

A STUDY OF ERGONOMIC RISK AND PHYSICAL EXERCISE OF MOBILE GAMERS

Muhammad Qaid Bin Nasri^{1, a}, Sabariah Binti Mohd Yusoff^{2, b}

^{1,2}Quality Engineering, Universiti Kuala Lumpur, Malaysian Institute of Industrial Technology, 81750 Masai, Johor, Malaysia

^aqaid.nasri@sunikl.edu.my

^bsabariahmy@unikl.edu.my

*Corresponding author's email;

sabariahmy@unikl.edu.my

Abstract

In the era of booming gaming industries, gamers are exposed to prolonged sitting involving awkward posture and repetitive tasks that contribute to the musculoskeletal disorders (MSD) which are neck-shoulder pain (NSP) and low back pain (LBP). The goal of this paper is to concentrate on mobile gamers' ergonomic risk experience in order to build a proper physical exercise to improve gamers' productivity. A cross sectional study was carried out during a period of two months among Mobile gamers in Unikl Mitec, Johor. The questionnaire was distributed with the consent form assuring confidentiality and approval of participants to take part in this research. The research questionnaire and hypothesis were formulated using Statistical Package for Social Sciences (SPSS) to analysis the results after data or information collected. Data were collected through a survey questionnaire responded by Mobile gamers in Unikl Mitec, Johor.

1.0 INTRODUCTION

The word Ergon is derived from "Greek" meaning Work, and "Nomos" means natural laws, as described by Golchha V et al., (2014). Golchha V et al., (2014) claimed further that ergonomics is the systemic research and rehabilitation of individuals, highly applicable and occupational medicine. It also makes people understand and teaches people how to be performed in the world in a healthy, efficient and comfortable way, as Golchha V et al., (2014) have declared. Musculoskeletal disorder (MSD) is a pain or injury, which affects the musculoskeletal system of humans such as muscles,

the ligament, the tendon, nerve and the joint according to Bridger (2017) and as described by Jun et al., (2015). Bridger (2017) mentioned that the adaptation of the odd position, repeated activity, intense strength exertion and physical stress are among the contributing factors of musculoskeletal disorder (MSD).

Hagen et al., (2011) stated that increased usage among the young population of computers and portable devices, such as smartphones, is the "most sensible reason" for increased neck-shoulder pain (NSP) prevalence. Low back pain is the general anarchy of muscles, nerves and bones in the back, according to the National Institute of Neurological Disorders and Stroke (2015). In this study, it focuses on these musculoskeletal disorders (MSD), which are neck-shoulder pain (NSP) and low back pain (LBP)

among mobile gamers. This research focuses on evaluating the ergonomic risk factor for mobile gamers when assessing their ergonomic risk after gaming session.

2.0 EXPERIMENTAL

1. To identify ergonomic risk factor experienced by mobile gamers.
2. To propose a physical exercise plan for preventing ergonomic risk among mobile gamers.
3. To examine the difference in the mean of ergonomic risk among semesters.

Ergonomic terms

1. Mobile game

A mobile game is defined as an interactive entertainment on a mobile device, for example a smartphone or a tablet. The goal of a video game, especially a mobile game, is to create an enjoyable experience for a player by fulfilling certain objectives outlined in the game, as claimed by Granic et al., (2014). According to Hill (2014), mobile games among smartphone users have become popular because of their portability and immersive play and complexity.

2. Musculoskeletal disorder (MSD)

Mobile gamers are not exempt from risk of musculoskeletal disorders in the age of thriving gaming industries. Lujan (2017) stated that because of the rising number of players in the gaming industry, musculoskeletal disorders have also increased among gamers and e-sport professionals.

3. Neck-shoulder pain (NSP)

Hagen et Al., (2011) mentioned that the increasing usage of computers and portable device, such as smartphones among young population, is "the most plausible explanation" of the increase in neck-shoulder pain prevalence. but since these devices were very smaller, lighter and touch screen, the findings of the research may not be applicable to the usage of mobile devices. Neck pain is caused by defect in the soft tissues such as muscles, ligament and nerves as well in bones and joints of the spine as claimed by the American Academy of Orthopedic Surgeons (2004).

Low back pain (LBP)

Low back pain is a common disorder in the muscles, nerves, and bones of the back, according to the National Institute for Neurological Disorders and Stroke (2015). National Institute for Neurological Disorders and Stroke (2015) stated that the ache may range from a persistent and tedious feeling to an unexpected pointing feeling. The research on occupational mechanical risk factors revealed increased neck-shoulder pain suffering in the work of mechanically exposed workplaces such as replicate motions, high force, arm elevation and hand-arm vibration as described by Dalboge A et al., (2014).

Physical exercise plan for Neck-shoulder pain (NSP) and Low back pain (LBP).

According to Gross A et al., (2015), physical exercise was considered to be advantageous to chronic neck pain in a variety of systematic reviews. However, Morley S et al., (2013) stated that physical exercise as a therapy requires that expected actions be done in the presence of pain, connecting psychological and behavioral factors with therapy of physical exercise.

3.0 METHODOLOGY

DATA ANALYSIS TECHNIQUE

The use of the Statistical Package for Social Science (SPSS) is essential in the research to evaluate the results following collected data or knowledge. The software of SPSS is the most relevant system with the latest update. Before the transition into the analysis system the SPSS programme helped researchers systematically obtain a number of respondents by category. Descriptive study, reliability analysis, correlation study and Anova are the components of the data analysis methodology.

1. Descriptive Study

Respondent experience as an input to gather information has been gained by using the interviewer's questionnaire. The primary data are the data from which the subject concerned, which were mobile gamer from Unkl MITEC.

The question asked about the ergonomic risk experienced by Unkl MITEC's mobile gamers. The design, data analysis and types of research questions that are being used for a specific theme are descriptive studies. It can also be stated as a cross-sectional study and it assist researchers to get research hypothesis easier. It is split into two that is quantitative and qualitative. The quantitative part includes how

many scores the respondents have received from the questionnaire. Based on the findings, mean, medium, mode and standard deviation between the variables in the research would be identified. It will assist researchers in this research to obtain the cause and effect.

Reliability analysis

Reliability is a reliable analytical method. The test of consistency and stability was assisted with this analysis method. The reliability coefficient assesses the accuracy of the whole scale with the most commonly used measurement being, Cronbach Alpha. As the Cronbach's Alpha result is nearer to one, indicating the higher the consistency reliability of the interior.

2.1 Normality Testing

A normality test is used to determine whether sample data has been drawn from a normally distributed population. In terms of normality of the data, this data follows normal distribution as it follows the requirement of Kolmogorov-Smirnov test (Statistic: 0.117, p-value: <0.001) and Shapiro-Wilk test (Statistic: 0.961, p-value: <0.001). Hence, parametric test should be used in this analysis such as ANOVA.

4.0 RESULT AND DISCUSSION

Descriptive Testing

1. How often do you play mobile games

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	3-4 times a week / 3-4 kali seminggu	35	17.7	17.7	17.7
	Everyday / Setiap hari	85	42.9	42.9	60.6
	Not often / Tidak selalu	55	27.8	27.8	88.4
	Once a week / Seminggu sekali	10	5.1	5.1	93.4
	Twice a week / Dua kali seminggu	13	6.6	6.6	100.0
	Total	198	100.0	100.0	

Table 1 show the 85 (42.9%) respondents play mobile games every day, followed by the respondents are not often play mobile games (55 (27.8%)). In addition, 13 (6.6%) respondents play mobile games twice a week.

2. Playing mobile game for a certain period of

time causing me a body pain

E1 Playing mobile game for a certain period of time causing me a body pain

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	15	7.6	7.6	7.6
	2	24	12.1	12.1	19.7
	3	50	25.3	25.3	44.9
	4	58	29.3	29.3	74.2
	5	51	25.8	25.8	100.0
	Total	198	100.0	100.0	

Table 2 above show In terms of question of Playing mobile game for a certain period of time causing me a body pain, 58 (29.3%) respondents are agreed, followed by 50 (25.3%) are neutral. In addition, 15 (7.6%) respondents are strongly disagreed

Reliability Test

Reliability Statistics

Cronbach's Alpha	N of Items
.897	6

From the table 3 shows the Cronbach's alpha value for the variable. 198 respondents were participated in the real case study. Referred to the following table, there is Good association among the questions under ergonomic risk since the Cronbach's Alpha is 0.897. The higher the Cronbach's Alpha value, the higher the validity.

Normality Testing

Tests of Normality

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
MeanErgonomicRisk	.117	198	<.001	.961	198	<.001

a. Lilliefors Significance Correction

A normality test is used to determine whether sample data has been drawn from a normally distributed population. In terms of normality of the data, this data follows normal distribution as it follows the requirement of Kolmogorov-Smirnov test (Statistic: 0.117, p-value: <0.001) and Shapiro-Wilk test (Statistic: 0.961, p-value: <0.001). Hence, parametric test should be used in this analysis such as ANOVA.

Physical exercise for mobile gamers

In this research, the researcher have come up with four (4) set of physical exercise for mobile gamers. There are four (4) sets of physical exercise for mobile gamers which are stretching for Pectoral muscles, stretching for upper Trapezius, stretching for Rhomboid muscle and stretching for Levator Scapulae.

1. Stretching for Pectoral muscles



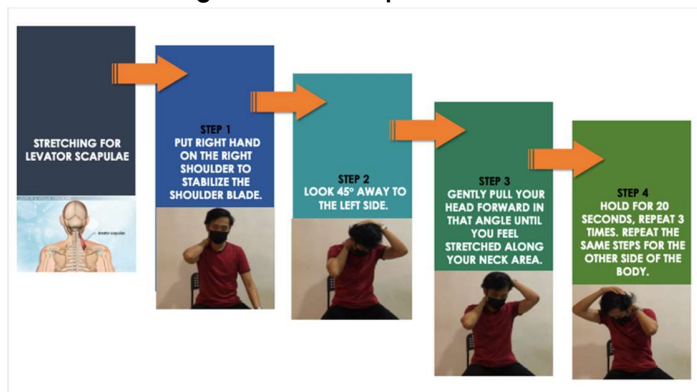
2. Stretching for upper Trapezius



3. Stretching for Rhomboid muscles



4. Stretching for Levator Scapulae



Based on the reference from data analysis in Chapter 4, the finding indicates that out of 198 respondents, 139 (70.2%) choose neck-shoulder pain (NSP) as a physical exercise plan for preventing ergonomic risk among mobile gamers. Only 59 (29.8%) choose low back pain (LBP). Since most of the respondent choose Neck shoulder pain (NSP) as a physical exercise plan for preventing ergonomic risk among mobile gamers, these four (4) sets of physical exercises will only focus on neck shoulder pain (NSP).

5.0 RECOMMENDATION AND CONCLUSION

Recommendation

- i. Increase the number of mobile gamers respondent by widened the research scope.
- ii. Suggest new set of physical exercise which cover both Low back pain (LBP) and Neck shoulder pain (NSP).
- iii. Suggest prototype to overcome ergonomic risk experienced by mobile gamers such as ergonomic stretching rope experience.

Conclusion

As a conclusion, this research is aimed to identify the ergonomic risk experienced by mobile gamers and determine which ergonomic risk between Neck-shoulder pain (NSP) and Low back pain (LBP) have the highest choose by respondent. Then, the proposed physical exercise will focus more on ergonomic risk that the most respondent choose which is Neck-shoulder pain (NSP), that has been discussed in this chapter.

However, some limitations do occur, but it does not affect the outcome of overall research. And lastly, there are some suggestions and recommendation that have been proposed for future of the study.

ACKNOWLEDGEMENT

First of all, thank Allah for the blessing and the chance given to complete my thesis, although we have faced problems particularly in terms of time, health and so on in this semester. This thesis is submitted in partial accordance with University Kuala Lumpur (UNIKL MITEC) specifications of the Bachelor of Quality Engineering and Technology degree. This study was performed between July 2020 and December 2020. I would like to express my heartfelt gratitude for all that has been involved in completing this research.

For the guidance, motivation and commentary in the final project year, I would like to express my sincere gratitude to my Supervisor Dr. Sabariah Mohd Yusoff. Without her assistance and encouragement it will not be done. I also want to thank those who give us a chance and corporation to finalise our thesis. I also thankful to my family for their help in this project. Their blessing gave me the high motivation and courage to face the dilemma that had arisen and resolve it. Finally, I would also like to thank my friends at UNIKL MITEC for their help and encouragement during this research period.

REFERENCES

- Lujan, M. (2017). Ergonomics and Videogames: Habits disease and health perception of gamers. *E-sport Yearbook 2015/216*, 95-116.
- Jun, M., Li, J., & Mao, J. (2015). Risk assessment of work-related musculoskeletal disorders among the TFT-LCD manufacturing operators. *Applied Ergonomics*, Vol. 30(2), 40-51.
- Nurmianto E, Ciptomulyono U, Suparno, Kromodihardjo S. Manual Handling Problem Identification in Mining Industry: An Ergonomic Perspective. *Procedia Manufacturing*. 2015;4:89-97.
- Hagen, K., Linde, M., Heuch, I., Stovner, L.J., Zwart, J., 2011. Increasing prevalence of chronic musculoskeletal complaints. A large 11-year follow-up in the general population (HUNT 2 and 3). *Pain Med*. 12, 1657-1666.
- Kietrys, D.M., Gerg, M.J., Dropkin, J., Gold, J.E., 2015. Mobile input device type, texting style and screen size influence upper extremity and trapezius muscle activity, and cervical posture while texting. *Appl. Ergon.* 50, 98-104.
- Vasavada, A.N., Nevins, D.D., Monda, S.M., Hughes, E., Lin, D.C., 2015. Gravitational demand on the neck musculature during tablet computer use. *Ergonomics* 58, 990-1004.
- Lee, S., Kang, H., Shin, G., 2015. Head flexion angle while using a smartphone. *Ergonomics* 58, 220-226.
- "Low Back Pain Fact Sheet". National Institute of Neurological Disorders and Stroke. November 3, 2015. Retrieved 5 March 2016.
- Dalbøge A, Frost P, Andersen JH, et al. Cumulative occupational shoulder exposures and surgery for subacromial impingement syndrome: a nationwide Danish cohort study. *Occup Environ Med* 2014;71:750-6.
- Koes, BW; van Tulder, M; Lin, CW; Macedo, LG; McAuley, J; Maher, C (December 2010). "An updated overview of clinical guidelines for the management of non-specific low back pain in primary care.". *European Spine Journal* 19 (12): 2075-94. doi:10.1007/s00586-010-1502-y. PMID 20602122.
- Casazza, BA (15 February 2012). "Diagnosis and treatment of acute low back pain". *American family physician* 85 (4): 343-50. PMID 22335313.
- Manusov EG (September 2012). "Evaluation and diagnosis of low back pain". *Prim. Care* 39 (3): 471-9. doi:10.1016/j.pop.2012.06.003. PMID 22958556.
- Salzberg L (September 2012). "The physiology of low back pain". *Prim. Care* 39 (3): 487-98. doi:10.1016/j.pop.2012.06.014. PMID 22958558.
- DePalma MJ, Ketchum JM, Saullo TR. 2011. Etiology of chronic low back pain in patients having undergone lumbar fusion. *Pain Med (Malden, Mass)* 12: 732-739.
- Gupta, A.; Bhat, M.; Mohammed, T.; Bansal, N.; Gupta, G. Ergonomics in dentistry. *Int. J. Clin. Pediatr. Dent.* 2014, 7, 30-34.
- Alghadir A, Anwer S. Prevalence of musculoskeletal pain in construction workers in Saudi Arabia. *Sci World J* 2015;2015:529873.
- Puntumetakul, R.; Siritaratiwat, W.; Boonprakob, Y.; Eungpinichpong, W.; Puntumetakul, M. Prevalence of musculoskeletal disorders in farmers: Case study in Sila, Muang Khon Kaen, Khon Kaen province. *J. Med. Tech. Phys. Ther.* 2011, 23, 297-303.
- Hignett, S.; Fray, M. Manual handling in healthcare. In *Proceedings of the 1st Conference of the Federation of the European Ergonomics Societies (FEES)*, Bruges, Belgium, 10-12 October 2010; pp. 10-12.

Kelsall, H.L.; McKenzie, D.P.; Forbes, A.B.; Roberts, M.H.; Urquhart, D.M.; Sim, M.R. Pain-related musculoskeletal disorders, psychological co morbidity, and the relationship with physical and mental well-being in Gulf War veterans. *Pain* 2014, 155, 685–692.

Golchha V, Sharma P, Wadhwa J, Yadav D, Paul R. Ergonomic risk factors and their association with musculoskeletal disorders among Indian dentist: a preliminary study using rapid upper limb assessment. *Indian Journal of Dental Research*. 2014 Nov 1;25(6):767.

Dar, H., Kwan, J., Liu, Y., Pantazis, O., & Sharp, R. (2019). The game performance index for mobile phones. arXiv preprint arXiv:1910.13872.

Ergonomics guidance for mobile workers – quick reference sheets. (n.d.). Retrieved October, 20th, 2020 from https://www.mobileoffice.guru/site_files/5706/upload_files/MobileOfficeAllGuidancedocv1.pdf?dl=1

Gross A, Kay TM, Paquin JP, et al. Exercises for mechanical neck disorders. *Cochrane Database Syst Rev* 2015; 1: Cd004250.

Morley S, Williams A and Eccleston C. Examining the evidence about psychological treatments for chronic pain: time for a paradigm shift? *Pain* 2013; 154: 1929–1931.

Update OK. American Academy of Orthopedic Surgeons, 2004.

Granic, I., Lobel, A. & Engels, R. 2014. The benefits of playing video games. *American Psychologist*, 69(1):66-78.

Hill, S. 2014. Common traits of successful casual mobile games. <https://crowdsourcedtesting.com/resources/mobile-games/> Date of access: 17 Oct. 2016.

Górska, E. (2015). *Ergonomia: projektowanie, diagnoza, eksperymenty* [Ergonomics: design, diagnosis, experiments]. Warszawa: Oficyna Wydawnicza Politechniki Warszawskiej Press.

Pawlak, H., Buczaj, A., Pecyna, A., and Konowatek, M. (2016). Świadomość ergonomiczna pracowników biurowych i ich pracodawców [Ergonomic awareness of the officeworkers and their employers]. *Zeszyty Naukowe Małopolskiej Wyższej Szkoły Ekonomicznej w Tarnowie*, 31(3), pp. 141-148.

Jasiak, A.E. (2012). Ergonomic awareness and its shaping. The Małopolska School of Economics in Tarnów Research Papers Collection, 36(4), pp. 111-128.

Shafer, D.M. An integrative model of predictors of enjoyment in console versus mobile video games. *PsychNology J.* 2013, 11, 137–157.

Wei, P.S.; Lu, H.P. Why do people play mobile social games? An examination of network externalities and of uses and gratifications. *Internet Res.* 2014, 24, 313–331.