The Importance of Ergonomic Work Station Presence at Home during Covid-19 Pandemic Era in Indonesia: A Preliminary Study

Fandita Tonyka Maharani[1], Dyah Utari[2], Farahdina Bachtiar[3], Condrowati[4], Yuridista Putri Pratiwi[5]

[1,2)] Public Health Department, Faculty of Health Sciences, Universitas Pembangunan Nasional Veteran Jakarta, Indonesia
Email : fanditatonykamaharani@gmail.com, yahutari@upnvj.ac.id

[3,4)] Physiotheraphy, Faculty of Health Sciences, Universitas Pembangunan Nasional Veteran Jakarta, Indonesia
Email : farahdinabachtiar@upnvj.ac.id, condrowati@upnvj.ac.id

[5)] Eijkman-Oxford Clinical Research Unit, Jakarta, Indonesia
Email : yuridista@gmail.com

ABSTRACT

Covid-19, which the WHO declared a global pandemic on March 11, 2020, quickly changed our way of life. Working from home becomes our new way of work to limit the virus spread. This study aims to present the musculoskeletal complaints by the workers and students, understand the related factors, and propose the ergonomic workstation design to reduce the complaints. We spread the standardized Nordic Questionnaire through google form randomly. The 104 participants living in Indonesia participate in this study. We interview them about the workstation they used at home. The questions about the perception of a “good” working position were also asked. The logistic regression risk factor model was used to understand the significance of variables. 42 % of respondents do not use chairs and only sit on the floor when working at home. 39.4 % of respondents work 4-6 hours/day. 67.3 % of respondents have musculoskeletal complaints, mostly felt in the neck (54 %). There was no association between the variables (age p-value=0.860, sex p-value=1.000, education p-value=0.928, work position perception p-value=0.110) and MSDS Complaints. We strongly argue that the ergonomic workstation must be implemented at home during the Covid-19 quarantine in Indonesia.

Keywords: Quarantine, ergonomic, work station, covid-19, musculoskeletal complaints

1. Introduction

Covid-19 firstly reported in Wuhan, China, and spread globally in a short amount of time. Covid-19, which the WHO declared a global pandemic on March 11, 2020, affects human life in every aspect ([6]; [22]). The human contact was proclaimed as the transmission of the disease, involving direct contact with the infected, the sick person's droplet, and later declared as an airborne disease in an enclosed area ([6]; [9]). These issues forced humans to keep the distance from each other to minimize the spread by reducing contact.

One of the affected aspects was the working process. Many companies in the world fastly adopt the "new" way of work. The work from home (WFH) and remote working terms have become popular. Twitter and Facebook are examples of companies that allow their workers to work remotely. Furthermore, Finland declared the new work concept as well. The previous study found that remote working has benefits, including improving the companies' commitment, upgrading work satisfaction, operational, financial aspects reduction, and flexibility elevation [7]. However, the policy faces challenges, as well.

Indonesian was forced to change the country's way of work as well. During the pandemic, Indonesia's government advise the citizen to work, study, and pray at home. Although the benefits of this concept present above, a new challenge arises—the workers and students who must study and work at home face uncomfortableness regarding their health. The musculoskeletal complaints were declared. A study conducted on the workers found that they experience musculoskeletal problems due to the prolonged sitting position, the un-ergonomic chair which only supports the lumbar and arms, the distance between the computer and mouse, the awkward head position to adjust the monitor, the lack of physical activity, and stress because of the work can become the cause of the musculoskeletal disorders [4].

Working is an essential aspect of human life. It can be said that working gives life meaning, and humans tend to keep working to find it [1]. A study found that age is significantly linear with these life searching meaning through work [1]. However, another finding resulted that some demographics, including age, gender, and working experience, are the crucial factors affecting MSDS complaints [13]. A study found that the workers face a higher risk of developing MSDS if they are getting older [13]. Furthermore, the same study also found that older women are at risk as well [13]. Humans must keep working to fulfill their physical, mental, and financial needs even in a pandemic era. However, a previous study found that most workers who work from home experience musculoskeletal complaints during the Covid-19 period, but the needed action control to tackle this issue has not been stated yet [5]. Thus, this research aims to present the musculoskeletal complaints by the workers and students, understand the related factors, and propose the ergonomic workstation design to reduce the complaints during the Covid-19 pandemic era.

2. Methods

A google form contains a standardized Nordic Questionnaire for randomly recruited respondents (104) living in Indonesia. The demographic of the respondents are asked to the participants. The further question about their workstation at home was also requested through interviews. The perception of the work position was questioned. We present seven closed statements about the perception of a “good” working position. We categorized the perception as low and high using the data median. The study was conducted during the Covid-19 Quarantine. The data were analyzed using statistical software. The logistic regression risk factor model was used to understand the significance of these variables (sex, age, education level, and perception of “good” working position). All participants have signed the online consent form.

3. Results

Table 1. The respondents’ work station at home

No	The Work Station at Home	N
1.	Arm Chair (have backseat and arm seat)	21
2.	Side Chair (have backseat but no arm seat)	32
3.	Bar Stool (the height of the chair roughly 80-90 cm, have footrest but no backseat and no arm seat)	2
4.	Sitting at the Floor without chair	44
5.	Couch	3
6.	Cushion Floor	1
7.	Sitting at the Bed	1
Total		104

Table 1 shows that 44 of 104 (42 %) respondents do not use chair and only sit at the floor when working at home.

Table 2. Respondents’ working hours/day

Working Hours/Day	N
1-3	37
4-6	41
>6	26

Table 3. Musculoskeletal complaints

Musculoskeletal Complaints	Frequency	Percentage
No	34	32.7
Yes	70	67.3
Total	104	100

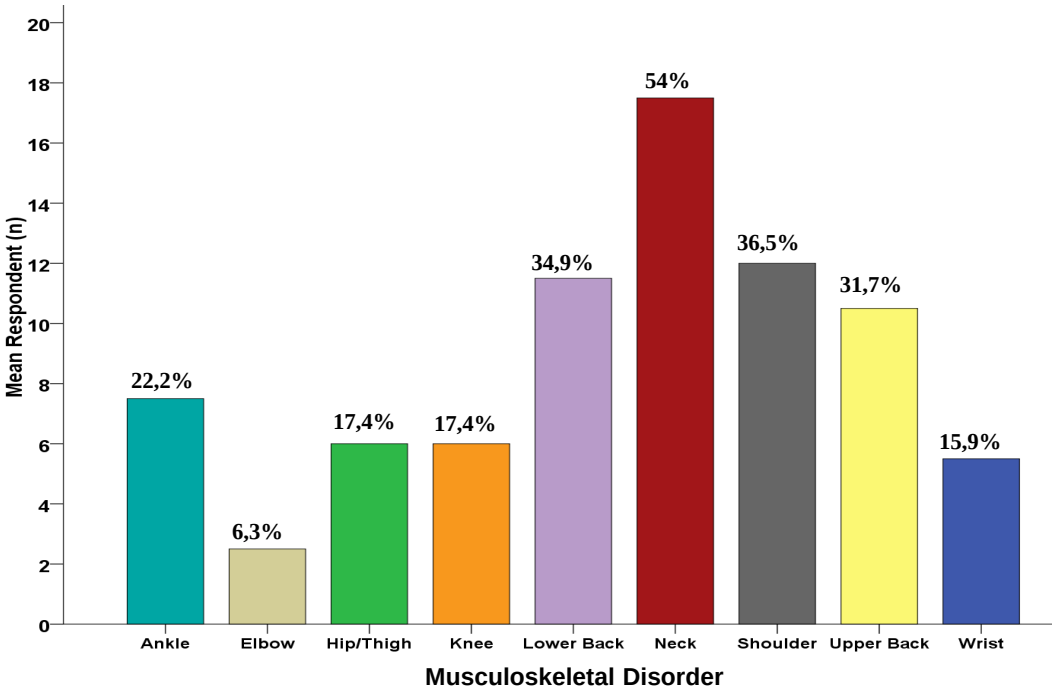

Figure 1. The body area of musculoskeletal complaints

Table 3 indicates most of the respondents (67.3 %) have musculoskeletal complaints. Figure 1 shows us that the workers experience pain and discomfort in the neck (54 %). It can be seen from Table 2 that the respondents mostly (39.4 %) work 4-6 hours/day.

Table 4. Bivariate analysis

Variable	MSDS Complaint						P-Value	OR	95% CI
	Yes		No		Total				
	N	%	N	%	N	%			
Age									
<= 29 years	46	68.7	21	31.3	67	100	0.860	0.843	0.360-1.971
< 29 years	24	64.9	13	35.1	37	100			
Sex									
Female	44	67.7	21	32.3	65	100	1.000	0.955	0.410-2.221
Male	26	66.7	13	33.3	39	100			
Education									
Low	6	75.0	2	25.0	8	100	0.928	0.667	0.127-3.491
High	64	66.7	32	33.3	96	100			
Work Position Perception									
Low	42	75.0	14	25.0	56	100	0.110	0.467	0.203-1.074
High	28	58.3	20	41.7	48	100			

We run bivariate analysis to see the association between musculoskeletal complaints and age, sex, education, and perception of good work position. Table 4 showed us that there is no significant association between musculoskeletal complaints and each independent variable.

4. Discussion

Table 3 clearly shows us that most of the respondents who worked from home during the pandemic experience musculoskeletal disorders complaints. Work-related musculoskeletal disorders can be defined as disorders of injuries of the nerves, muscles, joints, tendons, cartilage, and spinal discs caused by the work environment, work performance, and poor work conditions [2]. Figure 1 shows that most of the respondents have neck problems.

Since the respondents work from home, we present the workstation they use at home. Table 1 shows that most of them did not use a chair for work (42 %). Only 20.2 % of respondents use armchairs, which have the backseat and arm seat to support the lumbar and arm. However, we could not declare that the respondents using an armchair for work have an ergonomic workstation. The armchair might not be entirely suitable for the respondents' anthropometric. Further investigations, including direct observation and measurement of these respondents, must be carried out to ensure they have an ergonomic workstation. Therefore, it can be said that most of the respondents did not have an ergonomic workstation at home.

The lack of appropriate workstations in the ergonomic aspect will cause an issue, such as musculoskeletal complaints, which we already know the respondents had in this study. Some previous studies also find the same problems involving lack of ergonomic aspects in the workplace, and the questions followed. The investigations encourage the workplace must implement the correction action control to tackle the issues ([4]; [9]; [11]; [16]; [18]; [20]; [21]). Furthermore, Table 2 shows that most workers work for 4-6 hours/day (39.4 %), which might worsen the complaints if the issues could not be resolved.

Interventions as an active control must be implemented. Lawrence Green declared that behavior could be affected by predisposing factors that involve education and knowledge [8]. We test this theory using statistical analysis; however, table 4 informs us that the variables do not have an association. The workers who have high education and a high perception of "good" working posture still have musculoskeletal complaints. These findings encourage us to propose another way to solve the issue. We strongly recommend that the ergonomic workstation at home must be used.

The Importance of Ergonomic Workstation at Home During Pandemic Era

The workplace needs to consider the ergonomic workstation at their workers' home since we are in the middle of the pandemic, and we still do not know when it will end. Moreover, some studies predict that the Covid-19 pandemic will not become the last pandemic that can happen to humans. The next pandemic resulted from zoonotic will highly likely occur ([10]; [12]; [14]). Fortunately, the human can become well-adapted throughout the situations that might come. Redesigning our workstation to become ergonomic can be seen as our way to adapt to the new working method, which likely will become more flexible and remote. The work station redesigning is the example of engineering controls concept which valued over the protection effectiveness [2]. However, this intervention can be found pricey but will be getting cheaper over the longer term [2]. We suggest some steps that must become our consideration.

1. Establish the Relevant Regulations and Policies

Through the Ministry of Labor, Indonesia's government must include the ergonomic workstation in the working regulation during the pandemic. This regulation must be updated regularly during the pandemic because the situation can rapidly change. Moreover, the ergonomic workstation must become part of the regular workplace assessment. The Health, Safety, Environmental Department (HSE) from each company must actively be involved in this policy-making and disseminate it to the workers. The dissemination can be conducted during online seminars or other media such as chatting groups and online banners. Following that, it is important to create the relevant health and safety at home guidelines, involving the ergonomic workstation issue.

2. Collecting the Workers' Anthropometric Data

After knowing the urgencies of ergonomic workstation from each home, the workplace must collect the workers' anthropometry data. In non-pandemic era, the HSE department from each company can measure and collect the data, however, in the pandemic situation, it can be achieved by the workers themselves with each family members'

help. The family member of the workers can measure the sitting anthropometry. The sitting anthropometry measurement involving some data (Figure 2) such as stature (body height) (1), sitting height (erect) (2), shoulder height, sitting (3), lower leg length (popliteal height) (4), hip breadth, sitting (5), elbow height, sitting (6), buttock popliteal length (seat depth) (7), buttock-knee length (8), thigh clearance (9), Eye height, sitting (10), shoulder (bideltoid) breadth (11), knee height (12), and body mass (weight) (13) [19]. These data can be used to redesign the workers' workstation (chair and desk).

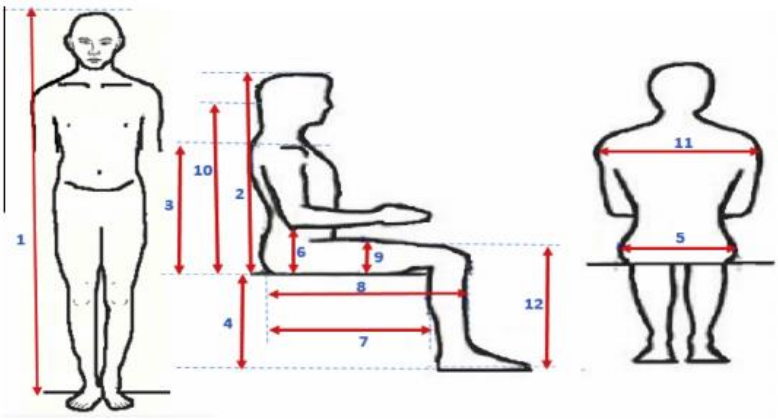

Figure 2. Sitting Anthropometry [19]

3. The Importance of Analyzing the Data and Provide the Ergonomic Workstation

After collecting the anthropometric data, the workplace through the HSE department must analyzed those data. The chair redesign based on the sitting anthropometry can be determined through these criteria (see Table 5) [19]. The company must provide these adjusted furniture and distribute them to the workers.

Table 5. Determinant Criteria for the Workstation ([19]; [15])

Feature	Anthropometric Data	Criteria	Dimension (Figure 3)
Seat depth	Buttock popliteal length	50th percentile (male) of Buttock popliteal length	
Seat width	Hip breadth, sitting	95th percentile (female) of Hip breadth	C
Backrest width	Hip breadth, sitting	50th percentile (male) of Shoulder breadth	
Backrest height above seat	Sitting shoulder height	5th percentile (female) of Sitting Shoulder height	F
Backrest angle	110^0	Literature review suggestions	
Arm rest height	Elbow rest height	5th percentile (female) of elbow sitting height	
Overall chair height	Sitting height	95th sitting height	A
	Hip breadth, sitting	95th hip breadth, sitting	B
Table height	Elbow rest height and popliteal height	5th–95th percentile of the elbow rest heights is added to chair heights.	D
Table Depth	Buttock knee length	95th percentile (male) of arm reach of the target groups	G
Table Width	Shoulder breadth	95th percentile of shoulder breadth (elbow to elbow length)	E
Table Angle	0^0-20^0	Literature review suggestions	

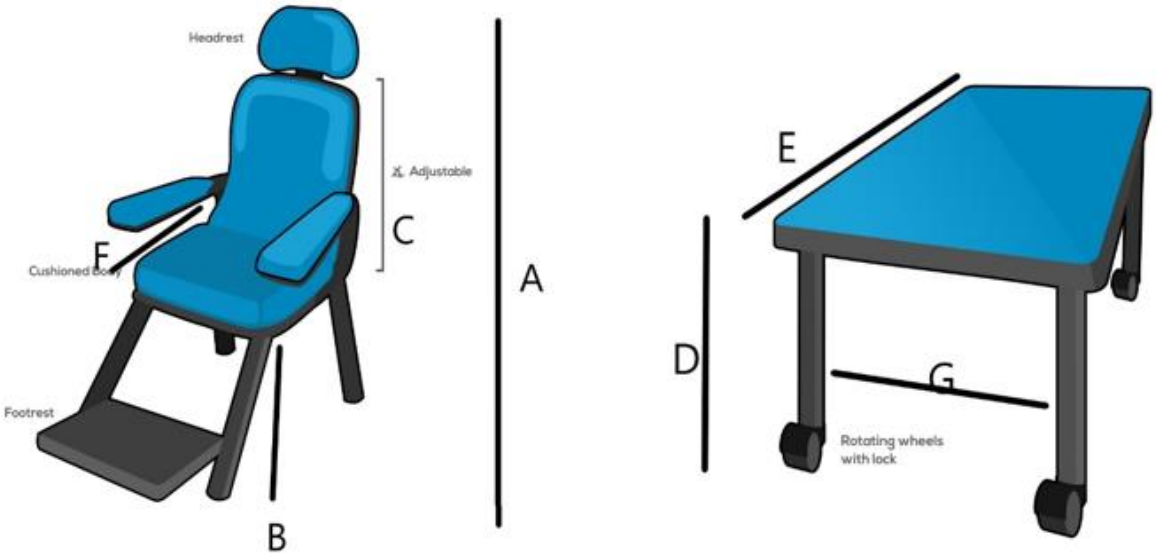

Figure 3. The Proposed Workstation

We proposed the workstation (chair and desk) design based on the anthropometric measurement measured from the workers' bodies (see Figure 3). The 5th percentile in the criteria (Table 5) is chosen to accommodate the workers whose body measurements smaller than the average population. The 95th percentile in the criteria (Table 5) is determined to accommodate the workers whose body measurements bigger than the average population. It is essential to collect the workers' anthropometric data depending on the company before determining its size. The purpose of this is to ensure that the workers can well use the workstation's dimension. We add the rotating wheels to the desk to enable the workers to adjust the workplace in any room in the house. We suggest the backrest angle be adjustable, though the literature mentioned that 110^0 would be sufficient. The adjustable backrest can help ease muscular fatigue. The adjustable footrest was also added. We also added the adjustable armrest for the workers. The headrest is added as well to support the head. However, further study must be conducted to test the effectiveness of this proposed workstation in reducing MSDS complaints.

After having the adjusted workstation, some further aspects must be taken into consideration such as the usage of adjustable chair and desk that can fully support the body [17], avoid awkward working position, computer usage not more than 4 hours/day [17], lighting, and noise aspect. Appropriate lighting must be used to avoid eyestrain complaints [17]. Further study about the lighting used by the respondents must be carried out. The noise measurement must be conducted to ensure that the workers can fully concentrate during their work at home during the Covid-19 pandemic era.

Conclusion

We can conclude from this study that most of the respondents who work from home during the pandemic in Indonesia experience musculoskeletal disorders complaints (67.3 %). We investigate the issue and found that most of them use workstations that lack of ergonomic aspects—this study urge to implement the ergonomic workstation at home.

References

[1] Allan. B. A., Duffy R. D., & Douglass R., Meaning in life and work: a developmental perspective.,*The Journal of Positive Psychology*. 10(4) (2015) 323–331.
[2] CDC. Hierarchy of Controls. (2020).
[3] CDC. Work-Related Musculoskeletal Disorders & Ergonomics. (2020).
[4] Celik, S., Celik, K., & Dirimese E., Determination of pain in musculoskeletal system reported by office workers and the pain risk factors, *International Journal of Occupational Medicine and Enviromental Health.* 31(1) (2018) 91–111.

[5] Condrowati, Bachtiar. F., Maharani F. T., & Utari, D., Musculoskeletal disorder of workers during work from home on covid-19 pandemic: a descriptive study. *ICHD* . 30 (2020) 153–160.
[6] Cucinotta, D., & Vanelli, M., WHO declares covid-19 a pandemic*?, Acta Bio Medica.*. 91(1) (2020) 157-60.
[7] Felstead. A., & Henseke. G., Assessing the growth of remote working and its consequences for effort, well-being and work-life balance. *New Technology, Work, and Employment*. 32(1) (2017) 195-212.
[8] Green, L W., & Kreuter, M. W. *Health Promotion Planning. An Educational and Environmental Approach*. London: Mayfield Publishing Company. (1991).
[9] Guan, W., Ni, Z., Hu, Y., et al., Clinical characteristics of coronavirus disease 2019 in china. *The New England Journal of Medicine*. 382(18) (2020) 1708–1720.
[10] Khubchandani, J., Jordan T. R., & Yang Y. T., Ebola, zika, corona…what is next for our world?, *International Journal of Environmental Research and Public Health.* 17(9) (2020) 5–11.
[11] Kushwaha, D. K., Kane, P.V., Ergonomic assessment and workstation design of shipping crane cabin in steel industry. *International Journal of Industrial Ergonomics*. 52 (2015) 29-39.
[12] Lloyd-Smith, J. O., Predictions of virus spillover across species. *Nature.* 546(7660) (2017) 603–604.
[13] Macpherson, R. A., Lane, T. J., Collie, A., & McLeod, C. B., Age, sex, and the changing disability burden of compensated work-related musculoskeletal disorders in Canada and Australia, *BMC Public Health*. 18(1) (2018) 1–11.
[14] Olival, K. J., Hosseini, P. R., Zambrana, C., Ross, N., Bogich, T. L., & Daszak, P., Host and viral traits predict zoonotic spillover from mammals, *Nature.* 546(7660) (2017) 646–650.
[15] Parvez, M. S., Parvin, F., Shahriar, M. M., & Kibria, G., Design of ergonomically fit classroom furniture for primary schools of Bangladesh. *Journal of Engineering*. (2018) 1-9.
[16] Sharifi, Z., Osqueizadeh, R., & Tabatabai Ghomshe S. F., Ergonomic redesign of industrial chair, *Iranian Journal of Ergonomics.* 3(1) (2015) 1-9.
[17] Shikdar, A. A., & Al-Kindi, M. A., Office ergonomics: deficiencies in computer workstation design, *International Journal of Occupational Safety and Ergonomics*. 13(2) (2007) 215-223.
[18] Sutalaksana, I. Z., & Widyanti, A., Anthropometry approach in workplace redesign in indonesian sundanese roof tile industries, *International Journal of Industrial Ergonomics*. (2016).
[19] Taifa, I. W., & Desai, D. A., Anthropometric measurements for ergonomic design of students' furniture in India, *Engineering Science and Technology, an International Journal*. 20(1) (2017) 232–239.
[20] Tavakkol. R., Karimi. A., Hassanipour, S., Gharahzadeh, A., & Fayzi, R. A., Multidisciplinary focus review of musculoskeletal disorders among operating room personnel. *Journal of Multidisciplinary Healthcare.* 13 (2020) 735–741.
[21] Vink P., & Kompier M. A. J., Improving office work: a participatory ergonomic experiment in a naturalistic setting. *Ergonomics*. 40(4) (1997) 435-449.
[22] WHO. Transmission of SARS-CoV-2: Implications for Infection Prevention Precautions. (2020).