



## Research article

# Relationship of Age, Duration of Work and Environmental Temperature With Worker Mental Workload

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## Abstract.

'Workload' refers to the job demands faced by workers compared to individual capacities. A high workload may cause overstress and injury. This study aimed to determine the relationship of age, duration of work, and temperature with workload. Descriptive quantitative methods were used with a cross sectional design. The sample included 40 respondents. The NASA-TLX questionnaire and thermohydrometer were used to collect the data which were analyzed using the Chi-square test. The findings showed that 55% of the workers had a moderate mental workload, and there was a relationship between age and mental workload ( $p$ -value = 0.045), while the duration of work ( $p$  = 0.340) and temperature climate ( $p$  = 0.602) did not have a relationship with mental workload. The mental workload of workers increased with an increase in age, so the recommendation given is to provide a workload according to the capacity of the worker.

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## 1. Introduction

Workload is a difference between the capacity or ability of workers with the demands of the work that must be done in the workplace. The workload can be a physical or a mental burden. High loading that is not proportional to work capacity can cause excessive energy consumption and overstress, on the contrary if the loading intensity is too low it will cause boredom and under stress [1]. Excessive tasks with a short time in completing the work will cause errors and reduce the physical condition of workers. In addition, the inability of workers to complete their duties or the demands for work standards that are too high and difficult will require higher technical and intellectual abilities from workers, at a certain point it will become destructive which causes mental fatigue, emotional and physical reactions [2].

The workload is influenced by external factors such as tasks (work design, workplace layout, and equipment), work organization (duration of work, shifts, work and remuneration

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systems), and work environment; and internal factor such somatic factors (gender, age, nutrition, and health conditions) and psychological factors (motivation, perception, and satisfaction) [1]. Every work activity requires muscle strength and thought. Increasing age will affect the body's ability and experience changes in physical, mental, psychosocial and spiritual [3]. The research of Budiman et al (2017) show that workers aged more than 30 years old with light workloads have moderate to severe levels of fatigue [4]. And according to Anwar and Mutiara (2015), there is a significant relationship between age and mental workload ( $p$  Value= 0.025) [5]. Duration of work and environmental conditions, especially the temperature climate can also be a stressor for the mental workload on workers. According to Senjaya's research (2020), it states that there is a correlation between mental workload and work duration ( $p$  value = 0.024) [6].

However the previous research was limited to know the correlation between age and duration of work with workload, while this research was measured mental workload which be affected by other risk factors associated with mental workload. And mental workload can affect work performance of the productivity of workers. Based on the above background, the purpose of this study is to analyze the relationship between age, duration of work, and temperature climate with workload.

## 2. Methods

### 2.1. Study design

This research is an analytic survey research with a cross sectional design, which measuremnets age, duration of work, environmental temperature and mental workload, was carried out at the same time.

This study used an analytic survey with a cross sectional design.

### 2.2. Sample

The sample in this study is total sampling, namely all workers in the maintenance and production department of geothermal energy in 2019.

### 2.3. Instruments

Data were collected through interviews with respondent using NASA-TLX questionnaire to measure mental workload and a thermohydrometer to measure the temperature

and humidity of the work environment. The NASA-TLX questionnaire is a compression between mental demand, physical demand; temporal demand, frustration level, own performance, and effort. If the NASA-TLX results show a score  $> 80$  it means that the workload is heavy; score 50-80 for moderate workload, and score  $< 50$  for light workload [7]. While the measurement duration of work is said to be risky if it is more than 8 hours and not risky if more than 8 hours. And the room temperature is said to be ineligible if between range  $24\text{-}28^{\circ}\text{C}$  and eligible if  $< 24^{\circ}\text{C}$  and more than  $> 28^{\circ}\text{C}.$ .

## 2.4. Data collection procedure

The implementation of the research began after obtaining a recommendation for research ethics with the number: 135/KE.STIKES/VII/2019. Respondents were asked to fill informed consent as an agreement to become respondents in the study. Measurement of environmental temperature is carried out by setting a sample point based on the area of the maintenance and production sections and the source of the hazard using a thermohygrometer. while the measurement of duration work and mental workload is done by conducting interviews with workers.

## 2.5. Data analysis

The data collected were analyzed univariately and bivariate using the chi square test with a significance level of 0.05 and 95% confidence interval, and analysis using the SPSS Software [8].

## 3. Results

Based on the results of the analysis, it is known that respondent who have a heavy mental workload experienced at risky age (56.5%), and respondents with age not at risk have a moderate mental workload (76.5%). The chi square test analysis obtained p value of 0.045 which means there is a relationship between duration of work with workload (Table 1)

Based on table 1 respondents who have a heavy mental workload are capable by respondents with a duration of work  $> 8$  hours (53.8%), while respondents with working hours  $< 8$  hours felt a moderate mental workload of 59.3%. The consequences of the chi square test investigation acquired p value of 0.340, which implies that there is no relation between duration of work and mental workload. In the meantime, respondents who

TABLE 1: The relationship between age, duration of work, and environmental temperature with mental workload.

Variable	Mental Workload								Total	P Value		
	heavy		medium		undemanding		N	%				
	N	%	N	%	N	%						
Age Risk No risk	13	56.5	9	39.1	11	4.3	23	100	0.045			
Duration of work	9	33.3	16	59.3	2	7.4	27	100	0.340			
Risk (> 8 hours)	7	53.8	6	46.2	0	0	13	100				
Not risk (< 8 hours)												
Temperature Risk (<24 and > 28°C)	2	66.7	1	33.3	0	0	3	100	0.602			
Not risk (24-28°C)	14	37.8	21	56.8	2	5.4	37	100				

N= 40; 95% CI

have a heavy mental workload have a temperature climate adequate the prerequisites of 66.7%, while the condition of a moderate mental workload has a temperature doesn't adequate (56.8%). The consequences of the chi square showed that there was no significant between work temperature and mental workload (p value = 0.602).

## 4. Discussion

Based on the results of the analysis, it is known that age is related to mental workload. This shows that the older the age of the worker, they feels that his workload is increasing as well. Mental workload that is greater than the body's ability will cause discomfort, fatigue, overstress, injury, pain, and decreased productivity [9]. The age factor is something that cannot be ignored considering age affect a person's physical and mental strength and age certain a worker will experience a change in work performance [10].

Age Relating to performance because at increasing age will followed by a process of degeneration of the organ so that in this case the ability of the organ will decrease. With a decrease the ability of the organ, then this will causes the workforce to increase prone to fatigue [4]. Conditions, abilities and capacities human body will decrease. The older you get, the more prone to fatigue. Aging will cause gradual damage on physiological, cycadean, and sleep systems. A person at the age of 40-49 years condition the decline began to be seen from the discovery diagnose the disease and at the age of 50 – 55 years one's working capacity will be decreasing [11],[12]. The results of this study are in line with Anwar's research, there is a significant relationship and influence between the age factor on the mental workload of employees shows the value of significance

of 0.025 at the 5% accuracy level [5]. The main research Utami (2018) also shows that there is a relationship between age and mental workload (*p*value = 0.033) [13].

The test analysis of the duration of work and the temperature climate is known to be unrelated to mental workload. If a job with a mediocre load, the productivity will decline after working 4 hours. This situation is mainly in line with the decrease in blood sugar levels in the blood [14]. Duration of work can affect performance both positively and negatively. Will have a positive influence on performance if the longer the working period the more experienced the workforce in carrying out their duties. Otherwise will have a negative effect if the longer the working period, the more loss in work. Long working hours and higher level of knowledge allows a person to be more productive when compared to others relatively less in gaining work experience [15]. Research result by Maulina's research that there is no relationship between length and duration of work with fatigue in workers (0.148) [16].

Based on the results there are not relationship between ambient temperature and mental workload. This may be because humans are classified as creatures that homeotherm which means humans can maintain their body temperature [17]. Although the microclimate in the work environment is very important, because can act as a stressor that causes strain to workers if not controlled properly[1]. Thus it is clear that the uncontrolled microclimate properly will affect the level of comfort of workers and health problems, so that it can increase the workload, accelerate the appearance of fatigue and subjective complaints and reduce work productivity [18]. The research Luke's showed that there is a relationship between work environment temperature with work stress [19].

## 5. Conclusions

Increasing age will affect the mental workload of a worker, but duration of work and temperature in environment was not relationship with the workload. The recommendation given is to provide a workload according to the capacity of the worker. And management to also pay attention to the workload carried out by workers so that they are able to carry out their duties properly so that the resulting productivity can be more optimal.

## References

- [1] Tarwaka T. Ergonomi industri dasar-dasar pengetahuan ergonomi dan aplikasi di tempat kerja. Surakarta: Harapan Press; 2015.
- [2] Schultz DP, Schultz D. Working conditions and work today. 6<sup>th</sup> ed. New York: Willey and Sons, Inc.; 2010.
- [3] Nugroho W. Keperawatan gerontik. Jakarta: EGC Press; 2000.
- [4] Budiman A, Husaini H, Arifin S. Hubungan antara umur dan indeks beban kerja dengan kelelahan pada pekerja di pt. karias tabing kencana. Jurnal Berkala Kesehatan. 2017;1(2):121-129.
- [5] Anwar S, Mutiara D. Beban kerja mental menurut level jabatan dan usia karyawan di industri CPO. Seminar Nasional Teknologi Informasi Komunikasi dan Industri. 2015;(Nov):328–34.
- [6] Senjaya MNA, Wahyuni I, Widjasena B. Hubungan antara beban kerja mental dan durasi kerja dengan kejadian human error pada petugas air traffic control (Studi kasus di Jakarta Air Traffic Services Center – Airnav Indonesia ). Jurnal Kesehatan Masyarakat. 2020;8(5):645–51.
- [7] Rubio S, Díaz E, Martín J, Puente JM. Evaluation of subjective mental workload: A comparison of SWAT, NASA-TLX, and workload profile methods. Applied Psychology. 2004;53(1):61–86.
- [8] Nugrahaeni DK, Mauliku NE. Metodologi penelitian kesehatan. Bandung: Stikesayani Pres; 2011.
- [9] Santoso G. Manajemen Keselamatan dan Kesehatan Kerja. Jakarta: Prestasi Pustaka; 2004.
- [10] Mauris LS. Selintas tentang kelelahan kerja. Yogyakarta: Amara Books; 2010.
- [11] Soedirman S. Kesehatan kerja dalam perspektif hiperkes dan keselamatan kerja. Jakarta: Erlangga; 2014.
- [12] Santoso J. Usia lanjut usia dari ilmu psikologi. Surabaya: Universitas Surabaya; 2011.
- [13] Utami N, Riyanto R, Evendi A. Hubungan antara usia dan masa kerja dengan kelelahan kerja pada pekerja industri rumah tangga peleburan alumunium di desa eretan kulon kabupaten indramayu. Afiasi Jurnal Kesehatan Masyarakat. 2018;3(2):69–71.
- [14] Hadyan S. Hubungan usia, lama kerja, masa kerja dan indeks massa tubuh (IMT) terhadap kejadian low back pain (LBP) pada petani di Desa Munca Kabupaten Pesawaran. Medula. 2017;7(4):141–5.

- [15] Mayasari D, Saftarina F. Ergonomi sebagai upaya pencegahan musculoskeletal disorders pada pekerja. Jurnal Kesehatan Unila. 2016.
- [16] Maulina N, Syafitri L. Hubungan usia, lama bekerja dan durasi kerja dengan keluhan kelelahan mata pada penjahit sektor usaha informal di kecamatan banda sakti kota lhokseumawe tahun 2018. AVERROUS Jurnal Kedokteran dan Kesehatan Malikussaleh. 2019;5(2):44-58.
- [17] Budiono AS. Bunga rampai hiperkes dan KK. Semarang: Universitas Diponegoro, CV Nugraha Sentosa; 2003.
- [18] Harrianto R. Bahaya kerja ergonomi. Kesehatan Kerja. Jakarta: EGC; 2013.
- [19] Lukas L, Suoth LF, Wowor R, Kesehatan F, Universitas M, Ratulangi S. Hubungan antara suhu lingkungan kerja dan jam kerja dengan stres kerja di PT. adhi karya (PERSERO) TBK unit manado proyek universitas sam ratulangi. Kesmas. 2018;7(4):1-9