According to the Posture Committee of the American Academy of Orthopedic Surgeons, proper posture is defined as "a state of muscular and skeletal balance that protects the body's support structures from injury and progressive deformity, regardless of posture (e.g., squatting, lying, standing)" (1). Accurately perceiving the postural vertical line is crucial for maintaining an upright posture and proper gait (2). Body awareness encompasses the physical and emotional dimensions of an individual's consciousness. It includes knowledge of different body parts, the perception of position, sense of movement, and the conditions necessary for movement, alongside the mental aspects involved (3). Habitual postural patterns are associated with musculoskeletal pain, and improving maladaptive postures requires heightened posture awareness (4). Body awareness

and posture are crucial in determining our quality of life and overall health. Research suggests body awareness positively impacts quality of life and is inversely related to pain and emotional well-being (3).

Physiotherapists are healthcare professionals who undergo four years of undergraduate education in the Physical Therapy and Rehabilitation (PTR) department. PTR students undertake numerous theoretical and practical courses related to anatomy, body awareness, posture assessment, and therapeutic exercise during their studies. These courses cover fundamental topics such as anatomy, physiology, exercise physiology, measurement and evaluation techniques, and exercise principles (5). The challenges associated with physiotherapy education and the varying postural demands in clinical practice may contribute to the development of maladaptive postural habits. However, the education and knowledge gained are expected to help reduce these habits. PTR students know the musculoskeletal issues they encounter during their academic and clinical training, the potential injuries, and their underlying causes. As a result, PTR students are well-prepared to address these challenges with a strong sense of professional awareness (6). Due to the education received by PTR students, postural errors are expected to decrease, and body awareness is expected to improve.

In contrast, engineering students with limited knowledge of head-neck posture and body awareness are expected to show more disadvantages in both head-neck posture and body awareness compared to PTR students. In addition, engineering students, who primarily engage in theoretical courses, often remain in static positions for extended periods while sitting at standard school desks and chairs. The comparison of students from different departments is important in demonstrating the effectiveness of the education they receive and their exposure to the musculoskeletal system during this process. When the literature is examined, it is seen that studies comparing the head-neck posture and body awareness of students from different departments are limited. A study comparing the posture of dentistry students and oral health students through a survey determined that dentistry students had poorer posture. It was emphasized that this issue begins during student life before their professional careers and that ergonomic training should be given greater importance (7). In a study comparing painting and sculpture students, the shoulder protraction rate was almost twice as high in sculpture students compared to painting students. However, this was said to be due to muscle shortness, and no significant difference was found between the two groups regarding postural aspects. The authors stated that ergonomic training specific to their fields should be provided, and working conditions should be organized (8).

To our knowledge, no studies have compared PTR and engineering students in terms of head-neck posture and body awareness. This study hypothesizes that PTR students will exhibit less head-neck posture deviation and higher body awareness because of their undergraduate education. Therefore, this study aimed to compare PTR students who received extensive education on correct and incorrect posture, body awareness, and exercise during their undergraduate education with engineering students who have not received such specialized education. By comparing these two groups, the study aims to highlight the potential impact of targeted training programs on improving posture and body awareness and the importance of incorporating such education into other fields of study to reduce posture problems and improve musculoskeletal health.

METHODS

Study Design

The research was conducted at Gazi University, Faculty of Health Sciences, Department of PTR, Athlete Health Unit. The Gazi University Ethics Commission approved the study at its meeting dated 04.04.2023 and numbered 07, with E-77082166-604.01.02-628505 and research code 2023-439. The individuals included in the study were informed about the study. Individuals who agreed to participate in the study signed an "Informed Voluntary Consent Form" indicating they voluntarily participated.

Demographic information of the students was recorded before the measurements were collected. The student's age, gender, body weight, height, Body Mass Index (BMI), and dominant extremity information were recorded. The dominant extremity was determined by questioning the

writing hand. The head-neck posture of the students was evaluated using a photographic method. Body awareness levels were assessed using the Body Awareness Questionnaire (BAQ) (points).

Participants

Individuals aged 18 to 24 years who had not experienced neck pain in the past 6 weeks were enrolled as students in the PTR or Engineering departments and consented to participate in the study. Individuals with any orthopedic, neurological, coordination, visual, or hearing impairments that would prevent measurements from being taken, those who were not students in the PTR or Engineering departments, and those who did not consent to participate were excluded from the study. Additionally, first- and second-year PTR students were excluded as they had not completed the department's basic courses yet. The study was conducted with 30 students from the PTR department and 30 from the Faculty of Engineering. The post hoc power analysis of the study was calculated using the G*Power 3.1.9.7 program. As a result of the calculation performed using the research data with a total sample size of 60, the effect size of the research was calculated as 0.75. With an effect size of 0.75 and a 5% margin of error ($\alpha = 0.05$), the power of the study ($1- \beta$) was calculated as 0.89.

Assessments

To assess cervical and shoulder posture, lateral digital imaging was performed while the participants stood. Photographic measurement has been reported to be valid against the gold standard of radiologic measurements and to show high inter/intra-observer reliability (9,10,11,12).

For photographic evaluation, the digital camera was placed on a stable tripod 1.5 meters from the posture chart, with no rotation or tilt. The camera base was aligned with the participants' acromion. Participants were asked to wear clothes so that their necks were visible. The C7 spinous processes, tragus, the midpoint of the humerus, and canthus of the eye were palpated, and marker tape was applied to these points. Before the photograph was taken, participants were asked to flex and extend their necks thrice and return to their most comfortable position. Participants were subsequently instructed to look straight ahead in their natural resting posture. Three measurements were taken by the same evaluator (13). Following the photographic capture, angle measurements were calculated using the IMAGE J software program, the 'gold standard' for determining angle measurements (14). In the Image J program, sagittal head angle (SHA), sagittal shoulder angle (SSA), and craniovertebral angle (CVA) were calculated by using lines drawn with markers on the photographs as described below.

- SHA: The angle between the horizontal line passing through the tragus of the ear and the line joining the tragus and the canthus of the eye was measured.
- SSA: The angle between the line connecting the C7 spinous process, the humerus midpoint, and the horizontal line passing through the middle of the humerus was measured.
- CVA: The angle between a horizontal line passing through the C7 spinous process and the line extending from the ear tragus to the C7 vertebra was measured (15).

To assess body awareness, BAQ was used. The Likert-type questionnaire consists of 18 items and four subgroups. Karaca et al. adapted the questionnaire into Turkish (16). Participants were asked to mark all 18 questions by scoring 1-7. The questionnaire questions were filled in by the individual himself/herself after being explained to the participant (scoring 1=not true at all, 7=very true). An increase in the score indicates increased body awareness (17).

Statistical Analysis

SPSS 26.0 program was used for statistical analysis. The data were expressed as numbers and percentages for qualitative variables and mean and standard deviation for quantitative variables. Normal distribution was determined with histograms and probability graphs. Since the data were normally distributed, the Independent Groups T-test was used to compare the two groups. The effect sizes were evaluated according to Cohen's d standards between-group differences. Effect size results were interpreted as small (≥ 0.2), medium (≥ 0.5), or large (≥ 0.8) according to guidelines. For statistical significance, $p < 0.05$ was accepted.

Table 1: Comparison of PTR and Engineering students in terms of demographic characteristics

		PTR Students (n=30) (Mean±SD)	Engineering Students (n=30) (Mean±SD)	p
Age (years)		21.73±1.08	21.67±1.56	0.848
Body weight (kg)		69.27±13.51	77.05±16.57	0.422
Height (cm)		174.07±8.56	175.97±9.59	0.051
BMI (kg/m^2)		22.73±2.86	24.36±3.58	**0.022***
		n (%)	**n (%)**	
Gender	**Female**	10 (33.3%)	8 (26.7%)	
	Male	20 (66.7%)	22 (73.3%)	
Student's grade	**First-Year**	0 (0%)	8 (26.7%)	
	Second Year	0 (0%)	4 (13.3%)	
	Third Year	10 (33.3%)	6 (20%)	
	Fourth Year	20 (66.7%)	12 (40%)	
Dominance	**Right**	30 (100%)	26 (86.7%)	
	Left	0 (0%)	4 (13.3%)	

* p<0.05 (Independent Groups T-test), PTR: Physiotherapy and Rehabilitation, SD: Standard Deviation, BMI: Body Mass Index, n: Number

RESULTS

When PTR and Engineering students were compared in terms of demographic characteristics, no differences were found in age (p=0.848), body weight (p= 0.422), or height (p= 0.051), except for BMI (p= 0.022, Table 1). While the two groups had similar age, body weight, and height, Engineering students had a larger BMI than PTR students.

When the postural angles of PTR and Engineering students were compared, it was found that there was no difference between the two groups in terms of SHA (p= 0.747), CVA (p= 0.171), and SSA (p= 0.152, Table 2). The two groups had similar postural angles.

When the body awareness levels of PTR and engineering students were compared, there was a difference between the two groups regarding BAQ points (p= 0.005, Table 2). The body awareness levels of PTR students were better than those of engineering students.

DISCUSSION

As a result of this study, which compared individuals who received education on correct posture, body awareness, and exercise with individuals who did not receive this education in terms of postural angle and body awareness, it was determined that the body awareness level of PTR students was better than Engineering faculty students. However, PTR students were found to have postural angles similar to those of engineering faculty students.

The physiotherapy program provided to students in schools includes theoretical and practical sessions to improve body mechanics and posture (both static and dynamic) during daily tasks (18). In a study conducted by Geldhof et al. on primary school students, it was reported that supporting students with a back training program, which includes explanations of anatomy and the pathology of spinal loads, could enhance both body awareness and postural alignment, ultimately leading to proper posture and improved quality of life (19).

Table 2: Comparison of PTR and Engineering students in terms of posture and body awareness

	PTR Students (n=30) (Mean±SD)	Engineering Students (n=30) (Mean±SD)	Effect size	p
SHA (°)	20.54±5.78	21.04±6.00	0.08	0.747
CVA (°)	52.71±5.49	50.75±5.42	0.35	0.171
SSA (°)	77.31±4.77	79.36±6.11	0.37	0.152
BAQ (points)	96.80±11.27	86.97±14.58	0.75	**0.005***

*p<0.05 (Independent Groups T-test), PTR: Physiotherapy and Rehabilitation, SD: Standard Deviation, SHA: Sagittal Head Angle, CVA: Craniovertebral Angle, SSA: Sagittal Shoulder Angle, BAQ: Body Awareness Questionnaire

Several studies in literature investigate the effectiveness of training programs provided to PTR students. A study conducted by Minghelli demonstrated that students played a crucial role in acquiring theoretical and practical knowledge immediately after receiving PTR education. Consequently, he suggested that posture and body awareness education could effectively prevent and/or minimize musculoskeletal disorders in adolescents (20). In another study that evaluated the impact of a 7-week clinical Pilates program on body awareness and flexibility in PTR students, it was concluded that posture disorders in these students improved following the exercise program, body perception was altered, and flexibility increased (21). These studies support the notion that education can provide positive benefits for individuals. This study aimed to examine the effect of receiving education during undergraduate studies on head-neck posture and body awareness. The study's results indicated that the postural angle values of students who had received the education were similar to those who had not.

Postural angles can be measured to assess posture (22). SHA reflects the relative position of the head to the neck (23). Regarding the relationship of the head to the upper cervical spine, a smaller SHA indicates increased upper cervical extension, and 15º above the horizontal has been recommended as a neutral SHA measurement (24). Ruivo et al. and Chansirinukor et al. reported the mean normal SHA as 17.2 and 16.3 degrees, respectively (25,26). Our study showed no difference between the two groups regarding SHA. However, it is observed that SHA values of both groups increased slightly compared to typical values. Considering that SHA is affected by computer use (11), the fact that computer use has increased so much today may explain the SHA above typical values in both groups.

An SSA below 52° indicates shoulder protraction (25). Although no significant difference was found between the two groups regarding SSA, the results revealed that the angle values were closer to normal in PTR students. In contrast, the shoulders of Engineering students were more protracted.

CVA is the most used value to assess forward head posture in photographic measurements. Although there are differences in the CVA norm value, a CVA below 48-50° is defined as forward head posture (27). Salahzaded et al. defined the normal craniovertebral range as 53.2-56.8°. They reported that CVA was 40.7-43.2° and 46.9-49.1° in individuals with moderate-severe forward head posture and mild forward head, respectively (10). In our study, there was no difference between both groups regarding CVA. However, when the mean values were analyzed, it was found that PTR students were within the normal craniovertebral range according to the classification of Salahzaded et al. However, Engineering students showed CVA closer to the forward head posture angles.

Body awareness is a complex concept that encompasses an individual's physical and emotional functions. It involves various parameters, including spatial perception, the sense of movement, and cognitive processes (3). Enhancing this awareness, in which physiological and psychological processes are intertwined, can be achieved through mind-body approaches. Such an increase plays a crucial role in improving balance, coordination, muscle-joint movements, and the control of breathing, mental processes, emotional regulation, and postural control (28). The effect of knowledge in these areas on body awareness is also important. In our study, the higher levels of body awareness observed in individuals who received PTR education, compared to Engineering students, underscore the positive impact of acquiring knowledge in these domains.

Limitations

Our study has some limitations. Firstly, there was a difference in BMI between the two groups. Since it is known that body awareness is affected by BMI, the fact that BMI values were not similar between the groups is an important limitation of the study. Secondly, only head-neck posture was evaluated in our study. Also, photographic measurement was used to evaluate head-neck posture in our study. More objective and comprehensive methods, such as 3D motion analysis systems, 3D scanners, and AI-assisted image analysis software, may provide a more detailed and accurate assessment. These advanced approaches can help overcome the current study's limitations and should be considered in future research. There is a need for studies in which more objective methods are used and the whole body is evaluated. In our study, only PTR

students were compared with engineering faculty students. Additional studies, including those of other professionals, are needed. In addition, only 3rd and 4th year PTR students were included in the study. Studies involving experienced physiotherapists can be planned to examine postural habits and body awareness changes that increase or decrease with experience.

CONCLUSION

Although no significant difference was found in the postural deviations between students who received education on head-neck posture and exercise and those who did not, the fact that PTR students exhibited postural angles closer to normal values and had higher levels of body awareness suggests that the education received by PTR students was effective. These findings suggest that PTR students trained in posture and body awareness can be an effective preventive strategy for individual and public health. Adapting such health education programs to other disciplines may have far-reaching benefits in preventing musculoskeletal disorders, improving the quality of life of individuals, and reducing the financial burden on the healthcare system. Furthermore, these educational programs have a potential impact on helping reduce healthcare costs. This study provides a strong basis for expanding the content of educational programs and increasing health awareness. It also recommends the development of interdisciplinary educational programs and further studies evaluating the effectiveness of these programs.

Acknowledgments

Author Contributions: AG: Study Design, Data Collection, Data Interpretation, Manuscript Preparation, Literature Search. **GC**: Study Design, Statistical Analysis, Data Interpretation, Manuscript Preparation, Literature Search. **ERB**: Study Design, Data Collection, Data Interpretation, Manuscript Preparation, Literature Search. **BE**: Study Design, Data Collection. **NAG**: Study Design, Data Interpretation, Reviewing.

Financial Support: This study was supported with project number 1919B012215083 within the scope of TUBITAK 2209- A University Students Research Projects Support Programme. Provided financial support for the supply of devices used for evaluation.

Conflict of Interest: The author(s) states that there are no potential conflicts of interest concerning the research, writing, and/or publication of this article.

Ethical approval: The Gazi University Ethics Commission approved the study at its meeting dated 04.04.2023 and numbered 07, with E-77082166-604.01.02-628505 and research code 2023-439.

How to cite this article: Gokdeniz A, Cobanoglu G, Bardakci ER, Ertus B, Guzel NA. Comparison of Physiotherapy and Engineering Students in Terms of Posture and Body Awareness. Journal of Hacettepe University Physical Therapy and Rehabilitation. 2025;3(2): 85-91.

REFERENCES

1.Grimmer-Somers K, Milanese S, Louw Q. Measurement of cervical posture in the sagittal plane. J Manipulative Physiol Ther. 2008;31(7):509-17.

2.Bisdorff AR, Wolsley CJ, Anastasopoulos D, Bronstein AM, Gresty MA. The perception of body verticality (subjective postural vertical) in peripheral and central vestibular disorders. Brain. 1996;119:1523-34.

3.Erden A, Altuğ F, Cavlak U, Investigation of the relationship between body awareness status, pain, emotional state, and quality of life in healthy individuals. SCIE. 2013;24(3):145-50.

4.Cramer H, Mehling WE, Saha FJ, Dobos G, Lauche R. Postural awareness and its relation to pain: validation of an innovative instrument measuring awareness of body posture in patients with chronic pain. BMC Musculoskelet Disord. 2018;19(1):109.

5.Gazi Üniversitesi Sağlık Bilimleri Fakültesi Fizyoterapi ve Rehabilitasyon Bölümü Lisans Ders Bilgi Paketi

6.Başarı GÖ, Balcı P, Nohutlu E, Ulusoy S, Atalay ES, Sertoğlu E, et al. The effect of professional awareness on posture in physiotherapy students. Turk Klinikleri J Sports Sci. 2018;1(1):31-7.

7. Ng A, Hayes MJ, Polster A. Musculoskeletal disorders and working posture among dental and oral health students. Healthcare. 2016;4(1):13.

8.Kisa EP, Husrevoglu S, Kalpar E, Kalpar B, Uzuner H, Ozkan I, Palabiyik S, Celiktas E. Comparison of postural evaluations of painting and sculpture department students. Hacettepe Univ Fac Health Sci J. 2021;8(2):314-330.

9.Shaimin-Nam SH, Son SM, Kwon JW, Lee NK. The intra-and inter-rater reliabilities of the forward head posture assessment of normal healthy subjects. J Phys Ther Sci. 2013;25(6):737-9.

10.Salahzadeh Z, Maroufi N, Ahmadi A, Behtash H, Razmjoo A, Gohari M, et al. Assessment of forward head posture in females:

observational and photogrammetry methods. J Back Musculoskelet Rehabil. 2014;27(2):131-9.

11.van Niekerk SM, Louw Q, Vaughan C, Grimmer-Somers K, Schreve K. Photographic measurement of upper-body sitting posture of high school students: a reliability and validity study. BMC Musculoskelet Disord. 2008;9:113.

12. Mylonas K, Tsekoura M, Billis E, Aggelopoulos P, Tsepis E, Fousekis K. Reliability and validity of non-radiographic methods of forward head posture measurement: A systematic review. Cureus. 2022;14(8):e27696.

13.Cobanoglu G, Guzel NA, Ecemis ZB, Demirkan MY. Investigation of muscle activation during kinetic chain-based exercises in individuals with and without forward head posture. J Back Musculoskelet Rehabil. 2024;37(6):1537-49.

14.Jabbar KM, Gandomi F. The comparison of two corrective exercise approaches for hyperkyphosis and forward head posture: A quasi-experimental study. J Back Musculoskelet Rehabil. 2021;34(4):677-687.

15.Torkamani MH, Mokhtarinia HR, Vahedi M, Gabel CP. Relationships between cervical sagittal posture, muscle endurance, joint position sense, range of motion and level of smartphone addiction. BMC Musculoskelet Disord. 2023;24(1):61.

16.Kocyigit E, Arslan N, Koksal E. The relationship between body awareness and anthropometric measurements in adults. Nutr Diet. 2018;46(3):248-56.

17.Karaca S, Bayar B. Turkish version of the Body Awareness Questionnaire: validity and reliability study. Turk J Physiother Rehabil. 2021;32(1):44-50.

18.Minghelli B. Postural habits in adolescents: the influence of a school physiotherapy program on improving the knowledge of postures. Int J Adolesc Med Health. 2020;34(3).

19.Geldhof E, Cardon G, De Bourdeaudhuij I, et al. Effects of back posture education on elementary schoolchildren's back function. Eur Spine J. 2007;16:829-39

20.Minghelli B. School physiotherapy programme: Improving literacy regarding postures adopted at home and in school in adolescents living in the south of Portugal. Work. 2020;67(1):95-102.

21.Atılga E, Tarakci D, Yildiz A, Mutluay F, Algun C. Evaluation of body awareness and flexibility in physiotherapists receiving clinical Pilates training. Hacettepe Univ J Health Sci. 2015.

22.Singla D, Veqar Z, Hussain ME. Photogrammetric Assessment of Upper Body Posture Using Postural Angles: A Literature Review. J Chiropr Med. 2017;16(2):131-138.

23.Barış RH, Güzel NA, Akçam MO, Kafa N, Ayyıldız E. Evaluating craniocervical posture by using a photographic postural analysis in adolescents with different malocclusions. Gazi Health Sci J. 2021;6(3):38-46.

24.Alkhateeb AM, Daher NS, Forrester BJ, Martin BD, Jaber HM. Effects of adjustments to wheelchair seat to back support angle on head, neck, and shoulder postures in subjects with cerebral palsy. Assist Technol. 2021;33(6):326-32.

25. Ruivo RM, Pezarat-Correia P, Carita AI. Cervical and shoulder postural assessment of adolescents between 15 and 17 years old and association with upper quadrant pain. Braz J Phys Ther. 2014;18(4):364-71.

26.Chansirinukor W, Wilson D, Grimmer K, Dansie B. Effects of backpacks on students: measurement of cervical and shoulder posture. Aust J Physiother. 2001;47(2):110-6.

27.Cobanoglu G, Demirkan MY, Ecemis ZB, Atalay Guzel N. Forward head posture and its effect on muscle activation. Gazi Health Sci J. 2024;9(1):85-93.

28.Bulut N, Pehlivan E. Does physical activity level depend on exercise perception and body awareness? Turk J Physiother Rehabil. 2023;34(1):38-44.