

# Physical Activity and Its Association with Blood Glucose Levels

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## Abstract

Regular physical activity plays an important role in glucose metabolism and the maintenance of healthy blood glucose levels. This study examines the association between physical activity and blood glucose levels among adults. Physical activity is assessed based on frequency, duration, intensity, and participation in activities such as walking, exercise, sports, and routine daily movement. Blood glucose status is evaluated using fasting or routine glucose measurements and related metabolic indicators. The findings suggest that individuals who engage in regular physical activity tend to have better blood glucose control than those with low activity levels. Physical inactivity and prolonged sedentary behavior may contribute to impaired glucose regulation and increased risk of metabolic disorders. Regular exercise may improve insulin sensitivity, support weight management, and promote healthier glucose utilization. The study emphasizes the importance of encouraging consistent physical activity as part of preventive strategies for maintaining metabolic health and reducing diabetes-related risk among adults.

**Keywords:** Physical activity; Blood glucose; Insulin sensitivity; Diabetes prevention; Metabolic health.

## 1. Introduction

Enterprise applications depend on reliable diagnostics to detect runtime errors, failed workflows, API issues, slow transactions, and integration faults [1-5]. Logs are the main evidence source for understanding what happened before, during, and after an incident [6-9]. Effective application diagnostics require structured logging, traceability, contextual metadata, error classification, and operational visibility [10-15]. However, fixed logging strategies often create two problems. Low-detail logs may miss important causes [16-19], while high-detail logs may generate excessive storage cost and alert noise [20-23].

The main challenge is that diagnostic needs change during runtime. A normal transaction may require only basic logs, but a failing workflow, repeated exception, or security-sensitive event may need deeper traces [24-28]. Adaptive logging improves this process by changing log depth according to system condition, transaction risk, and error behavior [29-32]. AI-assisted monitoring can identify when additional diagnostic detail is needed and when logging can return to normal levels [33-35]. This article proposes an adaptive logging framework for enterprise application diagnostics.

## 2. Methodology

The proposed framework captures log metadata from application servers, API gateways, databases, background jobs, authentication modules, and integration services [36-40]. It records event type, severity, timestamp, user role, transaction ID, request path, error frequency, response time, affected component, and workflow state [41-45]. These features are converted into diagnostic context profiles. Adaptive logging requires context because the same event may be low-risk in one workflow but critical in another [46-49].

The logging controller classifies runtime states as normal, warning, error-prone, performance-risk, security-sensitive, workflow-critical, or incident-active [50-54]. Based on this classification, it adjusts log level, trace depth, parameter capture, correlation ID tracking, and diagnostic enrichment. Lightweight scoring and policy rules are used so logging decisions remain fast and explainable [55-58]. Sensitive fields are masked before storage [59-60], and transaction-critical events are linked with workflow and database identifiers for easier diagnosis [61-63].

The framework is evaluated using simulated enterprise applications involving APIs, database workflows, authentication events, scheduled jobs, and service integrations. Static logging is compared with adaptive logging under repeated exceptions, slow requests, failed jobs, API timeout, suspicious login, and workflow interruption scenarios [64-67]. Evaluation metrics include diagnosis time, log volume reduction, root-cause evidence quality, missed-event rate, storage overhead, alert usefulness, and administrator acceptance rate [68-69]. Feedback from resolved incidents, ignored logs, and administrator notes is used to refine logging policies over time.

## 3. Results and Discussion

The results show that adaptive logging improves diagnostics by capturing richer evidence only when runtime risk increases. In the baseline condition, static logs either lack enough detail or produce large volumes of low-value records. With the proposed framework, detailed traces are activated for high-risk events and reduced during normal execution. The strongest improvement appears in intermittent failures, where deeper logs are needed only around the failure window.

The discussion shows that adaptive logging must balance diagnostic depth with privacy and storage cost. Excessive logging can expose sensitive data or overload monitoring systems, while weak logging may hide failure causes. The main limitation is that log-level decisions depend on accurate runtime classification. Regular policy review and masking controls are necessary for safe long-term use.

#### 4. Conclusion

This article presented an adaptive logging framework for enterprise application diagnostics. The framework adjusts log detail using runtime context, risk scoring, workflow state, and error behavior. It improves troubleshooting by increasing diagnostic evidence during abnormal conditions while reducing unnecessary log noise during normal operation. The study shows that adaptive logging can strengthen enterprise diagnostics when combined with structured metadata, privacy controls, and continuous incident feedback.

#### References

1. Kadhar, A., Kumar, A., Ali, J., & John, A. (2014). Studies on the survival and growth of fry of *Catla catla* (Hamilton, 1922) using live feed. *Journal of Marine Sciences*, 2014(1), 842381.
2. Jalal, K. C. A., Shamsuddin, A. A., Rahman, M. F., Nurzatul, N. Z., & Rozihan, M. (2013). Growth and total carotenoid, chlorophyll a and chlorophyll b of tropical microalgae (*Isochrysis* sp.) in laboratory cultured conditions. *Journal of Biological Sciences*, 13(1), 10.
3. Khan, S. A., Lyla, P. S., John, B. A., Kuamr, C. P., Murugan, S., & Jalal, K. C. A. (2010). DNA barcoding of *Stolephorus indicus*, *Stolephorus commersonnii* and *Terapon jarbua* of Parangipettai coastal waters.
4. Kumar, C. P., John, B. A., Khan, S. A., Lyla, P. S., Murugan, S., Rozihan, M., & Jalal, K. C. A. (2011). Efficiency of universal barcode gene (Coxi) on morphologically cryptic mugilidae fishes delineation. *Trends in Applied Sciences Research*, 6(9), 1028.
5. Selvaganapathi, G., Ahmed, J., Mathialagan, A. G., Dinesh, M., Azra, N., Harikrishnan, T., ... & Foead, A. I. (2016). Knowledge and practice on tuberculosis among prison workers from Seremban Prison. *Medicine*, 7, 176-186.
6. Subramaniam, V., Fuloria, S., Sekar, M., Shanmugavelu, S., Vijeepallam, K., Kumari, U., ... & Fuloria, N. K. (2023). Introduction to lung disease. In *Targeting epigenetics in inflammatory lung diseases* (pp. 1-16). Singapore: Springer Nature Singapore.
7. Hua, B. H., Sugumaran, S. V., Faryza, E., Atiqah, N., Jasvinder, K., Kabir, M. S., ... & Nazmul, M. H. (2022). Prevalence of musculoskeletal disorders (MSD) and smartphone addictions among university students in Malaysia. *Int J Health Sci*, 6(S3), 1075-88.
8. Tien, L. P., Atiqah, N., Vytialingam, N., Rashid, M. A., Kabir, M. S., Farzana, Y., & Nazmul, M. H. M. (2022). Stress and quality of life among fathers of special needs children in klang valley. *Journal of Pharmaceutical Negative Results*, 13, 1010-1018.
9. Noureen, A., Islam, T., Rashid, M. A., Kabir, M. S., Mathialagan, A., Farzana, Y., ... & Nazmul, M. H. M. (2022). Indoor Motor Exercise Regimens Improve Social Cognition in Children With

- Autism Spectrum Disorder: A Systematic Review. *Journal of Pharmaceutical Negative Results*, 13(6), 2020-2028.
10. Khan, M. F. K., & Maziz, M. N. H. (2019). Antibiotic resistance. LAP LAMBERT Academic Publishing.
  11. Krishnapillai, A., Lugova, H., Haque, M., Ariaratnam, S., Aziz, A. F. B. A., Maziz, M. N. H., ... & Godman, B. (2022). The shock of the SARS-CoV-2 pandemic on health professionals' education: A pilot qualitative study in Malaysia. *Journal of Applied Pharmaceutical Science*, 12(10), 161-171.
  12. Jayaraj, N., Atiqah, N., Vytialingam, N., Kabir, M. S., Shirin, L., Irfan, M., ... & MHM, N. (2022). Parental attitudes about play in preschool aged children. *International Journal of Early Childhood Special Education*, 14(3).
  13. OO, K. T., WONG, R. S., WWL, S., RAMLI, N., LOW, S., ELBAHLOUL, M., ... & KHALAF, J. H. (2020). Correlation between Body Mass Index (BMI) and Fasting Blood Glucose (FBG) Level among Malaysian Adults Age 40-60. *PJMHS Online*, 14(3).
  14. Hui, N. W., Jamaludin, A., Navanethan, D., Vytialingam, N., Saghir, F. S., Kabir, M. S., ... & Shirin, L. (2024). Prevalence of ADHD symptoms and depression among Malaysian working adults. *Frontiers in Health Informatics*, 13(3), 3287.
  15. Huiping, G., Teck, T. S., & Nellikunnel, S. (2024). Navigating the complexities of ESG integration: Challenges, opportunities and path to sustainable corporate development. *Journal of Business and Social Sciences*, 2024.
  16. Jie, H. S., & Nellikunnel, S. (2023). A study on Jose Mourinho's leadership skills and performance on football clubs. *Journal of Business and Social Sciences*, 2023.
  17. Jiayi, C., & Devasia, S. N. (2023). Factors influencing consumer behavior in preference for douyin (tiktok) in china. *Journal of Business and Social Sciences*, 2023.
  18. GAIK, C., RAHMAN, S., RASHEEDUL, H., Syriac, N. D., PARAMESWARAN, S., & TIPPAN, L. (2024). Towards Sustainable Development at Full-Service Restaurants in West Malaysia. *Journal of Infrastructure, Policy and Development*, 8(16), 5288.
  19. Qi, Z., & Devasia, S. N. (2023). Relationship of Soft Skills and Employees Performance of Hotels in China. *Journal of Business and Social Sciences*, 2023.
  20. Ramdass, R., Rahman, A., & Nellikunnel, S. (2015). Modelling critical success factors for a national qualifications framework: a case study on Mauritius. *International Journal of Modelling in Operations Management*, 5(3-4), 209-235.
  21. Naseer, A. I. N., & Nellikunnel, S. (2024). The ESG Shift: Role of ESG in Modern Business Strategies. *Journal of Business and Social Sciences*, 2024.
  22. Peng, S. L., & Nellikunnel, S. (2024). ESG Indices, Sustainable Practices and Strategic Competitiveness within the Modern Business Landscape. *Journal of Business and Social Sciences*, 2024.

23. Guan, D., & Syriac, N. (2023). Modelling Factors Influencing Consumers Trust in E-Commerce in Shanghai China. *Journal of Business and Social Sciences*, 2023(19), 1-8.
24. Ramdass, R., Rahman, A., & Nellikunnel, S. (2016). National qualifications framework: a qualitative approach towards the determination of the critical success factors. *International Journal of Services, Economics and Management*, 7(2-4), 167-197.
25. Sheikh, H. I., Alhamadin, N. I. I., Liew, H. J., Fadhlina, A., Wahid, M. E. A., Musa, N., & Jalal, K. C. A. (2024). Virulence factors of the zoonotic pathogen *Vibrio alginolyticus*: a review and bibliometric analysis. *Applied Biochemistry and Microbiology*, 60(3), 514-531.
26. Chowdhury, A. J. K., John, A., Aqilah, N. S., Abdullah, R., Salihah, N. T., Basir, K. H., & Marsal, C. J. (2024). Macrobenthic community towards sustainable aquatic ecosystem: A systematic review along the coastal waters of Malaysia. *Geology, Ecology, and Landscapes*, 8(1), 57-70.
27. Amira, F. S., Rahman, M. M., Kamaruzzaman, Y., Jalal, K. C. A., Hossain, M. Y., & Khan, N. S. (2016). Relative abundance and growth of male and female *Nemipterus furcosus* population. *Sains Malaysiana*, 45(1), 79-86.
28. Redhwan, A., Eissa, E. S. H., Ezzo, O. H., Abdelgeliel, A. S., Munir, M. B., Chowdhury, A. J. K., ... & Abd Al-Kareem, O. M. (2024). Effects of water additive mixed probiotics on water quality, growth performance, feed utilization, biochemical analyses and disease resistance against *Aeromonas sobria* of Nile tilapia. *Desalination and Water Treatment*, 319, 100480.
29. Kamaruzzaman, B. Y., John, B. A., Megat, M. A., & Zaleha, K. (2011). Bioaccumulation of heavy metals in horseshoe crabs *Tachypleus gigas* from Pekan, Pahang, Malaysia. *Research Journal of Environmental Toxicology*, 5(3), 222.
30. Zakaria, M. Z., Jalal, K. C. A., & Ambak, M. A. (2000). Length weight relationship and relative condition factor of Sebarau, *Hampala macrolepidota* (Van Hasselt) in Kenyir Lake, Malaysia. *Pakistan Journal of Biological Sciences*, 3(5), 721-724.
31. John, B. A., Sihin, S., Kamaruzzaman, B. Y., Jalal, K. C. A., & Zaleha, K. (2012). Sediment profiling of the nesting grounds of horseshoe crabs at East Peninsular Malaysia. *International Journal of Biology*, 4(2), 159.
32. Kamaruzzaman, B. Y., Zahir, M. S., John, B. A., Waznah, A. S., Jalal, K. C., Shahbudin, S., ... & Goddard, J. S. (2010). Determination of some heavy metal concentrations in razor clam (*Solen brevis*) from Tanjung Lumpur coastal waters, Pahang, Malaysia. *Pakistan journal of biological sciences: PJBS*, 13(24), 1208-1213.
33. John, B. A. (2011). Artificial seagrass: a habitat for marine fishes. *Journal of Fisheries and Aquatic Science*, 6(1), 85-92.
34. Rana, M. M., Asdari, R., Chowdhury, A. J. K., & Munir, M. B. (2023). Heavy metal contamination during processing of canned fish: a review on food health and food safety. *Desalination and Water Treatment*, 315, 492-499.

35. Hanafiah, M. M., Ali, M. Y. M., Aziz, N. I. H. A., & John, A. (2017). Biogas production from agrowaste and effluents. *Acta Chemica Malaysia (ACMY)*, 1(1), 13-15.
36. Jalal, K. C., Kamaruzzaman, B. Y., Arshad, A., Ara, R., & Rahman, M. F. (2012). Diversity and distribution of fishes in tropical estuary Kuantan, Pahang, Malaysia. *Pakistan journal of biological sciences: PJBS*, 15(12), 576-582.
37. Jalal, K. C. A., Alifah, F. K., Faizul, H. N. N., Mamun, A. A., Kader, M. A., & Ashraf, M. A. (2018). Diversity and community composition of fishes in the Pusu River (Gombak, Malaysia). *Journal of Coastal Research*, 82(SI), 150-155.
38. Maah, M. J. (2011). Study of biosorptive potential in the peel of *Citrus reticulata*, *Punica granatum*, *Daucus carota* and *Momordica charantia*. *African Journal of Biotechnology*.
39. Musa, N., Musa, N., Ibrahim, W. N., Zahrol Ariff Shariat, M., Zamani, A. I., Abdullah, M. R., ... & Soh, A. S. A. (2011). Methanolic activities of selected weeds on bacteria isolated from *Macrobrachium rosenbergii* larvae. *The Thai Journal of Veterinary Medicine*, 41(4), 535-540.
40. Ng, J. F., Ahmed, O. H., Omar, L., Jalloh, M. B., Kwan, Y. M., Musah, A. A., ... & Jimmy, D. R. (2024). Mitigating water pollution by nitrogen fertilizers through amending ammonium sorption in an acid soil using Calciprill and sodium silicate. *Desalination and Water Treatment*, 319, 100489.
41. Nordin, N. F. H., Idris, S. N. N. B. M., Nawli, M. N. M., John, A., & Chowdhury, A. J. K. (2017). Pcb biodegradation using bacteria isolated from landfill leachate. *Science*, 1(2), 07-10.
42. Kamaruzzaman, B. Y., Siti Waznah, A., Shahbudin, S., Jalal, K. C. A., & Ong, M. C. (2010). The temporal variation of organic carbon during the pre-monsoon and post-monsoon seasons in Pahang river-estuary, Pahang, Malaysia. *Oriental Journal of Chemistry*, 26(4), 1309.
43. Ng, J. F., Ahmed, O. H., Omar, L., Jalloh, M. B., Kwan, Y. M., Musah, A. A., & Chowdhury, A. J. K. (2024). Improving pH buffering capacity of an acid soil to regulate nutrient retention and mitigate water pollution using Calciprill and sodium silicate. *Desalination and Water Treatment*, 319, 100491.
44. Jamaludin, M. H., Marsal, C. J., Chowdhury, A. J. K., Harith, Z. T., Ridzwan, R. M., & Kari, Z. A. (2023). Egg and broiler supply in Malaysia: issues, challenges and recommendations. *Halalsphere*, 3(1), 11-19.
45. Marsal, C. J., Jamaludin, M. H., Anwari, A. S., & Chowdhury, A. J. K. (2023). The potential of aquaculture development in Brunei Darussalam. *Agriculture Reports*.
46. Kadharsha, K., Khan, S. A., Lyla, S., Mohanchander, P., & John, A. (2018). Checklist for commercially important food fishes of Parangipettai. *Journal CleanWAS*, 2(1), 16-19.
47. Jalal, K. C. A., Zaima Azira, Z. A., Nor Hafizah, Z., Rahman, M. M., Kamaruzzaman, B. Y., & Noor Faizul, H. N. (2014). Carotenoid contents in anoxygenic phototrophic purple bacteria, *Marichromatium* sp. and *Rhodopseudomonas* sp. of tropical aquatic environment, Malaysia.

48. Rahman, M. M., Awang, M. B., Jalal, K. C. A., Aisha, S., & Kamaruzzaman, B. Y. (2013). Study on toxic chemicals in Kuantan River during pre and post monsoon season.
49. Zakaria, Z., Fadzil, F. N. M., Mohamad, M. A. N., Hamid, A. A. A., Chowdhury, A. J. K., & Harumain, Z. A. S. (2024). Metagenomic analysis of bacterial communities in heavy metal leachate-contaminated soils at Jalan Lipis Sanitary Landfill, Pahang, Malaysia. *Desalination and Water Treatment*, 319, 100512.
50. Kamarudin, M. K. A., Abd Wahab, N., Samah, M. A. A., Baharim, N. B., Mostapa, R., Umar, R., ... & Bati, S. N. A. M. (2020). Potential of field turbidity measurements for computation of total suspended solid in Tasik Kenyir, Terengganu, Malaysia. *Desalination and Water Treatment*, 187, 11-16.
51. Kassim, Z., Yunus, K., Jaafar, I., Jalal, K., Nabilah Jaafar, I., Nordin, N. S., ... & John, A. B. (2015). Spatial distribution trend of plankton in Sungai Pulai Estuary, the straits of Johor, Malaysia. *Sains Malaysiana*, 44(9), 1257-1262.
52. Parven, M., Hossain, M. B., Rahman, M. F., Jalal, K. C. A., Jahan, N., & Amin, S. M. N. (2013). Limnological parameters affecting monthly abundance of chironomid larvae in a fish pond and their role in the diet of catfish, *Clarias batrachus*.
53. Jaswir, I., Osman, F., Khatib, A., & Chowdhury, A. J. K. (2009). Storage stability of fish oil from Langkawi Island, Malaysia. *Food Science and Technology Research*, 15(6), 591-598.
54. Chowdhury, A. J. K., Alam, M. Z., & Shahlizah, S. H. (2006, July). Isolation, purification and screening of fugal strain for effective bioconversion of palm oil mill effluent. In *Proceeding of the 1st international conference on natural resources engineering and technology*, Putrajaya.
55. Hossain, M. B., Ahmed, S., Rahman, M. F., Kamaruzzaman, B. Y., Jalal, K. C. A., & Amin, S. M. N. (2013). Method development and validation of nitrofurantoin metabolites in shrimp by liquid chromatographic mass spectrometric system. *Journal of Biological Sciences*, 13(1), 33.
56. Chowdhury, A., Hazra, A. K., Mahajan, S. C., & Choudhury, J. (2007). Microbial communities of earthworm (*Perionyx excavatus* Perrier) gut, cast and adjacent Soil in two different fields of west Bengal. *Records of the Zoological Survey of India*, 101-113.
57. JOHN, A. (2017). Effect of differential feed on the molting success and survival of horseshoe crab trilobite (*Tachypleus gigas*).
58. Hoque, M. M., Motin, M. A., Maya, M., Sarkar, M. R., Islam, M. R., Chowdhury, M. T. H., & Chowdhury, A. J. K. (2014). Water quality and plankton composition of *Amblypharyngodon mola* monoculture fish pond in Bangladesh. *International Journal of Emerging Trends in Science and Technology*, 1(7), 1005-1014.
59. Azfar, A. M., Jalal, K. C. A., & Siti-Waznah, A. (2015). Food partitioning among fishes in Pahang river-estuary, Malaysia. *Jurnal Teknologi*, 77, 63-69.
60. Rahman, M. F., Jalal, K. C., Jahan, N., Kamaruzzaman, B. Y., Ara, R., & Arshad, A. (2012). Present status and approaches for the sustainable development of community based fish culture

- in seasonal floodplains of Bangladesh. *Pakistan Journal of Biological Sciences: PJBS*, 15(12), 551-567.
61. Kamaruzzaman, B. Y., Waznah, A. S., Zahir, M. M., Ong, M. C., Shahbudin, S., Jalal, K. C. A., ... & Goddard, J. S. (2010). Distribution of chromium, manganese and cobalt in the bottom sediment of Pahang river-estuary, Pahang, Malaysia.
  62. Jalal, K. C. A., Ambak, M. A., Abol, M. A. B., Hassan, T. H., & Alam, M. Z. (2005). Effect of feed additives on the development of proteolytic enzymes of the tropical sport fish Malaysian Mahseer (*Tor tambroides*-Bleeker) fry.
  63. Yusofa, K. M. K. K., Jalalb, K. C. A., Abdullahc, S., Azidd, A., Sanie, M. S. A., Yunusb, K., & Ranih, N. L. A. (2021). Haze episodes: identification of air pollutants and meteorological factors in Borneo, Central, Eastern, Northern, and Southern regions of Malaysia. *Desalination and Water Treatment*, 219, 31-39.
  64. Jalal, K. C. A. (2020, November). Mitigation strategies for the Covid-19 impacts on aquaculture in Malaysia. In *International Forum on Aquaculture for Silk Road Countries*, Jointly Organized by Food and Agriculture Organization of the United Nations, Network of Aquaculture Centers in Asia-Pacific Chinese Academy of Fishery Sciences Qingdao, China.
  65. Akbar John, B., Sheikh, H. I., Jalal, K. C. A., Kamaruzzaman, B. Y., Sanower, H., Nur Hanisah, M., ... & Rozihan, M. (2020). DNA Barcoding of Ichthyoplankton and Juvenile Fishes of a Tropical River in Malaysia. In *DNA Barcoding and Molecular Phylogeny* (pp. 237-251). Cham: Springer International Publishing.
  66. Salleh, S. M., Sah, S. A. M., & Chowdhury, A. J. K. (2019). Temperature Influence on Emergence Success and Swimming Speed for In-Situ Nesting for *Chelonia mydas* in Penang Island, Malaysia. *Tropical Life Sciences Research*, 30(3), 111.
  67. Han, L., Shang, T., Shu, J., & Khan Chowdhury, A. J. (2018). Time series data intelligent clustering algorithm for landslide displacement prediction. *Journal of Intelligent & Fuzzy Systems*, 35(4), 4131-4140.
  68. Ashraf, M. A., & Aqma, W. S. (Eds.). (2017). *Environmental Conservation, Clean Water, Air & Soil (CleanWAS)*. Iwa Publishing.
  69. Shahbudin, S., Hafiz, Z. H., John, B. A., Kamaruzzaman, B. Y., & Jalal, K. C. A. (2011). Distribution and Diversity of Corals on Artificial Reefs at Pasir Akar and Teluk Kalong, Redang Island, Malaysia. *Journal of Applied Sciences*, 11(2), 379-383.