



Differences in Lactic Acid Levels Before and After Administration of Red Ginger Herbal Drink in Palm Oil Harvesters Experiencing Fatigue at PT. Tasma Puja Kampar

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Abstract

Keywords:

Lactic Acid,
Red Ginger,
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Physical work fatigue is a significant problem in the palm oil plantation sector, characterized by decreased physical performance that may increase the risk of occupational accidents. Intensive physical activity among palm oil plantation workers can elevate lactic acid levels, which contribute to muscle fatigue. Red ginger is known to contain gingerol and shogaol, powerful antioxidants that help reduce oxidative stress, thereby accelerating muscle recovery and lactic acid metabolism. However, no previous research has demonstrated the effectiveness of red ginger in reducing lactic acid levels among palm oil plantation workers. This study aimed to analyze the differences in lactic acid levels before and after the administration of a red ginger herbal drink in palm oil harvesters experiencing work-related fatigue at PT. Tasma Puja Kampar. This study employed a quasi-experimental design with a one-group pretest-posttest approach. The sample was obtained using total sampling from a population of 138 palm oil harvesters, with 57 respondents meeting the inclusion criteria. Lactic acid levels were measured before and 30 minutes after the intervention using the Accutrend Plus device. Data were analyzed using the non-parametric Wilcoxon Signed-Rank test. The findings revealed a decrease in mean lactic acid levels following the administration of the red ginger herbal drink by 0.78 mmol/L. Prior to the intervention, the mean lactic acid level was 2.75 mmol/L, which decreased to 1.97 mmol/L after the intervention. Statistical analysis indicated a significant difference with a p-value = 0.000. The administration of red ginger herbal drink was found to be significantly effective in reducing lactic acid levels among palm oil harvesters experiencing work-related fatigue. This intervention has the potential to serve as a natural solution for managing work fatigue caused by lactic acid accumulation in labor-intensive environments.

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INTRODUCTION

Occupational Safety and Health (OSH) is a crucial aspect of the workplace to protect workers from accidents and occupational diseases. One of the most common health problems experienced by workers

engaged in heavy physical activity, such as palm oil harvesters, is work-related fatigue. Work fatigue not only reduces productivity but also represents a major cause of workplace accidents, accounting for approximately 60% of such incidents.

Physiologically, work fatigue occurs due to the accumulation of lactic acid in muscle tissue. Lactic acid is a byproduct of the anaerobic glycolysis process, in which the body converts carbohydrates into energy in the absence of sufficient oxygen. Prolonged and intensive physical activity, as performed by palm oil harvesters, triggers anaerobic metabolism, leading to increased production and buildup of lactic acid in the muscles, which in turn causes pain and fatigue.

One effort to reduce fatigue is through the intervention of consuming red ginger herbal drinks. Red ginger (*Zingiber officinale* var. *rubrum*) is known to contain active compounds such as gingerol and shogaol, which have antioxidant and anti-inflammatory properties. These compounds can help improve blood circulation, increase oxygen supply to the muscles, and stimulate lactic acid excretion through sweat, thereby reducing fatigue. Therefore, this study aims to analyze the profile of lactic acid levels among palm oil harvesters experiencing work-related fatigue and to determine the effect of red ginger herbal drink administration on reducing these lactic acid levels.

METHOD

This study employed a quasi-experimental method with a one-group pretest–posttest design. The research was conducted in August 2024 at PT. Tasma Puja, Kampar Regency, Riau.

Population and Sample

The study population consisted of all palm oil harvesters at PT. Tasma Puja Kampar, totaling 138 individuals. Sampling was carried out using the total sampling technique, resulting in 58 respondents who met the inclusion criteria and agreed to participate. Inclusion criteria included registered palm oil harvesters who were willing to participate and experienced moderate to very high levels of work-related fatigue based on the IFRC questionnaire. Exclusion criteria were a history of red ginger allergy, hypertension, or diabetes.

Research Procedure

A total of 57 respondents were involved. After completing their work, respondents' fatigue levels were measured using the IFRC questionnaire, followed by an initial measurement of lactic acid levels (pretest) through capillary blood samples using the Accutrend Plus device (Roche). The experimental group was given 100 ml of red ginger herbal drink, while the control group received 100 ml of herbal drink without red ginger. After 30 minutes, lactic acid levels were measured again (posttest) in both groups.



Figure 1. Accutrend Plus Lactic Acid Meter, Roche Brand

Data Analysis

Data were analyzed using SPSS version 25. Normality testing was performed with the Kolmogorov-Smirnov test. Since the data were not normally distributed, bivariate analysis was conducted using the non-parametric Wilcoxon Signed-Rank Test to compare pretest and posttest data within each group.

RESULT AND DISCUSSION

Respondent Characteristics

The majority of respondents in both groups were within the productive age range, had more than five years of work experience, and reported smoking habits. Most respondents had a normal nutritional status. Detailed characteristics of the respondents are presented in Table 1.

Table 1. Characteristics of Research Respondents

Age Characteristics (Years)	Experimental Group n (%)
17-25	2 (3.5%)
26-35	26 (45.6%)
36-45	27 (47.4%)
46-55	2 (3.5%)
Length of Service	
≤5 Years	3 (5.3%)
>5 Years	54 (94.7%)
Smoking Habits	
Smoking	55 (96.5%)
Non-Smoking	2 (3.5%)
Nutritional Status	
Normal	51 (89.5%)
Thin	5 (8.8%)
Obese	1 (1.8%)

Work Fatigue Level

The majority of workers in the experimental group experienced very high levels of work-related fatigue (45.6%).

Lactic Acid Levels

Before the intervention, there was no significant difference, with an average lactic acid level of 2.75 mmol/L. After the intervention, a greater reduction was observed, with the average lactic acid level decreasing to 1.97 mmol/L. Thus, it can be concluded that there was a difference in lactic acid levels of 0.78 mmol/L (Table 2).

Table 2. Average Lactic Acid Levels Before and After Treatment

Variable	N	Mean (mmol/L)	Min (mmol/L)	Max (mmol/L)	Std. Deviation
Before Treatment (Pretest)	57	2.75	1.20	4.50	0,746
After Treatment (Posttest)	57	1.97	1.40	2.80	0.336

Table 3. Kolmogorov Smirnov Normality Test

Lactic Acid Level Measurement	Sig
Pre test	0.004
Post tes	0.028

Table 4. Results of Lactic Acid Level Measurements Before and After Giving Red Ginger Herbal Drink

		N	Mean Rank
Post test experiment - pre test experiment	Negatives Rank	55 ^a	29.50
	Positive Ranks	2 ^b	15.25
	Ties	0 ^c	
	Total	57	

- a. Experimental posttest < experimental pretest
- b. Experimental posttest > experimental posttest
- c. Experimental posttest = experimental pretest

Table 5. Statistical Test of Lactic Acid Levels Before and After Red Ginger Herbal Drink Treatment

	Post Test Experiment - Pre Test Experiment
Z	-6.333
Asymp.Sig.(2 tailed)	0.000
a. Wilcoxon Signed Rank Test	
b. Based on positive ranks	

Bivariate Analysis

The Wilcoxon Signed-Rank test showed a significant difference in lactic acid levels before and after the intervention in both groups ($p = 0.000$), indicating that the red ginger herbal drink was effective in reducing lactic acid levels.

Discussion

The findings of this study demonstrate that the administration of red ginger herbal drink had a significant effect in lowering lactic acid levels among palm oil harvesters experiencing work-related fatigue. The mean reduction in lactic acid levels in the experimental group was 0.78 mmol/L.

This decrease can be explained by the bioactive compounds present in red ginger, particularly gingerol and shogaol. These compounds possess strong anti-inflammatory and antioxidant properties. Heavy physical activity performed by palm oil harvesters triggers oxidative stress and inflammation in the muscles, which contributes to lactic acid accumulation. The antioxidants in red ginger, such as flavonoids,

help neutralize free radicals, while its anti-inflammatory effects reduce inflammatory responses, thereby accelerating muscle recovery.

In addition, red ginger has been shown to improve blood circulation. Enhanced blood flow to the muscles allows for more efficient oxygen delivery. With better oxygen availability, the body becomes less dependent on anaerobic metabolism, which is the primary pathway for lactic acid production. Active compounds such as zingerone in red ginger are capable of dilating blood vessels, directly supporting this mechanism.

These findings are consistent with previous studies. Research conducted by Imam et al. (2020) and Black et al. also found that red ginger supplementation significantly reduced lactic acid levels and muscle soreness following intensive physical activity. The timing of the intervention—30 minutes after work—was also a critical factor, as it coincides with the golden hour of muscle recovery, during which lactic acid clearance is most optimal.

Although the control group, which consumed a herbal drink without red ginger (containing turmeric, cloves, cinnamon, cardamom, and palm sugar), also showed a slight reduction in lactic acid levels, the effect was not as pronounced as in the red ginger group. This suggests that other components in the control drink may have limited effects in lowering lactic acid compared to red ginger. Palm sugar in the control beverage may provide a quick energy source but does not directly address lactic acid accumulation.

CONCLUSION

Based on the findings of this study, it can be concluded that the administration of red ginger showed a significant difference in lactic acid levels before and after the intervention in each group ($p = 0.000$). The red ginger herbal drink has the potential to serve as an effective and natural non-pharmacological intervention for managing work-related fatigue associated with lactic acid accumulation among workers engaged in heavy physical activity.

REFERENCES

- Adiratna, Y., Astono, S., Fertiaz, M., Subhan, Sugistria, C. A. O., Prayitno, H., Khair, R. I., Brando, A., & Putri, B. A. (2022). Profil Keselamatan dan Kesehatan Kerja Nasional Indonesia Tahun 2022. Kementerian Ketenagakerjaan Republik Indonesia.
- Hidayah, I. (2018). Peningkatan Kadar Asam Laktat Dalam Darah Sesudah Bekerja. *The Indonesian Journal of Occupational Safety and Health*, 7(2).
- Iman Haritsah, F. (2023). Kelelahan Kerja dan Cara Mengatasinya. Kementerian Kesehatan Nasional.
- Mao, Q. Q., Xu, X. Y., Cao, S. Y., Gan, R. Y., Corke, H., Beta, T., & Li, H. Bin. (2019). Bioactive compounds and bioactivities of ginger (*zingiber officinale roscoe*). *Foods*, 8(6), 1-21.
- Mashadi NS, Ghiasvand R, G, A., M, H., L, D., & Mofid MR. (2013). Anti-Oxidative and Anti-Inflammatory Effects of Ginger in Health and Physical Activity: Review of Current Evidence. *International Journal of Preventive Medicine*.
- Prasetyo, D. B., Setyaningsih, Y., Suhartono, & Suroto. (2023). Individual, Habits, and Work Environment Factors Associated With Blood Lactic Acid Levels in Roof Tile Manufacturing Workers. *Malaysian Journal of Public Health Medicine*, 23(1), 253-260.
- Redi Aryanta, I. W. (2019). Manfaat Jahe Untuk Kesehatan. *Widya Kesehatan*, 1(2), 39-43.
- Restuputri, D. P., Achmad, R. U., Lukman, M., & Masudin, I. (2021). Analysis of Work Posture Using the Muscle Fatigue Assessment (MFA) and Novel Ergonomic Postural Assessment (NERPA). *Jurnal*

Ilmiah Teknik Industri, 20(1), 9-20.

Safira, E. D., Pulungan, R. M., & Arbitera, C. (2020). Kelelahan Kerja pada Pekerja di PT. Indonesia Power Unit Pembangkitan dan Jasa Pembangkitan (UPJP) Priok. *Jurnal Kesehatan*, 11(2), 265.