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RELATIONSHIP OF WORKLOAD WITH FATIQUE AND SLEEP QUALITY IN FEMALE EXERCISERS

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Abstract

Fatigue is a critical issue for female exercisers that may lead to medical errors, degradation in performance, decreased mental acuity, and social problems. Poor sleep quality is also a contributing factor in the fatigue that female exercisers experience. Overwork is a factor that causes poor sleep quality in female exercisers. The aim of the present study was to investigate the relationship between workload, fatigue, and sleep quality among female exercisers in the Sleman Regency District. A cross-sectional study was conducted from December 2023 to March 2024 using a self-reported questionnaire of the Workload questionnaire adapted from the National Aeronautics and Space Administration task load index, the Leeds Sleep Evaluation Questionnaire (LSEQ), and the Subjective Self Rating of Fatigue Assessment Scale (FAS) from the WHO Quality of Life Assessment Instrument (WHOQOL-EF) in Sleman Regency with 200 respondents. The equation model by PLS was used to analyze the relationship between workload, sleep quality, fatigue, and the indicators of each instrument. The results showed female exercisers who were more than 40 years old, had children at home, had informal work, did daily exercise in the evening, and had a work schedule in the night had a higher risk of fatigue and poorer sleep quality than those below 40 years old who didn't have children at home, had formal work, did daily exercise in the morning, and had a work schedule in the morning. Fatigue, sleep quality, and workload are measured by a subjective self-rating test. The training load and intensity of exercise programs influenced fatigue levels, which simultaneously affected sleep quality. Female exercisers may face challenges in balancing exercise with other commitments, such as family responsibilities, leading to overtraining and resulting in fatigue. The equation model test showed a significant relationship between sleep quality and the level of perceived fatigue (p-value = 0.000). It can be concluded that fatigue has a greater relationship with causing fatigue in female exercisers. So, the effort of setting the capacity of the workload is very important to improve sleep quality and reduce the risk of work fatigue.

Keywords: Fatigue, Female Exerciser, Sleep Quality, Workload.

INTRODUCTION

Fatigue refers to a decline in the ability to withstand physical exertion, and its underlying causes are often activity-specific [1]. Factors such as excessive physical activity, inadequate rest periods, poor physical fitness, insufficient or over-intensive training, and stress can contribute to the onset of fatigue [2]. There are two distinct types of fatigue: mental fatigue, which results from prolonged mental exertion and can manifest as disinterest or saturation, and physical fatigue, which arises from physical or muscular activity [3]. It could be state as emotional, and mental exhaustion that results from prolonged exposure. Research conducted by [4]states that the strongest relationship was between fatigue and sleep quality. The result indicated that participants who reported poor sleep quality also reported higher fatigue. Similarly, state fatigue (i.e., current mood) was associated with worse sleep quality. These findings are of interest because it continues to support recent evidence that the relationship of workload with fatigue and sleep quality for active woman who needs more to be studied.

Female exercisers are women who engage in physical exercise as part of their regular routine or for various purposes such as fitness, health, recreation, or sport. They participate in a wide range of activities aimed at improving their physical fitness, strength, flexibility, and overall well-being. Female exercisers may have diverse motivations for engaging in physical activity, including improving fitness and health, managing weight, reducing stress, enhancing mood, boosting self-confidence, and enjoying social interactions. They may also face unique challenges and considerations related to exercise, such as hormonal fluctuations, pregnancy and postpartum considerations, and societal expectations regarding body image and athleticism [5, 6].Based on the data from the Central Bureau Statistics of Indonesia (BPS) in 2019, there were 52 million female workers in Indonesia, where 7.9 million of them worked in the manufacturing industry sector.

According to the Central Bureau of Statistics of Indonesia, compared to the prior year in 2017, the percentage of female workers in 2019 slightly rose from 55.4% to 55.5% [7, 8]. Increasing the number of female workers in sport area of their productive age may cause fatigue, which is a problem in work health and safety that may lead to injury and accidents. The management of work health and safety is important to achieve healthy, safe, and productive workers. Fatigue is caused by several factors, including job demands, type of work, work environment (noise, lighting, heat stress, vibration), changes in the biological clock of workers, and the need to adapt to their work [9,10].

Research conducted on American workers stated 37.9% of the total workers experienced fatigue. Meanwhile, research conducted in Indonesia stated that the prevalence of fatigue in workers was high, reaching 65 percent [11]. However, recent studies don't explore the effect of workload to the fatigue and sleep quality. How workload relates to each of these constructs remains unclear, particularly within female exercisers with double job (exercisers and worker at home). We hypothesized that work quality has relationship to the sleep quality and the fatigue as highly predictive of aspects.

Based on the background of research, the aims of this study are to investigate the relationship between workload, fatigue, and sleep quality among female by exploring the impact of various factors, such as job demands, work environment, and the fatigue levels of female workers engaged in physical exercise. The gap of this research is investigating the relationship of workload with fatigue and sleep quality among female exercisers who have multiple roles and responsibilities (work at home and outside home).

The outcomes derived from this paper will offer valuable perspectives regarding the complex interplay between workload, fatigue, sleep quality, and exercise participation among female workers, with the goal of informing strategies for promoting health, safety, and productivity in this population. In order to achieve the aims of this study, this research raises three main research questions:

RQ1: How does the influence of workload on the fatigue of female exercisers?

RQ2: How does the influence of workload on the sleep quality of female exercisers?

RQ3: Does the workload have a relationship with fatigue and sleep quality?

METHODS AND MATERIALS

Study Design, Settings and Participants

This study used a cross-sectional survey research design to determine the relationship between workload, sleep quality, and work fatigue among female excersicers. This research was conducted from December 2023 to April 2024 in Sleman Regency, Special Region of Yogyakarta, Indonesia. Sampling was carried out by taking into account the inclusion and exclusion criteria that had been set, and the total number of samples was 200 female exercisers with a variety of personal backgrounds. The sample inclusion criteria in this study were women between the ages of 18 and 50,, doing regular sports activities, being married, and having a job. The sample exclusion criteria in this study were that they were women over 50 years old, did not do regular sports activities, were not married, and did not have a job. Everyone in the sample received an invitation to join the study and a questionnaire via social media. They were asked to answer the self-item test via Google Form for 90 minutes of one-day observation. Questions encompass demographics, workload, fatigue, and sleep quality. We excluded 21 respondents who did not fulfill the criteria of inclusion, leaving an analytical sample of 200 female exercisers. Demographic variables included age (range 18–50 years old), which divided into two groups (“<40 years” or “>40 years”): children living at home (“yes”, “no”), exercise schedule type (“morning only” or “evening/night only”), workplace (“formal” and "informal"), and work schedule type (“morning only” or “night only”). Formal jobs are for women who work in the government, banking, education, healthcare, and manufacturing industries. The informal jobs are for women who are not regulated by the government, such as salespeople, laborers, and waiters who do a lot of activity and movement. These variables were moderating variables. Several variables were treated as both continuous and categorical, depending on the analysis.

Instruments

Independent Variables

The independent variable in this study was the workload. The workload data was collected on self-reported workload through questionnaire. The workload assessment is an adaptation of the National Aeronautics and Space Administration task load index. This tool has been extensively validated, with its use reported in more than 500 publications since its development [12]. An adaptation of the tool is presented in Figure 1. For each of the six items, participants place an ‘x’ on a line 10 cm in length, which is subsequently converted to a numerical value for each of the items. In addition, assessment of total workload can be completed by simply summing the scores of the six subscales. NASA TLX has six aspects [13] namely (1) Mental demand (MD) is measuring activities mental and perceptual to see, remember, and find; (2) Physical demand (PD) is measuring the number of physical activities that needed (example: pull, push, rotate, etc.); (3) Temporal demand (TD) is measuring time pressure that felt during work whether the work can be done slowly, or quickly so that is feels tiring; (4) Performance (P) is the success of workers in carrying out their duties and how they are satisfied with the results of their work; (5) Frustration (FR) is how many workers feel insecure, desperate, offended, or disturb when doing their work; (6) Effort (EF) is amount of hard work that workers need to achieve the required level of performance. Given the small sample size, an a priori decision was made to eliminate extreme performance outliers from the analysis.

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Workload assessment: Questions 1-3 relate to the demands placed on you by the procedure that you have just performed. Questions 4-6 relate to your behaviour and feelings during the procedure that you have just performed. Place an 'X' on the line, between 0 (low) and 100 (high).

1. Mental Demand:

How much mental and perceptual activity was required to perform the procedure (e.g. thinking, decision-making, looking, listening, remembering, reasoning, etc.)? Was the procedure easy or demanding, simple or complex, exacting or forgiving?

0 ______________________________ 100
Low **High**

2. Physical Demand:

How much physical activity was required to perform the procedure (e.g. pushing, pulling, looking, turning, controlling, etc.)? Was the procedure trivial aor demanding, easy or strenuous, restful or laborious?

0 ______________________________ 100
Low **High**

3. Time Demand:

How much time pressure did you feel due to the rate of pace of the procedure? Was the pace slow and leisurely, or rapid and frantic?

0 100
Low **High**

4. Effort:

How hard did you have to work mentally and physically to perform and learn during this procedure?

0 ______________________________ 100
Low **High**

5. Performance:

During this procedure, how successful do you think you were in accomplishing the goals set aout by the trainer or yourself? How satisfied were you with

0 100
Low **High**

6. Frustation/anxiety:

How discouraged, imitated, stressed and anxious (versus gratified, content, relaxed and secure) did you feel during the procedure

0 ______________________________ 100
Low **High**

Figure 1: Workload Questionnaire Adapted from the National Aeronautics and Space

Administration task load index

Dependent Variables

Dependent variables in this study were fatigue and sleep quality. Fatigue was measured instrument developed by Michielsen and colleagues [14] analyzed the scale's psychometric properties and found an internal consistency of 0.90. Results on the scale also correlated highly with the fatigue-related subscales of other measures like the Checklist Individual Strength. This study use ten items related to musculoskeletal complaints in the body. Each item of the FAS is answered using a five-point, Likert-type scale ranging from 1 ("never") to 5 ("always"). Items 4 and 10 are reverse-scored. Total scores can range from 10, indicating the lowest level of fatigue, to 50, denoting the highest. The first 5 item questions investigate physical fatigue, the other 5 investigate mental fatigue. The following 10 statements refer to how you usually feel as clearly presented in Table 1.

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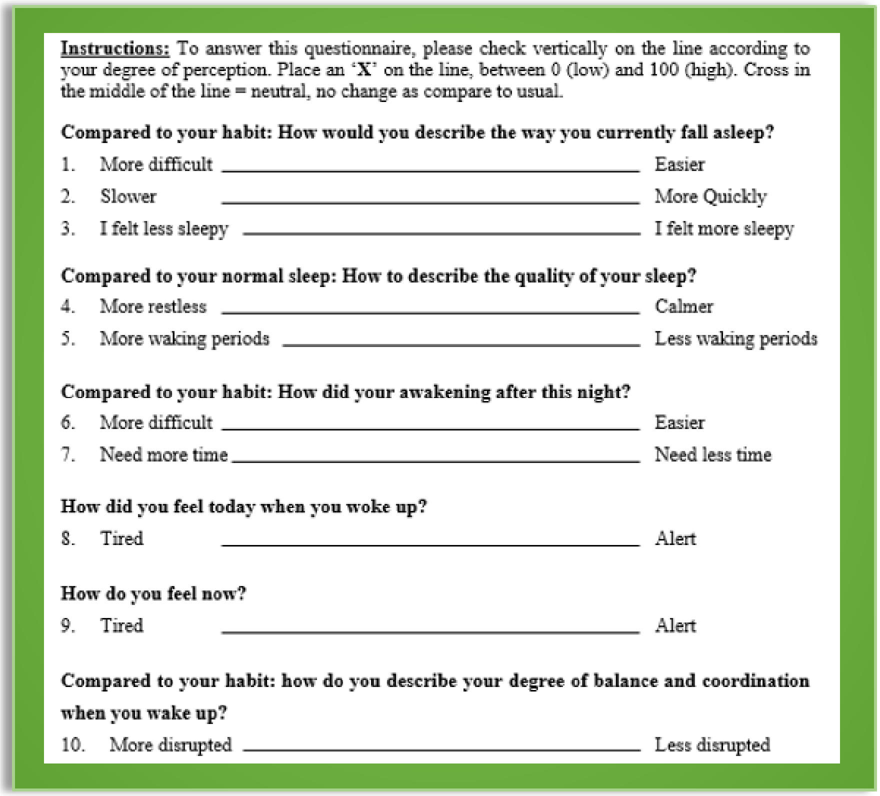
Table 1: FAS Questionnaire Adapted from [14] **and WHOQOL**

Items	Never	Sometimes	Regularly	Often	Always
I am bothered by fatigue (WHOQOL)	1	2	3	4	5
I get tired very quickly (CIS)	1	2	3	4	5
I don't do much during the day (CIS)	1	2	3	4	5
I have enough energy for everyday life (WHOQOL)	5	4	3	2	1
Physically, I feel exhausted (CIS)	1	2	3	4	5
I have problems starting things (FS)	1	2	3	4	5
I have problems thinking clearly (FS)	1	2	3	4	5
I feel no desire to do anything (CIS)	1	2	3	4	5
Mentally, I feel exhausted (FS)	1	2	3	4	5
When I am doing something, I can concentrate quite well (CIS)	5	4	3	2	1
The abbreviations after the items indicate the scale from which the items has been abstracted. The following are the scales of CIS (Checklist Individual Strength), WHOQOL (World Health Organization Quality of Life Assesment Instrument) and FS (Fatigue Scale). Reprinted from Michielsen et al. [14,15]					

Leeds sleep evaluation was measured instrument developed by [16]. The Leeds Sleep Evaluation Questionnaire (SEQ) contains ten questions pertaining to four consecutive aspects of sleep: getting to sleep (GTS) – (1, 2, 3), quality of sleep (QOS) – (4, 5), awakening from sleep (AFS) – (6, 7), and behaviour following wakefulness (BFW) – (8, 9, 10). Parrot and the collegous analyzed the Leeds scale's psychometric properties and found an internal consistency of 0.90. Each item of the SEQ is answered using a ten-point. Total scores can range from 1-10, indicating the lowest level of sleep quality to 10, and 100 denoting the highest. The components scores were asummed and reported as sleep quality score.


Instructions: To answer this questionnaire, please check vertically on the line according to your degree of perception. Place an 'X' on the line, between 0 (low) and 100 (high). Cross in the middle of the line = neutral, no change as compare to usual.

Compared to your habit: How would you describe the way you currently fall asleep?

1. More difficult ____________ Easier
2. Slower ____________ More Quickly
3. I felt less sleepy ____________ I felt more sleepy

Compared to your normal sleep: How to describe the quality of your sleep?

4. More restless ____________ Calmer
5. More waking periods ____________ Less waking periods

Compared to your habit: How did your awakening after this night?

6. More difficult ____________ Easier
7. Need more time ____________ Need less time

How did you feel today when you woke up?

8. Tired ____________ Alert

How do you feel now?

9. Tired ____________ Alert

Compared to your habit: how do you describe your degree of balance and coordination when you wake up?

10. More disrupted ____________ Less disrupted

Figure 2: Leeds Sleep Questionnaire adapted from [16] **Statistical Analysis**

The data collected from the instruments were analyzed to examine the relationships between dependent and independent variables. The high values of Cronbach's alpha suggested that the instruments had good reliability level and a good internal consistency of the scales. This means that the items within each scale are closely related and consistently measure the same construct. For investigating the influence of workload to fatigue and sleep quality, data analysed using path coefficient analysis. Furthermore, the inter-item correlation matrix provided insights into the relationships between the variables. Direct and indirect associations among variables were examined to evaluate a model by proposing a predetermined set of relationships based on theoretical, empirical, and general knowledge. A partial least square (PLS) approach was employed because of the exploratory nature of the present study. All data analyses were conducted using the Smart PLS Version 3.0 software [17] and SPSS. The structural model determines the strength and significance of the model relationships. The model fit was assessed using various indexes [18]. The model fit statistics accorded with the suggested criteria demonstrating a good fit between the model and data as clearly presented in Table 2.

Table 2: Good Criteria of Model [18]

Category	Measure	Recommended Criterion
Goodnees of Fit Model	SRMR	Acaptable if < 0.1
	NFI	Acaptable if < 1 The closer the NFI to 1, the better the fit
Outer Model	Outer Loading	Acaptable if > 0.7
	AVE Contruct Reflective	Acaptable if > 0.5
	Cronbach's Alpha	Acaptable if > 0.7
Inner Model	Path Coeficient	Acaptable if p< 0.05
	R-adjusted	Acaptable if original sample > 0.6
	t-value	Acaptable if > 1.96

RESULTS OF RESEARCH

The descriptive analysis was performed on workload, fatigue, and sleep quality, as presented in Table 3. In summary, Table 4 provided a helpful numerical overview of model fit, where the equation models have fulfilled the standard requirement, which was applicable to the recommended criterion. A strong positive correlation with an adjusted an Adjusted R of 0.821 between workload with sleep quality and workload with fatigue of 0.703 was presented in Table 4.

It indicated that individuals with a greater workload also tend to increase the score of fatigue and poor sleep quality. Based on the path analysis, variable workload had a significant direct relationship with fatigue and sleep quality. The detailed result analysis can be seen in the attachment pages. Therefore, it could be concluded that the result analysis of the Goodness of Fit Model, Outer Model, and Inner Model have fulfilled the standard requirement.

Table 3: Descriptive Statistics

Variable	Aspect	Indicator		N	Mean	Std. Error	Std. Deviation	Cronbach's Alpha
Moderating Variables	Age	Fatigue	<40	99	39.29	1.13	.113	0.98
			>40	101	40.28	1.25	.124	
		Sleep Quality	<40	99	20.94	.88	.089	
			>40	101	21.75	1.06	.105	
	Children at home	Fatigue	No Children	114	39.19	1.24	.116	0.96
			Yes Children	86	40.59	.83	.090	
		Sleep Quality	No Children	114	20.89	.87	.081	
			Yes Children	86	21.95	.98	.106	
	Workplace	Fatigue	Formal	89	39.19	1.26	.133	0.99
			Informal	111	40.27	1.09	.104	
		Sleep Quality	Formal	89	20.89	.93	.098	
			Informal	111	21.72	1.01	.096	
	Daily exercise schedule type	Fatigue	Morning	99	39.18	1.21	.122	0.98
			Evening	101	40.39	1.06	.106	
		Sleep Quality	Morning	99	20.88	.90	.091	
			Evening	101	21.81	1.00	.099	
	Work schedule type	Fatigue	Morning	93	39.22	1.25	.130	0.96
			Night	107	40.28	1.10	.107	
		Sleep Quality	Morning	93	20.93	.90	.094	
			Night	107	21.71	1.05	.102	
Independent Variables	Workload	Mental Demand		200	.69	.05	8.10	0.756
		Physical Demand		200	.69	.05	7.90	
		Time Demand		200	.86	.06	8.39	
		Effort Demand		200	.79	.05	7.83	
		Performance Demand		200	.84	.06	7.94	
		Frustation/Anxiety		200	.42	.03	8.80	
Dependent Variables	Fatigue	Physical Fatigue		200	40.26	1.46	.103	0.935
		Mental Fatigue		200	39.33	1.19	.085	
	Sleep Quality	Getting to Sleep (GTS)		200	25.32	1.67	.119	0.833
		Quality of Sleep (QOS)		200	17.41	1.20	.085	
		Awakening from Sleep (AFS)		200	17.04	.73	.052	
		Behaviour Following Wakefulness (BFW)		200	25.65	1.23	.088	

The descriptive data of this study was analysed using SPSS as presented in Table 3, and for the structural equation model, the interaction value was analysed using Smart PLS as presented in Table 4. The higher R-square adjusted means a higher relationship between workload, fatigue, and sleep quality. It means the higher workload of female exercisers would have a greater influence on fatigue and sleep quality. Based on the data above, female exercisers who were more than 40 years old, had children at home, had informal work, did daily exercise in the evening, and had a had a work schedule in the night got more risk of fatigue and poor sleep quality than those below 40 years old who didn't have children at home, had formal work, did daily exercise in the morning, and had a had a work schedule in the morning.

Table 4: Model Fit

Model Fit	Saturated Model	Estimated Model
SRMR	0.089	0.119
d_ULS	0.903	1.064
d_G	1.056	1.166
Chi-Square	999.914	1033.207
NFI	0.622	0.610

Tabel 5: R-Square Adjusted

Variable	R-Square	R-Square Adjusted
Fatigue	0.705	0.703
Sleep Quality	0.822	0.821

Tabel 6: Path Coefficient

Variables	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	p-values (<0.05)
Work Schedule -> Fatigue	0.328	0.329	0.127	2.573	0.010
Work Schedule -> Sleep Quality	0.258	0.259	0.255	2.063	0.027
Daily Exercise -> Fatigue	0.281	0.289	0.109	2.582	0.010
Daily Exercise -> Sleep Quality	0.216	0.214	0.068	3.193	0.001
Age -> Fatigue	0.204	0.207	0.261	3.270	0.044
Age -> Sleep Quality	0.349	0.355	0.438	2.356	0.022
Children at home -> Fatigue	0.341	0.315	0.252	2.277	0.024
Children at home -> Sleep Quality	0.145	0.150	0.067	2.173	0.030
Workplace -> Fatigue	0.206	0.201	0.310	3.355	0.016
Workplace -> Sleep Quality	0.114	0.112	0.052	2.199	0.028
Workload -> Fatigue	0.857	0.850	0.039	22.244	0.000
Workload -> Sleep Quality	0.892	0.896	0.031	28.455	0.000

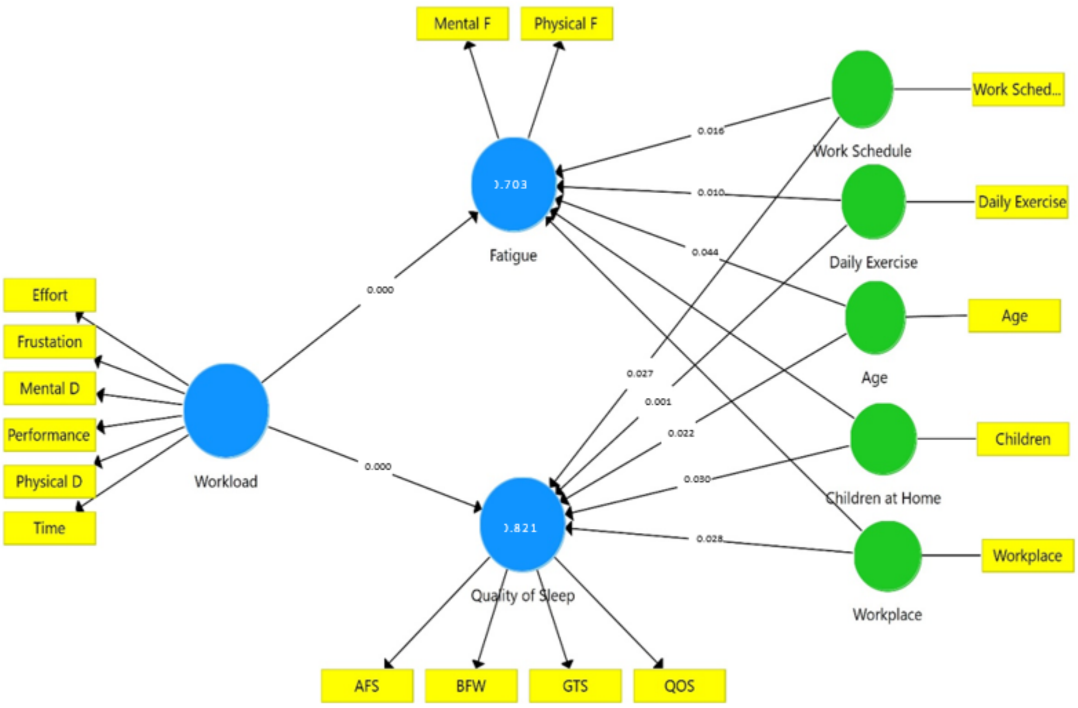


Figure 3: p-value of Structural Equation Model

The green circles represent the moderating variables of work schedule, daily exercise, age, children at home, and workplace. Blue circles represent the variables of workload (independent variables), fatigue, and sleep quality (dependent variables). Yellow circles represent the indicators of variables. The score across the line is the p-value. The diagram above showed that there was an influence of workload on fatigue and sleep quality in female exercisers, with a p-value <0.05. There was a relationship between workload and sleep quality among female exercisers with an R-value > 0.6.

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DISCUSSION

The Influence of Workload on the Fatigue for Female Exercisers

Studies indicate that both the intensity and volume of physical activity significantly impact fatigue levels. High training loads without adequate recovery lead to increased fatigue, impacting performance and overall well-being. high-intensity training can lead to significant fatigue if not balanced with adequate recovery periods. Overtraining, characterized by excessive physical workload without sufficient rest, results in chronic fatigue, impaired performance, and increased risk of injuries [19,20]. Women in physically demanding jobs, excessive workload contributes to higher fatigue levels. Research focusing on female workers in informal sectors found that increased workload is a significant predictor of occupational fatigue. This relationship underscores the importance of managing workload to maintain health and productivity in various settings [19,21,22]. Another aspect is the interaction between mental and physical workload. High cognitive demands combined with physical exertion can exacerbate fatigue. This interaction is crucial in understanding how different types of workloads affect overall fatigue and performance in female exercisers [19,20,22]. Female exercisers in this study focus on female workers whi doing regular exercise activities. Studies on female workers in informal sectors reveal that excessive occupational workload contributes to higher fatigue levels. Factors such as long working hours, physically demanding tasks, and lack of adequate rest periods are significant predictors of occupational fatigue. These findings emphasize the need for effective workload management strategies in the workplace to reduce fatigue and enhance productivity [23].

The Influence of Workload on the Sleep Quality of Female Exercisers

Studies on female workers in various sectors highlight that excessive occupational workload contributes to poor sleep quality. Long working hours, high physical demands, and inadequate rest periods result in increased fatigue and disrupted sleep. Addressing workload through better work schedules and rest periods can enhance sleep quality for female exercisers who having work at home and outside home [24,25]. Age is another important factor affecting sleep quality. Younger individuals generally have better sleep quality compared to older adults. As people age, the prevalence of sleep disturbances increases due to various physiological changes and the onset of chronic conditions. In a study of nurses, those over 30 years of age reported poorer sleep quality and higher levels of depressive symptoms compared to their younger counterparts. The relationship between age and sleep quality is also influenced by the cumulative effect of stress and workload over time [25,26]. Having children significantly impacts sleep quality, especially for working parents. The demands of childcare, particularly in younger children, can lead to frequent night awakenings and reduced sleep duration. This is compounded by work-related stress, creating a challenging environment for maintaining good sleep quality. Studies indicate that parents, especially mothers, often report poorer sleep quality compared to their childless counterparts. The stress of balancing work and family responsibilities contributes to this trend [26,27]. The interaction between workload, age, and having children creates a complex scenario for sleep quality. Older parents with high workloads tend to experience the worst sleep outcomes. The stress from high job demands combined with the responsibilities of childcare exacerbates sleep disturbances. For instance, married nurses with children reported higher levels of work-family conflict, which significantly impaired their sleep quality. Effective management of workload and support for childcare responsibilities are essential to mitigate these effects [25,28]. Informal jobs need high workload leads to increased fatigue and stress, negatively impacting sleep. Age exacerbates sleep disturbances due to physiological changes and the cumulative effect of stress. Having children adds to the burden, especially when coupled with high workload, leading to significant sleep disruptions.

The Relationship of Workload With Fatigue and Sleep Quality of Female Exercisers

Workload, both physical and mental, significantly impacts sleep quality. High workloads lead to increased stress and fatigue, which disrupt sleep patterns. This is particularly evident in professions with demanding physical and cognitive tasks. For instance, nurses with high workloads experience poorer sleep quality, characterized by reduced sleep duration and frequent awakenings [26,29]. Age is a critical factor influencing sleep quality. As individuals age, sleep disturbances become more prevalent due to physiological changes and the accumulation of stress over time. Studies indicate that older adults tend to have poorer sleep quality compared to younger individuals. This trend is also seen in female exercisers, where older age is associated with increased sleep issues [29–31]. Having children at home can significantly affect sleep quality, especially for working parents. The demands of childcare, particularly with younger children, lead to frequent night awakenings and reduced sleep duration. This effect is compounded by work-related stress, making it challenging to maintain good sleep quality. Mothers, in particular, report poorer sleep quality compared to childless women, as balancing work and family responsibilities increases stress and sleep disruptions [32–34].

The type of workplace also influences sleep quality. Formal workplaces with structured environments and regulated work hours tend to offer better conditions for maintaining good sleep quality. In contrast, informal workplaces, often characterized by irregular hours and higher physical demands, can contribute to poorer sleep quality. Female exercisers working in informal sectors may face more significant sleep challenges due to less predictable schedules and higher stress levels [35,36].Work schedules have a profound impact on sleep quality. Night shifts and rotating schedules are particularly detrimental, as they disrupt the body's natural circadian rhythms. Female exercisers working night shifts often report poorer sleep quality, including difficulties falling asleep and maintaining sleep, compared to those working morning shifts. Shift work can lead to chronic sleep deprivation and associated health problems [37–39].

CONCLUSION

This study provides us with some interesting insights about the influence of workload on both fatigue and sleep quality in female exercisers and highlights several critical factors. High-intensity training and excessive physical workload, without adequate recovery, significantly contribute to increased fatigue, impacting performance and overall well-being. Similarly, demanding job conditions, especially in informal sectors, exacerbate fatigue due to long working hours, physically demanding tasks, and insufficient rest periods. Moreover, high workloads also detrimentally affect sleep quality. Female exercisers with high physical and cognitive demands experience disrupted sleep patterns, characterized by reduced sleep duration and frequent awakenings. This issue is compounded by age, with older individuals facing more pronounced sleep disturbances due to physiological changes and accumulated stress. Additionally, having children adds to the complexity, as childcare responsibilities further disrupt sleep, particularly for working mothers. Effective management of workloads through structured work environments and better work schedules is essential to mitigating these adverse effects. Providing adequate recovery periods, support for childcare responsibilities, and minimizing night shifts or rotating schedules can help improve both fatigue levels and sleep quality for female exercisers. These measures are crucial for maintaining health and productivity across different settings.

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