Direct Research Journal of Engineering and Information Technology
Vol. 12 (2), Pp. 81-95, June 2024
ISSN: 2354-4155
DOI: https://doi.org/10.26765/DRJEIT1524563099
Article Number: DRJEIT1524563099

https://journals.directresearchpublisher.org/index.php/drjeit

Assessment of Musculoskeletal Disorder in Banking Industry: A Case Study of Selected Banks in Effurun, Delta State

Ikpesu, Jasper Ejovwokoghene[1,2,3]*, Okeke, Gerald, Ndubuisi[3]; Ovuru, B.S.[1], Ali, Peace[1]; Aminu, Momodusani[1] and Woko, Ogochukwu[1]

[1]Petroleum Training Institute, Department of HSE and General Services, Delta State, Nigeria.
[2]School of Chemical and Metallurgical Engineering, University of the Witwatersrand, South Africa.
[3]Hghstone Global University, Texas, USA.
Corresponding author email: Jasper.ikpesu1@students.ac.za ; jasper.ie70@gmail.com

Received 2 May 2024; Accepted 27 May 2024; Published 15 June 2024

ABSTRACT: This study assessed the musculoskeletal disorder in banking industry due to poor ergonomic design. The objectives of this study were to determine the computer workstation ergonomic of bankers in the banking industry, to assess the area of discomfort experienced by computer operators in the banking industry, to evaluate the anthropometric design of the computer user workstations (chair and desk) dimensions and to compare the results obtained from this study with recommended standard of ergonomic design. For this to be accomplished primary data acquisition were used. The data were analyzed and presented using appropriate statistical table and percentage format. A total number of 60 respondents were sampled from four banks XA, XB, XC and XD in Effurun, Warri, Delta State. Results showed that four types of designs of chairs and tables were identified in the four banks sampled (XA, XB, XC, XD). The furniture in banks classified as Type A, shows dimensions of the seat height as 102 cm, Type B shows seat heights average of 82 cm, Type C shows seat height of 86 cm and Type D shows seat height of 56 cm. The chairs in Type A have seat depth of 53 cm and width 39 cm and Type B, C D have an average of 43.5 cm, 41 cm and 51.2 cm for both seat depth and width respectively. The seat upper and lower backrest height for Type A is 42.1 cm and 20 cm, Type B are 25 cm and 15 cm while for Type C and Type D is 0cm because they have no upper and lower backrest. The seat to desk clearance in Type A, B, C and D workstation have an average of 16 cm, 19 cm, 15 cm and 11 cm respectively. The sitting shoulder height is considered for the design of the upper and lower backrest height. It was observed that the highest prevalence pain complaints were from shoulder (87% from XD), followed by eye (73% from XB), lower legs (53% from XC), nape (40% from XB), fingers (73% from XA) and the wrists (67% from XA). This is an indication that their workstations were ergonomically poorly designed. It is highly recommended that Operators are advised to make use of adjustable chair that can adjust its height, armrest, upper and lower backrest.

Keywords: Musculoskeletal, disorder, banking industry

Citation Ikpesu, J. E., Okeke, G., N. Ovuru, B.S., Ali, P.; Aminu, M. and Woko, O. (2024). Assessment of Musculoskeletal Disorder in Banking Industry: A Case Study of Selected Banks in Effurun, Delta State. Direct Res. J. Eng. Inform. Tech. Vol. 12 (2), Pp. 81-95. https://doi.org/10.26765/DRJEIT1524563099

INTRODUCTION

In recent years the computer has become a wide-spread work tool. Technological advances and software development resulted in introducing computers in new fields which so far had been computer-free. There has been an increase of computer work stations not only in offices, but also in corporate finance departments, as well as in the banking, insurance, IT, accounting, commerce, and science sectors (Wioletta, Mirosława, & Adrian, 2016). More and more people from various market sectors spend long work hours in front of computers. Meanwhile, the Polish Labor Code states that working for more than 4 hours per day in front of a computer constitutes ‘particularly arduous working (Decree of the Minister of Labor and Social Policy, 2018). This classification is well-grounded: ignoring negative aspects of working with a computer leads to significant health consequences for the workers. Kowalska and Bugajska, (2019) carried out an analysis of office work and identified negative health consequences in persons working in front of computers. Among the most commonly reported problems were: musculoskeletal system disorders (MSDs), peripheral nervous system diseases, as well as eye diseases and psychosocial stress. Bendíková, (2017) proved that sedentary position translates into log-term immobilized spine, which results in a spinal overload, causing increased pressure of vertebrae, as well as static load on torso and back muscles. This leads to incorrect spine curvature, which in turn results in pain and degenerative changes. According to research conducted in 27 EU member states by Zheltoukhova et al. (2018), as many as 22% of employees face musculoskeletal system disorders, significantly impact mobility and efficiency of employees in many various sectors.

It affects both individuals and teams, lowering productivity and quality of work, and – consequently – financial results and competitiveness advantage of enterprises. Results show that in 2010 MSDs and carpal tunnel syndrome caused 26 million days of absence from work (Zheltoukhova et al., 2018). These numbers justify an urgent need to treat MSDs as one of top priorities of national health care in the coming years (Raciborski, Władysiuk, Bebrysz, & Samoliński, 2019). This problem will increase not only due to lack of healthy practices and low health awareness of employees, but also due to aging of Polish employees, who – with time – will experience natural morphological, metabolic and operational changes in their skeletal muscles (with various intensity in men and women) (Bartuzi and Roman-Liu, 2019).

MSDs are among the most important causes of occupational injury and disability in many industries in both developed and developing countries. This results in high economic costs for these industries (Negahban et al., 2018). Currently, controlling and reducing MSDs in the workforce is one of the most important global concerns for experts in ergonomics. The importance of controlling and reducing these disorders is so high that many countries consider the prevention of work-related MSDs among the workforce as one of the national priorities (Motamedzade and Moradpour, 2016)

According to surveys by the WHO, as well as the documentations provided by this organization in 2013, work-related MSDs are at second place of occupational diseases following occupational respiratory diseases (World Health Organization., 2018). The most common equipment used in most workplaces, especially banks, is the computer. This has increased exponentially over the last 20 years (Taieb-Maimon, 2019). According to a report by the National Bureau of Statistics of Nigeria, in 2007, 60% of workers in the workplace use computers. This increases to 88% in business and economic services (Adebayo, 2017). More than half of employees in European Union member countries use computers during their workday. Numerous studies have shown that computer use is associated with an increase in the prevalence of MSDs. The results of longitudinal follow-up studies of 3 months to 5 years indicate an increased risk of pain in the neck and shoulders among computer users. Giahi, (2014), in a study on bank users in Iran—showed that 70.2% of subjects had discomfort in at least one area of the body. The duration of working with a computer and inadequate resting time were the most important factors contributing to discomfort.

Objectives of the study

- To examine the ergonomic workstation in the banking industry.
- To assess the area of discomfort experienced by computer operators in the banking industry.
- To evaluate the anthropometric design of the workstation furniture (chair and desk), the dimensions and to compare the results obtained from this study with recommended standard checklist.

LITERATURE REVIEW

Conceptual Framework of the study

Ergonomics is about designing for people and is defined as the science of fitting a workplace to the user's needs. Ergonomics aims to increase efficiency, productivity and reduce discomfort (Humanscale, 2021) (Figure 1).

According to Safe Work Australia June (2014), the total economic cost of work-related injuries and illnesses is estimated to be $60 billion dollars. Recent research has shown that lower back pain is the world's most common work-related disability affecting employees from offices, building sites (in the highest risk category) and agriculture. Ergonomics aims to create safe, comfortable and productive workspaces by bringing human abilities and limitations into the design of a workspace, including the individual's body size, strength, skill, speed, sensory abilities (vision, hearing), and even attitudes. To achieve best practice design, Ergonomists use the data and techniques of several disciplines:

- Anthropometry: body sizes, shapes; populations and variations.
- Biomechanics: muscles, levers, forces, strength.
- Environmental physics: noise, light, heat, cold, radiation, vibration body systems: hearing, vision, sensations.
- Applied psychology: skill, learning, errors, differences.
- Social psychology: groups, communication, learning, behaviours (Safe Work Australia, June 2014).

Musculoskeletal disorders encompass a collection of inflammatory and degenerative conditions that affect the joints and surrounding soft tissues of the body as well as the peripheral nerves and supporting blood vessels with resultant physical and psychosocial symptoms, mostly pain and discomfort (Janwantanakul et al., 2019). Musculoskeletal injury resulting from a work-related event is termed work-related musculoskeletal disorder (WMSD) (Salik, 2019). It is an effect of over-exertion which occurs

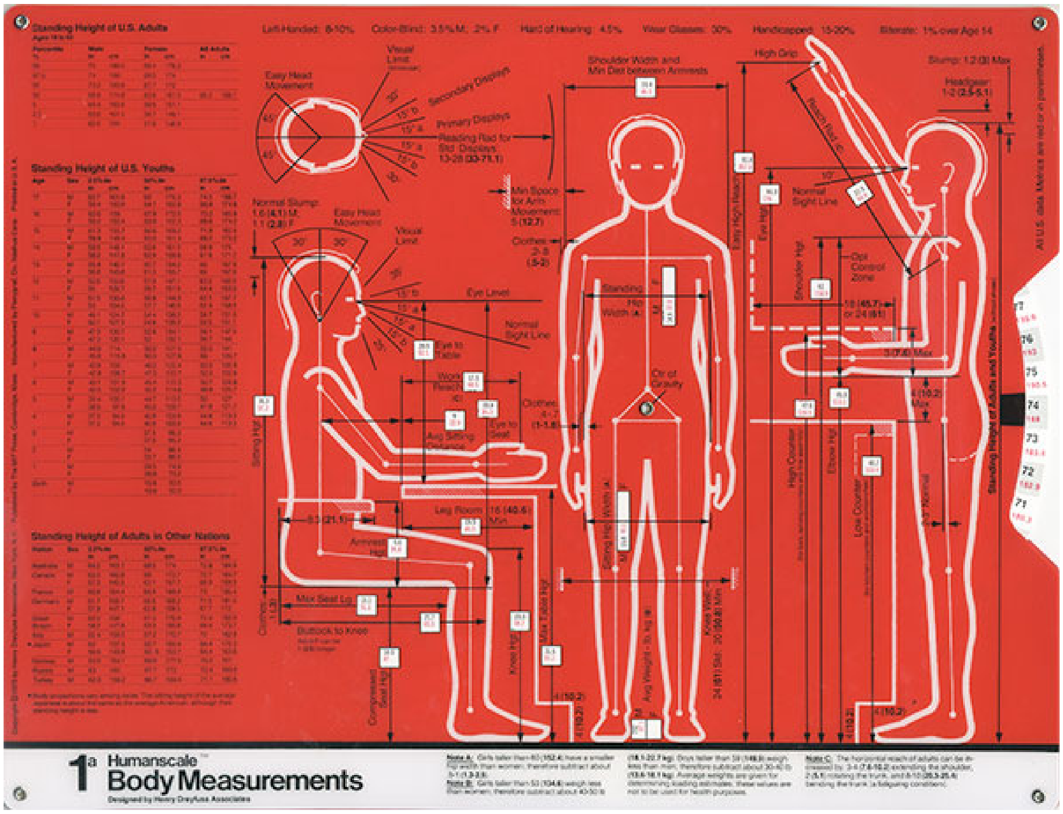

Figure 1: showing angular positions of seating and standing (Human scale, 2021).

when workers are repeatedly exposed to forceful and prolonged activities in awkward postures or unsympathetic environments (Sommerich et al., 2019). In the banking sector, bankers' works involve the use of computer for data collection, processing and programming, hence they are exposed to risk factors for the development of musculoskeletal disorders inherent in the computing industries. Jobs requiring stereotyped movements of the arms, hands and fingers, and repetitive occupational tasks with short cycle times have become more and more frequent in modern technology as seen in banking jobs with many of them associated with increased rates of pain and musculoskeletal disorders (Turhan et al., 2018).

What is a computer workstation?

A computer workstation is the environment around your computer:

• **Furniture:** chair and desk or other work surface.
• **Computer equipment:** computer, monitor or flat panel display, keyboard, mouse or pointing device.
• **Accessories:** document holder, footrest, telephone, palm rest, Mouse Bridge.
• **Ambient factors:** noise, illumination, glare, temperature, humidity, and static electricity (OSHA, 2016).

Redesign of workstation using Ergonomics

The important requirements of workstation as specified by International Standards Organization (ISO) are the sitting posture, back rest, position of monitor, arm rest, leg room, work area which includes position of keyboard and mouse. The conventional chair encourages a straight posture retaining right angles of elbow, hips, knees and ankles (Sreerag et al., 2021).

Working in this kind of a posture for prolonged time leads to musculoskeletal disorders. Thus, the chair must be designed to permit reclined sitting posture. The seat height and depth of chair must be adjustable permitting the feet to rest on the footrest and accommodate wide range of people from lowest to uppermost setting. The back rest should provide ample support and clearance for buttocks. The inclination and height of back rest must be adjustable so that one can sit in wide range of postures. The arm rests which supports the elbow while using keyboard and mouse is most preferable, as it reduces the load on the arms, shoulder and neck (Sreerag et al., 2021).

In fact, it is desirable to design arm rests as an optional feature. The height, length and width of the arm rest must be such that it provides sufficient cushioning to reduce pressure on elbows and underside of the forearms. The monitor position, viewing distance and viewing angle are other vital parameters. The height to which monitor positioned must be such that it does not result in greater muscle activity. If it is positioned too low, it increases the flexion of the head relative to neck. The range of preferable viewing distance is 63 – 85 cm for people with normal visual capabilities. Beyond this range, it leads to visual fatigue. The monitor display must be positioned such that viewing area must be with $(0 – 60)^0$. In addition, the work surface height, must be adjustable; the leg room must be ample; the surface area containing keyboard and mouse must be sufficient and adjustable (Sreerag et al., 2021).

The undeniable benefits of ergonomics

Focusing on Worker Behaviors in Relation to their Workstation

In addition, employers should observe whether workers are exhibiting any of the following actions:

•Modifying their tools, equipment, or work area.
•Shaking their arms and hands.
•Rolling their shoulders.
•Bringing back belts or wrist braces into the workplace.

These behaviors can be meaningful signs workers are experiencing ergonomic issues. Talk with them and review their work to see if any risk factors for MSDs are present. Workers can identify and provide important information about hazards in their workplaces. Their opinions and suggestions for change are most valuable once worker actions and risk factors are identified; conducting an in-depth ergonomic job analysis can help offer solutions to prevent MSDs. An ergonomic job hazard analysis focuses on job tasks as a way to identify hazards before they occur. It focuses on the relationship between the worker, the task, the tools, and the work environment (Walsh, 2019).

In Nigeria, study by Nwaogazie, (2016) started that there is a strong relationship between the workstation set up and development of musculoskeletal discomfort in classrooms and offices stating that most staff and students experienced low back and neck pains due to poor ergonomic practices Ogedengbe, (2015) appraised the academic library of a Nigerian University ergonomically after comparing the anthropometric data collected from subjects with the dimensions of the seats and tables concluded that the dimensions of the existing furniture are compatible with the values estimated from the anthropometric data of the library users.

A similar study which investigated the influence of workstation and work posture ergonomics on the job satisfaction of Librarians in Federal and State University Libraries in Southern Nigeria revealed that there are adverse effects of neglecting ergonomic principles in the designing of workstations and equipment which results in numerous health effects such as MSDs resulting in a decrease in performance and production (Ikonne, 2014).

Theoretical Framework

According to global research results, which suggest that pain among computer operators is common. Sillanpaa et al. showed that 63% of the analyzed computer operators reported neck pain, while 16% suffered from hand pain (Sillanpaa et al, 2017). German employees (n=1065) suffered from neck pain (55% of subjects), hand and wrist pain (21%) (Klussmann et al., 2019). Study on Swedish call center operators who worked in front of computers (n=1183) showed that 75% of subjects reported musculoskeletal system pain (Norman et al., 2018).

Research conducted in the UK (n=869) proved that 34% of subjects reported neck pain, while 35% – wrist joint pain (Devereux et al., 2018).

Cross-sectional study of high- and low-level knowledge workers who worked in front of computers (n=6191) showed that 45.7% and 56% (respectively) experienced pain and numbness of neck (Korpinen et al., 2016).

Results obtained in author's own study suggested that proper work conditions as well as correct position of computer work station elements are available to employees in large city branches, rather than in small towns. Worryingly, only 25% of computer work stations in the small-town branch met the requirements for ergonomic work station, i.e. footstools and wrist rests. Placement of work station elements and employee's adjusting themselves to the station by working in twisted position was also very troubling. Incidence of MSDs was significantly higher among small town employees than those from large cities.

The study revealed significant differences in terms of computer work station equipment between city/town branches. In small towns, bank offices occupied old buildings which were adapted to suit bank's needs many years before.

Meanwhile, in the large city branches, the employees had much greater comfort of work. They had better opportunities to equip their work stations, the rooms tend to be newer and, in many cases, buildings had been adapted from scratch.

It was confirmed by study results, which showed statistically significant differences in existence of dangerous physical factors that influence bank employees' MSDs. Most common mistakes in small town branches were: lack of footstools and wrist rests, and the most common complaints were related to twisted torso position.

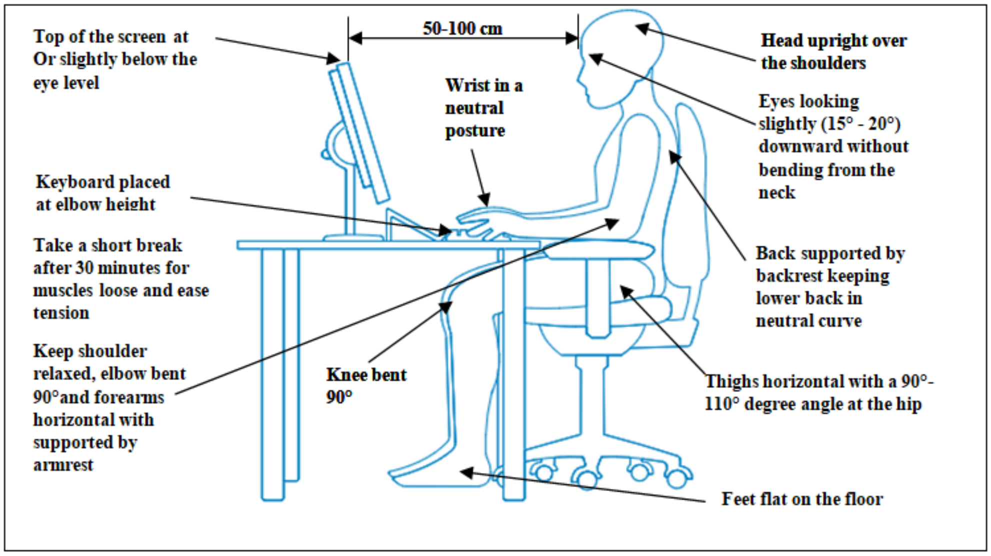

Figure 2.. Recommended Ergonomic Guidelines for Monitor, Keyboard, Mouse Placement and Sitting Postures (Source: National Institutes of Health).

Figure 2: Incorrect, Too High Position of the Table Top Surface *(Source:* Żabińska et al., 2018*).*

Empirical framework of the study

Computer workstation design

Ergonomic Diagnosis on the Computer Workstation

In a research carried among 8 enterprises in which about 120 employees were tested. In this group, 44 employees had a sitting position using a computer station. They were people working on computer workplaces continuously (for 100% of their working time) as well as people who also performed other work as part of their duties. However, it should be noted that even in the case of the second group, the time spent working at a desk using a computer was not less than 70-80% of working time. Observations carried out during the tests revealed a number of repeated irregularities resulting mainly from incorrect equipment of work stations (Żabińska et al., 2018). Below are some incorrect workstation designs from (Figures 2-4).'

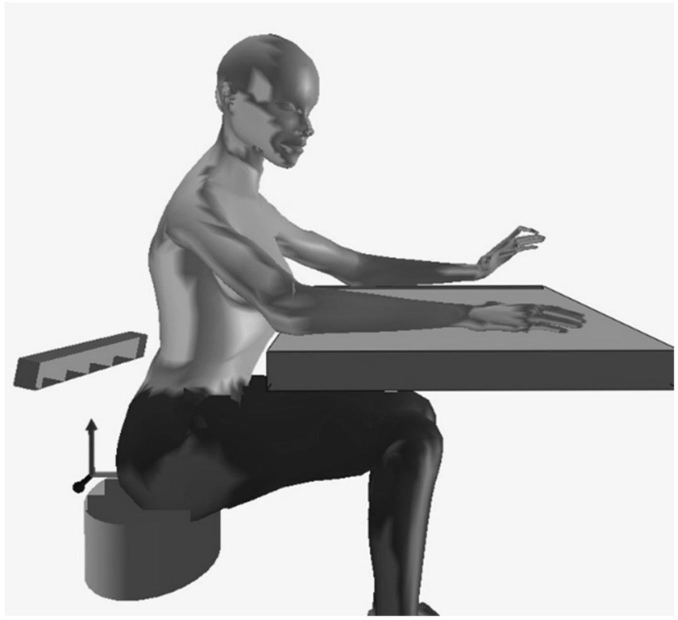

Figure 3. Incorrect Position of Hands When Working on a Moved Away Keyboard *(Source:* Żabińska et al., 2018*).*

Figure 4: Incorrect Hand Position When Working With a too Short Wire of a Computer Mouse *(Source:* Żabińska et al., 2018*)*

METHODOLOGY

Study area

The study area is Warri metropolis where the banks are located. This study is limited in scope to the assessment of fifteen (15) computer users' workstations in the Banking Industry (EcoBank, Access Bank, Zenith Bank and GTB).

Research design

This study uses a survey tools which involves asking the same set of questions to a large number of individuals via the use of standard questionnaire adopted from Cornell Musculoskeletal Discomfort Questionnaire (CMDQ) to ascertain WMDSs and the use of standard checklist adopted from National Institute of Health (NIH) to see if there is a mismatch between the operators and their furniture and also the quantitative survey by taking anthropometric design of the operators furniture and compare with standard ergonomic design.

Target population

The targeted population for this study is fifteen (15) computer users' workstations from each banking organization i.e. fifteen (15) from Ecobank, Access bank, Zenith Bank and GT bank respectively. Making a total of sixty (60) respondents respectively.

Sampling procedure and sample size

This study employed the simple random selection technique. This method involves distributing a survey questionnaire randomly without considering a particular group of the population under study. The sample size is used to determine the specific population under study from, the target population to obtain an accuracy of the findings. The study will make used of 100% of the target population which will be fifteen (15) computer users' workstations from each banking organization i.e. fifteen (15) from Ecobank, Access bank, Zenith Bank and GTB respectively. The study will be carried out during closing hours so as not to interfere with the work of the bank employee; to be précised the study will be carried out between 1600hrs and 1700hrs for a period of two weeks excluding Saturdays and Sundays with each day being used for assessing one bank institute. In the selected bank institute, the following furniture dimensions such as sitting height (SH), seat depth (SD), seat width (SW), Popliteal Height (PH), buttock popliteal height (BPH), desk height (DH), sitting elbow height (SEH), backrest height (BH), sitting shoulder height(SSH), seat to deck clearance (SDC), and thigh clearance (TC) will be measured and recorded in centimeter (cm) using standard ergonomic measurement with a measuring tape. The measurements will be taken on an even floor.

Description of shop furniture measurements

Seat height

The seat height will be measured as the vertical distance from the floor to the top of the front edge of the seat.

Seat depth

The seat depth will be measured as the horizontal distance, of the sitting surface from the back of the seat, at a point where it was assumed that the buttock begins to the front of the seat.

Seat width

The seat width will be measured as the horizontal distance available for sitting, as per one student from the edge viewed from the flat plane.

Seat backrest height (upper and lower)

The seat backrest height (upper and lower) will be measured from the seat surface to the top of the backrest in the available design.

Seat slope

The difference in height and breadth between the two edges will be measured as viewed from the flat Plane and will be calculated using SOHCAHTOA. To calculate the seat slope,

$$\text{Tan}\theta = \frac{\text{Opposite}}{\text{Adjacent}}$$

$$\theta = \text{Tan}^{-1}\left[\frac{\text{Opposite}}{\text{Adjacent}}\right]$$

Seat to desk clearance

The difference in the horizontal distance from the top of the front edge of the table top to the seat backrest pan will be measured.

Table height

The table height will be measured as the vertical distance from the floor to the top of the front edge of the table.

Table depth

The table depth will be measured as the horizontal distance of the sitting surface from the back of the seat, at a point viewed from the flat plane.

Table slope

The difference in height and breadth between the two edges will be measured as viewed from the Flat Plane will be calculated using SOHCAHTOA. To calculate the table slope,

Length of table top

The length of table top was measured as the horizontal

$$\text{Tan}\,\theta = \frac{\text{Opposite}}{\text{Adjacent}}$$

$$\theta = \text{Tan}^{-1}\left[\frac{\text{Opposite}}{\text{Adjacent}}\right]$$

distance available for writing and working as per one student from the edge viewed from the flat plane.

Table clearance

The difference in the vertical distance from the floor to the bottom of the front edge of the desk will be measured.

Measuring instruments

The measuring instrument used for this study is a metal measuring tape that was used to measure the chairs and table dimensions, sitting height, sitting elbow height, sitting shoulder height, knee height, popliteal height and eye height, Buttock-Popliteal Length, Buttock-knee Length and Forearm- Hand Length (Figure 5).

Figure 5. Massband, Measuring Tape, 5m *(Source:www.reichelt.com)*

Data source

The source of data include data collected directly from respondents who are directly involved and also from anthropometric design of operators' furniture.

Research instrument and design

The tools employed in this study is for the purpose of achieving the objectives of this study which involves a self-administered questionnaire, checklist and anthropometric design of furniture already listed in the sampling procedure and sample size. The questionnaire contains only closed end questions, the checklist contains questions that only need ticking and the anthropometric design of furniture will be used to obtain the dimension of the furniture.

Method of data analysis

Analysis of data generated from the questionnaire survey was carried out using the standard questionnaire adopted from Cornell Musculoskeletal Discomfort Questionnaire (CMDQ) to ascertain WMDSs, Simple statistical method such as percentage; mean and frequency will also be used to analyze the data.

RESULTS

Ergonomic assessment was conducted by carrying out anthropometric measurement in their various workstations to ascertain if they are ergonomically designed. The results obtained from this study were compared with standard ergonomically designed workstation to ascertain if their workstations are in conformity to standard.

Demographic description of the respondents

The descriptive demographics of the respondents in this study are presented in (Table 1). A total of sixty questionnaires were distributed, with 15 each for groups XA, XB, XC, and XD.

DISCUSSION

Table 1, shows the descriptive demographics of the respondents of this study of the retrieved questionnaire, 47% of the respondents from X_A were male while 53% were female; 67% of the respondents from X_B were male while 33% were female; 60% of the respondents from X_C were male while 40% were female; 27% of the respondents from X_D were male while 73% were female.
Table 2, shows the descriptive demographics of the respondents of this study of the retrieved questionnaire, 13% of the respondents from X_A were between the age limit of 18 to 25years while 87% were between the age of 25years and above; 20% of the respondents from X_B were between the age limit of 18 to 25 years while 80% were between the age of 25years and above; 0% of the respondents from X_C and X_D were between the age limit of 18 to 25 years while 100% were between the age of 25years and above. Table 3, shows the descriptive demographics of the respondents of this study of the retrieved questionnaire, 0% of the respondents from X_A, X_B, X_C and X_D were Primary and Secondary school educated while 100% of all the banks had tertiary education (Tables 3-8).

Table 1: Gender

Items	Respondents							
	X_A		X_B		X_C		X_D	
	No of Respondents	% of Respondents	No of Respondents	% of Respondents	No of Respondents	% of respondents	No of Respondents	% of respondents
Male	7	47	10	67	9	60	4	27
Female	8	53	5	33	6	40	11	73
Total	15	100	15	100	15	100	15	100

Table 2: Age

Items	Respondents							
	X_A		X_B		X_C		X_D	
	No of Respondents	% of Respondents	No of Respondents	% of Respondents	No of Respondents	% of respondents	No of Respondents	% of respondents
10 to 17	2	13	3	20	0	0	0	0
18 and above	13	87	12	80	15	100	15	100
Total	15	100	15	100	15	100	15	100

Table 3: Educational Status.

Items	Respondents							
	X_A		X_B		X_C		X_D	
	No of Respondents	% of Respondents	No of Respondents	% of Respondents	No of Respondents	% of respondents	No of Respondents	% of respondents
Primary	0	0	0	0	0	0	0	0
Secondary	0	0	0	0	0	0	0	0
Tertiary	15	100	15	100	15	100	15	100
None	0	0	0	0	0	0	0	0
Total	15	100	15	100	15	100	15	100

Table 4: Areas of discomfort experienced by Ecobank Staff (n=15).

	OPERATOR									
AREAS OF DISCOMFORTS	AGREED	% of Agreed	STROGLY AGREDED	% of strongly agreed	DISAGREED	% of disagreed	STROGLY DISAGREED	% of strongly disagreed	NOT APPLICAABLE	% of not applicable
Nape (back of the neck)	6	40	2	13	3	20	5	33	0	0
Shoulders	2	13	9	60	2	13	2	13	0	0
Lower Back	12	80	5	33	0	0	0	0	0	0
Elbows	9	60	6	40	0	0	0	0	0	0
Forearms	11	73	4	27	0	0	0	0		0
Wrists	14	93	10	67		0		0		0
Fingers	4	27	11	73	0	0	0	0	0	0
Eyes	4	27	6	40	3	20	2	13	0	0
Thighs	0	0	9	60	0	0	6	40	0	0
Knee	12	80	3	20	0	0	0	0	0	0
Lower Legs	0	0	8	53	5	33	2	13	0	0
Ankles/Feet	5	33	10	67	0	0	0	0	0	0

Table 5: Areas of discomfort experienced by Access Bank Staff (n=15).

	OPERATOR									
AREAS OF DISCOMFORTS	AGREED	% of Agreed	STROGLY AGREDED	% of strongly agreed	DISAGREED	% of disagreed	STROGLY DISAGREED	% of strongly disagreed	NOT APPLICAABLE	% of not applicable
Nape (back of the neck)	12	80	2	13	1	7	0	0	0	0
Shoulders	9	60	4	27	2	13	0	0	0	0
Lower Back	8	53	7	47	0	0	0	0	0	0
Elbows	7	47	6	40	1	7	0	0	0	0
Forearms	6	40	6	40	2	13	1	7	0	0
Wrists	3	20	8	53	3	20	0	0	1	7
Fingers	4	27	6	40	3	20	2	13	0	0
Eyes	3	20	11	73	0	0	1	7	0	0
Thighs	10	67	3	20	2	13	0	0	0	0
Knee	11	73	2	13	0	0	2	13	0	0
Lower Legs	8	53	6	40	1	7	0	0	0	0
Ankles/Feet	7	47	0	0	6	40	2	13	0	0

Table 6: Areas of discomfort experienced by Zenith Bank Staff (n=15)

	OPERATOR									
AREAS OF DISCOMFORTS	**AGREED**	**% of Agreed**	**STROGLY AGREDED**	**% of strongly agreed**	**DISAGREED**	**% of disagreed**	**STROGLY DISAGREED**	**% of strongly disagreed**	**NOT APPLICAABLE**	**% of not applicable**
Nape (back of the neck)	6	40	6	40	4	27	0	0	0	0
Shoulders	7	47	5	33	3	20	0	0	0	0
Lower Back	4	27	6	40	5	33	0	0	0	0
Elbows	6	40	5	33	4	27	0	0	0	0
Forearms	9	60	3	20	2	13	0	0	0	0
Wrists	7	47	3	20	3	20	2	13	0	0
Fingers	5	33	6	40	4	27	0	0	0	0
Eyes	6	40	4	27	2	13	2	13	1	7
Thighs	8	53	6	40	1	7	0	0	0	0
Knee	7	47	4	27	4	27	0	0	0	0
Lower Legs	4	27	8	53	2	13	0	0	0	0
Ankles/Feet	8	53	2	13	3	20	2	13	0	0

Table 7: Areas of discomfort experienced by GTB Staff (n=15)

	OPERATOR									
AREAS OF DISCOMFORTS	**AGREED**	**% of Agreed**	**STROGLY AGREDED**	**% of strongly agreed**	**DISAGREED**	**% of disagreed**	**STROGLY DISAGREED**	**% of strongly disagreed**	**NOT APPLICAABLE**	**% of not applicable**
Nape (back of the neck)	6	40	4	27	3	20	2	13	0	0
Shoulders	2	13	13	87	0	0	0	0	0	0
Lower Back	9	60	6	40	0	0	0	0	0	0
Elbows	4	27	11	73	0	0	0	0	0	0
Forearms	7	47	8	53	0	0	0	0	0	0
Wrists	6	40	9	60	0	0	0	0	0	0
Fingers	4	27	9	60	2	13	0	0	0	0
Eyes	9	60	6	40	0	0	0	0	0	0
Thighs	8	53	5	33	2	13	0	0	0	0
Knee	10	67	3	20	2	13	0	0	0	0
Lower Legs	13	87	2	13	0	0	0	0	0	0
Ankles/Feet	15	100	0	0	0	0	0	0	0	0

Characteristics of the existing chairs and tables in the selected Banks

From (Table 9), the seat surface height, seat depth, seat width, upper backrest height, lower backrest height, and seat slope are the important dimensions for the design of chairs while table height, table width, length of table top and table slope are the dimensions that are essential for the design of tables. It is important to note that the table and chair measured were picked at random from the tables and chair available in the respective banks. Measurements were taken in average.

This study showed that, four types (designs) of chairs and tables were identified in the four banks sampled.

The furniture in bank classified as Type A, shows dimensions of the seat height as 102 cm, however, the furniture in the bank classified as Type B design, shows seat heights with an average of 82 cm, Type C had a furniture seat height of 86 cm and the furniture seat height of Type D design have an average of 56 cm. This shows that Type A chair height at an average fall in line with the recommended height of 112.5 cm adjustable (Kibra and Rafiquzzaman, 2019).

The chairs in Type A have seat depth of 53 cm and width 39 cm and Type B, C D have an average of 43.5 cm, 41 cm and 51.2 cm for both seat depth and width respectively. However, the seat surface slope angles for Type A Banks is 3^0 with Type B seat slope angles having an average of 2^0, 2^0 at an average for type C and 2^0 for banks classified as type D. The seat upper and lower backrest height for Type A is 42.1 cm and 20 cm, Type B are 25 cm and 15 cm while for Type C and Type D it is 0 cm because they have no upper and lower backrest. The seat to desk clearance in Type A, B, C and D workstation have an average of 16 cm, 19 cm, 15 cm and 11 cm respectively. From table 4.9, the recommendation given by Kibra and Rafiquzzaman shows that Type A and B are in conformity to ergonomic compliance except for Type C and D chairs which have no backrest.

Ergonomically, furniture (Chair and Desk) design means design the seat parameters like seat height, seat depth, seat width, backrest, armrest and desk height by considering users anthropometric measurements and ergonomic principles. Haqueet.al (2014) considered eleven anthropometric measurements to design ergonomic workstation furniture and these measurements

Table 8: Computer workstation ergonomics: assessment checklist.

S/N	The office chair	Yes	% of Yes	No	% of No	N/A	% of N/A	Total number	Total Percentage
1.	Can the height, seat and back of the chair be adjusted to suit operator?	32	53	28	47	0	0	60	100
2.	Are operator's feet fully supported by the floor when he/she is seated?	41	68	12	20	7	12	60	100
3.	Does operator chair provide support for his/her lower back?	16	27	44	73	0	0	60	100
4.	When operator back is supported, was he/she able to sit without feeling the chair seat on the back of his/her knees?	19	32	38	63	3	5	60	100
5.	Do operator armrests allow him/her to get to his/her workstations?	46	77	12	20	2	3	60	100
	Keyboard and Mouse	Yes	% of Yes	No	% of No	N/A	% of N/A	Total number	Total Percentage
6.	Are operator's keyboard, mouse and work surface at his/her elbow height?	26	43	34	57	0	0	60	100
7.	Are frequently used items within easy reach?	36	60	24	40	0	0	60	100
8.	Is the keyboard close to the front edge of the desk allowing space for the wrist to rest on the desk surface?	13	22	40	67	7	12	60	100
9.	When operator is using the keyboard and mouse, are his/her wrists straight and his/her upper arms relaxed?	12	20	48	80	0	0	60	100
10.	Is operator's mouse at the same level and as close as possible to his/her keyboard?	19	32	41	68	0	0	60	100
	Work surface	Yes	% of Yes	No	% of No	N/A	% of N/A	Total number	Total Percentage
11.	Is operator's monitor directly in front of him/her?	49	82	11	18	0	0	60	100

12.	Is operator's monitor positioned at least an arm's length away?	**52**	**87**	**8**	**13**	**0**	**0**	**60**	**100**
13.	Is operator's monitor height below eye level?	**52**	**87**	**8**	**13**	**0**	**0**	**60**	**100**
14.	Is operator's monitor and work surface free from glare?	**16**	**27**	**44**	**73**	**0**	**0**	**60**	**100**
15.	Are frequently used items located within the usual work area and items which are only used occasionally in the occasion work area?	**26**	**43**	**34**	**57**	**0**	**0**	**60**	**100**
	Breaks	**Yes**	**% of Yes**	**No**	**% of No**	**N/A**	**% of N/A**	**Total number**	**Total Percentage**
16.	Does operator take postural breaks every 30 minutes? E.g. standing, walking to printer/ fax etc.	**6**	**10**	**54**	**90**	**0**	**0**	**60**	**100**
17.	Does operator take regular eye break from looking at his/her monitor?	**13**	**22**	**47**	**78**		**0**	**60**	**100**
	Accessories	**Yes**	**% of Yes**	**No**	**% of No**	**N/A**	**% of N/A**	**Total number**	**Total Percentage**
18.	Is there a slopped desk surface or angle board for reading and writing tasks if required?	**0**	**0**	**60**	**100**	**0**	**0**	**60**	**100**
19.	Is there a document holder either beside the screen or between the screen and keyboard required?	**6**	**10**	**54**	**90**	**0**	**0**	**60**	**100**
20.	Is operator using a headset or speakerphone if he/she is writing or keying while talking on the phone?	**49**	**82**	**11**	**18**	**0**	**0**	**60**	**100**

were stature, sitting height, sitting shoulder height, politeal height, sitting elbow height, hip breadth, buttock politeal length, knee height, shoulder breadth and sitting eye height. Design nature of Seat parameters affects the sitting postures of user while sitting (Haworth, 2008). Postural dynamics of users is important element of workstation design that significantly affected by human-computer interface (Taifa and Desai, 2017).

The tables heights were almost the same for Type A, B and C workstation furniture with an average of 72 cm, 71 cm and 70 cm respectively except for D that has an average of 69.2 cm. There was enough legroom for use by the respondents since their seat to desk clearance can be moved. The table depths for all four Types have an average of 54 cm, 60 cm, 53 cm and 62 respectively. The table slope for Type A, B, C and D are 0^o while the length

Table 9: Comparison of chair and desk dimensions of the four types of furniture dimensions with standard furniture dimension.

Furniture dimension	Standard furniture Dimension (cm)	Type A (cm)	Type B (cm)	Type C (cm)	Type D (cm)
Seat height	112.5 (adjustable)	102	82	86	56
Seat depth	45	53	43.5	41	51.2
Seat width	58.5	39	43.5	41	51.2
Seat backrest height (upper)	45 minimum	42.1	25	0	0
Seat backrest height (lower)	15-25	20	15	0	0
Seat Slope	0-45^o	3^O	2^O	0^O	2^O
Seat to desk clearance	23-33	16	19	15	11
Table height	52.38-85.42	72	71	70	69.2
Table depth	90	54	60	53	62
Table surface slope	2-25^O	0^O	0^O	0^O	0^0
Length of table top	160	120	100	90	120

of table top have an average for Type A, B and C to be 72 cm, 71 cm, 70 cm and 69.2 cm respectively. Most of the computer workstation guidelines such as OSHA (2008), CAN/CSA-Z412, ISO9241, ANSI/HFES-100, AS-3590.2, and other researchers recommend the height adjustable desk for easily accommodate the knee without any problems (Deros, et al., 2009). Desk height should be adjustable with suitable keyboard-forearm relation and adequate leg room.

Sloping tables reduce the trunk and flexion of seated persons engaged in reading and writing. Based on assertion, Chaffin (2006) proposed that tables should be at an angle of 15^0 towards the user so that the visual angle may be reduced and allow the user to have an upright posture of the trunk, However, Chaffin et al., (2006) suggested that the table should have an angle of inclination between 15^0 and 20^0. This study observed that the table slopes of existing tables were 0^o which is lower than the above recommendations and may cause the users to experience discomforts in their back of neck, shoulders, elbows, forearms, lower back and lower legs which confirms the high respondents complains for nape, shoulder, lower back, elbow, forearm, wrist and finger pains.

The operator's anthropometric data was considered for fitness. Considering the seat heights of this study, the Type D shows that seat height will cause them some sort of discomfort, thereby exposing the operators to risk of pains in the nape, shoulder and back, the type D chair is seen in X_B, few in X_A and more in X_D; this is confirmed that 13%, 27% and 47% of the respondents from X_B strongly agreed that they usually feel nape, shoulder and lower back pain respectively when compared with XA, 13%, 60% and 33% confirmed that they feel nape, shoulder and lower back pain respectively, 27%, 87%, and 40% of respondents from X_D strongly agreed of feeling nape, shoulder and lower back pain. It can be seen from table 4.7 that 40% of the staff from X_C complained of thighs pain, table 4.6 and 4.8 also showed that 20% of the staff of X_B and X_D complained of thighs pain with X_A having the highest record of 60% of staff complained of thighs pain; a High seat makes the underside of the thigh to become compressed causing discomfort and restriction in blood circulation. While low seat could cause the operators to reach out for use of items on the table and to compensate for this, a sitting person moves forward his buttocks on the seat or they may tend to use the legs to support oneself in the case of low chairs making the body to assume awkward postures. This is in agreement with findings by Dhanajay, et al., (2011). It was observed that the Type B furniture sets are more suitable for the staff in relation to their mean popliteal height obtained. The mean buttock popliteal length for the operator which is compatible with the existing seat depth of the chairs Type A, B, C and D chairs. If this was shallow seat depth it may cause the user to have the sensation of falling off and may result in lack of support of the lower thighs, as reported by Dianat et al., (2013).

This research observed highest prevalence of complains of nape, shoulder and lower back in Type B and C from X_D staffs as it was deducted that 27%, 87%, and 40% of the X_D staffs had the highest among the four banks. The frequent upward and downward movement of the head as a result of lack of an angle board for reading and no document holder either beside the screen or between the screen and keyboard can be attributed to the pain in the neck. For the lower back and shoulder, some chairs in type B and C have no backrest, while the others have other backrest are not small to support them while sitting. While the forearms, wrists and fingers are in awkward position as a result of chairs not having armrest in Type B and C workstation. These operators are therefore exposed to the risk of discomforts in the aforementioned areas. In the research observation were also made on the areas of less discomfort which can be seen elbows, thigh, knee, lower legs and ankle/feet. This can be attributed to the fact that keyboard and mouse settings and work surface settings are in compliance to standard ergonomics design.

A study carried out by Benden, (2014) confirmed that a forward inclining seat slope of 2-25^o affects the lumbar spine positively and improve the posture of the other parts of the spine. The respondent while typing may assume a forward inclination due to the observed 2-3° angles of the seats. However, this level of slope may be

comfortable for respondent as it helps to keep the knee at 90^o to the horizontal reducing stress on the knee.
The sitting shoulder height is considered for the design of the upper and lower backrest height. This study found out that the upper seat backrest height of 15 to 20 cm (Table 4.9) for Type A and B Banks seats.

Musa et at., (2013) reported that the height of the table with respect to the person using it is very important for the shoulders and torso height depending on the position and supporting arms as a work surface above the elbow causes arm abduction resulting in an increase in the stress of the shoulders, arms and necks. A high table height may make a person to bend forward or be forced to raise shoulders resulting in muscle strain on the back and shoulders as the user would not be able to make use of the backrest. Table heights of 70 cm to 72 cm in Type A, B and C banks (Table 4.9) is in lower than the addition of the mean sitting elbow height of 22.0 cm and mean sitting height of 73.0 cm (Table 4.9) which gives a total of 3.02 cm mean which agrees with the report by Dianat et at, (2015). This may have accounted for participants complains of discomforts in the shoulders, lower back, forearms and elbow.

The distance between the elbow and the hand was used as a deciding dimension for the table depth which is known as the forearm hand length. The tables in Type A to D banks have a table depth ranging from 53 to 62 cm which is higher than the participants mean forearm hand length of 43 cm. This will increase the work space available for use by the respondent's population and could make the users to place less of their loads or items on their thigh which reduces pressure and pain on the thigh and lower legs which agrees with the study by Samira, (2013). This finding therefore justifies the less complaints of thigh and tower legs pains.

Sloping tables reduce the trunk and flexion of seated persons engaged in reading and writing. Based on assertion, Chaffin (2006) proposed that tables should be at an angle of 15^0 towards the user so that the visual angle may be reduced and allow the user to have an upright posture of the trunk, However, Chaffin et al., (2006) suggested that the table should have an angle of inclination between 15^0 and 20^0. This study observed that the table slopes of existing tables are 0^0 which is lower than the above recommendations and may cause the users to experience discomforts in their back of neck, shoulders, elbows, forearms, lower back and lower legs which confirms the high student complains for neck and lower back pains.

Conclusion

The examination of computer users' workstation ergonomics in several selected commercial banks in Effurun, Delta State, was completed successfully. The results show that the operators are at risk of MSDs because their workstations do not comply to recommended ergonomic workstation designs.The largest prevalence of pain complaints was found in the shoulder (87% from XD), followed by the eye (73% from XB), lower legs (53% from XC), nape (40% from XB), fingers (73% from XA), and wrists (67% from XA). This indicates that their workspace is not ergonomically designed properly. This might result in either a chronic or acute consequence, which can have a severe impact on their economy due to missed work and frequent hospital visits. Poor ergonomics can lead to injuries such as slips, trips, and falls, resulting in lost time and productivity. Workers who are uncomfortable or in pain as a result of poor ergonomics may find it harder to concentrate and be less productive.

Recommendations

Based on the findings of this research, the following recommendations are made;

- Operators are advised to make use of adjustable chair that can adjust its height, armrest, upper and lower backrest.
- There should be a document holder, an angled board and the use of headset if using the phone and keyboard.
- For the laptop users, they should obtain the necessary accessories such as external keyboard and mouse.
- Trainings and prevention programs to raise awareness of employees and promote health work habits play a crucial role in reducing incidence of MSDs.
- Education activities should be supported and an appropriate incentive (procedure) system needs to be implemented in order to develop musculoskeletal pain among computer operators in the banking sector.

In order to deal with the advancements of computer technology and reduce the health risk factor due to non-ergonomics designs for computer workstations, a modification of the existing model is important. Nowadays, the ergonomics standards, guidelines and recommendations for computer workstations are easily available and these are usually not a compulsory requirement. However, a great concentration on the working environment of computer users and related with their comfort is important. The presented guidelines, recommendations and findings provide a useful support for ergonomics design and may use to improve future research.

REFERENCES

Adebayo, D. (2017). Visual display terminal use increases the prevalence and risk of work-related musculoskeletal disorders among Nigeria office workers. *J Occup Health , 54* (1), 34-43.

Bartuzi, P., & Roman-Liu, D. (2019). *Assessment of musculoskeletal load in terms of employee age.* New York: Polish Print.

Bendíková, E. (2017). Lifestyle, Physical and Sports Education and Health Benefits of Physical Activity. *European Researcher , 69* (2), 343-

348.
Decree of the Minister of Labor and Social Policy. (2018). health and safety at computer work stations. *Journal of Laws , 1* (2), 148-160.
Giahi, O. (2014). display terminal use and musculoskeletal disorders among Iranian bank tellers. *Advance Environ Health Res Jour , 2* (1), 22-28.
Kowalska, M., & Bugajska, J. (2019). Health problems among computer workers. *Medycyna Pracy journal , 60* (4), 321-325.
Nunes, I. L. (2019). "FAST ERGO-X : a tool for ergonomic auditing and work-related musculoskeletal disorders prevention," (Vol. 34). Lagos: Work.
Motamedzade, M., & Moradpour, Z. (2016). Design and fabrication of a personal digital assistant (PDA) prototype for postural assessment using RULA, REBA and QEC techniques. *ranian J Ergon Journal , 2* (4), 32-40.
Negahban, A., Jalali, M., Meshkani, M., & Rahimpoor, R. (2018). Evaluation of risk factors in musculoskeletal disorders by HAL-TLV, SI and OCRA methods and comparison with other methods. *Journal of Rafsanjan Uni Med Sci. , 13* (9), 749-764.
Pingle, G. (2019). Population of Nigeria. *research journal*, *1* (2), 22-31.
Project. (2020). Analysis of the hygienic condition of canteen food services in nigeria. Retrieved April 11, 2022, from Project: https://iproject.com.ng/food-science-and-technology/analysis-of-the-hygienic-condition-of-canteen-food-services-in-nigeria/index.html
Raciborski, F., Władysiuk, M., Bebrysz, M., & Samoliński, B. (2019). Productivity loss as a result of rheumatic diseases – absenteeism and presenteeism. *Rheumatology Journal , 51* (5), 355-362.
Taieb-Maimon M, C. J. (2019). The effectiveness of a training method using self-modeling webcam photos for reducing musculoskeletal risk among office workers using computers. *Appl Ergon Journal , 1* (6), 11-30.
Wioletta, Ł., Mirosława, S.-E., & Adrian, J. (2016). ASSESSMENT OF IMPACT OF THE COMPUTER WORK STATION ON THE RISK OF MUSCULOSKELETAL SYSTEM DISEASES IN BANKING SECTOR EMPLOYEES. *LASE JOURNAL OF SPORT SCIENCE , 7* (2), 93-105.
World Health Organization. (2018). WHO global plan of action on workers' health (2008-2017):. *Baseline for implementation , 1* (2), 13-20.
Zheltoukhova, K., Bevan, S., & Reich, A. (2018). *Able to work? Musculoskeletal system diseases versus labor market in Poland.* Poland: The Work Fundation, London.
Devereux, J. J., Vlachonikolis, I. G., & W, B. P. (2018). Epidemiological study to investigate potential interaction between physical and psychosocial factors at work that may increase the risk of symptoms of musculoskeletal disorders of the neck and upper limb. *Journal of Occupational and Environmental Medicine , 59* (2), 269-277.
Humanscale . (2021). *What is Ergonomics?* Retrieved Ferbuary 11, 2023, from human scale : https://mena.humanscale.com/ergonomics/what-is-ergonomics/#:~:text=Ergonomics%20is%20about%20designing%20for%20people.%20Defined%20as,computer%20monitor%2C%20or%20the%20height%20of%20your%20desk.
Janwantanakul, P., Pensri, P., Jiamjarasrangsi, W., & Sinsongsook, T. (2019). Associations between prevalence of self-reported musculoskeletal symptoms of the spine and biopsychosocial factors among office workers. *Journal Occup Health , 5* (1), 114-122.
Klussmann, A., Gebhardt, H., Liebers, F., & . Rieger, M. A. (2019). Musculoskeletal symptoms of the upper extremities and the neck: A cross sectional study on prevalence and symptom-predicting factors at visual display terminal (VDT) workstations. *BMC Musculoskeletal Disorders, journal , 9* (9), 96-111.
Korpinen, L., Pääkkönen, R., & Gobba, F. (2016). White-Collar Workers' Self-Reported Physical Symptoms Associated With Using Computers. *International Journal of Occupational Safety and Ergonomics, , 18* (2), 137-147.
Norman, K., Floderus, B., Hagman, M., Toomingas, A., & Tornqvist, E. (2018). Musculoskeletal symptoms in relation to work exposures at call centre companies in Sweden. *work journal , 30* (2), 201-214.
OSHA. (2016). *Evaluating your Computer Workstation.* Oregon, United States of America.
Salik, O. A. (2019). Work-related musculoskeletal disorders: a survey of physical therapists in Izmir-Turkey. *BMC Musculoskelet journal , 1* (2), 5-17.
Sillanpaa, J., Huikko, S., Nyberg, M., Kivi, P., Laippala, P., & & Uitti, J. (2017). Effect of work with display units on musculoskeletal disorders in the office environment. *Occupational Medicine Journal , 53* (7), 443-451.
Sommerich, C., McGlothlin, J., & Marras, W. (2019). Occupational risk factors associated with soft tissue disorders of the shoulder. *a review of recent investigations in the literature. Ergonomics , 36* (2), 697-717.
Sreerag, Arunkumar, Jayadeep, and Pereira. (2021, October 4). Redesign of Computer Workstation Using Ergonomics. *Journal of Physics: Confrence Series* .
Turhan, N., Akat, C., Akyüz, M., & Cakci, A. (2018). Ergonomic risk factors for cumulative trauma disorders in VDU operators. *Int J Occup Saf Ergo , 2* (1), 417-422.
Walsh, A. (2019, February 14). Ignoring Ergonomics Can Be Costly. *Water Well Journal* .
OSHA. (2008). *Evaluating your Computer Workstation*. Retrieved June 11, 2023, from . Oregon, United States of America: www.orosha.org
Benden, M. E., Zhao, H., Jeffrey, C. E., Wendel, M. L., & Blake, J. J. (2014). The evaluation of the impact of a stand-biased desk on energy ex2enditure and physical activity for elementary school students.International. *Journal of Environmental Public Health , 11* (9), 9361-75.
Chacko, E., & Chetan, R. (2018). Awareness on Computer Ergonomics and Prevention of MSD among the Millennials in Bangalore. *Reseaarch Review International Journal of Multidisciplinar , 30* (11).
Deros, B. M. (2014). Recommended chair and work surfaces dimensions of VDT tasks for Malaysian citizens. *Eur. J. Sci. Res , 34* (2), 156-167.
Dianat, I. A., Asl-Mashemic, A., & Babrampour, S. (2013). Classroom Furniture and Anthropometric Characteristics of Iranian High Scool Students: Proposed Dimensions Based on Anthropometric Data. *Applied Ergonomics , 44* (1), 101-108.
Kibria, G., & Rafiquazzman, G. (2019). Ergonomic Computer Workstation Design for University Teachers in Bangladesh. *Jordan Journal of Mechanical and Industrial Engineering* , 91-103.
Musa, A. I., Adejuyigbe, S. B., Akinyemi, O. D., & Abolarin, M. S. (2013). *, (2013).'Comparison of biomechanical and anthropometrical data!of Nigeria tertiary institution students with some selected countries', Management Science Letters* (Vol. 2). Lagos: Alfred Press.
Taifa, I. W., & Desai, D. A. (2017). Anthropometric measurements for ergonomic design of students' furniture in India. *Engineering Science and Technology, an International Journal , 20* (1), 232-239.