Journal of Health and Nutrition Research
Vol. 5, No. 2, 2026, pg. 596-607, https://doi.org/10.56303/jhnresearch.v5i2.1336
Journal homepage: https://journalmpci.com/index.php/jhnr/index

e-ISSN: **2829-9760**

Determinants of Work Productivity: The Roles of Health and Lifestyle among Government Employees

Wafa Ma'mun[1], Isna Qadrijati[1,2]*, Adi Magna Patriadi Nuhriawangsa[1,3]

[1] Department of Nutrition Science, Faculty of Medicine, Sebelas Maret University, Indonesia
[2] Department of Occupational Health and Safety, Faculty of Medicine, Sebelas Maret University, Indonesia
[3] Department of Animal Science, Faculty of Animal Husbandry, Sebelas Maret University, Indonesia

Corresponding Author Email: isnaqadrijati@staff.uns.ac.id

ORIGINAL ARTICLES

Submitted: 10 March 2026

Accepted: 09 May 2026

Published: 01 August 2026

Keywords:
Breakfast Habit, Nutritional Status, Physical fitness, Sedentary Behavior, Work Productivity

ABSTRACT

Work productivity is an important aspect for workers and institutions that is influenced by internal factors such as education level, discipline, attitude, work motivation, health, nutrition, and physical condition, as well as external factors associated with the environment, including workplace conditions, organizational policies, wages, and infrastructure. This study aims to determine the relationship between physical fitness, sedentary behavior, nutritional status, and breakfast habits with the work productivity of employees at the Ministry of Religious Affairs in Central Java Province. This study used a quantitative method with a cross-sectional design. A sample of 101 employees was selected using purposive sampling. Questionnaires were used to collect data on work productivity, sedentary activities, and breakfast habits. Physical fitness was measured using the YMCA step test method, and nutritional status was measured using body mass index. Data were analyzed using SPSS with Somers' D test and ordinal logistic regression. The results show that there is a significant relationship between physical fitness, breakfast habits, and nutritional status with work productivity while sedentary behavior is not related to work productivity. In conclusion, physical fitness, breakfast habits, and nutritional status are related to the work productivity of employees at the Ministry of Religious Affairs in Central Java Province.

Key Messages:

- Work productivity can be improved by focusing on health and nutritional factors, including balanced dietary habits and regular physical activity.
- Regular nutritional interventions and health monitoring are essential to maintain employees' health and nutritional status, ensuring they remain in optimal condition to sustain work productivity.

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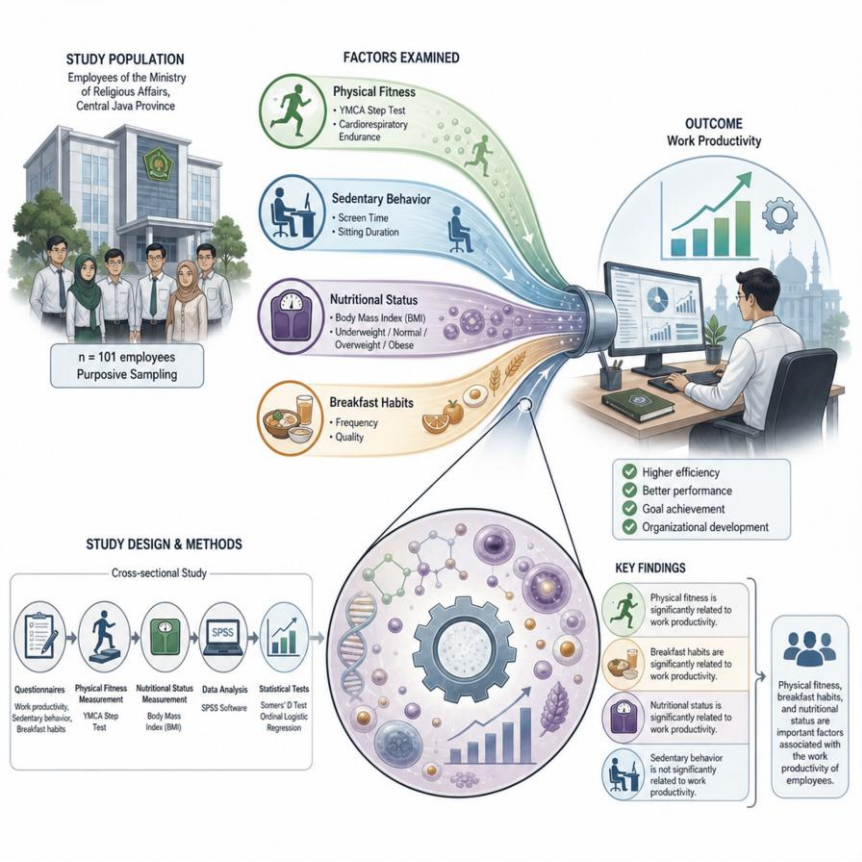
GRAPHICAL ABSTRACT



INTRODUCTION

Productivity is a crucial factor in supporting the success of an institution. Productivity is defined as the ratio of the results achieved to the total resources used (1). According to the Asian Productivity Organization (2023) Productivity Databook report (2), Indonesia has a low level of work productivity of 26.3% and ranks 11th in Asia. Meanwhile, the Central Java Regional Office of the Ministry of Religious Affairs reported that the average performance achievement from January to November 2024 reached 75%, which is categorized as satisfactory (3). Based on a preliminary study conducted on July 31, 2025, involving 30 employees, the results showed that 14 employees (46.7%) had low work productivity. In addition, 6 employees (30%) demonstrated poor breakfast habits. Furthermore, 27 employees (90%) had high levels of sedentary behavior, and 14 employees (46.7%) had poor physical fitness. These findings also supported by preliminary observations indicating that employees of the Central Java Regional Office of the Ministry of Religious Affairs work from 07:30 to 16:00 (Monday-Thursday) and 07:30 to 16:30 (Friday), with most tasks being administrative in nature and involving prolonged sitting. This work pattern increases the likelihood of sedentary behavior.

Work productivity is influenced by internal factors related to individuals, such as education level, discipline, attitude, work motivation, health, nutrition, and physical condition, as well as external factors associated with the environment, including workplace conditions, organizational policies, wages, and infrastructure (4). Previous study demonstrated a significant relationship between nutritional status and work productivity (5). Workers with poor nutritional status tend to have lower physical capacity and motivation, which may slow work performance and lead to decreased productivity (6). Furthermore, inadequate nutritional intake can reduce energy production, causing fatigue and decreased enthusiasm in carrying out daily activities, ultimately affecting work productivity (5)(6). Nutritional status is influenced by direct factors, particularly dietary intake and health conditions. Therefore, regular and balanced breakfast consumption may contribute to maintaining optimal nutritional status. Breakfast is an important component of daily dietary patterns, however, it is often skipped by workers due to due to time constraints, workload demands, or lack of appetite in the morning. Regular breakfast consumption helps maintain

https://doi.org/10.56303/jhnresearch.v5i2.1336

physical endurance during work, thereby supporting optimal work productivity through adequate nutrient intake (7). Establishing a habit of having breakfast before work can help prevent excessive and uncontrolled food intake caused by hunger during working hours, which may contribute to weight gain, suboptimal nutritional status, and decreased work productivity (8).

In addition to dietary factors, physical fitness is considered an important determinant of employees' work productivity. Good physical fitness has a positive impact on physical capacity, including reducing the risk of non-communicable diseases and improving work performance (9). This is because regular physical activity enhances cardiovascular function, allowing oxygen to be delivered more efficiently to the brain and throughout the body (10). Workers with good physical fitness tend to be more focused, punctual, and less prone to fatigue when completing their tasks. However, optimal work effectiveness also requires an appropriate workload to support sustained performance (10)(9).

Meanwhile, high sedentary behavior is prevalent in workplace settings. In Central Java Province, the proportion of individuals aged ≥10 years classified as having low physical activity levels increased from 29.5% in 2018 to 30.4% in 2023 (11)(12). Workers with high levels of sedentary behavior (>91%) are reported to have lower job satisfaction compared to those with shorter sitting durations (<75%), as well as higher fatigue levels than workers with lower sedentary behavior (13). Excessive sedentary behavior may lead to energy imbalance and fat accumulation, as well as reduced cognitive function. This decline in physical condition and endurance will affect productivity at work (14).

Physical fitness is one of the key indicators of optimal physical condition that is essential for work efficiency in the era of Industry 4.0, as it can enhance work productivity (15), particularly in occupations dominated by prolonged sitting and computer-based tasks such as those performed by employees of the Ministry of Religious Affairs. Regular physical activity improves oxygen circulation to the brain, enabling workers to perform tasks efficiently and effectively while maintaining good concentration. In addition, physical activity helps reduce stress through the release of hormones that stabilize emotions. Insufficient physical activity and high levels of sedentary behavior can negatively affect physical health, including overall health conditions and nutritional status, as well as psychological well-being, such as increased stress, depression, and poor sleep quality. These conditions may also reduce concentration and work productivity (10)(16). Therefore, maintaining optimal physical fitness and nutritional status through physical activity and balanced nutrition among workers is important to prevent cognitive impairment related to poor nutritional status, enhance physical endurance, and improve work performance, ultimately supporting both individual and institutional productivity. Based on this background, this study aims to further examine the relationship between physical fitness, sedentary behavior, nutritional status, and breakfast habits with work productivity among employees of the Central Java Regional Office of the Ministry of Religious Affairs.

METHODS

This study uses a quantitative approach with a cross-sectional design to examine the correlation between independent and dependent variables. The study was conducted at the Ministry of Religious Affairs of Central Java Province in August-September 2025 after obtaining approval from the Health Research Ethics Committee (KEPK) of Dr. Moewardi Hospital with number 1.612/VII/HREC/2025 issued on July 21, 2025. The samples in this study were obtained through purposive sampling and calculated using the Lameshow cross-sectional formula (17), resulting in a total of 101 people. The inclusion criteria used were employees aged > 18 years, while the exclusion criteria were: 1) not currently or regularly fasting, 2) currently pregnant, 3) having a history of cardiovascular disease, respiratory disease, and bone and joint disease.

After selection, participants were first given an explanation of the data collection procedure and provided with an informed consent form if they agreed to become respondents. Data collection was carried out using the following procedures: 1) respondents filled in their personal data, 2) data on work productivity and breakfast habits were collected using questionnaires, 3) body weight was measured using digital scales and height was measured using a stadiometer, 4) physical fitness was measured using a 5-minute step test (YMCA) (18), 5) Respondents were given the Sedentary Behavior Questionnaire (SBQ) to

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complete over the following week. The questionnaire instruments used to collect data on work productivity and breakfast habits were first tested for validity and reliability using Pearson's correlation test and Cronbach's Alpha (19). The work productivity questionnaire used a 1-4 Likert scale similar to the breakfast habits questionnaire but only contained scores of 1-3. The questionnaires for work productivity and breakfast habits were proven to be valid and reliable, with Cronbach's Alpha values of 0.868 and 0.941 (>0.60).

All variables were then categorized into 3 groups based on their respective scores. Work productivity was categorized into three levels: good (54-72), moderate (36-53), and poor (18-35). Breakfast habits were categorized similarly to work productivity: good (31-39), fair (22-30), and poor (13-21). Physical fitness is categorized as good, adequate, or poor, with scores adjusted for the respondent's gender and age. Sedentary habits were categorized as high (≥35 hours/week), moderate (≥22-35 hours/week), and low (<21 hours/week). Nutritional status was categorized into three groups based on body mass index: overweight (>25.1), normal weight (18.5–25), and underweight (<17–18.4).

The data was then processed using SPSS to examine the relationship between independent and dependent variables using Somer's D test (20), followed by multivariate analysis using ordinal logistic regression (21) to determine which independent variables had the strongest relationship with work productivity. The results of data processing were considered significant if the p-value was <0.05.

CODE OF HEALTH ETHICS

Ethical approval for this study was obtained from the Health Research Ethics Committee of Dr. Moewardi Hospital (No. 1.612/VII/HREC/2025) on July 21, 2025.

RESULTS

Table 1 presents the characteristics of the respondents. The majority of respondents were adults aged 19–44 years (65.3%), with males accounting for 57.4% of the respondents. Most respondents earned incomes above the regional minimum wage (64.4%). Additionally, the majority had a length of service of ≥5 years (63.4%). Most respondents were non-smokers (80.2%) and reported engaging in regular physical exercise (83.2%). Accordingly, the majority demonstrated good physical fitness (41.6%). With regard to sedentary behavior, a high level was observed among most respondents (96%). The majority of respondents tended to have good breakfast habits (59.4%). In terms of nutritional status, the majority of respondents (52.5%) had a higher nutritional status, and a significant proportion (41.6%) reported good work productivity.

Table 1. Characteristics of Respondents

Characteristics	n	%
Age (years)		
Adult (19-44)	66	65,3
Pre-elderly (45-59)	34	33.7
Sex		
Male	58	57.4
Female	43	42.6
Wages		
> Regional minimum wage	65	64.4
Regional minimum wage	27	27
< Regional minimum wage	9	8.9
Years of service		
< 5 years	37	36.6
≥ 5 years	64	63.4
Smoking habits		
Yes	20	19.8
No	81	80.2
Exercise		
Yes	84	83.2
No	17	16.8
Physical fitness		
Good	42	41.6
Moderate	28	27.7

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Characteristics	n	%
Poor	31	30.7
Sedentary behavior		
High	97	96
Moderate	4	4
Low	-	-
Breakfast habits		
Good	60	59.4
Moderate	23	22.8
Poor	18	17.8
Nutritional status		
Overweight	53	52.5
Normal	45	44.6
Underweight	3	3
Work productivity		
Good	42	41.6
Moderate	31	30.7
Poor	28	27.7

Table 2 shows the cross-tabulation between respondent's characteristics and work productivity levels. Among respondents with good work productivity, most respondents show good physical fitness (18.2%), high sedentary behavior (38.6%), normal nutrition status (21.8%), and good breakfast habits (31.7%). In the moderate productivity group, most respondents show good physical fitness (14.8%), high sedentary behavior (31%), overweight nutritional status (17.8%), and good breakfast habits (17.8%). Meanwhile, in the poor work productivity group, most respondents show poor physical fitness (15.8%), high sedentary behavior (26.7%), overweight nutritional status (16.8%), and poor breakfast habits (12.9%).

Table 2. Frequency Distribution of Respondents Characteristics Based on Work Productivity

Characteristics	Work Productivity					
	Good		Moderate		Poor	
	n	%	n	%	n	%
Physical fitness						
Good	19	18.2	15	14.8	8	7.9
Moderate	17	16.8	7	6.9	4	4
Poor	6	5.9	9	8.9	16	15.8
Sedentary behavior						
High	39	38.6	31	30.7	27	26.7
Moderate	3	3	-	-	1	1
Low	0	-	0	-	0	-
Nutritional status						
Overweight	18	17.8	18	17.8	17	16.8
Normal	22	21.8	13	12.8	10	9.9
Underweight	2	2	0	-	1	1
Breakfast habits						
Good	32	31.7	18	17.8	10	9.9
Moderate	8	7.9	10	9.9	5	4.9
Poor	2	2	3	3	13	12.9

Table 3 indicates that physical fitness productivity ($p = 0.009$) and breakfast habits ($p = 0.001$) was significantly associated with work. Meanwhile sedentary behavior and nutritional status were not significantly associated with work productivity ($p > 0.05$).

Table 3. Bivariate Analysis

Variables	d	p-value
Physical fitness	0.228	0.009*
Sedentary behavior	-0.268	0.395
Nutritional status	-0.165	0.113
Breakfast habits	0.389	0.001*

*Significant (Somers' D test ($p<0.05$))

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Table 4 shows that age (p = 0.006) and years of service (p = 0.020) were significantly associated with work productivity. The correlations between age and years of service with work productivity were very weak and negative, indicating that higher age and longer years of service were associated with lower levels of work productivity.

Table 4. Bivariate Analysis of Respondents Characteristics with Work Productivity

Variables	r	p-value
Sex[a]	-0.025	0.801
Smoking habits[a]	0.007	0.945
Exercise[a]	-0.021	0.837
Years of service[a]	-0.232	0.020*
Age[a]	-0.274	0.006*
Wage[b]	0.157	0.154

*Significant (a = Spearman Rank (p<0.05); b = Somers'D (p<0.05))

Based on bivariate analysis, there were three independent variables and three confounding variables that met the criteria for multivariate testing (p < 0.25), namely physical fitness, nutritional status, and breakfast habits, as well as age, salary, and length of service (22). Table 5 shows that physical fitness (p=0.036), breakfast habits (p=0.001), and nutritional status (p=0.036) are related to work productivity. The Cox & Snell R^2 value shows that breakfast habits, physical fitness, and nutritional status explained 26% of the variation in work productivity, while the remaining 74% was explained by other factors not included in the model. Based on the estimated coefficients, physical fitness (0.502) and breakfast habits (0.984) showed positive associations with work productivity, whereas nutritional status (-0.786) showed a negative association. The difference results between bivariate and multivariate analysis on nutritional status may be attributed to confounding effects. When analyzed simultaneously, the influence of other variables was controlled, allowing the independent effect of each variable to become more apparent (17).

This suggests that better physical fitness and breakfast habits are associated with higher work productivity, while poorer nutritional status is associated with lower work productivity. Among the three variables examined, breakfast habits exhibited the highest coefficient, indicating the strongest association with work productivity. Furthermore, based on the Odds Ratio values calculated using the Exp(B) formula, showed that respondents with good breakfast habits were 2.675 times more likely to have good work productivity compared to those with poor breakfast habits. Meanwhile, good physical fitness increased the likelihood of good work productivity by 1.652 times, whereas suboptimal nutritional status was associated with lower odds of good work productivity (OR = 0.456).

Table 5. Multivariate Analysis of Independent & Confounding Variables

Variables	Estimate (B)	OR	Sig (p-value)	95% CI (lower-upper bound)		Cox and Snell
Independent Variables						
Physical fitness	0.502	1.652	0.036*	0.033	0.971	
Nutritional status	-0.786	0.456	0.041*	-1.539	-0.033	
Breakfast habits	0.984	2.675	0.001*	0.425	1.542	
Confounding Variables						0.260
Age	-0.232	0.793	0.631	-1.179	0.715	
Years of service	-0.430	0.651	0.411	-1.454	0.595	
Wage	0.071	1.074	0.848	-0.651	0.792	

*significant (Ordinal Logistic Regression (p<0,05)).

DISCUSSION

This study found that the mean work productivity score of respondents was 50.52 ± 15.01, indicating an adequate (moderate) level of productivity. Work productivity is influenced by various internal and external factors (4). In this study, several internal factors were examined, including physical fitness, sedentary behavior, nutritional status, and breakfast habits, as well as age, length of service, and other individual characteristics among employees of the Ministry of Religious Affairs in Central Java Province.

https://doi.org/10.56303/jhnresearch.v5i2.1336

This study focused on analyzing the relationships between these factors and employee work productivity.

Physical Fitness and Work Productivity

This study found that physical fitness was positively associated with work productivity in both bivariate and multivariate analyses, indicating that better physical fitness is linked to higher work productivity. This finding is consistent with a study in 2024, which reported a significant relationship between physical fitness and work productivity. In 4.0 industry era, work demands emphasize efficiency, requiring employees to maintain optimal physical conditions to perform daily tasks effectively without excessive fatigue, in other words, to have good physical fitness (15). Good physical fitness can be achieved through regular physical activity according to age group. For adults, such as the respondents in this study, a minimum of 150-300 minutes of moderate-intensity exercise per week is recommended (22). Good physical fitness supports cognitive function and psychological well-being through hormonal regulation, which contributes to improved work performance. Regular physical activity improves hypothalamic function in regulating the body's stress response through hormonal mechanisms, such as reducing cortisol levels, optimizing catecholamines, and restoring the balance of leptin and ghrelin (16). In addition, physical activity stimulates the release of neurotransmitters that enhance psychological resilience to stress, thereby supporting work performance (23).

During physical activity, heart rate increases, leading to higher oxygen demand and improved blood circulation, which optimizes the delivery of oxygen and nutrients to the brain. Adequate oxygen and nutrient supply delivered to the brain enhances cognitive functions such as concentration, allowing the brain to function more effectively (10). A study in 2022 reported that individuals with higher physical fitness, assessed through aerobic performance tests (running 1000-1200 meters and vertical jumps) demonstrated longer concentration capacity compared to those with lower fitness levels (23). Cardiorespiratory endurance resulting from aerobic exercise is known to be associated with brain health, oxygen levels in the prefrontal cortex, nervous system function, neurogenesis, and neurotrophic regulation, which contribute to improving cognitive function (24).

In addition, smoking is also one of the factors that may affect physical fitness. This study also shows that 81 out of 101 respondents were non-smokers, which may contribute to better overall physical fitness among the study population. Carbon monoxide contained in cigarette smoke has a higher affinity for hemoglobin than oxygen, thereby reducing oxygen transport in the bloodstream, also damage the inner lining of blood vessels, and promote the accumulation of fatty deposits within the vascular walls, which may lead to vascular obstruction (25). As a result, individuals who smoke may experience reduced aerobic capacity and fatigue more easily during physical activity due to decreased VO_2max. 66 out of the 101 respondents were within the productive adult age range (19-44 years) that is related to the decline in physical function with age, which is followed by a decrease in the ability to carry out activities and work. This decline in physical function usually occurs between the ages of 30 and 40 at a rate of 0.8-1% per year, due to a decreased organ function and reduced efficiency of oxygen transport (26)(27)(28). This indicates that good physical fitness can optimize cognitive function through blood circulation in the brain that transports oxygen and nutrients, enabling the brain to work optimally and helping to regulate emotions and psychological stress through the hormonal system, enabling employees to work efficiently and ultimately improving work productivity, but also affected by other factors (29).

Sedentary Behavior and Work Productivity

This study found no significant association between sedentary behavior and work productivity, which is consistent with findings reported in 2022, which also reported no significant relationship between sedentary behavior and work productivity. The study further explains that office workers with shorter sitting durations tended to have higher job satisfaction and lower fatigue levels compared to those with prolonged sitting time. Workers who spent less than 75% of their working hours sitting also demonstrated higher productivity levels (13). Nearly all respondents (96%) in this study had high sedentary behavior due to work activities such as prolonged computer use, attending meetings, and participating in administrative tasks, which typically required sitting for approximately eight hours per day. This lack of

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variability in sedentary behavior may have contributed to the absence of a significant relationship with work productivity.

The results of this study also indicated that most respondents engaged in regular physical activity despite having high sedentary behavior due to work demands. The lack of a significant relationship between sedentary behavior and work productivity may be influenced by other factors, such as age and years of service. In this study, both age and length of service were significantly associated with work productivity, with negative correlation coefficients and the average age of respondents was approximately 40 years old, and years of service was 11.5 years. The negative relationship suggests that increasing age and longer years of service are related to decreased work productivity. As age increases, physical and cognitive functions also decline compared to younger workers, even though they are still in their productive age (30). Younger workers are considered to have stronger physiques and better cognitive functions, enabling them to work faster and maximize their work output (30). Meanwhile, longer years of is often associated with repetitive and monotonous work tasks, which may contribute to job boredom and work-related stress. Both age-related physical decline and prolonged exposure to routine work demands may negatively affect work productivity (31).

Nutritional Status and Work Productivity

In this study, no significant association was observed between nutritional status and work productivity in the bivariate analysis. However, a significant relationship emerged in the multivariate model after adjustment for other variables. The lack of a significant association in the bivariate analysis may be influenced by the high level of sedentary behavior among respondents. High levels of sedentary behavior and insufficient physical activity reduces the body's energy expenditure, leading to an accumulation of unused energy. If this excess energy intake is not balanced with adequate physical activity, it may contribute to the development of obesity over time due to energy is stored in the body as fat (32). Nevertheless, nutritional status emerged as a significant predictor in the multivariate model after adjustment for other independent and confounding variables that met the bivariate inclusion criteria ($p < 0.25$). The difference results may be attributed to confounding effects. When analyzed simultaneously, the influence of other variables was controlled, allowing the independent effect of each variable to become more apparent (17). Workers with optimal nutritional status tend to have better work capacity and physical endurance (6). In line with the research in 2021 (33), which explains that nutritional status is linked to work productivity, as working in a state of good and optimal nutrition can maximize work capacity and build strong physical resilience, as well as enhance cognitive ability to work more diligently and with greater enthusiasm (6). Workers with suboptimal nutritional status tend to be more susceptible to health problems, both those with undernutrition and those with overnutrition will experience a decline in productivity (34). This occurs due to a decline in their ability to complete their work, both physically and cognitively (6).

These finding also in line with a study conducted 2023 (7), which involved office workers with similar work characteristics to those in the present study and also reported that nutritional status was significantly associated with work productivity. Their study explained that workers with overweight or undernutrition experienced decreased efficiency due to health limitations caused by non-ideal nutritional status (7). In this study, respondents predominantly performed sedentary work activities, such as sitting in front of computers or attending meetings throughout the day, which did not require high physical exertion. However, the majority of respondents in this study reported engaging in regular physical activity outside working hours by exercising, which may contribute to a better physical fitness. Adequate physical fitness supports optimal physiological and cognitive functions, so productivity remains high even though the respondents do not have optimal nutritional status thereby helping to maintain work productivity even among individuals with suboptimal nutritional status (16)(24)(35). Performing work with good and optimal nutrition can maximize work capacity and create good physical endurance. Supported by a balanced nutritional intake, it can support optimal cognitive function. Workers with suboptimal nutritional status tend to be more prone to health problems, whether they are under- or over-nourished, which will

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result in decreased productivity. This occurs due to a decline in their ability to complete their work, both physically and mentally (33)(6).

Maintaining an optimal nutritional status remains important for supporting overall health and institutional productivity, as poor nutritional status may increase the risk of health problems that ultimately impair work performance. Suboptimal nutritional status over a long period will cause a decline in health and physical condition, which may reduce work efficiency and ultimately decrease productivity. (36).

Breakfast Habits and Work Productivity

This study found that breakfast habits are significantly associated with work productivity, consistent with the findings conducted in 2023 (7). The multivariate analysis also indicated that breakfast habits had the strongest association with work productivity among the studied variables as consuming breakfast in the morning plays an important role in supporting physiological and cognitive functions after the overnight fasting period. Adequate nutrient supply to the brain contributes to improved cognitive performance and concentration, thereby enabling employees to work more efficiently and productively. A balanced breakfast is recommended to provide approximately 25% of daily energy requirements, equivalent to around 500 kcal for adults (34)(37). Adequate and balanced breakfast intake is essential for workers to maintain concentration and optimize cognitive function. Insufficient breakfast consumption or skipping breakfast altogether may lead to energy deficiency, as the body has not received nutritional intake after the overnight fasting period, resulting in fatigue and reduced concentration (38). After a period of overnight fasting, glycogen stores in the liver decrease along with blood glucose levels. Consuming breakfast plays a key role in restoring glucose availability and rebuilding glycogen reserves, thereby supporting optimal brain energy needs (39). In addition, skipping breakfast may increase the tendency to consume high-calorie snacks as a compensatory behavior to replenish energy. This pattern not only negatively affects cognitive performance but may also contribute to suboptimal nutritional status if sustained over time. Conversely, excessive breakfast consumption may cause discomfort, sluggishness, drowsiness, and decreased concentration levels, which can also impair work performance (38).

The immediate effect of eating breakfast is to provide energy after fasting during sleep at night. Meanwhile, the long-term effect is a balance of energy intake and distribution that affects cognitive function and other metabolic functions, including hunger regulation and concentration improvement (40). A study conducted in 2025 reported that higher cognitive test scores among individuals who consumed breakfast compared to those who skipped it. ood quality plays a crucial role in linking breakfast habits to work productivity (41). A nutritionally balanced breakfast can enhance concentration, processing speed, and memory. Macronutrients, particularly fats, are essential for optimal brain function. Fatty acids such as polyunsaturated fatty acids (PUFAs) and monounsaturated fatty acids (MUFAs) contribute to the regulation of neuronal structure and function, as well as endothelial and glial cell activity in the brain (42). PUFAs, in particular, help maintain cognitive function and reduce the risk of cognitive decline through their anti-inflammatory and antithrombotic properties, while inadequate PUFA intake has been associated with memory impairment (42). Micronutrients such as iron also play an important role in cognitive performance. Iron supports hemoglobin formation, facilitating oxygen transport to the brain, and iron deficiency can disrupt neurophysiological metabolism, leading to impaired concentration and memory (42). Therefore, consuming a balanced breakfast is essential to support cognitive function and maintain optimal energy levels, which in turn can enhance work productivity. These findings suggest that regular and nutritionally adequate breakfast consumption may play a key role in sustaining cognitive readiness and performance during working hours.

Overall, the results of multivariate analysis show that breakfast habits have the strongest relationship with work productivity. Good breakfast habits contribute to higher productivity through balanced nutritional intake, which optimally supports cognitive function and influences nutritional status. In contrast, poor breakfast habits may lead to suboptimal nutritional status, either due to insufficient intake or excessive and unbalanced intake, ultimately reduces work productivity. Meanwhile, nutritional status is also influenced by other factors, particularly physical activity. Regular physical activity or exercise helps

https://doi.org/10.56303/jhnresearch.v5i2.1336

balance the body's energy reserves, thereby maintaining optimal nutritional status and supporting cognitive function through the transport of oxygen carried by hemoglobin throughout the body, including the brain. Therefore, efforts to increase work productivity can be made through health and nutrition. This study as limited by the use of the step test method in collecting physical fitness data, which only examines endurance due to field conditions and the use of questionnaires to measure work productivity, rather than objective indicators such as work output or attendance records. This approach was adopted because access to individual employee performance data was restricted by institutional policies.

CONCLUSION

Bivariate analysis shows that physical fitness and habits are significantly associated with work productivity among employees of the Ministry of Religious Affairs in Central Java Province. Meanwhile, multivariate analysis shows that physical fitness, nutritional status, and breakfast habits were related to work productivity, with breakfast habits demonstrating the strongest association. Based on the findings of this study, it is recommended for employees to improve their lifestyle by consuming nutritionally balanced meals according to daily needs, particularly by maintaining regular and adequate breakfast habits to support work performance, also recommended for the institution to implement regular and periodic health screenings to maintain employees' optimal physical condition. In addition, workplace interventions such as the provision of standing desks and scheduled stretching breaks are recommended to reduce prolonged sedentary behavior and support work performance and productivity. This should be balanced by engaging in physical activity appropriate to individual physical capacity and age in order to maintain optimal nutritional status and bodily functions. Future studies are suggested to apply additional physical fitness assessment methods, such as measurements of muscle strength and flexibility and to use longitudinal or retrospective cohort study designs to better examine causal relationships.

DECLARATION OF THE USE OF AI

The authors declare that no artificial intelligence (AI), AI-assisted technologies, or large language models (LLMs) were used in the conception of the study, data analysis, or the drafting, writing, and editing of this manuscript. The only exception is the graphical abstract, which was created using the design platform Illustrae (https://illustrae.co/). The authors take full responsibility for the content and accuracy of the graphical abstract and the entire manuscript.

FUNDING

This research received no external funding.

ACKNOWLEDGMENTS

The authors would like to express their sincere gratitude to the Ministry of Religious Affairs of Central Java Province for granting permission to conduct this research. The authors also extend their appreciation to all employees who willingly participated as respondents in this study.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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