Original Research

The Indonesian Journal of Public Health
Vol 20 No. 3 December 2025
p- ISSN 1829-7005 e- ISSN 2540-8836

DIETARY INTAKE, WORKLOAD, WORK FATIGUE AND STRESS LEVEL OF FEMALE WORKERS AT WOOD FACTORY IN EAST JAVA, INDONESIA

Dominikus Raditya Atmaka[1*], Shintia Yunita Arini[2], Mawadatul Khoiroh[3]
[1] Department of Nutrition, Faculty of Public Health, Universitas Airlangga, Surabaya, Indonesia ; Center for Health and Nutrition Education, Counseling, and Empowerment (CHENECE), Surabaya, Indonesia
[2] Department of Occupational Health and Safety, Faculty of Public Health, Universitas Airlangga, Surabaya, Indonesia ; Occupational Health and Safety Management (OHSM), Surabaya, Indonesia
[3] Department of Nutrition, Faculty of Public Health, Universitas Airlangga, Surabaya, Indonesia
Correspondence address: Dominikus Raditya Atmaka
Email: dominikus.raditya@fkm.unair.ac.id

ABSTRACT

Introduction : Study in a Semarang factory showed 91% workers experience work fatigue and stress, which then increase the probability of work accidents. Work stress created by various factors and influence physical and psychological imbalances, which affect the emotions, thought processes, and conditions of a person being abused. **Aims** : This study aimed to examine the relationship between work stress and mental workload, work fatigue, and nutrient adequacy levels. **Method** : We used cross-sectional data of 120 female workers at "X" wood factory located in Lumajang, East Java, Indonesia. Assessment of mental workload, work fatigue, nutrient adequacy levels (energy, protein, and vitamin C), and work stress sequentially using NASA TLX (National Aeronautics and Space Administration Task Load Index) questionnaire, Questionnaire from the Industrial Fatigue Research Committee (IFRC), SQFFQ (Semi Quantitative Food Frequency Questionnaire), and a modified Questionnaire of the Management Standards and HSE Indicator Tool (HSE-MS IT). **Results** : The work stress of study participants 58.3% included in medium category, the nutritional adequacy was 50% normal category for energy, protein deficit 88.4%, and vitamin C deficit 80.0%. The level of work fatigue of respondents is moderate (48.3%) and high (1.7%). The percentage of respondent's mental work is mostly included in high mental workload (63.3%). Workload (p=0.018) and protein adequacy (p=0.037) have correlation with work stress, while work fatigue (p=0.099), energy adequacy (p=0.117), and vitamin C adequacy (p=0.087) have no relationship. **Conclusion** : Work stress is related to mental workload, while work fatigue and levels of nutritional adequacy are not related.

Keywords: Dietary Intake, Female Workers, Productivity, Stress Levels, Work Fatigue, Women Health

INTRODUCTION

Stress has been recognized as a source of many biological effects on human daily life and a source of physical and mental health impairment, namely it may reduce the effectiveness of the immune system and can contribute to the incidence of the diseases. Working stress or work stress is very common felt by workers where work stress is a prevalent occupational issue caused by the high workload (ILO, 2016). Research from Tabing (2020) explained that the workers had frequent experience of work stress due to work overload (Tabing et al., 2020). Several factors that cause work stress in workplace identified as stressors, namely work demands or workload, working environment, shift schedule, and social disruption (Gumasing and Ilagan, 2019). The following things can affect their work performance and productivity (Beheshtifar and Nazarian, 2013). Work stress that is endured for a long time can reduce the immune system and become a possible factor in the development of disease risks, in example hypertension, stroke, cardiovascular disease, or any other non-communicable diseases (Gamage and Seneviratne, 2016). Work stress is usually characterized by feelings of sadness,

CITE THIS AS: Atmaka, D.R., Arini, S.Y., and Khoiroh, M, (2025). Dietary Intake, Workload, Work Fatigue And Stress Levels Of Female Workers At Wood Factory In East Java, Indonesia. The Indonesian Journal of Public Health, 20(3), 435-447. https://doi.org/10.20473/Ijph.v20i3.2025.435-447

hopelessness, loss of joy, fatigue and tiredness, changes in appetite and insomnia (Kurniawan and Kurniawan, 2018; Hidayat et al., 2020). Stress can lead to unhealthy food choices, namely stress makes the body crave foods that contain high levels of fat and sugar (Torney, Johnson and Miles, 2009). In conditions of acute stress, there is a tendency to decrease appetite, while chronic stress can cause an increase in appetite (Kurniawan and Kurniawan, 2018; Hidayat et al., 2020).

Secretion of adrenocorticotropin hormone (ACTH) to adrenal cortex by pituitary gland increase in hypothalamus that occurs when body is under chronic stress. levels of this hormone can increase appetite (Ried, Travica and Sali, 2016; Plotnick et al., 2017; Stammers et al., 2020). Changes in appetite can affect absorption of nutrients, especially energy. Energy is needed by the body to carry out various metabolic and physiological functions of the body. The amount of energy intake from food must be in accordance with the needs of everyone which is influenced by the age factor, and the type of activity carried out. Energy intake that exceeds needs can trigger obesity, which is closely related to cardiovascular disease, while lack of energy intake causes a person to easily experience fatigue (Goetzel et al., 2014; Supriasa, Bakri and Fajar, 2017; Thamaria, 2017; the Central Bureau of Statistics of Lumajang, 2020). In addition, people who are in high stress condition and endure stress for a long time has no time to fit healthy eating habits around their daily schedule and it can even have the effect of making people skip their meals. When a person is under stress and cannot get enough of the required amount of nutrients, there will be inconsistencies in their blood sugar and other metabolites. This condition leads to more health problems, such as tiredness, loss and decreased of concentration, and affecting their mood (Gonzalez and Miranda-massari, 2014). Meanwhile, protein and vitamin C are nutrients that help reduce stress.

Protein and vitamin C have different mechanisms in reducing stress. The neurotransmitters that play a role the most in depression are monoaminergic neurotransmitters, namely norepinephrine (NE), dopamine (DA), and serotonin (5-HT). 5-HT1B receptors are monoaminergic neurotransmitter that located on the presynaptic and regulate serotonin release by inhibition/feedback inhibition, whereas 5-HT1A receptors are monoaminergic neurotransmitter located on presynaptic and postsynaptic neurons to regulate serotonin function. In depressive disorders, the availability of serotonin in the synaptic cleft is decreased. This is due to decreased receptor sensitivity, so there is no inhibition of serotonin reuptake. NE receptors are monoaminergic neurotransmitter located in the presynaptic region and responsible for inhibiting the release of norepinephrine. In depressed patients, the sensitivity of the NE receptor increases, so that the ability to secrete norepinephrine decreases. Serotonin and norepinephrine are synthesized from tryptophan and tyrosine, then stored in the vesicles of the presynaptic neuron. tryptophan and tyrosine are types of amino acids that are not produced in the body, these amino acids can be found in protein sources such as nuts (Goetzel et al., 2014; Kurniawan and Kurniawan, 2018; Hidayat et al., 2020).

Research conducted by (Ried, Travica and Sali, 2016) showed that giving high doses of vitamin C can reduce blood cortisol levels, the shear stress effect of high blood pressure and provide a better response to psychological stress. Cortisol is a very important pathway in the formation of free radicals. Cortisol can increase free radicals through the Hypoalamus-Pituitari-Adrenal (HPA) axis pathway, immune reactions and increased epinephrine (Ried, Travica and Sali, 2016; Plotnick et al., 2017). Therefore, the decrease in the amount of cortisol due to the administration of vitamin C can reduce the levels of free radicals in the body which has close

relationship to depression (Klingmann, Kugler and Steffke, 2014).

Other aspects that affect the level of stress in workers are workload and work fatigue. Workload, equated to job demand, is a condition where physical, mental abilities and time are used to do work (Tarwaka, 2014). Workload is a key determinant of stress and determined the work fatigue levels among employees. High stress conditions caused by excessive workload led to performance quality impairment, injuries and accidents during working period, and stress-related illness related to work (Nordander et al., 2016; Balogh et al., 2019; Farid, Jayanti and Ekawati, 2019). A survey conducted by the National Occupational Safety and Health Council in the Electricity Sector (PLN) explained that the number of work accidents reached 1.485 cases. The main cause is the low level of worker concentration (Rachman, 2013). In East Java in 2014, the number of work accidents reached 2.283 cases with work fatigue as the main cause (Health, 2015).

High level of work fatigue results in serious and chronic conditions, especially when there is lack of opportunity to rest and recover. In addition to work fatigue, the perceived high workload, and high work stress can also increase the number of work accidents. In a study on fertilizer factory workers at the port of Tanjung Emas, Semarang-Indonesia, physical workload was associated with work accidents ($p=0.000$), and workers who had an overall physical workload experienced work accident. Research in the same place also states that fatigue work related to work accidents ($p=0.003$), and 91% of workers who experience work fatigue are experiencing work accidents (Kurniawan and Kurniawan, 2018).

Research by Hidayat, et al. (2020) on cleaning services at Ulin Hospital Banjarmasin showed work stress has significant correlation with work accidents ($p=0.010$) and workers with high work stress levels 75% of whom had work accidents (Hidayat et al., 2020). This can cause bad work performance which affects the quality of services and products and result in work accidents, increased depression risk, and health problems, like infectious and cardiovascular diseases. Long-term effects that can occur are workers can experience disability and lead to absenteeism from work (Goetzel et al., 2014). Looking to the high probability of work accidents if workers might experience higher work stress and workload in the future, we aimed to conduct study to examine the relationship between work stress and mental workload, work fatigue, and nutrient adequacy levels.

METHODS

Study Design

A quantitative, cross-sectional study was carried out from April to July 2021. This study involved female workers aged 18 to 64 who work shifts at "X" wood factory located in Pasirian District, Lumajang, East Java Regency. This study focuses on female workers who are of productive age because at this age a person can find work and work to generate income to meet their daily needs. Based on BPS (2020) the most population in the study area work in the processing industry, especially wood processing, and the proportion of female workers is higher than that of men, especially in the plywood-type wood processing industry (the Central Bureau of Statistics of Lumajang, 2020). Proportional random sampling method was used. Sample size calculated using two-proportion population hypothesis test formula with total sample size of 120 participants. This study relied upon a structured validated questionnaire consist of numbers of questions related to the variables of the research objective. Independent variable included in this study were dietary intake, workload, and work fatigue. Meanwhile the dependent variable is work stress level. The data collection methods included using interviews between the researcher and the participant one by one where the researcher

asked directly related matters according to the questionnaire and direct anthropometric measurement.

Recruited participants who were able to meet the inclusion criteria which included female workers who work morning shifts, aged 18 to 64 years old, willing to participate by signing the informed consent, while those who did not come to work, and did not sign the informed consent and the questionnaire were excluded. Informed consent about terms and consents was written the first page of the questionnaire and needs to be signed by the respondents. In informed consent was written information about anonymity of the study, the voluntariness, and the possibility to stop their participation at any stage. Before enrollment, participants should agree on the consent before proceeding in the completion of the questionnaire. Ethical clearance was approved by the Health Research Ethical Clearance Commission, Faculty of Dental Medicine, Universitas Airlangga, Indonesia (249/HRECC.FODM/V/2021).

Anthropometric Measurement

Body weight and body height measured using Omron digital weight scale made in China with level of accuracy of 0,1 kg, while the measurement of height using microtoise stature meter with the level of accuracy of 0.1 cm (Supriasa, Bakri and Fajar, 2017; Thamaria, 2017). Body weight and body height then were used to measure their body mass index (BMI) and BMI data were presented in ratio.

Dietary Assessment

Assessment of dietary intake, including energy, protein, and vitamin C intake, was carried out by identifying eating habits of female workers through SQFFQ (Semi Quantitative Food Frequency Questionnaire) from the last 6 months (Tang et al., 2015; Zalaket, Matta and Hanna-Wakim, 2019). The questionnaire consists of all types of food ingredients which are classified according to certain food groups. The questionnaire contains food and ingredients that are commonly consumed, can be found, bought, obtained and accessed by participants in the study area (nearby or maximum in 1 km radius from the house and the workplace). The results of the SQFFQ were then used to calculate the average dietary intake of female workers.

Instrumentation

Several questionnaires designed to assess stresses at work, work fatigue, mental workload and translated into Bahasa Indonesia to make it more understandable. NASA TLX (National Aeronautics and Space Administration Task Load Index) questionnaire used to analyze mental workload faced by workers who are required to perform various duties in their jobs (Morales et al., 2020). This method is a subjective measurement of mental workload. Measurement of 6 dimensions of mental workload, namely, effort, mental demand, physical demand, temporal demand, own performance, and frustration level is the reason for using this questionnaire. The questionnaire divided workload levels into five 7-point scales. Increasement of these levels (high, medium, and low) estimated for each point result into 21 gradation scales. Data results were presented in categorical data. The score of less than 9 is categorized as low, 10 to 29 categorized as moderate, 30 to 49 categorized as high, 50 to 71 categorized as very high, and more than 70 categorized as extreme (Morales et al., 2020).

Questionnaire modified from HSE's Management Standards and Indicator Tool (HSE-MS IT) used to assess stress related to work at organizational level. The questionnaire includes 35 questions related to six primary stressors identified in Management Standards approach to tackle work-related stress. Scores range from one (never) to five (always). Work stress level of respondents was categorized into five,

namely low (score 140-175), moderate (score 105-139), high (score 70-104), and very high (score 35-69) (Watterson and Ladou, 2003; Tarwaka, 2011).

Questionnaire from Industrial Fatigue Research Committee (IFRC) was used as a method in in describing the level of work fatigue (Tarwaka, 2011). This questionnaire consists of 30 items which is divided into three parts with ten questions each, relating to fatigue. Respondents asked to fulfill all questions by putting a check on the four Likert-scale. Analysis of the work fatigue is calculated by accumulating the scores from the 30 item questions.

Statistical Analysis

Statistical analysis using IBM SPSS version 26. Result is statistically significant when $p < 0.05$. Means, frequencies, and standard deviations were used to present the descriptive data, such as the demographic data of participants, body height, weight, body mass index, heart rate, sleep quality, work-related stress, work fatigue, mental workload, and physical activity habits. Kolmogorov-Smirnov performed in finding the normality of the data. Further, correlations between key study variables were analyzed by Pearson Correlation test to find out the correlations between dietary adequacy, mental workload, work fatigue with work stress among female workers.

RESULT

Respondents Characteristics

Sixty female workers who work shifts at "X" wood factory located in Pasirian District, Lumajang, Regency-East Java were included in the study. The subject were 36.62 ± 9.22 years, and their body weight 56.81 ± 9.17 kg, body height 152.01 ± 7.15 cm, BMI (Body Mass Index) 24.79 ± 4.87, heart rate 73.48 ± 13.78 times per minutes, sleep duration 7.51 ± 0.87 hours per day, and sleep quality scale 8.6 ± 1.09.

The percentages of subject married is 78.3%, not yet married 13.3%, and divorced 8.3%. In terms of educational level, most of respondents were included in middle graduates 43.3%, then followed by high graduates 36.7%, and elementary graduates 20.0%. About 80.0% subject has no medical history. Habit of staying up late the subject is never staying up late (43.0%) seldom staying up late (41.7%) and always staying up late (15.0%). Habit of doing physical activity the subject is regularly (16.7%) and not regularly (83.3%). The physical activities that subjects do 1-2 times per week are rope skipping (3.3%), light walking (13.3%), jogging (6.7%), and aerobic (3.3%) (Table. 1).

Table 1. Respondent Characteristics Distribution

Characteristics	n	%	Mean ± SD
Age			
Late adolescent	18	15.0	22.64 ± 1.65
Early adult	32	26.7	29.82 ± 2.94
Late adult	48	40.0	40.85 ± 2.78
Early elderly	22	18.3	48.11 ± 2.31
Marital Status			
Married	94	78.3	-
Not yet married	16	13.3	
Divorced	10	8.3	
Education Level			
Elementary school	24	20.0	-
Middle school	52	43.3	
High school	44	36.7	

Characteristics	n	%	Mean ± SD
Medical History			
Yes	24	20.0	-
No	96	80.0	
Body Weight (kg)	-	-	56.81 ± 9.17
Body Height (cm)	-	-	152.01 ± 7.15
Body Mass Index	-	-	24.79 ± 4.87
Heart Rate	-	-	73.48 ± 13.78
Sleep Duration	-	-	7.51 ± 0.87
Sleep Quality Scale	-	-	8.60 ± 1.09
Habit of Staying Up Late			
Always	18	15.0	-
Seldom	50	41.7	
Never	52	43.3	
Habit of Doing Physical Activity			
Regularly	20	16.7	-
Not regularly	100	83.3	
Type of Physical Activity			
Rope-skipping			
1-2 times per week	4	3.3	-
Never	116	96.7	
Light walking			
1-2 times per week	16	13.3	-
Never	104	86.7	
Jogging			
1-2 times per week	8	6.7	-
Never	112	93.3	
Aerobic			
1-2 times per week	4	3.3	-
Never	116	96.7	

Work Stress

Work stress of subject was identified by questionnaire modified from HSE's Management Standards and Indicator Tool (HSE-MS IT). 41.7% of respondents have low work stress with mean of 151.56 and the standard deviation (SD) of 6.86 (Table. 2), and 58.3% of respondents have medium work stress with mean of 124.77 and standard deviation (SD) of 9.89 (Table. 2).

Nutrient Adequacy : Energy, Protein, and Vitamin C

Nutrient adequacy is level of nutrients consumption to fulfillment of nutrient requirement for adequate, and described as a percentage (Bhattacherjee et al., 2016). Significance value of the data normality analysis using Kolmogorov-Smirnov test is 0.805 or more than 0.05, which means that the variables of energy, protein, vitamin C intake, and work stress are normally distributed.

Table 2. Work Stress Distribution

Work Stress	n	%	Mean ± SD
Low	50	41.7	151.56 ± 6.86
Medium	70	58.3	124.77 ± 9.89

Energy adequacy subject majority were below adequacy level (50.0%), followed with normal adequacy level (46.7%), and the remaining were above adequacy level (3.3%). Protein adequacy

subject majority were below adequacy level (88.3 %), followed normal adequacy level (10.0%), and the remaining were above adequacy level (1.7%). Classified vitamin c adequacy of respondent was below adequacy level (80.0%), normal adequacy level (10.0%), and above adequacy level (10.0%) (Table. 3). The correlation of protein adequacy level with work stress is significant because p-value is <0.05 or 0.037. The correlation of energy adequacy level and vitamin C adequacy level with work stress is not significant since p value is more than 0.05 (Table 3).

Table 3. Distribution and Correlations of Nutrients Adequacy with Work Stress

Nutrients Adequacy	Low Work Stress		Medium Work Stress		Mean ± SD	p*
	n	%	n	%		
Energy adequacy						
Deficit	22	18.33	40	33.33	71.87 ± 11.20	
Normal	28	23.33	26	21.67	101.16 ± 8.32	0.117
Above	0	0.00	4	3.33	120.91 ± 1.82	
Protein adequacy						
Deficit	46	38.33	60	50.00	59.27 ± 14.62	
Normal	4	3.33	8	6.67	99.97 ± 6.69	0.037
Above	0	0.00	2	1.67	125.96 ± 3.57	
Vitamin C adequacy						
Deficit	22	18.33	40	33.33	32.11 ± 23.03	
Normal	28	23.33	26	21.67	99.14 ± 3.06	0.087
Above	0	0.00	4	3.33	166.98 ± 18.51	

* Statistical test is using Pearson correlation

Table 4. Distribution and Correlation of Work Fatigue, Mental Workload with Work Stress

Variable	Low Work Stress		Medium Work Stress		Mean ± SD	p*
	n	%	n	%		
Work Fatigue						
Low	30	25.00	30	25.00	42.00 ± 5.57	
Moderate	20	16.67	38	31.67	57.72 ± 4.95	0.099
High	0	0.00	2	1.67	80.00 ± 3.72	
Mental Workload						
Moderate	6	5.00	0	0.00	42.22 ± 5.67	0.018
High	34	28.33	42	35.00	59.18 ± 6.05	
Very high	10	8.33	28	23.33	83.74 ± 8.44	

* Statistical test is using Pearson correlation

Work Fatigue

Fatigue is more than feeling tired and drowsy (Marino, 2019). Significance value of data normality test using Kolmogorov-Smirnov is 0.547 (>0.05), which means work fatigue, and work stress are normally distributed. Mean work fatigue of respondent was 50.23 and standard deviation (SD) was 10.20. Work fatigue of respondents was dominated with low (50.0%) and moderate (48.3%). Correlation of work fatigue with work stress is not significant because p value >0.05 or 0.099

Mental Workload

Workload was determined as the key determinant of stress and the high value of work fatigue levels among employees (Nordander et al., 2016; Balogh et al., 2019). The significance value of the data normality analysis using Kolmogorov-Smirnov test is 0.454 or more than 0.05, which means that the variables of workload and work stress are normally distributed.

In this study, we used questionnaire NASA-TLX to assess mental workload. The percentages of mental workload respondent were high mental workload 63.3%, very high mental workload 31.7%, and moderate mental workload 5.0% which means that most of the workers are experiencing high mental workload that needs to be prevented in the future.

Table 5. NASA-TLX Score

NASA-TLX Subscale	Score (Mean ± SD)
Mental Demand (MD)	85.33 ± 65.28
Physical Demand (PD)	297.92 ± 99.50
Temporal Demand (TD)	163.43 ± 93.91
Own Performance (OF)	224.33 ± 105.39
Frustration Level (FR)	51.67 ± 117.03
Effort (EF)	168.67 ± 131.54

Workload assessment based on the NASA-TLX questionnaire includes 6 assessment subscales were mental, physical, and temporal demand, frustration level, and efforts. In table 6 shows that physical demand has the highest average score (297.92 + 99.55) and the lowest frustration level (51.67 + 117.03), this indicates that type of work carried out by respondents uses a lot of physical strength and causes low frustration (Table 6).

DISCUSSION

In this study, analysis performed to examine the relationship between work fatigue, mental workload, energy, protein, and vitamin C adequacy with stress levels of female workers. Our findings show that only mental workload and protein adequacy have significant relationship with work stress. Consumption of high carbohydrates and fats are correlated with high energy intake can improve mood and reduce stress levels (Harris, 2015).

Data analysis showed no significant correlation between energy and work stress (p-value=0.117). This study is not agreed to previous research which resulted to positive correlation between energy intake and stress related to work (Radwan, 2013). Differences in research results are due to differences in the types of food sources of energy studied, data collection methods used, and differences in respondents. The amount of energy intake was calculated from food or beverages commonly consumed in the last 6 months accompanied by the amount and frequency, while in previous studies the assessment of the amount of energy intake focused on one type of food that was usually consumed when stressed, for example fast food, or high energy drinks.

Consumption of high protein can reduce stress cortisol, and consumption of protein that has a high amino acid content especially tryptophan can maintain mental health and can reduce work stress levels (Firk and Markus, 2009; Lemmens et al., 2011; Glenn, Madero and Bott, 2019). This statement is in accordance with this study which showed significant correlation between protein adequacy and work stress (p-value=0.037), and the relationship direction was negative, which means that the lower the level of protein adequacy due to low intake, the level of work stress experienced. the higher it is. In this study, the respondent's protein adequacy level was dominated by the category with deficit (88.4%) and stress level was dominated by medium category (58.3%).

Based on the statement in Journal of Nutritional Biochemistry, vitamin C deficiency is related with some stress-

related diseases like bad mood and anxiety (Moritz et al., 2020; Muntholib, 2020). This statement is not in accordance with this study which stated no significant relationship between protein evaluation levels and work stress. Differences in research results caused by differences in food sources of vitamin c studied, data collection methods used, and differences in respondents. In this study, the amount of vitamin C intake was calculated from food or drinks commonly consumed in the last 6 months along with the amount and frequency, while in previous studies it focused on the number of vitamin C supplements consumed in one day.

Participants work fatigue were assessed by Questionnaire from Industrial Fatigue Research Committee (IFRC). Participants work fatigue has no relationship with work stress (p-value 0.099). Fatigue is often described as a feeling of weariness, tiredness, or a lack of energy (Atiqoh, Wahyuni and Lestantyo, 2014; Wright and O'Connor, 2014; Dietch et al., 2016). Fatigue is correlated with work-related stress such as excessive workload. The allostatic concept explains that when stress such as not being able to adapt to the environment can cause fatigue, especially when there is an accumulation of allostatic loads present. Interest that does not lack vacation time as a reduction in the effects of stress due to work is another factor that triggers fatigue (Winwood, Bakker and Winefield, 2007).

Our findings show that work fatigue of female workers at "X" wood factory has no relationship with the work stress (p-value=0.099). In previous studies, to describe the relationship between fatigue and stress, it is necessary to control social factors, health behavior, current and previous depression which in this study did not control these factors (Rose et al., 2017). In the researched company, female workers are responsible for the assembly and finishing processes. Assembly is the stage of assembling plywood using glue. Finishing is the final process of making plywood which includes double saw, putty, and sandpaper. Meanwhile, the role of women in the household is very large, both in housework (sweeping, cooking, and washing) and as mothers for their children. The double role of women as housewives and breadwinners causes the perceived mental workload to be higher. According to Ashfort, workloads can trigger stress because it causes psychological reactions that damage and grow burnout symptoms (van der Meij et al., 2018).

Too high mental workloads can lead to a low work productivity leading to stress (Pertiwi, Denny and Widjasena, 2017). Our findings show that workload of female workers at "X" wood factory has a relationship with the work stress (p-value=0.018). The direction of correlation between mental workload and stress related to work is unidirectional, this is because the p-value is positive or 0.018. Thus, it can be concluded that the higher the mental workload felt by female workers, the higher the level of work stress. All female workers had a heavy workload where 63.3% were in the high category, 31.7% in the very high category, and 5.0% in the rather high category. The study by Tahrirah, (2019) on schools of disabled children's teachers in Jombang also gave same results which has showed correlation between workload mentally with work stress (Tahrirah, 2019).

CONCLUSION

Work stress is significantly related to mental workload, and have no significant relationship with work fatigue and the level of nutritional adequacy, both energy, protein, and vitamin C. It is suggested to women workers to increase their diet quality to decrease work fatigue.

REFERENCES

Atiqoh, J., Wahyuni, I. and Lestantyo, D., 2014. Faktor-Faktor Yang Berhubungan Dengan Kelelahan Kerja Pada Pekerja Konveksi

Bagian Penjahitan Di Cv. Aneka Garment Gunungpati Semarang. *Jurnal Kesehatan Masyarakat Universitas Diponegoro*, 2(2), pp.119–126. https://doi.org/10.14710/jkm.v2i2.6386

Balogh, I., Arvidsson, I., Björk, J., Hansson, G.Å., Ohlsson, K., Skerfving, S. and Nordander, C., 2019. Work-related neck and upper limb disorders - Quantitative exposure-response relationships adjusted for personal characteristics and psychosocial conditions. *BMC Musculoskeletal Disorders*, 20(1). https://doi.org/10.1186/s12891-019-2491-6

Beheshtifar, M. and Nazarian, R., 2013. Role of Occupational Stress in organizations. *Interdisciplinary Journal of Contemporary Research in Business*, 4(9), pp.648–657.

Bhattacherjee, S., Datta, S., Ray, K. and Mukhopadhyay, D., 2016. Nutrient adequacy and its correlation in a sub-Himalayan region of West Bengal, India. *Journal of Family Medicine and Primary Care*, 5(2), p.314. https://doi.org/10.4103/2249-4863.192315

Dietch, J.R., Taylor, D.J., Sethi, K., Kelly, K., Bramoweth, A.D. and Roane, B.M., 2016. Psychometric evaluation of the PSQI in U.S. college students. *Journal of Clinical Sleep Medicine*, 12(8), pp.1121–1129. https://doi.org/10.5664/jcsm.6050

Farid, M.M., Jayanti, S. and Ekawati, 2019. Hubungan Antara Stres Kerja Dengan Kecelakaan Kerja Pada Pekerja Bagian Bekisting PT Kontsruksi X Di Kota Semarang. *Jurnal Kesehatan Masyarakat (e-Journal)*, 7(4), pp.331–335.

Firk, C. and Markus, C.R., 2009. Mood and cortisol responses following tryptophan-rich hydrolyzed protein and acute stress in healthy subjects with high and low cognitive reactivity to depression. *Clinical Nutrition*, 28(3), pp.266–271. https://doi.org/10.1016/j.clnu.2009.03.002

Gamage, A.U. and Seneviratne, R.D.A., 2016. Perceived Job Stress and Presence of Hypertension Among Administrative Officers in Sri Lanka. *Asia Pacific Journal Public Health*, 28(1 Suppl), pp.41S-52S. https://doi.org/10.1177/1010539515598834

Glenn, J.M., Madero, E.N. and Bott, N.T., 2019. Dietary protein and amino acid intake: Links to the maintenance of cognitive health. *Nutrients*, 11(6), pp.1–16. https://doi.org/10.3390/nu11061315

Goetzel, R.Z., Henke, R.M., Tabrizi, M., Pelletier, K.R., Loeppke, R., Ballard, D.W., Grossmeier, J., Anderson, D.R., Yach, D., Kelly, R.K., McCalister, T., Serxner, S., Selecky, C., Shallenberger, L.G., Fries, J.F., Baase, C., Isaac, F., Crighton, K.A., Wald, P., Exum, E., Shurney, D. and Metz, R.D., 2014. Do workplace health promotion (wellness) programs work? *Journal of Occupational and Environmental Medicine*, 56(9), pp.927–934. https://doi.org/10.1097/JOM.0000000000000276.

Gonzalez, M.J. and Miranda-massari, J.R., 2014. Diet and Stress. *Psuchiatr Clin N Am*, 37, pp.579–589. https://doi.org/10.1016/j.psc.2014.08.004

Gumasing, M.J.J. and Ilagan, J.G., 2019. A cross-sectional study on occupational risk factors of BPO agents in the Philippines. *Proceedings of the International Conference on Industrial Engineering and Operations Management*, 2019(MAR), pp.827–836.

Harris, R.B.S., 2015. Chronic and acute effects of stress on energy balance: are there appropriate animal models? *American Journal of Physiology - Regulatory Integrative and Comparative Physiology*, 308(4), pp.R250–R265. https://doi.org/10.1152/ajpregu.00361.2014

Health, I.M. of, 2015. *Infodation : Situasi Kesehatan Kerja*. *Pusat Data dan Informasi Kementerian Kesehatan RI*.

Hidayat, T., Fauzan, A., Rahman, E., Arsyad, M. and Banjari, A., 2020. HUBUNGAN BEBAN KERJA DAN STRES DENGAN KECELAKAAN KERJA PADA PETUGAS CLEANING SERVICE DI RUMAH SAKIT UMUM DAERAH (RSUD) ULIN BANJARMASIN TAHUN 2020 The Relationship Between Workload And Stress With Work Accidents At Cleaning Service Officers At Ulin Banj. *Fakultas Kesehatan Masyarakat Universitas Islam Kalimantan*, pp.1–8.

ILO, 2016. *Workplace Stress: a collective challenge*. *International Labour Organization*, .

Klingmann, P.O., Kugler, I. and Steffke, T.S., 2014. Editorial. *Journal of Musculoskeletal Pain*, 10(1).

Kurniawan, Y. and Kurniawan, B., 2018. Hubungan Pengetahuan, Kelelahan, Beban Kerja Fisik, Postur Tubuh Saat Bekerja, Dan Sikap Penggunaan Apd Dengan Kejadian Kecelakaan Kerja (Studi Pada Aktivitas Pengangkatan Manual Di Unit Pengantongan Pupuk Pelabuhan Tanjung Emas Semarang). *Jurnal Kesehatan Masyarakat (e-Journal)*, 6(4), pp.393–401.

Lemmens, S.G., Martens, E.A., Born, J.M., Martens, M.J. and Westerterp-Plantenga, M.S., 2011. Lack of effect of high-protein vs. high-carbohydrate meal intake on stress-related mood and eating behavior. *Nutrition Journal*, 10(1), pp.1–10. https://doi.org/10.1186/1475-2891-10-136

Marino, F.E., 2019. Defining and measuring fatigue. In: *Human Fatigue*. https://doi.org/10.4324/9781315674759-4

van der Meij, L., Gubbels, N., Schaveling, J., Almela, M. and van Vugt, M., 2018. Hair cortisol and work stress: Importance of workload and stress model (JDCS or ERI). *Psychoneuroendocrinology*, 89(July 2017), pp.78–85. https://doi.org/10.1016/j.psyneuen.2017.12.020.

Morales, A.F.C., Hernandez Arellano, J.L., Muñoz, E.L.G. and Macías, A.A.M., 2020. Development of the NASA-TLX Multi Equation Tool to Assess Workload. *International Journal of Combinatorial Optimization Problems and Informatics*, 11(1), pp.50–58.

Moritz, B., Schmitz, A.E., Rodrigues, A.L.S., Dafre, A.L. and Cunha, M.P., 2020. The role of vitamin C in stress-related disorders. *Journal of Nutritional Biochemistry*, 85, p.108459. https://doi.org/10.1016/j.jnutbio.2020.108459.

Muntholib, A., 2020. *PENGARUH SUPLEMENTASI VITAMIN C TERHADAP TINGKAT STRES MAHASISWA FAKULTAS KEDOKTERAN ANGKATAN 2016 UNIVERSITAS CIPUTRA*. *Universitas Ciputra*.

Nordander, C., Hansson, G.Å., Ohlsson, K., Arvidsson, I., Balogh, I., Strömberg, U., Rittner, R. and Skerfving, S., 2016. Exposure-response relationships for work-related neck and shoulder musculoskeletal disorders - Analyses of pooled uniform data sets. *Applied*

Ergonomics, 55, pp.70–84. https://doi.org/10.1016/j.apergo.2016.01.010.

Pertiwi, E., Denny, H. and Widjasena, B., 2017. HUBUNGAN ANTARA BEBAN KERJA MENTAL DENGAN STRES KERJA DOSEN DI SUATU FAKULTAS. *Jurnal Kesehatan Masyarakat (e-Journal)*, 5(3).

Plotnick, M.D., D'Urzo, K.A., Gurd, B.J. and Pyke, K.E., 2017. The influence of vitamin C on the interaction between acute mental stress and endothelial function. *European Journal of Applied Physiology*, 117(8), pp.1657–1668. https://doi.org/10.1007/s00421-017-3655-4.

Rachman, H., 2013. *Gambaran Kelelahan Kerja pada Pekerja Bagian Factory di PT. Maruki International Indonesia Makassar*. *UIN Alauddin Makassar*.

Radwan, H., 2013. The effect of work stress on employees' performance and satisfaction in fast food restaurants.

Ried, K., Travica, N. and Sali, A., 2016. The acute effect of high-dose intravenous Vitamin C and other nutrients on blood pressure: A cohort study. *Blood Pressure Monitoring*, 21(3), pp.160–167. https://doi.org/10.1097/MBP.0000000000000178.

Rose, D.M., Seidler, A., Nübling, M., Latza, U., Brähler, E., Klein, E.M., Wiltink, J., Michal, M., Nickels, S., Wild, P.S., König, J., Claus, M., Letzel, S. and Beutel, M.E., 2017. Associations of fatigue to work-related stress, mental and physical health in an employed community sample. *BMC Psychiatry*, 17(1), pp.1–8. https://doi.org/10.1186/s12888-017-1237-y.

Stammers, L., Wong, L., Brown, R., Price, S., Ekinci, E. and Sumithran, P., 2020. Identifying stress-related eating in behavioural research: A review. *Hormones and Behavior*, 124. https://doi.org/10.1016/j.yhbeh.2020.104752.

Supriasa, I.D.N., Bakri, B. and Fajar, I., 2017. Penilaian Status Gizi Edisi 2. In: *Penerbit Buku Kedokteran: EGC*. pp.39-41–249.

Tabing, E.V.P., Atienza, L.M., Africa, L.S. and Santos, R.A.B., 2020. Work Stress, Dietary Intake, and Nutritional Status of Night-Shift Call Center Employees in Lipa City, Batangas, Philippines. *Journal of Nutrition Research and Food Science*, 1(02).

Tahrirah, T., 2019. the Relationship Between Mental Workload and Work Stress in Teachers of Schools of Disabled Children. *The Indonesian Journal of Occupational Safety and Health*, 8(1), p.76. https://doi.org/10.20473/ijosh.v8i1.2019.76-83.

Tang, Y., Liu, Y., Xu, L., Jia, Y., Shan, D., Li, W., Pan, X., Kang, D., Huang, C., Li, X., Zhang, J., Hu, Y., Konglin, L. and Zhuang, J., 2015. Validity and reproducibility of a revised semi-quantitative food frequency questionnaire (SQFFQ) for women of age-group 12-44 years in Chengdu. *Journal of Health, Population and Nutrition*, 33(1), pp.50–59.

Tarwaka, 2011. *Dasar – Dasar Pengetahuan Ergonomi dan Aplikasi di Tempat Kerja*. *Ergonomi Industri*. Harapan Pers.

Tarwaka, 2014. *Ergonomi Indutri: Dasar-Dasar Ergonomi dan Implementasi di Tempat Kerja*. *Harapan Press*.

Thamaria, N., 2017. *Penilaian Status Gizi*. Pertama ed. Kementerian Kesehatan RI.

the Central Bureau of Statistics of Lumajang, 2020. Kabupaten Lumajang Dalam Angka 2020. *Catalog*, 148.

Torney, L.K., Johnson, A.J. and Miles, C., 2009. Chewing gum and impasse-induced self-reported stress. *Appetite*, 53(3). https://doi.org/10.1016/j.appet.2009.07.009.

Watterson, A. and Ladou, J., 2003. *Health and safety executive inspection of U.K. semiconductor manufacturers*. *International Journal of Occupational and Environmental Health*, https://doi.org/10.1179/oeh.2003.9.4.392.

Winwood, P.C., Bakker, A.B. and Winefield, A.H., 2007. An investigation of the role of non-work-time behavior in buffering the effects of work strain. *Journal of Occupational and Environmental Medicine*, 49(8), pp.862–871. https://doi.org/10.1097/JOM.0b013e318124a8dc.

Wright, J. and O'Connor, K.M., 2014. Fatigue. *Medical Clinics of North America*, 98(3), pp.597–608. https://doi.org/10.1016/j.mcna.2014.01.010.

Zalaket, J., Matta, J. and Hanna-Wakim, L., 2019. Development, validity, and reproducibility of a semiquantitative food frequency questionnaire for the assessment of antioxidant vitamins intake in Lebanon. *Nutrition*, 58, pp.11–17. https://doi.org/10.1016/j.nut.2018.06.014.