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Banking Behind the Desk, How Forward Head Posture Influences Neck Pain in Bankers: A Cross-sectional Study

Aizaz Ullah Khan
Lecturer University of Swat, Charbagh Swat
Email: 004aizaz@gmail.com
Mariam Rahim
Student MS-OMPT Riphah International University Malakand
Email: maryammohsinullah@gmail.com
Mahrukh Habib
Student MS-OMPT Riphah International University Malakand
Email: mahrukhhabib2000@gmail.com
Hamza Shehzad
Student MS-OMPT Riphah International University Malakand
Email: hamzakh688@gmail.com
Hafsa Rahim
Lecturer IHS-Khyber Medical University, Swat
Email: hafsa.rahim62@gmail.com
Zahoor Ahmad
Lecturer Riphah international University Malakand
Email: zahooor.ahmad@riphah.edu.pk
Mian Waleed Ahmad
Senior Physiotherapist Pak-Austria Fachhochschule: Institute of Applied Science and Technology, Mang, Haripur Email: mianwaleed50@gmail.com

Author Details

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Corresponding E-mail & Author*:
Aizaz Ullah Khan
Lecturer University of Swat, Charbagh Swat
Email: 004aizaz@gmail.com

Abstract

Background: Different factors such as prolong sitting at work or abnormal posture of head during work may have great role in occurrence of neck pain among those who use computer. In literature forward head posture has not always been associated with neck pain.

Objective: To determine the association between forward head posture with neck pain among bankers of Malakand, Pakistan.

Methodology: it was cross sectional study to explore association between forward head posture and neck pain. 86 bankers were examine using photogrammetric method and web plot digitizer software for plotting angle on digital image. Numeric pain rating scale and neck disability index questioner was used to measure neck pain and intensity.

Results: Most of the participants 80.2% had forward head posture. Majority 47.7% were in age between 20-30 and having mean age 33.8±8.8. the mean score of neck disability index was 5.88±4.9. the chi square test showed no significant association (P>0.05) between forward head posture and neck pain.

Conclusion: This study concluded that forward head posture is quite common in bankers but there is no association between forward head posture and neck pain.

Introduction

Neck pain (NP) is a common disorder of cervical region between occipital bone and T1 characterized by pain discomfort and tenseness which may or may not be referred to upper limb. (1, 2)Neck pain is a musculoskeletal disorder cause by postural disturbance causing functional limitations.(3) .Neck pain is the 4th highest leading cause of disability.(2)Neck pain is a common condition effecting people both physically and economically.(4) Neck pain highly affects an absolute increase in number of patients (5). Globally, the prevalence of neck pain ranges from 16.7% to 75.1%(6). In Finland NP prevalence was 5750.3, in Norway NP prevalence was 6151.2, in Denmark NP prevalence was 5316 per 100000 populations. Point prevalence of NP in United Kingdom was 14.6%, in Sweden NP prevalence was 10.4%, in Kuwait NP prevalence was 2.6%(7).In Netherland NP point prevalence varies between 6% and 22% in 1 year prevalence between 1.5 % and 75% (4). In Hong Kong NP lifetime prevalence was 65.4%, 12 month prevalence was 53.6 % (8).

Neck pain is common among children and adults as neck symptoms are mostly associated with sustaining poor posture during work and study(9). People with poor posture complain more of headache as pain follows pattern with tightness in upper cervical vertebrae and muscles of neck rising to posterior and then anterior scalp (10). Neck pain is commonly reported health problem leading to economic burden. People face different work related problems such as absentee from work due to NP(11). NP leads to decrease in quality of life and working capacity of workers (12).Neck pain is mostly associated with occupational categories who work >6 hour/day on a computer sitting in a non-neutral spine posture (13). Forward head posture is the most common poor posture contributing to neck pain (9). Office workers and people with sedentary lifestyle are at risk for neck pain due to prolong work time or poor postures such as unfitting neck flexion and rotation .Inappropriate placement of computer (not placed in front) contributes to NP as an important risk factor in computer users (12).Whiplash associated injury or disorder is one of the main causes of NP in approximately 50% of cases(14). 95% people who experience mechanical injury (traumatic injury) were facing the issue of persistent NP while based on the study on 1500 patients in emergency department (15).

Non-specific neck pain is NP with idiopathic cause of unknown pathology and causes no or less disturbance with daily life activities (16, 17). Non specific neck pain is very common and concerned problem worldwide for office workers (17). This work related neck pain is tenacious and long lasting and is recurrent in nature (18). Also adolescent period is very tactful period of life where NP may develop and impact daily activities and further future health (19). NP has substantial effect on people and their surroundings, including their daily activities. According to a study it was concluded that rate of occurrence of NP is higher in office workers and also people who use computers(20). Global burden of disease declared NP as the 4th main reason for prolong disability. Epidemiological studies show an annual prevalence of NP ranging from 15% to 50%(21). Almost 50-85% people who have NP experience reappearance of pain after 1-5 years without complete cure of symptoms(16).FHP is a disorder of neck which is also known as ‘text neck’, ‘tech neck’, ‘scholars neck’, ‘wearies neck’, ‘hunch’, ‘reading neck’(22-24). Most frequently observed atypical posture of cervical spine in OPD is FHP. FHP is defined as head protruding forward, anterior to the trunk and plumb line or center line of the body(22, 23). It is the structural forward bending causing lower C.spine (c4-c7) flexion and upper C.spine (c1-c3) hyperextension(25). Adaptation of divergent posture of body is related with pain in neck region (26).

Prolong computer and smart phone use have lead to MSK disorders by increasing anterior weight bearing of C.spine causing change in biomechanics (23).FHP affects huge number of population and causes consequential neck pain. Patients reporting neck pain for a long time were presented with FHP(27). Globally, 1 year prevalence of FHP was 16.5-75.1% in people aged 17-70 years. FHP prevalence in patients with neck pain was 37%(23). FHP prevalence in patients with neck pain who use computers was 61.3% (27). Prevalence of FHP among university students of Pakistan was 63.96%(28) while among university students of Malaysia prevalence was 67%. A study on healthy subjects showed 66% of FHP prevalence(29). In dental staff FHP prevalence was 85.5%(30). In adolescents FHP prevalence was 53.5% (31). In a study on heroin users prevalence of FHP was 36.7% of moderate FHP and 20.0% severe FHP.(32)Increase in FHP occurs due to maintaining poor posture for prolong periods of time in daily life activities. Contributing factors include age, gender, occupation, physical activities(29). FHP mainly occurs due to using high pillows which causes head elevation higher than normal, prolong use of laptops, computers and smart phones, due to nutrient deficiency and lack of back muscle strength(24).Maintaining poor posture during computer work causes even more worst neck pain that is associated with FHP (28).Normal posture of neck is when the acoustic meatus is in line with the center line of body(27). Due to FHP the mass center or point of balance move forward and causes stress on muscles leading to muscle imbalance(28). FHP leads to rounded shoulders and upper cross syndrome which further causes reduction in cervical lordosis and kyphosis. If not treated it causes shortening of neck extensors leading to chronic neck pain (29). FHP also effects cervical range of motion, spinal curvatures like increase in thoracic kyphosis and reduction in lumbar lordosis, reduced neck flexion, extension and rotational ROM (24).Normal posture is the balanced position in which there is slightest stress and strain on muscles and bones. Sitting with a faulty posture for prolong period of time leads to changes in body alignment as head moves forward and weigh more and causes the supporting head and neck muscle fatigue. Weight on spine increases due to FHP leading to disturbance of normal spinal curvatures and increased stress on spine, causing deterioration and depletion of neck muscles(22). FHP weakens deep cervical flexor muscles, mid thoracic rhomboid muscles and mid and lower trapezius. FHP shortens pectoralis major and neck extension muscles. Increase in upper trapezius activity leads to increase in fatigue and stress which further causes pain in neck from muscle overuse (33) During adolescence people are more prone to develop poor posture. Prolong use of computers and smart phones causes disorder by sitting in wrong posture for long period of time. Sitting with deviated posture exert 3.6x more force and stress on muscles than in normal posture (25). Neck pain caused by FHP has high epidemiological incidence rate by many etiological factors. Epidemiology shows that FHP occurs from puberty and is the most common neck deviation (26)Forward head posture is increasing greatly nowadays due to abnormal posture in office workers and that abnormal posture also effects neck muscles and causes Neck pain. Work has been done on forward head posture and neck pain in various foreign countries on different people of different profession. In developing country like Pakistan there was no study found on forward head posture associated with neck pain especially on bankers in Pakistan. Therefore this study is designed to find out association between forward head posture and Neck pain in bankers of swat.

LITERATURE REVIEW

Studies describe that FHP which is an internal factor leads to pain and discomfort in head and neck region(1). Increase in use of computer, smart phone and working hours spent in wrong posture for longer period of time leads to FHP and NP (2 ,3).

Computer use causes a long term effect on spine and NP as long time neck flexion facilitates FHP (36). Neck disorders and pain are very common in office workers intensely using computers. Study shows that there was significant association between FHP and NP in office workers sitting in wrong posture for long time (37). The prevalence of NP in office workers using computers in Sudan was 64%. In ASIA the highest prevalence rate of NP was in Iran with urban 13.4% and rural 17.9%. In dentists working with flexed neck position NP prevalence was 28-61% (1). 12 month prevalence of NP in office workers was 45.5% (37). Regarding association between FHP and NP, age is the confounding factor as adults with NP show increased FHP rather than asymptomatic adults. NP and FHP showed no association in adolescent and older(36). People with non specific NP tend to have more FHP as compared to people without NP (35). Cranio-vertebral angle is related to the manifestation of NP as CVA in people with NP is smaller indicating FHP than in normal people(38). Increased FHP associated with many changes in range of motion, flexion, extension and rotation maybe related to NP. In literature FHP and NP haven't been associated always and is still debatable. The existing evidence seem to be controversial as previous studies showed association while other studies showed no association between FHP and NP.(36)Forward head posture is the structural change from the normal position of the head i.e leading the head position more anteriorly and also increases the cervical lordosis. In forward head posture the lower cervical spine adopts a flexed position on the other hand upper cervical spine is in extension.(39). Forward head posture can be described clinically as an unusual position of the head which moves forward with comparison to the shoulders. Forward head posture can be sometimes cause by different diseases that includes thoracic hyperkyphosis, improper muscle activation and degenerative changes(40). Forward head posture also causes scoliosis and head-neck-shoulder-thoracic problems thus by correcting forward head posture these conditions also improves(41).The cervical spine is divided into four sections anatomically which are atlas, axis, C2-C3 junction and all typical cervical vertebrae other than that (42). The anatomy of neck is complex organize web of muscles, bones, nerves and spinal cord. So the irritation of nerves causes the neck pain mostly. Prolong use of electronic devices like mobile also causes neck pain by keeping neck in forward flex position and bent down to see these devices(43).keeping neck in flexion for prolong period of time is marked as one of the main reasons for the development of chronic neck pain. Abnormal behavior or changes in cervical spines muscles also leads to neck pain or other cervical spine disorders(44). Any change which occur in the sagittal alignment of the head and neck complex region is responsible for the variation of cervical spine musculature, it may increase or decrease the muscle length. Those muscles which become short in length or stretch experiences weakness due to the abnormal alignment of the sarcomeres. According to the Current literature the changes in the muscle length are associated with forward head posture. Physical therapist can improve the treatment methods along with assessment due to the changes occurring in muscle length associated with forward head posture(40).In some studies gonio meter was used to measure CVA which is measured by angle between C7, tragus of ear and a horizontal line crossing C. Angle was measured while patient standing straight. The patient was told to maintain their usual head position and symmetrical weight distribution in anatomical position. The C7 process was palpated and marked for the ease of measuring CVA. Then CVA measurements were noted and the procedure was repeated several times. The measurements were taken in the sagital plane from weather left or right side as there is no difference between them. The CVA was found to be both reliable and valid (34). Gonio meter is mainly used for measuring Range of motion than angles of body and not used usually in practice for posture assessment (24).FHP is characterized by CVA

the angle between 7th cervical vertebrae, tragus and the horizontal line (34). To know FHP the CVA is measured, the pendulum was fixed to the ceiling with the help of thread and the center line was used as a standard. The 7th cervical vertebrae and tragus of each person was marked properly and a camera was placed 1.5m away from the subjects in a horizontal level with the mark. The images were to be captured in a neutral position in standing with the arms at side. The procedure of image in sitting position was same as standing. The angle was measured through ImageJ software. The angle was made by horizontal line drawn perpendicular to the center line that intersects the mark on 7th cervical vertebrae and the line joining 7th c.vertebrae with tragus of ear (25).The accurate measurement of FHP is through photogrammetry method also known as digital imaging technique. It's used to measure CVA in longitudinal plane. Greater CVA indicated ideal alignment and lesser indicates FHP (3). This photogrammetric method was used to assess the head and neck posture in standing in sagital plane. Literature shows that photogrammetric is an equitable method to measure body postures and have good validity and reliability for CVA evaluation by angles and distance analysis on digital image for FHP measurement (23, 27).The camera was installed 1.5m away from subject and adjusted according to person height. The subject faces straight and lateral to the camera. The 7th C.vertebrae was palpated and marked by tape. Two angles can be measured to indicate FHP, the craniovertebral angle and the cranial-rotational angle (CRA). CVA is measured by a horizontal line passing through C7 process and joining C7 to tragus of ear. Theta angle 49.9^0 of CVA is normal, the more less than normal angle the more severe FHP (23, 24). Literature shows that this is the most common angle for measurement of FHP and its validity and reliability have been confirmed (35). The CRA formed by line between C7 with tragus and canthus of eye, so greater CRA indicates FHP. The angles were drawn by MB ruler software or web plot digitizer (WPD)(23, 24). This photogrammetry method is cheap, easy and fast relative to other methods. It also has good intra rater reliability in measuring neck angles. Reliability of photogrammetry is >0.972.(45)Literature reveals that there are much software's for body posture assessment but are very technical or need to be purchased and their reliability was not assured. The WPDS have excellent inter and intra-rater reliability and can be clinically used for head and neck posture assessment. It's an online software and open resource which work with different plots and images(45). FHP quantitative evaluation through photogrammetry is easy by using computer and Web Plot Digitizer (24). The digital image is uploaded into WPDS and FHP was measured using option 'angle measure' and drawing craniovertebral angle through marked points. It works as mathematical algorithm transforming 3 dots on image to angles (27). The WPD may be useful to evaluate FHP in patients with neck pain(46).Most of the people nowadays spent majority of their time by sitting in front of computers at work due to which forward head posture is common in recent years. This abnormal posture causes injuries to soft tissues and causes neck pain, Therefore, recovery from FHP is considered very important for relieving neck pain. There are different ways for the management and treatment of FHP including cervical mobilization and cervical mobilization in addition with thoracic mobilization are both effective for FHP recovery, the combination of cervical and thoracic mobilization gives more positive and accurate result in treatment (47).Therapeutic exercise, which includes strengthening weak muscle, stretching tight muscle and postural education, is also very effective for correcting FHP. Kinesio taping (KT) is widely used in clinical practice. It has also been used in the treatment of FHP or mechanical neck pain. Applying KT in addition with exercise was more effective in easing pain intensity and neck disability in mechanical neck pain than exercise alone(41).

Materials & methods:
Study Design: Study design was Cross-sectional study
Study Population/Settings: The study was conducted at banks of Malakand.
Sample Size: The sample size was 86 participants with confidence interval at 95% and keeping the hypothesize 50% proportion of outcome factor in the population (p) with total population of 110. The sample size was calculated using sample size calculator i.e. Raosoft.
Sampling Technique: Non-probability convenient sampling

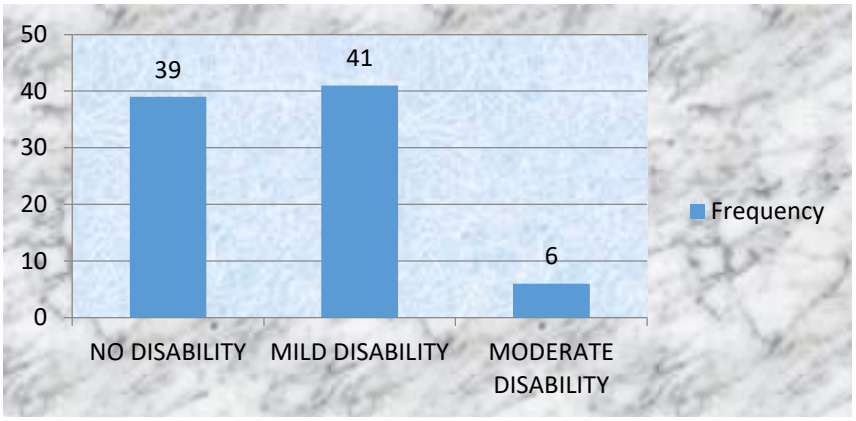
Inclusion Criteria
Bankers on job for 6 months
Age group between 20-60 years
Both male and female
Bankers who work for 6 hours per day average

Exclusion Criteria:
Bankers who was irregular or on job for less than 6 months
Participants who were not willing to participate
Bankers having congenital postural disorders were excluded
Supportive staff (i.e Peon etc)
Data collection procedure: permission was taken from the concerned banks managers through official permission letters in order to conduct the study. All the willing bankers were briefed about the purpose and procedure of this study. The agreed bankers were screened through inclusion and exclusion criteria.
Data collection tools: Data was collected using following data collection tools:
A questionnaire including demographic data was filled from each participant,
Photogrammetric digital imaging technique used to measure cranio vertebral angle for forward head posture,
Web plot digitizer (window based online software) for plotting angle on digital image.
Numeric pain rating scale (NPRS) to measure intensity of pain
Neck disability index (NDI) questionnaire were used to measure neck pain.
Data analysis procedure: The data was analyzed using SPSS (Statistical Package for Social sciences) version 26. Data had been presented in the form of tables and charts, Chi square test had been used to find out significant association among various variables.
Informed consent
Participants were informed verbally about the aims and objectives of this study. Consent forms were given to the participants and explained to them by the interviewers.

Results
Ndi categories: The number of participants was 86, out of which 45.3% i.e. (n=39) were with no disability, followed by 47.7% i.e. (n=41) were with mild disability, and 7% i.e. (n=6) were with moderate disability.

NDI CATEGORIES	Frequency	Percent	Cumulative Percent
NO DISABILITY	39	45.3	45.3
MILD DISABILITY	41	47.7	93.0
MODERATE DISABILITY	6	7.0	100.0
TOTAL	86	100.0	

Showing the NDI Categories



Showing NDI Categories in Bar Chart

NPRS and FHP association: Out of 86 participants 17(100%) were with no FHP including 23% (n=4) with no pain, 58.8% (n=10) with mild pain and 17.6% (n=3) with moderate pain. Remaining 69 (100%) participants were with FHP including 31.9% (n=22) with no pain, 59.4% (n=41) with mild pain, 7.2% (n=5) with moderate pain and 1.4% (n=1) with severe pain.
P-value is 0.542 which shows no association.

FHPcat		No Pain	Mild Pain 1-4	Moderate pain 5-7	Severe Pain 8-10	Total	P-value
No	Count	4	10	3	0	17	.542
	% within FHPcat	23.5%	58.8%	17.6%	0.0%	100.0%	
Yes	Count	22	41	5	1	69	
	% within FHPcat	31.9%	59.4%	7.2%	1.4%	100.0%	
Total	Count	26	51	8	1	86	
	% within FHPcat	30.2%	59.3%	9.3%	1.2%	100.0%	

FHP and NDI association: Out of 86 participants17 (100%) were with no FHP including 47.1% (n=8) with no disability, 41.2% (n=7) with mild disability and 11.8% (n=2) with moderate disability.Remaining 69 (100%) participants were with FHP including 44.9% (n=31) with no disability, 49.3% (n=34) with mild disability, 5.8% (n=4) with moderate disability.

P-value is 0.638 which shows no association.

	FHPcat	No disability	Mild disability	Moderate disability	Total	p-value
No	Count	8	7	2	17	.638
	% within FHPcat	47.1%	41.2%	11.8%	100.0%	
Yes	Count	31	34	4	69	
	% within FHPcat	44.9%	49.3%	5.8%	100.0%	
Total	Count	39	41	6	86	
	% within FHPcat	45.3%	47.7%	7.0%	100.0%	

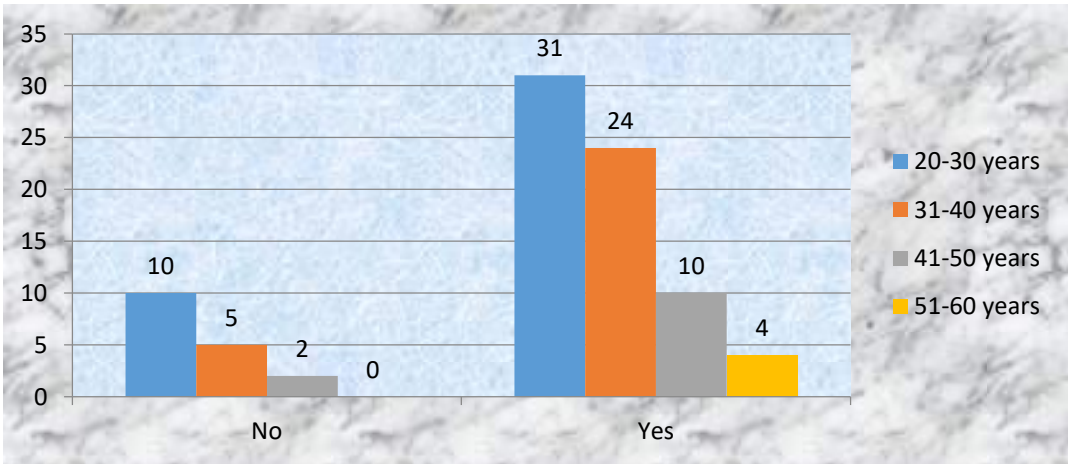
NPRS & NDI ASSOCIATION: Out of 86participants 39(100%) people were with NO DISABILITY including 61.5% (n=24) with no pain, 35.9%(n=14) with mild pain,

2.6% (n=1) with moderate pain.41(100%) out of 86 participants were with mild disability including 4.9% (n=2) with no pain, 85.4% (n=35) with mild pain, 9.8% (n=4) with moderate pain. 6 (100%) out of 86 participants were with moderate disability including 33.3% (n=2) with mild pain, 50% (n=3) with moderate pain, 16.7% (n=1) with severe pain
P-value is 0.000 which is smaller than 0.05 showing association.

NDI Categories		No Pain	Mild Pain 1-4	Moderate Pain 5-7	Severe Pain 8-10	Total	p-value
No Disability 0-4	Count	24	14	1	0	39	.000
	% within NDIcategories	61.5%	35.9%	2.6%	0.0%	100.0%	
Mild Disability 5-14	Count	2	35	4	0	41	
	% within NDIcategories	4.9%	85.4%	9.8%	0.0%	100.0%	
Moderate Disability 15-24	Count	0	2	3	1	6	
	% within NDIcategories	0.0%	33.3%	50.0%	16.7%	100.0%	
Total	Count	26	51	8	1	86	
	% within NDIcategories	30.2%	59.3%	9.3%	1.2%	100.0%	

AGE and FHP: We recruited bankers of age 20-60, out of total 86 participants 17 reported no FHP including 10 participants of age 20-30, 5 participants of age 31-41, 2 participants of age 41-50.69 participants reported FHP including 31 participants of age 20-30, 24 participants of age 31-40, 10 participants of age 41-50 and 4 participants of age 51-60.

P-value is 0.631 which is greater than 0.05 showing no association.



Discussion: Forward head posture is the anterior translation of head to the center line of the body which results in variations in the upper and lower cervical spine.(25) FHP is more frequently present in computer users as a result of prolong sitting and improper posture. Neck pain is the pain or irritation in the cervical region caused by postural disturbance.(1-3) Computer users due to their positions are at high risk for improper posture and MSK disorders(35).
In this study we assessed different variables and its association with FHP using

photogrammetric method. The bankers participated in this study were 86 in total, from age 20-60 having mean age of 33.8±8.8. The bankers ranging between 20-30 years were 41(47.7%), ranging between 31-40 years were 29(33.7%), ranging between 41-50 years were 12 (14.0%) and range between 51-60 years were 4 (4.7%). In contrast other studies reported different age categories. In a study with age categories ranging from 18-28 having mean age 22.2 ±2.48 concluded that forward head posture has no effect on neck pain(48). Another study conducted in Iran having mean age value 39 ±8 which is somewhat relative to my study concludes that there is no relation between age and neck pain relating forward head posture.(1)

Spending a lot of time in front of computer in working hours while sitting in faulty posture for extended time leads to FHP and NP (1). Total bankers participated were 86 out of which 17 (19.7%) reported no FHP and 69 (80.2%) reported FHP. The participants with no disability were 45.3%, those with mild disability were 47.7% and participants with moderate disability were 7%. A study in Portugal concluded that there is association between forward head posture and neck pain of longer duration (34). Another study in Korea also showed conflicting results concluding that participants with neck pain had a decreased Cranio vertebral angle resulting association between both the variables and suggest that FHP can be predictor of pain (3). Three combined studies on adults showed more FHP with neck pain. While another study on adults >50 reported that there was no association of FHP with NP. In adolescents there is no significant difference between FHP and people with and without neck pain which is concluded by 3 combined studies (36). A study conducted in Europe discussing work related physical factors and neck pain revealed that NP was significantly associated with computer working time while previous studies were inconsistent about it(37). As my subjects have consistent breaks and equally deal with clients as they use computer, hence the results are not significant. Another study conducted in India on desktop users using computer 3-4 hours average showed contrasting results, the participants were of age 30-40 reveals that there is no significant association between FHP and NP(49). A study conducted in Iran on office workers concluded that FHP was only related to NP in working position and there was no association between NP and FHP in neutral forward looking position (1), this quietly relates with our study as we measured FHP in neutral position of standing rather than working position as we were not permitted by bank managers. The degree of angulation of the chair's backrest support is an important factor that should be taken into account when considering seating adjustments that are likely to influence head and neck posture (50).In this study we checked neck disability index categories, which are no, mild, moderate, severe and complete disability. Among them the most reported category was mild disability. Furthermore, FHP was correlated with age had P-value of $p=0.631 > 0.05$ showing no association between age and FHP. In addition, we associated FHP with neck disability which also showed no association having P-value of $p=0.63$

Conclusion:

This study concluded that forward head posture is quite common in bankers but there is no association between forward head posture and neck pain.

Limitations:

This study considered only bankers of Malakand, Sample size was very small and access was limited due to workload on bankers. Most of Female bankers didn’t allow us to take their pictures for our data. Many bank managers didn’t permit us for data collection due to bank confidentiality.

Recommendations:
This study should be conducted on province level and longitudinal study should be performed for good inter and intra rater reliability. Population and sample size should be larger.

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