ISSN 3123-9005

Laboratory Journal of Infectious Diseases

Homepage: https://jurnal.poltekkeskupang.ac.id/index.php/LJID

Kemenkes Poltekkes Kupang

Original Article

Correlation between Blood Lead and SGPT Levels in Parking Attendants in Kuanino Subdistrict, Kupang City

Winioliski L.O. Rohi Bire [1], Elisabet Christanti Kase [2], Agnes Rantesalu [3]

[1]Pharmacy Department, Citra Bangsa University, Kupang City, Indonesia
[2]Medical Laboratory Technology Study Program, Poltekkes Kemenkes Kupang, Kupang City, Indonesia
[3]Medical Laboratory Technology Study Program, Poltekkes Kemenkes Kupang, Kupang City, Indonesia

ARTICLE INFO

Article history:
Received 08 October 2025
Revised 25 October 2025
Accepted 15 November 2025

Keywords:
Blood lead levels
SGPT
Parking attendants

Corresponding author:
Winioliski L.O. Rohi Bire
Kupang City
winioliski@gmail.com

Doi:
https://jurnal.poltekkeskupang.ac.id/index.php/LJID/article/view/2390

ABSTRACT

Parking attendants are considered an occupational group at risk of exposure to environmental pollutants, including lead. Lead can enter the body through inhalation, ingestion, dermal contact, and ocular exposure. Chronic accumulation of heavy metals such as lead may induce hepatocellular damage, which can be reflected by increased serum glutamic pyruvic transaminase (SGPT) levels, a biochemical marker of liver injury. Elevated blood lead levels have been associated with hepatotoxic effects in several studies. This study aimed to analyze the correlation between blood lead levels and SGPT levels among parking attendants in Kuanino Subdistrict, Kota Raja District, Kupang City. An analytical observational study with a cross-sectional design was conducted using purposive sampling. Ten parking attendants were recruited. Data were obtained through interviews and laboratory examinations measuring blood lead levels and SGPT concentrations. The results showed that blood lead levels ranged from 29 µg/dL to 111 µg/dL, with a mean of 75,5 µg/dL, indicating markedly elevated levels compared to recommended safety thresholds and suggesting potential clinical risk. SGPT levels ranged from 10,2 U/L to 33,1 U/L, with a mean of 21,54 U/L. Pearson correlation analysis demonstrated no statistically significant correlation between blood lead levels and SGPT levels (p = 0,331). Future studies involving a larger sample size and additional liver function indicators are warranted to clarify this finding.

Introduction

Technological advancement accompanied by rapid population growth has led to an increasing demand for transportation, particularly land-based vehicles, including both two-wheeled and four-wheeled modes. Motor vehicle emissions contribute approximately 85% of ambient air pollution, with lead (Pb) identified as one of the major hazardous contaminants (Rachmawati et al., 2020). Lead released from vehicle combustion may enter the human body through dermal contact, inhalation, ingestion of contaminated food or beverages, and ocular exposure (Purwoko & Prastiwi, 2019). Consequently, outdoor occupational groups such as gas station attendants, street vendors, parking attendants, roadside cleaners, and waste collectors are at elevated risk of lead exposure due to continuous contact with polluted ambient air (Hikmah, 2024; Aryasa & Cahyaningrum, 2021).

Acute toxicity is relatively rare, whereas chronic toxicity is far more prevalent and typically develops when blood lead concentrations reach approximately 40–60 µg/dL. Pb exposure induces oxidative stress, impairs mitochondrial and cellular functions, and promotes lipid peroxidation, resulting in hepatocyte damage and

Citation: ....

increased serum liver enzyme levels. If not managed promptly, this condition may progress to a more severe state, presenting with symptoms such as persistent vomiting, encephalopathy, lethargy, delirium, seizures, and even coma (Flora, Gupta, & Tiwari, 2012). Hepatocellular injury results in the leakage of SGPT into the circulation, making this enzyme a sensitive biomarker of liver damage (Farihatun et al., 2020).

Previous studies have documented elevated blood lead concentrations among occupational groups exposed to air pollution. Kustiningsih, Fitriyanti, & Nurlailah (2017) reported that 13 out of 15 traditional food vendors exhibited blood lead levels exceeding the reference value of 20 µg/dL. Devitria, Sepryani, & Putri (2016) observed urinary lead concentrations ranging from 0,597 to 3,103 ppm among parking attendants at Pekanbaru Central Market, surpassing the normal limit of 0,15 ppm. Similarly, Sumba (2019) reported blood lead levels of 25 µg/dL among gas station attendants in Oesapa Subdistrict, Kupang City, exceeding recommended thresholds. Studies conducted among lead-mine workers have reported that chronic lead exposure is associated with a significant elevation in serum ALT levels, indicating hepatocellular injury. Furthermore, long-term occupational exposure to lead has been shown to increase serum transaminase enzyme levels (Firoozichahak et al., 2022). Collectively, these findings indicate that elevated blood lead levels and altered SGPT activity may occur across diverse outdoor occupational groups, including gas station attendants, drivers, workshop workers, street vendors, and parking attendants, identifying these populations as occupationally vulnerable (Tasya, 2018).

Parking attendants play a central role in managing and securing vehicles in high-traffic areas. Continuous exposure to motor vehicle emissions places them at increased risk of lead absorption, particularly in the absence of appropriate personal protective equipment (PPE), such as face masks (Devitria, Sepryani, & Putri, 2016). Kuanino Subdistrict, Kota Raja District, Kupang City, represents a commercial center characterized by dense traffic flow and active public transportation routes, conditions that potentially intensify ambient air pollution and occupational exposure among parking attendants. Therefore, this study aimed to investigate the relationship between blood lead levels and SGPT among parking attendants in Kuanino Subdistrict, Kupang City.

Methods

Study Design

This study employed an analytical observational design with a cross-sectional approach to examine the relationship between blood lead levels and SGPT among parking attendants in Kuanino Subdistrict, Kupang City. The study population consisted of all parking attendants in Kuanino Subdistrict, Kupang City, totaling 20 individuals. A sample of 10 participants was selected using purposive sampling based on predefined inclusion and exclusion criteria. The inclusion criteria were: willingness to participate, male sex, working duration of 8–12 hours per day, employment period exceeding one year, and being within productive age. The exclusion criteria included alcohol consumption, positive hepatitis B surface antigen (HBsAg) status, and working duration exceeding 12 hours per day.

Instruments and Materials

The instruments used in this study included laboratory glassware, oven, atomic absorption spectrophotometer (AAS; Agilent 200 AA), hot plate, Biosystem BA-200 analyzer, disposable syringes, tourniquets, dry cotton, 70% alcohol swabs, red-cap vacuum tubes, micropipettes, tube racks, yellow and blue tips, cool box, and centrifuge. The materials consisted of distilled water (aquades), nitric acid (HNO_3), perchloric acid ($HClO_4$), and Whatman filter paper.

Blood Sample Collection

Venous blood samples were collected from the median cubital vein free of lesions. A tourniquet was applied to the upper arm, and the participant was instructed to clench the fist. The puncture site was disinfected using 70% alcohol swabs. A sterile syringe was inserted at a 45° angle; once blood appeared in the needle hub, the angle was adjusted to approximately 30°, and 3 mL of blood was slowly withdrawn. The tourniquet was released, and dry cotton was applied while the needle was carefully removed. The puncture site was compressed and covered with adhesive tape. Blood samples were transferred into red-cap vacutainer tubes.

SGPT Measurement

SGPT levels were examined at the Laboratory of S.K. Lerik Hospital, Kupang City, using a Biosystem BA-200 automated analyzer in accordance with standard laboratory operating procedures. Results were expressed in U/L.

Determination of Blood Lead Levels Using AAS

One milliliter of blood sample was transferred into a glass beaker, followed by the addition of HNO_3 and $HClO_4$ in a 1:5 ratio. The mixture was heated on a hot plate at 250 °C until evaporation occurred. After cooling, the solution was filtered using Whatman No. 14 filter paper and diluted to 50 ml with distilled water in a volumetric flask. Lead concentration was determined using an Agilent 200 AA atomic absorption spectrophotometer at a wavelength of 283,53 nm.

Data Analysis

Collected data were recorded, tabulated, and statistically analyzed to evaluate the relationship between blood lead levels and SGPT. Normality testing was performed before correlation analysis. If the data were normally distributed (p > 0,05), Pearson correlation was applied; otherwise, Spearman correlation was used. A *p-value* < 0,05 was considered statistically significant.

Results

This study aimed to analyze the correlation between blood lead levels and SGPT levels among parking attendants in Kuanino Subdistrict, Kota Raja District, Kupang City. A total of 10 parking attendants who met the inclusion and exclusion criteria participated in this study. Ethical approval was obtained from the authorized ethics committee before data collection. Blood samples were first analyzed for SGPT at S.K. Lerik Regional Hospital, Kupang City, using a Biosystem BA-200 analyzer. Subsequently, the samples were prepared at the Chemical Laboratory of the Medical Laboratory Technology Program and analyzed for lead concentration at the Bioscience Laboratory of Nusa Cendana University.

Sample preparation was performed using the wet digestion method with a mixture of HNO_3 and $HClO_4$. Wet digestion involves heating organic or biological samples with strong oxidizing mineral acids, either singly or in combination, until organic components are decomposed and metals remain in inorganic form (Rosita & Widarti, 2018). This process aims to eliminate organic compounds and interfering metals in blood samples, enabling optimal determination of lead concentration. In this procedure, $HClO_4$ acts as a strong oxidizing agent that enhances the action of HNO_3 in decomposing blood samples until complete dissolution is achieved (Nasir, 2019). The digested solutions were subsequently analyzed using an Agilent 200 AA atomic absorption spectrophotometer (AAS) at a wavelength of 283,53 nm. The measured blood lead levels and SGPT values are presented in Table 1.

Table 1. Blood Lead Levels, SGPT and Respondent Characteristics

Sample Code	Working Hours (Hour)	Employment Duration (Years)	Age (Years)	SGPT Levels (U/L)	Blood Lead levels (µg/dL)
YA	12	10	54	33,1	67
BN	9	10	30	18,2	29
RL	12	4	32	13,5	52
HH	9	4	62	19,0	63
ASA	12	5	60	23,4	65
ASB	11	2	20	10,2	79
BD	10	20	64	39,4	83
IL	10	5	60	27,0	96
FW	10	3	38	18,5	110
HP	12	10	50	13,1	111
Average	10,7	7,3		21,54	75,5

As shown in Table 1, all participants had blood lead levels exceeding the recommended reference limit established by the Indonesian Ministry of Health (25 µg/dL), with a mean value of 75,5 µg/dL. Despite these elevated levels, Pearson correlation analysis demonstrated no statistically significant association between blood lead levels and SGPT (p = 0,331).

Discussion

Parking attendants represent a population with potential chronic exposure to traffic-related pollutants due to prolonged work duration in roadside environments (Susanto, Marsudi, & Irwadi, 2021). Elevated blood lead levels may be influenced by several factors, such as smoking habits, lack of personal protective equipment, environmental conditions, nutritional status, age and duration of exposure, all of which may contribute to interindividual variability in biological responses to toxicants (Ardillah, 2016; Putri et al., 2024).

The absence of a statistically significant correlation in this study may therefore be explained by several considerations. First, the small sample size (n = 10) limits statistical power and reduces the likelihood of detecting weak or moderate associations. Second, biological variability among individuals may influence hepatic responses to lead. Third, liver injury related to chronic toxic exposure may develop gradually and may require more sensitive biomarkers or longitudinal assessment to be detected.

Although no significant association was observed, this finding does not necessarily indicate the absence of hepatotoxic effects. Previous studies have shown that lead-induced liver injury may occur through mechanisms such as oxidative stress, disruption of cellular homeostasis, and inflammatory responses, which may not immediately be reflected in routine liver enzyme measurements (Belsty, Nebiyu, & Legesse, 2023; Fidiyatun, Setiani, & Suhartono, 2013; Yang et al., 2022).

Several limitations should be acknowledged. The small sample size limits generalizability and statistical sensitivity. Only one liver biomarker (SGPT) was assessed, whereas evaluation of hepatic function ideally includes multiple parameters. In addition, the cross-sectional design does not permit causal inference or assessment of long-term effects. Future studies with larger samples, longitudinal designs, and broader biomarker panels are recommended to clarify the relationship between chronic lead exposure and liver function.

Conclusions

This study found no significant correlation between blood lead levels and SGPT in Kuanino Subdistrict, Kupang City (p = 0,331). However, the markedly elevated blood lead levels observed suggest substantial occupational exposure and warrant further investigation using larger samples and additional liver function indicators.

Author contributions

WLORB, ECK, and AR contributed to the study's concept and design. ECK assisted with experimental studies and data acquisition. ECK managed the literature search, data analysis, and statistical analysis. All authors participated in manuscript preparation, with ECK and WLORB responsible for editing and review. All authors have read and agreed to the published version of the manuscript.

Acknowledgements

The authors would like to express their gratitude to Poltekkes Kemenkes Kupang.

Funding

There is no specific funding for this study.

Ethical approval statement

This research activity was approved by the Ethics Committee of the Kupang Health Polytechnic (Poltekkes Kemenkes Kupang) No.LB.02.03/1/0014/2023 and permitted by the local government of both NTT Province and Kupang District Nomor: Kec.KR.074/4/III/2023.

Conflicts of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Supplementary materials

No supplementary material available.

References

Ardillah, Y. (2016). Faktor Risiko Kandungan Timbal di Dalam Darah. *Jurnal Ilmu Kesehatan Masyarakat*, *7*(3), 150-155. https://doi.org/10.26553/jikm.2016.7.3.150-155

Aryasa, I. W. T., & Cahyaningrum, P. L. (2021). Analisis Kadar Timbal (Pb) dan Serum Glutamic Pyruvic Transaminase (SGPT) pada Pengemudi Ojek Online di Kota Denpasar, Bali. *The Journal of Muhammadiyah Medical Laboratory Technologist*, *4*(2), 170-180. https://doi.org/10.30651/jmlt.v4i2.7815

Belsty, T., Nebiyu, W., & Legesse, M. (2023). The Toxicological Effect of Lead on Liver Histology and Biochemical Parameters: a Systematic Review. *Journal of Liver Disease and Transplantation, 12*(1). https://doi.org/10.%204172/2325-9612.1000216

Devitria, R., Sepryani, H., & Putri, E. M. D. (2016). Identifikasi Timbal pada Urin Tukang Parkir yang Bekerja di Pasar Pusat Pekanbaru. *Jurnal sains dan teknologi laboratorium medik*, *1*(2), 23-29. DOI: 10.52071/jstlm.v1i2.11

Farihatun, A., Siti, E., Janah, N., Dewi, Y., & Edhiatmi, K. M. (2020). SGPT Levels (Serum Glutamic Pyruvat Transaminase) on Pil KB Contraception Acceptors. *Jur Kes STIKes Mu Cis*, *7*(2), 39-43. https://doi.org/10.52221/jurkes.v7i2.93

Fidiyatun, F., Setiani, O., & Suhartono, S. (2013). Hubungan Kadar Pb dalam Darah dengan Kejadian Gangguan Fungsi Hati pada Pekerja Peleburan Timah Hitam di Kabupaten Tegal. *Jurnal Kesehatan Lingkungan Indonesia*, *12*(2), 149-153. https://doi.org/10.14710/jkli.12.2.149%20-%20153

Firoozichahak, A., Rahimnejad, S., Rahmani, A., Parvizimehr, A., Aghaei, A., & Rahimpoor, R. (2022). Effect of Occupational Exposure to Lead on Serum Levels of Lipid Profile and Liver Enzymes: an Occupational Cohort Study. *Toxicology reports*, *9*, 269-275. https://doi.org/10.1016/j.toxrep.2022.02.009

Flora, G., Gupta, D., & Tiwari, A. (2012). Toxicity of Lead: a Review with Recent Updates. *Interdisciplinary toxicology*, *5*(2), 47-58. https://doi.org/10.2478/v10102-012-0009-2

Hikmah, A. M. (2024). Analisis Tingkat Pengetahuan Keracunan Timbal (Pb) dan Karbon Monoksida (CO) dengan Kadar Hemoglobin pada Pekerja Luar Ruangan. *Jurnal Kesehatan Amanah*, *8*(2), 62-70. https://doi.org/10.57214/jka.v8i2.656

Kustiningsih, Y., Fitriyanti, N., & Nurlailah, N. (2017). Kadar Logam Timbal (Pb) dalam Darah Penjual Klepon. *Medical Laboratory Technology Journal*, *3*(2), 47-52. https://doi.org/10.31964/mltj.v3i2.168

Nasir, M. (2019). *Spektrofotometri Serapan Atom*. Syiah Kuala University Press. Retrieved from: https://uskpress.usk.ac.id/spektrometri-serapan-atom-m-nasir/

Purwoko, D., & Prastiwi, D. E. (2019). Pengaruh Lokasi dan Waktu Pengukuran Sumber Bergerak (Kendaraan) Dengan Kandungan Timbal (Pb) pada Udara Underpass di Simpang Lima Mandai Kota Makassar. *Sulolipu: Media Komunikasi Sivitas Akademika dan Masyarakat*, *17*(2), 39-47. DOI: 10.32382/sulolipu.v17i2.825

Putri, M. P., Purnadianti, M., Prodyanatasari, A., Agustina, N., & Nelson, A. D. (2024). Hubungan Kadar Timbal (Pb) dengan Kadar hemoglobin (Hb) dalam Sampel Darah Petugas Sampah TPS Bandar Lor Kota Kediri. *Jurnal Wiyata: Penelitian Sains dan Kesehatan*, *11*(2), 137-142. https://doi.org/10.56710/wiyata.v11i2.826

Rachmawati, N., Anliza, S., Hilya, H., Lestari, S. I., & Novita, N. (2020). Penentuan Kadar Logam Timbal pada Rambut Supir Bus Rute Tangerang-Padang-Surabaya-Yogyakarata di Terminal Poris Tangerang. *JPP (Jurnal Kesehatan Poltekkes Palembang)*, *15*(2), 73-79. https://doi.org/10.36086/jpp.v15i2.531

Rosita, B., & Widiarti, L. (2018). Hubungan Toksisitas Timbal (Pb) Dalam Darah dengan Hemoglobin Pekerja Pengecatan Motor Pekanbaru. *Prosiding Seminar Kesehatan Perintis, 1*(1). https://jurnalupertis.com/index.php/PSKP/article/view/64

Sumba, I. H. (2019). Analisis Kadar Logam Timbal (Pb) dalam Darah Petugas Stasiun Pengisian Bensin Umum (SPBU) Kelurahan Oesapa Kota Kupang. *(DIII) Karya Tulis Ilmiah*, Poltekkes Kemenkes Kupang. Retrieved from: http://repository.poltekeskupang.ac.id/id/eprint/1883

Susanto, Z. A., Marsudi, L. O., & Irwadi, D. (2021). Penyuluhan Kesehatan dan Pemeriksaan Kadar Hemoglobin pada Penyapu Jalanan. *Jurnal Pengabdian Masyarakat Teknologi Laboratorium Medik Borneo*, *1*(1), 21-24. https://doi.org/10.35728/abd_mlt.v1i1.830

Tasya, Z. (2018). Analisis Paparan Timbal (PB) pada Petugas Stasiun Pengisian Bensin Umum (SPBU) CV. Arba di Kota Palu. *Media Publikasi Promosi Kesehatan Indonesia (MPPKI)*, *1*(3), 118-124. https://doi.org/10.56338/mppki.v1i3.315

Yang, C., Li, Y., Ding, R., Xing, H., Wang, R., & Zhang, M. (2022). Lead Exposure as a Causative Factor for Metabolic Associated Fatty Liver Disease (MAFLD) and a Lead Exposure Related Nomogram for MAFLD Prevalence. *Frontiers in public health*, *10*, 1000403. https://doi.org/10.3389/fpubh.2022.1000403