ORIGINAL ARTICLE

HABITS OF DONNING HEADSCARF: CORRELATION BETWEEN NECK RANGE OF MOTION AND PROPRIOCEPTION AMONG FEMALE STUDENTS OF IIUM KUANTAN CAMPUS, MALAYSIA

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ABSTRACT

Investigating the potential relationship between cervical spine mobility and proprioception among collegiate student with hijab wearing habits is an interesting avenue of research, particularly given the cultural significance of the hijab and its potential impact on daily activities and posture. The present study aimed to quantify the cervical spine mobility and assess for proprioceptive deficits among hijab wearing women. A total of 122 subjects between the age group of 20-26 years were selected from International Islamic university Kuantan. Cervical spine mobility and proprioception were assessed using universal goniometer and Joint position error method (JPE) respectively. Results were described in means, standard deviations, frequencies, and percentages. The mean and standard deviation (M $\pm$ S.D) of cervical flexion, cervical extension, right lateral flexion, left lateral flexion, right rotation, and left rotation ranges from 50.0 $\pm$ 9.87, 52.7 $\pm$ 8.09, 34.3 $\pm$ 6.63, 3.43 $\pm$ 6.63, 68.9 $\pm$ 6.15, 67.8 $\pm$ 6.23 degrees respectively. On the other hand, the (M $\pm$ S.D) of JPE for cervical flexion, cervical extension, right lateral flexion, left lateral flexion, right rotation, and left rotation were 1.00 $\pm$ 0.16, 1.00$\pm$ 0.09, 1.00 $\pm$ 0.18, 1.00 $\pm$ 0.09, 1.00 $\pm$ 0.28, and 1.00 $\pm$ 1.00 degrees respectively. Pearson's Correlation revealed a negligible linear relationship between cervical mobility and JPE for all cervical movements except for right lateral flexion (r = +0.239 p = 0.008), where a weak positive relationship was observed. These findings suggest that though the cervical mobility may get affected due to wearing of hijab in long term, but it does not seem to affect the cervical proprioception significantly.

Key Words: Cervical range of motion, proprioception, head scarf.

INTRODUCTION

Cervical spine plays a crucial role in facilitating the intricate movements of the head while ensuring the maintenance of visual focus and equilibrium. Its unique structure allows for a wide range of three-dimensional movements, which are essential for various activities of daily living and maintaining spatial awareness. One of the key functions of the cervical spine is to support the head and allow it to move in coordination with the eyes. This coordination is vital for activities such as tracking moving objects, maintaining balance during locomotion, and adjusting posture in response to environmental stimuli[1]. Cervical pain or neck pain is one of the commonest musculoskeletal disorders experienced by 20-70% of general population at some period of their life[2]. Out of many risk factors decrease in neck muscle strength and decreased range of motion of cervical spine have been identified as two important factors that can cause neck pain[3]. Decrease in active cervical range of motion has been reported a very important finding while assessing the level of severity of pain and disability in patients with neck pain[4]. Restrictions on cervical spine with artificial tools like helmets has also been shown to significantly reduce the cervical range of motion among elite American football players[5]. This restriction and reduced

range of motion can be an important precursor of cervical spine pathologies and has been studied extensively and reported to cause decreased sensory inputs which affects the proprioception and posture of cervical spine and finally leads to pain and disability[2]. Proprioception is the unconscious perception of movements and spatial orientation arising from stimuli within the body itself and it plays an important role in sensory and motor control of posture and movements[6]. This proprioceptive deficit of cervical spine not only effects the posture but has been reported as a cause of postural sway in patients with mechanical neck pain, which gives an impression of how important the mobility of cervical spine is to maintain a good posture[2]. Studies have also reported that Cervical spine movements cause the stimulation of the proprioceptors and continuously keep on feeding the central nervous system about positioning in space[7]. So, the movement of cervical spine in space is necessary for maintaining intact proprioceptive mechanism.

Wearing head scarfs is a traditional practice in many countries among various populations either as a cultural or a religious identity[8] and wearing head scarf for long term may potentially compromise the mobility of cervical spine which can lead to deficits in cervical proprioception and which in turn can cause neck disability in long

term. As explained earlier how crucial role cervical spine plays in facilitating intricate head movements while maintaining visual focus and equilibrium, the proprioceptive system of cervical spine is so delicate that any deficits in cervical spine mobility can lead to proprioceptive impairments of cervical spine[9]. This possible connection has been reported by some studies who concluded that wearing of headscarf for prolonged periods (more than 6 hours a day) in daily routine is associated with cervical spine discomfort and reduced cervical mobility[10,11]. Despite the prevalence of headscarf wearing among general population in Malaysia, no study has yet quantified and assessed the cervical range of motion among hijab wearing females of Malaysia and very few studies have investigated effect of head scarf wearing on cervical spine mobility and proprioception. We hypothesize that the women who wear headscarf daily may exhibit reduced active range of motion due to the restrictions imposed by headscarf on the mobility of head and neck, which can lead to altered movement patterns and decreased proprioception. Hence this study aims to quantify cervical range of motion and proprioception and investigate their correlation among females wearing headscarves daily. At the same time the authors acknowledge and respect the cultural and religious significance of hijab use. Our study aims to approach this aspect with understanding and inclusivity, while focussing on physical and health complications of headscarf use. By exploring the effects of headscarf wearing on cervical spine mobility and proprioception, this study will provide valuable insights and inform evidence-based strategies and advice that clinicians can offer to headscarf-wearing females who report neck pain, ultimately promoting spinal health, wellbeing, and empowering these individuals to maintain their cultural practices while minimizing potential musculoskeletal risks.

METHODS

Study design and location
The cross-sectional study method was used for this study to get a picture of the relationship between wearing headscarf and its effect on cervical range of motion and proprioception. Due information was gathered from a specific population and in a specific period. The study was conducted in International Islamic University Malaysia (IIUM) Kuantan Campus owing to its advantageous location, which provided ease of access to potential subjects for the study.

Study sampling and sampling procedure
The target population were females who wear hijab from IIUM Kuantan Campus. Due to less time available to gather data and lack of resources, non-probability convenient sampling was used to recruit participants, which allowed us to gather data on time from easily accessible population. A poster and public awareness message was created about the study, which was then circulated via WhatsApp groups as it was the most convenient method to reach out to individuals interested in participating in this research. Those interested in participating were encouraged to contact researcher via WhatsApp. Additionally, researcher reached out personally to individuals listed in the Mahallah(hostel) WhatsApp groups. A total of 122 participants were recruited based on their availability, accessibility, and adherence to the inclusion and exclusion criteria. The participants consent also was taken before doing the screening process.

Instruments and procedures
The data collection was done in a research lab at the Physiotherapy Clinic of Kulliyyah of Allied Health Sciences (KAHS). The procedures were divided into three parts which were: screening for inclusion and exclusion criteria and recording of demographic data, assessing cervical range of motion (ROM) and assessing proprioception.

Eligible criteria was defined as: subjects aged between 18 to 30 years; subjects free from any bad head and neck posture like forward headed posture in sagittal plane or asymmetry between shoulder tips and ear levels in frontal plane, assessed by researcher using observational method; subjects with no history of neck pain in past 6 months; subjects wearing hijab for more than 6 hours a day; and subjects free from any congenital deformities like scoliosis or torticollis. We restricted our study to participants aged between 18-30 years to minimize the confounding factors like occupational stress and age-related disorders which this age group is less likely to be influenced by.

Subjects fulfilling the criteria of inclusion were included in the study and were briefed about the study and an informed consent was obtained from them before their participation in the study and the subject's demographic data including age, gender was recorded. Then subject's cervical range of motion was recorded using a universal goniometer [12]. The universal goniometer has been established as a reliable and valid instrument for measuring range of motion, with studies demonstrating excellent intra-rater reliability (ICC = 0.83-0.98) and excellent inter-rater reliability (ICC = 0.79-0.92) for assessing active cervical range of motion[13]. Furthermore, it has shown high criterion validity, with a strong correlation ($r = 0.97$) when compared to radiographic measurements of cervical range of motion[14]. To ensure accurate and reliable measurements, the researcher underwent comprehensive training and practice before conducting the active cervical movement assessments. Participants were then asked to perform six active cervical movements: flexion, extension, right and left lateral flexion, and right and left rotation. To minimize errors, three

measurements were taken for each movement, and the average value was recorded as the result.

Lastly subject's cervical spine proprioception was obtained through the Cervical Joint Position Error (JPE) test. This test measures the ability of the blind folded to accurately relocate the head back to the original position after movement[15]. Firstly, the researcher demonstrated the cervical movements namely flexion, extension, right side flexion, left side flexion, right rotation, and left rotation to the subjects. Each subject was then made to wear helmets with laser pointer fixed on top of the helmet. The subject was asked to sit in a chair and adopt a comfortable position. Subject was then instructed to adjust their head and neck and find the most relaxing position of the neck, which corresponds to neutral cervical position. Then subjects were instructed to close the eyes and perform the movement of flexion or extension or rotations or side flexions and after the movement is complete, subjects were instructed to return their head to the original neutral position without opening their eyes and they were asked to verbally confirm when they feel they have returned to the neutral position. The distance from where the laser beam begins and ends on the wall was measured in centimetres and then converted into degrees using the formula: angle = tan 1[(error distance/90 cm). So, if there was an error distance of approximately 7.1 cm, it indicates a significant error of 4.5 degrees[16]. To minimize errors, the researcher underwent a proper training of JPE error test before conducting this test on the selected subjects and each movement of the cervical movement was repeated for three times and the best readings of the differences was recorded as the final measurement.

Data analysis

Statistical analysis for both cervical range of motion and proprioception was conducted using the Statistical Package for the Social Sciences (SPSS) version 26 for MacOS. Mean, standard deviation, frequency and percentage was used to describe data. Cervical range of motion data, including flexion, extension, right lateral flexion, left lateral flexion, right rotation and left rotation were summarized using means and standard deviations. Cervical movements were categorized as hypo flexibility, normal, or hyper flexibility and the frequency and percentage of each category was described. Normal values for cervical flexion are approximately 40 to 45 degrees, extension 50 to 70 degrees, lateral flexion 20 to 45 degrees, and rotation 70 to 90 degrees[17]. Joint proprioception assessed by calculating the mean joint position error (JPE) in six directions was described using mean and standard deviation. Readings were categorized as normal or abnormal, and the frequency and percentages of each category were recorded. An abnormal JPE was considered when the value was 7.1cm/4.5° or above. The correlation between cervical range of motion (ROM) and cervical proprioception was assessed using the Pearson correlation test.

RESULTS

Demographic data

The characteristics of the participants are outlined in Table 1. A total of 122 students, aged 20 to 26 years old, voluntarily took part in this study, and there was no missing data. The mean age of the participants was 21.63 years.

Frequency and percentage of hypo flexibility, normal and hyper flexibility of cervical range of motion (ROM) among headscarf wearers

The results displayed in Table 2 depict the cervical range of motion for all six movements, with each movement categorized into hypo flexibility, normal, and hyper flexibility. The most impacted movement was left rotation and right rotations showing the highest number of hypo flexibility instances. Left rotation with a mean range of movement of 67.8 degrees had 75 participants (61.5%) demonstrating deficit in range, while only 47 subjects (38.5%) exhibited normal range of movement. Right rotation showed a mean range of 68.9 with 56 participants (45.9%) having reduced range of movement.

In contrast, right and left lateral flexion seemed to have a totally different result. Right rotation recorded normal readings for all participants, with a mean movement of 34.3 degrees with all of the participants, 122 (100%), exhibiting normal readings. Left lateral flexion, only 1 subject (0.8%) displaying hypo flexibility and a mean movement of 34.3 degrees.

For cervical flexion, the mean range of movement recorded was 50.0 degrees, with 74 individuals (60.7%) having hyper flexibility, 17 individuals (13.9%) exhibiting hypo flexibility, and 31(25.4%) subjects demonstrating a normal reading. For extension, the mean range of movement was 52.7 degrees, with 44 participants (36.1%) having hypo flexibility and 78 participants (63.9%) displaying normal readings.

Frequency and percentage of normal and abnormal cervical proprioception among headscarf wearers

The mean joint position error (JPE) of all six cervical movements were recorded as shown in Table 3. All cervical movements had a mean JPE of 1.0 each respectively. For cervical flexion, 119 subjects (97.5%) exhibited a normal JPE reading, with only 3 subjects (2.5%) showing abnormalities. For extension 99.2% subjects recorded normal proprioception and only 1(0.8%) subject reporting abnormality.

Right lateral flexion, 118 participants (96.7%) had a normal JPE, while 4 participants (3.3%) had an abnormal reading. Left lateral flexion was

recorder normal in 121 participant (99.2%) with only 1 subject reporting abnormal findings.
On the other hand, right rotation had the highest number of abnormal JPE readings at 8.2%, comprising 10 subjects, with the remaining 112 subjects (91.8%) showing normal readings.
Finally, 117 subjects (95.9%) exhibited a normal JPE for left rotation, whereas only 5 subjects (4.1%) displayed an abnormal reading.

Table 1 Characteristics of the participants (n = 122)

Variables	Frequency	Percentage (%)
Age Mean (SD) = 21.6 (1.19)		
20	30	24.6
21	13	10.7
22	61	50.0
23	11	9.0
24	5	4.1
25	1	0.8
26	1	0.8
Total	122	100.0

Table 1 Frequency and percentage of hypo flexibility, normal and hyper flexibility of cervical Range of Motion (ROM)

Variables	Frequency	Percentage (%)
Flexion Mean (SD) = 50.0 (9.87)		
Hypo flexibility	17	13.9
Normal	31	25.4
Hyper flexibility	74	60.7
Extension Mean (SD) = 52.7 (8.09)		
Hypo flexibility	44	36.1
Normal	78	63.9
Hyper flexibility	0	0
Right Lateral Flexion Mean (SD) = 34.3 (6.63)		
Hypo flexibility	0	0
Normal	122	100.0
Hyper flexibility	0	0
Left Lateral Flexion Mean (SD) = 34.3 (6.63)		
Hypo flexibility	0	0
Normal	121	99.2
Hyper flexibility	1	0.8
Right Rotation Mean (SD) = 68.9 (6.15)		
Hypo flexibility	56	45.9
Normal	66	54.1
Hyper flexibility	0	0
Left Rotation Mean (SD) = 67.8 (6.23)		
Hypo flexibility	75	61.5
Normal	47	38.5
Hyper flexibility	0	0

The correlation between cervical range of motion and proprioception

As illustrated in Table 4, Pearson correlation test was conducted to check if the deficit in range of motion is correlated with JPE. There was no significant correlation between cervical ROM and proprioception for flexion, extension, left lateral flexion, right and left rotation among the subjects who wear headscarf more than 6 hours per day. However, a significant weak correlation observed in right lateral flexion ($p = 0.008$; $r = + 0.239$) indicating there was a slight increase in proprioceptive deficits in this movement direction.

Table 2 Frequency and percentage of normal and abnormal cervical proprioception

Variables	Frequency	Percentage (%)
Flexion Mean (SD) = 1.0 (0.16)		
Normal	119	97.5
Abnormal	3	2.5
Extension Mean (SD) = 1.0 (0.09)		
Normal	121	99.2
Abnormal	1	0.8
Right Lateral Flexion Mean (SD) = 1.0 (0.18)		
Normal	118	96.7
Abnormal	4	3.3
Left Lateral Flexion Mean (SD) = 1.0 (0.09)		
Normal	121	99.2
Abnormal	1	0.8
Right Rotation Mean (SD) = 1.0 (0.28)		
Normal	112	91.8
Abnormal	10	8.2
Left Rotation Mean (SD) = 1.0 (1.0)		
Normal	117	95.9
Abnormal	5	4.1

Table 3 The correlation between Cervical Range of Motion (ROM) and Cervical Proprioception (JPE)

	Cervical JPE	p-value	r-value*	Interpretation
Cervical ROM	Flexion	0.151	-0.131	Negligible linear relationship
	Extension	0.238	+0.108	Negligible linear relationship
	Right lateral flexion	0.008	+0.239**	Weak positive linear relationship
	Left lateral flexion	0.608	+0.047	Negligible linear relationship
	Right rotation	0.107	+0.147	Negligible linear relationship
	Left rotation	0.756	-0.028	Negligible linear relationship

Pearson Correlation
**Correlation was significant at the 0.01 level (2-tailed)*

DISCUSSION

The present study aimed to quantify cervical range of motion (ROM) and proprioception while also exploring potential correlations between the two. The findings of the study suggest that a significant number of the subjects experienced reductions in cervical range of motion (ROM), particularly in rotation movements. Specifically, most subjects demonstrated decreased ROM in left and right cervical rotations, with 61.5% experiencing reduced ROM in left rotation and 45.9% in right rotation. This indicates potential limitations in the ability to rotate the neck to the left and right sides. In contrast, cervical flexion and extension had fewer subjects with reduced ROM, with only 13.6% experiencing decreased flexion and 36.1% experiencing decreased extension. This suggests that forward and backward bending movements of the neck were less affected compared to rotational movements. Interestingly, lateral flexion movements to the right and left sides did not show reductions in ROM among any of the participants ("zero participants with hypo flexibility"). This suggests that the ability to bend the neck sideways was generally well-maintained among the subjects. On the contrary, joint position error (JPE), which reflects proprioceptive function, was found to be abnormal in a small percentage of subjects across various cervical movements. JPE abnormality was observed in 2.5% of subjects during cervical flexion, 0.8% of subjects during cervical extension, 3.3% of subjects during right lateral flexion, 0.8% of subjects during left lateral flexion, 8.2% of subjects during right rotation, and 4.1% of subjects during left rotation. These findings indicate that while most subjects had normal proprioceptive function during cervical movements, a small percentage demonstrated abnormalities in joint position sense. This suggests potential deficits in proprioception among some individuals, which could impact their ability to accurately perceive the position of their cervical spine during movement. There is an unexpected negative correlation between cervical range of motion (ROM) and joint position error (JPE), except for right lateral rotation which showed a weak positive linear relationship, suggesting an intriguing relationship between these variables.

The previous studies have explored the impact of wearing headscarves on cervical range of motion (ROM) and found significantly reduced ROM and cervical discomfort in individuals wearing headscarves compared to those not wearing them[9-11]. Studies have also reported that females

wearing hijab for more than 6 hours have significantly restricted ROM of all six movements compared to females wearing head scarf less than 6 hours[18]. This suggests that the presence of a headscarf may impose restrictions on cervical movements, potentially due to the fabric's constraining effect on head and neck mobility. In contrast, the present study aimed to quantify cervical ROM among individuals wearing headscarves without directly comparing them to a control group of individuals not wearing headscarves. While the absence of a control group limits the ability to draw direct comparisons, the study still provides valuable insights into cervical ROM within the context of headscarf-wearing individuals.

The findings from previous study indicating increased joint position error (JPE) for all cervical movements[19] contrasts with the results of the present study, which reported a lower incidence of proprioceptive error among participants. The present study classified subjects into normal and abnormal categories based on JPE and investigated the correlation between proprioception and range of motion (ROM). The observation of very few subjects exhibiting proprioceptive errors in the present study suggests that, contrary to previous findings, wearing headscarves may not necessarily lead to significant impairments in proprioception among individuals in this population. This discrepancy could be due to differences in study populations, methodologies, or other factors. Moreover, the lack of a positive correlation between proprioception and ROM, except for a weak positive correlation in right lateral flexion, suggests that the relationship between these variables is not straightforward. This finding underscores the complexity of factors influencing proprioception and ROM in the cervical spine.

The findings from past studies indicating increased frequencies of neck pain among hijab-wearing females[20], as well as the differential effects of various types of headscarves on neck symptoms[11], underscore the importance of understanding the interaction between headscarves and neck health. While the present study did not directly assess the presence of neck pain and associated disabilities, the reported reductions in cervical range of motion and potential implications on proprioception among headscarf-wearing individuals could provide valuable context for understanding the musculoskeletal effects of wearing head coverings.

The findings of this study offer valuable insights into the distribution of cervical Range of Motion (ROM) limitations among the participants. However, it is essential to acknowledge the study's limitations. Due to resource and time constraints, a convenient sampling method was employed, which may not be representative of the larger population. Consequently, selection bias cannot be ruled out, and the results may not accurately reflect the characteristics of the population. We recognize these limitations and interpret the results with caution.

Further studies can build upon our findings, addressing these limitations to provide a comprehensive understanding of the interaction between proprioception and ROM in individuals wearing headscarves and to elucidate the underlying mechanisms driving any observed correlations or lack thereof. Additionally, investigating potential interventions aimed at improving proprioception and ROM in this population could have important implications for musculoskeletal health and overall well-being.

CONCLUSION

Wearing headscarves, such as the hijab, may have a potential effect on cervical range of movement. This implies that there might be some impact on the flexibility or mobility of the neck due to wearing a headscarf. However, relationship between ROM and proprioception in females wearing hijab does not appear to be greatly affected. Further studies should investigate this relationship in females of different age groups who have been wearing hijab for varying lengths of time for more comprehensive understanding of how wearing headscarves impacts cervical movement and proprioception across different demographics.

List of acronyms
ROM – Range of motion
JPE – Joint position error

Ethics approval
The ethical consideration was obtained from the IIUM Research Ethics Committee (IREC) (reference no.: IIUM/504/14/11/2/IREC 2023-KAHS/DPRS10 Date: November 30, 2023).

Conflict of interest
No competing interest

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