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EDITORIAL PREFACE

Dear Readers,

Alhamdulillah, we are pleased to announce the publication of the second edition of the third volume of the Jambura Medical and Health Science Journal (JMHSJ), a peer-reviewed journal produced by the Faculty of Medicine at Universitas Negeri Gorontalo. This edition features four original research articles and one case report contributed by esteemed researchers from various institutions, including the Universitas Indonesia Timur Makassar and Universitas Negeri Gorontalo. The diversity of submissions showcases the growing interest in JMHSJ among academics, researchers, and practitioners across Indonesia.

The range of topics presented in this edition is noteworthy, encompassing critical areas such as the knowledge levels of junior high school students regarding early evacuation procedures during natural disasters, findings from a pilot study assessing neuropathy screening in motorized scooter drivers, evaluations of blood glucose levels in diabetes mellitus patients concerning carbohydrate and cholesterol intake, electrocardiography screening outcomes among athletes in Gorontalo Province, and an intriguing case report on aural myiasis of the outer ear.

We anticipate that future editions will continue to attract a diverse range of articles from various medical fields, reflecting our commitment to advancing knowledge and enhancing the quality of our journal, which has recently achieved accreditation from SINTA 3. We extend our heartfelt gratitude to all contributors and reviewers for their dedication and support. We wish you an insightful reading experience.

Gorontalo, July 2025

Dr. dr. Muhammad Isman Jusuf, Sp.N

Chief Editor

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ORIGINAL ARTICLE **Open Access**

Knowledge of School Residents' on Self-Evacuation of Natural Disaster Victims at SMP Negeri 1 Botupingge

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ABSTRACT

Introduction: Natural disasters can cause significant losses to life, the environment, and the economy. In the past decade, Gorontalo Province recorded 169 disasters. Schools play a crucial role in disaster management through risk education, evacuation drills, and community protection. This study assesses the knowledge of self-evacuation procedures among school residents at SMP 1 Botupingge. The findings will help develop better educational programs to enhance school and community disaster preparedness.

Method: This quantitative descriptive study involved 313 individuals, with final sample size 63 selected through accidental sampling. Data were collected using a validated questionnaire and analyzed with univariate tests.

Results: Most respondents had "good" category knowledge of self-evacuation (55.6%), followed by "sufficient" category (41.3%) and "insufficient" category (3.1%).

Conclusion: The majority of SMP Negeri 1 Botupingge residents mostly demonstrate good self-evacuation knowledge. Regular simulations and training are recommended to strengthen disaster preparedness.

Key words: Disaster planning, knowledge, natural disasters, self evacuation

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Introduction

Natural disasters are unexpected events that can cause significant losses to human life, the environment and the economy. These disaster have highly detrimental impacts on various parties, necessitating swift and appropriate actions to reduce risks and protect communities affected by such events.[1] One of the strategies to address this is independent evacuation of disaster victims. Globally, the number of fatalities due to natural disasters varies significantly yearly. More than 200,000 deaths have been attributed to global disasters, accounting for over 0.4% of total fatalities. On a global scale, the death toll in 2023 alone reached 62,162.[2]

Based on data from the National Disaster Management Agency (Badan Nasional Penanggulangan Bencana, BNPB), a total of 7,318 disasters were recorded during the 2023–2024 period, resulting in 737 fatalities. Indonesia is categorized as a disaster-prone region, facing risks from natural, non-natural, and social disasters. This vulnerability is influenced by various factors, including geographical, demographic, sociological, and historical conditions. The occurrence of disasters in Indonesia highlights the urgency of addressing natural disasters with serious and comprehensive measures.[3]

Gorontalo is a province consisting of five regencies and one city, with topography dominated by hills and mountains of varying elevations. Between 2020 and 2022, a total of 83 disasters were recorded in the Gorontalo region, including earthquakes and floods. According to data collected from DIBI (Data Informasi Bencana Indonesia), BNPB (Badan Nasional Penanggulangan Bencana), and BPBD (Badan Penanggulangan Bencana Daerah), Gorontalo Province has experienced 169 disasters over the past decade. These figures indicate that the frequency of natural disasters is relatively high on global, national, and local scales.[4]

To reduce risks, prepare for disaster emergency responses, and facilitate recovery from disaster impacts, disaster management efforts involving various stakeholders are essential. Schools play a crucial role in disaster management, not only as educational institutions but also as centers for information dissemination, evacuation, and psychosocial support. Schools can provide disaster risk education, conduct evacuation drills, and offer physical and psychological support. Additionally, schools serve as community evacuation centers, acting as a frontline in safeguarding the safety and well-being of residents during disasters.[5]

Knowledge of evacuation procedures, safe routes, and emergency actions must be supported by a positive attitude to encourage active community participation in evacuation efforts. This is highly important as it can be utilized as a disaster-related skill in the event of a disaster. If not properly understood, it may have adverse effect on both individual and the

surrounding environment. Therefore, this study focuses on understanding the knowledge of school members regarding independent disaster evacuation.[6] The study aims to evaluate the level of knowledge among school members about independent evacuation and contribute to the development of more effective educational programs to enhance community preparedness for natural disasters.

Methods

This study employed a quantitative approach using descriptive quantitative methods. The research had been conducted at SMP (Junior High School) 1 Botupingge. It was started in August 2024 and was completed in november 2024. The sample size was determined based on the sampling formula by Gay & Airasian (2009), selecting 20% of the total population.[7] The sampling technique used in this study is accidental sampling, resulting in a final sample size of 63 participants, which was obtained by taking 20% of the total population of 313 people, comprising school members who were willing to serve as research respondents. Prior to the data collection, respondents were required to sign the informed constent form after receiving a detailed explanation.

The assessment of knowledge regarding independent evacuation of disaster victims included several components: the definition of disaster evacuation, levels of disaster evacuation, general mechanisms for aiding and evacuating disaster victims, targets and objectives of disaster evacuation, and techniques for independent evacuation of disaster victims. The variable used in this study was the knowledge of school members about independent evacuation of disaster victims, categorized into three levels: good, sufficient, and insufficient. The criteria for assessment are as follows: good (final score 76–100), sufficient (56–75), and insufficient (<55). Research data were collected directly through primary data obtained from respondents. Data processing and analysis were conducted using the Statistical Package for Social Sciences (SPSS) software and analyzed with univariate analysis techniques.

The instrument used in this study was a questionnaire that has undergone validity and reliability testing using SPSS software. The questionnaire on knowledge of independent evacuation of disaster victims was distributed to respondents in printed form and utilized the Guttman scale, consisting of 24 yes-no questions. The questionnaire comprises 24 items, including 12 positive (+) and 12 negative (-) questions. The scoring for positive questions is "Correct = 1" and "Incorrect = 0."

Result

Table 1 shows that, out of a total of 63 respondents, the majority were female, with 44 respondents (69.8%), and 19 were male (30.2%). Among the male group, the frequency distribution of knowledge levels shows that most felt under the "good" category, with 9 respondents, followed by the "sufficient" category with 8 respondents, and "insufficient" with 2 respondents. Meanwhile, among the female group, the highest frequency of knowledge levels was in the "good" category, with 26 respondents, followed by "sufficient" with 18 respondents, and no respondents in the "insufficient" category.

Table 1. Respondent characteristics based on gender, age and profession

Characteristics Respondent	Frequency	Percentage (%)
Gender		
Male	19	30.2
Female	44	69.8
Age		
12 – 16	40	63.5
24 – 34	10	15.9
35 – 44	7	11.1
45 – 54	6	9.5
Proffesion		
Student	40	63.5
Teacher	17	27
Administrative staff	6	9.5

Regarding age characteristics, the age distribution of respondents at SMP 1 Botupingge was dominated by the 14-year-old group (34.9%). Based on the respondents' knowledge levels according to age, the majority of respondents aged 14 years (35%) had a "sufficient" level of knowledge, with 14 respondents, followed by "good" knowledge at 8 respondents. The 13-year-old group ranks second (19%), with the majority had a "good" knowledge level, represented by 9 respondents.

Regarding the characteristics based on respondents' professions at the school, the frequency distribution of respondents at SMP 1 Botupingge shows that the majority of respondents were students, with 40 respondents (63.5%), followed by teachers with 17 respondents (27%), and administrative staff with 6 respondents (9.5%). Based on knowledge levels for each group, the majority of student respondents showed an equal distribution in the "good" and "sufficient" categories, with 19 respondents (47.5%) in each category. Among teacher respondents, the dominant knowledge level was "good," with 14 respondents

(82.4%). Meanwhile, among administrative staff respondents, the most frequent knowledge level was "sufficient," with 4 respondents (6.3%).

Table 2 presents the frequency distribution of knowledge levels categorized as "good," "sufficient," and "insufficient." The majority of respondents felt under the "good" category, with 35 respondents (55.6%), followed by the "sufficient" category with 26 respondents (41.3%), and the "insufficient" category with the fewest respondents, totaling 2 (3.1%).

Table 2. Frequency distribution of respondents' knowledge level

Knowledge Category	Frequency	Percentage (%)
Good	35	55.6
Sufficient	26	41.3
Insufficient	2	3.1

The distribution of knowledge for each respondent type shows the knowledge results for each group (Table 3). At the "good" knowledge level, a total of 35 respondents (55.6%) were recorded, consisting of 19 students (30.2%), 14 teachers (22.2%), and 2 administrative staff members (3.2%).

Table 3. Frequency distribution of knowledge for each type of respondent

Respondent	Knowledge Level						Total	
	Insufficient		Sufficient		Good			
	n	%	n	%	n	%	n	%
Student	2	3.2	19	30.2	19	30.2	40	**63.5**
Teacher	0	0.0	3	4.8	14	22.2	17	**27**
Administrative staff	0	0.0	4	6.3	2	3.2	6	**9.5**
Total	**2**	**3.2**	**26**	**41.3**	**35**	**55.6**	**63**	**100.0**

Discussion

The analysis results indicate a significant difference in disaster preparedness knowledge levels based on gender. Among the 63 respondents, females were more dominant in the "good" knowledge category (26 respondents) compared to males (9 respondents). In contrast, the "insufficient" knowledge category was dominated by males (2 respondents), while no females were found in this category. These findings are consistent with the study by Aprilia (2023), which revealed that females tend to have better preparedness compared to males, with a higher proportion of female respondents (64%) compared to males (36%).[8]

The high proportion of females in the "good" knowledge category can be linked to

factors such as emotionality, social roles, and access to information. Previous studies have indicated that females tend to be more sensitive to risks and proactive in preventive measures, although high emotional responses may hinder rational decision-making.[9,10] In contrast, males tend to rely more on logic but exhibit lower awareness of risks. Additionally, the division of social roles also influences preparedness levels. Males are more likely to have access to technical training and formal information, while females are more actively involved in household-level mitigation, such as preparing emergency supplies.[11]

The difference in access to information also plays a crucial role. Males are generally exposed to formal information through their work or training, while females often obtain information through informal channels, such as community networks.[10] Community-based communication strategies are considered important for enhancing inclusive access to information and ensuring equitable preparedness across genders.[12] Therefore, females are more responsive to disaster threats because they are more proactive in seeking information and preparing preventive measures.

The age distribution of respondents is dominated by the 12–15-year-old group, which corresponds to a cognitive development stage where logical and abstract thinking abilities begin to develop, yet still require guidance in decision-making.[13] In contrast, the adult age group (33 years and older) has fewer respondents, with a relatively even distribution of "good" knowledge across each age group.

These results indicate the need for a focus on enhancing knowledge within the adolescent age group to optimize their cognitive development potential. Education for the 12–15-year-old group should be prioritized, as they dominate the respondent pool but still require knowledge enhancement to reach the "good" category.[14] Meanwhile, the adult age group requires a different approach, such as more practical information that is relevant to their daily experiences. Although the number of adult respondents is smaller, they have the potential to exert a significant influence on knowledge-based actions. Therefore, the implementation of age-based educational strategies is crucial to ensure that the content delivered aligns with the cognitive development stages and specific needs of each age group. This can enhance the overall effectiveness of education programs and disaster preparedness.

Based on the data analysis of the 24 questions regarding knowledge of independent evacuation of disaster victims, the knowledge levels of school members were categorized into three groups. Respondents with "good" knowledge totaled 35 (55.6%), "sufficient" knowledge was 26 (41.3%), and "insufficient" knowledge was 2 (3.1%). The majority of respondents in the "good" knowledge category were teachers (14 respondents or 70%),

followed by students (19 respondents or 47.5%), and administrative staff (2 respondents or 33.3%). These findings support the results of Ana and Dewi (2024), who reported that 66.0% of students had good knowledge regarding independent evacuation.[15]

From a tectonic perspective, Bone Bolango is a region prone to earthquake and tsunami disasters.[16] Several factors influence knowledge levels, including education and experience. Pariati and Jumriani (2021) explain that the higher an individual's level of education, the broader their knowledge base. This is reflected in the higher percentage of "good" knowledge among teachers compared to students and administrative staff, given that teachers typically have higher education levels.[17] Additionally, experience is also a significant factor, where individuals with greater disaster-related experience tend to have better knowledge.

Another factor influencing the analysis results is the implementation of disaster simulation programs and training in schools. Rahman (2024) found a significant increase in awareness and preparedness after training, from 68.5% to 92%. Regular simulations involving all school members, such as those conducted at SDN 1 Soropia, can enhance preparedness, with 91.9% of respondents acknowledging the effectiveness of the simulations. The ease of access to formal training is also a determining factor. Teachers or staff who have participated in disaster-related training from organizations such as BPBD have a better understanding, which can be transferred to students. The findings of this study are consistent with Rahman (2024), where understanding of evacuation procedures increased from 75.6% to 94.2% after training. Therefore, improving access to training and direct involvement from disaster management institutions is crucial to enhancing the capacity of all school members to face emergency situations.[18]

At SMP Negeri 1 Botupingge, several socialization sessions have been conducted, including the provision of materials on disaster management, including proper evacuation procedures. However, not all school members attended these sessions. This may influence the responses provided by the respondents in this study. Some students who attended the sessions generally exhibited better knowledge compared to other school members who did not participate. A study by Yusuf (2024) found that disaster training through material provision successfully improved students' knowledge to the "good" category. These results indicate that disaster programs at schools, such as disaster simulations and evacuation training, significantly contribute to improving knowledge and preparedness among school members. Additionally, integrating disaster-related material into extracurricular activities, such as group discussions and hands-on practice, reinforces students' understanding, making them more prepared to apply the knowledge when needed.[19] A study by Gani (2024) showed that

disaster knowledge levels among medical students at the Faculty of Medicine, Gorontalo State University, were categorized as good, but no significant relationship was found between knowledge levels and disaster preparedness attitudes.[20] The researcher assumes that the insignificant results may be due to several factors, one of which is how individuals interpret a situation based on the challenges they face. The novelty of this study lies in its focus on self-evacuation, specifically exploring how individuals can use their own evacuation skills to assist in evacuating others during a disaster. This approach provides a unique perspective on disaster preparedness, emphasizing personal responsibility in ensuring the safety of both oneself and others in crisis situations. This can also be further enhanced by implementing disaster training or simulations, ensuring that the theory learned can be directly applied when a disaster occurs. Such practices would not only reinforce individual preparedness but also promote a more effective collective response during actual disaster situations.

The limitations of this study include the relatively small sample size. Additionally, during the data collection process, some respondents were not directly supervised by the researcher while completing the questionnaire, which may have led to potential biases in the research results.

Conclusion

The majority of school members at SMP Negeri 1 Botupingge have a "good" level of knowledge. This indicates a relatively high level of awareness regarding the procedures for independent evacuation among most school members. To further enhance this understanding, it is recommended that the government strengthen disaster preparedness programs by providing regular simulations and training at SMP Negeri 1 Botupingge. Additionally, future research is encouraged to examine the impact of evacuation education on the knowledge of school members.

Conflict of Interest

Nothing to declare

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Nothing to declare

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ORIGINAL ARTICLE **Open Access**

Neuropathy Screening Based on Sensory Nerve Examination of Bentor Drivers in Gorontalo City: A Pilot Study

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ABSTRACT

Introduction: Neuropathy, a disorder affecting the nervous system in the limbs, poses a significant concern for bentor drivers due to their occupational activities. The early detection of neuropathy through sensory nerve examinations is essential for timely medical intervention and the prevention of serious complications. This study aimed to assess the incidence of neuropathy among bentor drivers in Gorontalo City, emphasizing the urgency of addressing this issue.

Method: An observational study utilizing quantitative descriptive methods was conducted in July 2024. The sample comprised 30 bentor drivers in Gorontalo City, selected through purposive sampling. Neuropathy was evaluated based on sensory nerve examinations in the lower limbs, utilizing the Neuropathy System Score (NSS) and the Neuropathy Deficit Score (NDS) questionnaires.

Results: According to NSS and NDS assessments, the incidence rates of neuropathy were 73.3% and 66.6%, respectively. Most participants exhibited moderate neuropathy as indicated by NSS (30.0%) and mild neuropathy according to NDS (43.3%).

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Conclusion: The screening results indicate a relatively high incidence of neuropathy among bentor drivers in Gorontalo City, underscoring the necessity for early detection programs. This study advocates for further research to identify factors contributing to neuropathy within this group, engaging stakeholders in the ongoing pursuit of enhancing occupational health.

Key words: Bentor driver, lower extremity, nervous system, neuropathy, occupational health

Introduction

Neuropathy is a microvascular disease of the small arterial blood vessels that supply blood to the central and peripheral.[1] Neuropathy is characterized by pain such as burning in the feet and legs, stabbing, tingling, numbness, weakness, electric shocks, and instability when standing or walking.[2] Peripheral neuropathy occurs in about 2.4% to 8% of the world's population, with higher prevalence rates in Southeast Asian countries such as Malaysia (54.3%), Philippines (58.0%), and Indonesia (58.0%).[3] The prevalence of toxic neuropathy is still limited, but the prevalence of neuropathy generally increases with the use of certain drugs and industrial exposure.[4]

Factors that contribute to neuropathy include intrinsic factors such as metabolism, systemic factors, diet, gender, nutrition, and autoimmune diseases. Extrinsic factors that can affect neuropathy include alcoholism, toxic substances (air pollution, heavy metals, and chemicals), and activity or work. The population in 2019 in Gorontalo City was a total of 219,399 people with a wide area of 79.59 km^2 so the that population density was 2,756 people/km^2, and the data on bentors operating in Gorontalo City amounted to 3,220 units.[5] Bentor drivers experience less ergonomic working conditions, especially the lower extremities, such as exposure to engine vibrations and continuous repetitive movements while working, which can cause neuropathy. Some neuropathy complaints often occur in drivers who have limited space to move and work in a fixed position for a long period.[6]

This study conducted neuropathy screening based on sensory nerve examination focusing on the lower extremities. Peripheral neuropathy in the lower extremities is more often found in bentor drivers, which can be caused by less ergonomic working conditions such as sitting posture, exposure to vibrations from the machine, obstructed blood circulation, static foot position, and mechanical load on the lower body. This study aimed to assess the incidence of neuropathy among bentor drivers in Gorontalo City, emphasizing the urgency of addressing this issue.

Methods

This quantitative study with a descriptive design aimed to assess the incidence of neuropathy among bentor drivers in Gorontalo City. The research was conducted in July 2024, involving 30 bentor drivers in Gorontalo City selected through purposive sampling. Although Sugiyono (2019) suggests that a good sample size ranges between 30-500, The limited sample size in this study limits the applicability of the findings[7]. Due to the limited number of participants, this study was conducted as a pilot study, which serves as a preliminary investigation to assess feasibility, refine research methodologies, and identify potential challenges before conducting a larger-scale study. Anamnesis was conducted to assess respondents included in the inclusion criteria and exclusion criteria. Inclusion criteria included respondents aged > 18 years, not suffering from diabetic neuropathy, not cancer patients, not undergoing chemotherapy, not chronic infection patients based on anamnesis only, and domiciled in Gorontalo City. Meanwhile, the exclusion criteria were respondents with serious illnesses, did not participate in a series of examinations, and did not come during the examination. This research has received ethical approval from Komite Etik Penelitian Kesehatan (KEPK) of Gorontalo State University with letter number 086B/UN47.B7/KE/2024 dated July 8, 2024.

The data obtained was primary data by *Neuropathy System Score* (NSS) questionnaire and *Neuropathy Deficit Score* (NDS) questionnaire. NSS is a subjective questionnaire while NDS is objective. Both questionnaires use a scoring system of (3-4) mild neuropathy, (5-6) moderate neuropathy, and (7-10) severe neuropathy. The data were then subjected to univariate analysis to describe the distribution of the data. Univariate analysis in this study was age, education, work experience, work duration, smoking habits, and incidence of neuropathy. Smoking habits can be categorized based on the number of cigarettes consumed per day (cigarettes per day/CPD) and the duration of smoking. The smoking habit categories include light daily smokers (≤10 cigarettes per day with a duration of <10 years), moderate daily smokers (11–20 cigarettes per day with a duration of >10 years), and heavy daily smokers (>20 cigarettes per day with a duration of >10 years).[8]

Result

Table 1 shows the respondents' characteristics. In this study, the most prevalent age groups were 21–25 years (7 participants, 23.3%) and 26–30 years (7 participants, 23.3%). Most of the respondents in this study were final high school education (13 people, 43.3%). Most respondents had worked > 10 years (12 people, 40.0%), the long work duration > 8

hours/day (24 people, 80.0%), and moderate smoking habits (13 people, 43.3%).

Table 1. Distribution of characteristics bentor drivers based on age, final education, work experience, work duration and smoking habits in Gorontalo City.

Characteristics	Total (n)	Percentage (%)
Age (years)		
21-25	7	23.3
26-30	7	23.3
31-35	4	13.3
36-40	3	10.0
41-45	5	16.7
46-50	2	6.7
>50	2	6.7
Education		
Elementary School	6	20.0
Junior High School	11	36.7
Senior High School	13	43.3
Work Experience		
≤ 5 years	11	36.7
6-10 years	7	23.3
>10 years	12	40.0
Work Duration		
≤ 8 hours /day	6	20.0
>8 hours /day	24	80.0
Smoking Habit		
Light daily smokers	13	43.3
Moderate daily smokers	13	43.3
Heavy daily smokers	4	13.3

Table 2 shows the incidence of neuropathy from respondents based on sensory nerve examinations using the NSS dan NDS questionnaires. The highest incidence of neuropathy among bentor drivers in Gorontalo City were based on NSS (22 people, 73.3%) and NDS (20 people, 66.6%).

Table 2. Distribution of neuropathy among bentor drivers based on the *Neuropathy System Score* (NSS) questionnaire and *Neuropathy Deficit Score* (NDS) in Gorontalo City

Variables	Neuropathy			
	Negative		Positive	
	n	%	n	%
NSS	8	26.66	22	73.33
NDS	10	33.33	20	66.66

Table 3 shows the distribution of neuropathy severity based on NSS from bentor drivers in Gorontalo City. The respondents with moderate neuropathy dominate the total number of respondents with a score neuropathy of 5-6 (9 people, 30.0 %).

Table 3. Distribution of neuropathy severity among bentor drivers based on the *Neuropathy System Score* (NSS) questionnaire in Gorontalo City

Neuropathy (NSS)	Total (n)	Percentage (%)
Normal (score ≤ 2)	8	26.66
Mild (score 3-4)	7	23.33
Moderate (score 5-6)	9	30.0
Severe (score 7-10)	6	20.0

Table 4 shows the distribution of neuropathy severity based on NDS from bentor drivers in Gorontalo City. The respondents with light neuropathy dominate the total number of respondents with a score neuropathy of 3-4 (13 people, 43.3 %).

Table 4. Distribution of neuropathy severity among bentor drivers based on the *Neuropathy Deficit Score* (NDS) questionnaire in Gorontalo City.

Neuropathy (NDS)	Total (n)	Percentage (%)
Normal (score ≤ 2)	10	33.33
Mild (score 3-4)	13	43.33
Moderate (score 5-6)	7	23.33
Severe (score 7-10)	0	0.0

Discussion

The sample in this study consisted of bentor drivers aged 21–60 years. The majority of respondents belonged to the 21–25 and 26–30 age groups, namely 7 (23.3%), respectively. There were not enough samples with elderly characteristics. In general, in this study there was variation in the severity of neuropathy based on age. This is in line with research by Obata *et al*., (2020) which states that with increasing age, nerve degeneration will occur, where nerve fibers become easily damaged. The incidence of neuropathy is not only determined by the number of respondents in an age group, but also by the duration and intensity of exposure to risk factors.[9]

In this study, the majority of respondents were high school graduates, among bentor drivers in Gorontalo City, namely 13 (43.3%). Based on research by Raghupathi (2020) which states that there is a positive relationship between education level and health, with more educated individuals tending to have better health outcomes.[10] Factors that influence more high scool graduates are limited job opportunities, pressing needs, costs of further education, ease of access to work, environmental influences, lack of career information or guidance, and individual independence.[11]

The findings of this study revealed that the majority of bentor drivers in Gorontalo City

had more than 10 years of work experience, with a total of 12 respondents (40%). This is in line with research by Syahputra, et al (2015) which states a relationship between work experience and peripheral neuropathy.[12] Prolonged work experience, combined with exposure to a dusty and polluted work environment, increases the risk of developing neuropathy.[8]

In this study, the duration of work exposure > 8 hours/day dominated the total number of respondents, namely 24 (80 %). This in line with study by Mustafa, *et al* (2023) which states that work process with term long time with posture work that is not ergonomic can trigger complaint painful non-specific neck among computer user employees.[13] Repetitive movements and typical postures of bentor drivers that can impact the legs such as pressing the brakes and gear levers cause stress on the leg muscles, tendons, and nerves.[14]

Most of the bentor drivers in Gorontalo City had the habit of light smoking (13 people, 43.3%) and moderate smoking (13 people, 43.3%). This is in line with research by Taghizade (2016) which proves that 44.8% of respondents who had a smoking habit experienced peripheral neuropathy compared to only 19.7% in the non-smoker group.[8] Toxic components in cigarettes, such as nicotine and carbon monoxide, cause vasoconstriction in small blood vessels, reducing oxygen supply to peripheral nerves, and accelerating axonal damage and demyelination of nerves.[15]

The incidence of neuropathy among bentor drivers in Gorontalo City is relatively high with the number based on NSS (22 people, 73.3%) and NDS (20 people, 66.6%). The study conducted by Mildawati, *et al.* (2019) found that the distribution of neuropathy types among 50 Go-Jek drivers in the Medan Community revealed that 31 drivers (62%) experienced nociceptive pain and 19 drivers (38%) experienced neuropathic pain.[16] Neuropathy occurs due to repetitive motion caused by a combination of factors such as nerve compression, ischemia, inflammation, direct mechanical damage, and oxidative stress.[13]

The severity of neuropathy among bentor drivers in Gorontalo City based on NSS was dominated by moderate neuropathy (9 people, 30%). This finding is consistent with the study by Gordon and Verity (2020) which states that workers with repeated exposure to mechanical vibrations have a prevalence of moderate neuropathy of 25-35%. Axons that are repeatedly exposed to vibrations can degenerate and lose myelin, a protective layer that isolates axons, and increases the speed of nerve signal conduction. This results in neuropathy symptoms such as tingling and pain.[2]

The severity of neuropathy among bentor drivers in Gorontalo City based on NDS was dominated by mild neuropathy (13 people, 43.3%). This is in line with research by Mildawati, *et al*. (2019) research in Medan, which demonstrated that 60% of respondents

exhibited symptoms of peripheral neuropathy, with work durations exceeding 8 hours significantly increasing the risk.[16] Neuropathy incidents occur due to non-ergonomic sitting postures causing pressure on the nerves in the lower back and legs. Prolonged compression can disrupt blood flow to the nerves and cause ischemia which leads to neuropathy.[17]

The difference in NSS and NDS results can be caused by the different focus of measurement of the two methods. NSS assesses more subjective symptoms, such as pain, tingling, burning sensations, or numbness so that the results can vary in intensity and frequency depending on individual perception. Meanwhile, NDS evaluates more objective physical signs such as tendon reflexes, muscle strength, and vibration or pain sensations. This difference can cause severe symptoms (high NSS), but no significant physical deficits (low NDS), or vice versa.[2]

This study has limitations in including number of samples, namely 30 samples in July 2024 and the lack of sample cooperation in the examination. In addition, this study uses primary data, it has limited capacity to enhance statistical power and identify the factors influencing the occurrence of neuropathy among bentor drivers.

Conclusion

There showed relatively high incidence of neuropathy among bentor drivers in Gorontalo City. It is expected service health can make policy or a programs for bentor drivers and the community such as ergonomic modifications to seat and foot pedal designs, routine health checks that focus on early detection of neuropathy, health education on smoking cessation and metabolic health management. Suggestions for further study are expected to involve larger samples to enhance statistical power and identify factors that influence neuropathy on benthic drivers.

Conflicts of Interest

There is no conflicts of interest in this research

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ORIGINAL ARTICLE **Open Access**

Blood Glucose Levels in Type II Diabetes Mellitus Patients Who Consumed Carbohydrates and Cholesterol: A Cross-Sectional Study in The Outpatient Setting

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ABSTRACT

Introduction: Diabetes mellitus is a disease caused by disorders related to the insulin hormone. This study aims to determine the results of fasting blood glucose levels in Type II Diabetes Mellitus sufferers who consume carbohydrates and cholesterol in the outpatient Universitas Indonesia Timur Wisata Hospital, Makassar City.
Method: The type of research used is observational with a cross-sectional approach. The sample was 10 outpatients with type II diabetes mellitus at the Wisata Hospital of the Universitas Indonesia Timur. Data were collected using purposive sampling. The research results are made in tabular form and narrated.
Results: The average fasting blood glucose (FBG) level is 129.3 mg/dl, which was included in the diabetes category. The average 2-hour post-prandial blood glucose level (BG2PP) value was 244.1 mg/dl, which was also included in the diabetes category. Carbohydrate and cholesterol consumption had an average value of 255.6 grams and 223.9 mg, respectively.
Conclusion: The average fasting blood glucose and 2-hour post-prandial blood glucose values are included in the diabetes category. Impaired FBG increases the patient's risk of developing diabetes in the future compared to if the patient has impaired blood glucose tolerance.

Key words: Blood glucose levels, carbohydrate intake, cholesterol intake

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Introduction

Diabetes derives from the Greek term "to siphon," while "mellitus" is the Latin term for honey, referencing the sweet taste of urine in affected individuals. Diabetes mellitus is characterized by the excretion of large volumes of urine with a sweet taste. This condition encompasses at least three primary forms: type I diabetes mellitus, type II diabetes mellitus, and gestational diabetes.[1] It is a chronic metabolic disorder marked by hyperglycemia, which involves elevated glucose levels in the bloodstream and specifically affects the body's glucose metabolism.[2]

Diabetes mellitus is a metabolic disorder characterized by abnormalities in insulin secretion, insulin action, or both. This condition can arise from insufficient insulin production due to pancreatic dysfunction or impaired cellular utilization of insulin. Consequently, glucose levels in the bloodstream become dysregulated and may rise significantly. Prolonged hyperglycemia can lead to glucotoxicity, adversely affecting various organs and systems throughout the body.[3]

Diabetes mellitus is a chronic metabolic disorder characterized by persistent hyperglycemia. Patients often remain asymptomatic during the initial stages of the disease, leading to its designation as the "silent killer." Diabetes can affect individuals across all age groups.[4] The diagnosis of diabetes mellitus should be considered in the presence of symptoms such as polyuria, polydipsia, polyphagia, and unexplained weight loss.[5] Chronic manifestations of diabetes may include neuropathic symptoms such as paresthesia, heat sensations, or needle-like pricking in the skin, along with numbness, fatigue, excessive daytime sleepiness, and visual disturbances such as blurred vision.[6]

Diabetes mellitus is a chronic condition that currently cannot be cured; however, effective management of blood glucose levels can be achieved through a combination of dietary modifications, physical activity, and pharmacological interventions.[7] Acute complications may arise from rapid fluctuations in blood glucose levels. Significant decreases in glycemia can occur when a patient adheres to a restrictive diet that does not adequately meet their nutritional needs. Such drastic alterations in blood glucose levels can lead to severe and potentially life-threatening outcomes.[8] If the condition remains unmanaged, long-term complications may develop, including cardiovascular disease, nephropathy, retinopathy, atherosclerosis, and, in extreme cases, the need for limb amputation.[9] To mitigate the risk of these chronic complications, it is critical to implement effective diabetes management strategies, which should aim to achieve the following targets: fasting blood glucose levels of 80-<100 mg/dL, postprandial blood glucose levels (2 hours after eating) of 80-<144 mg/dL,

total cholesterol levels of <200 mg/dL, triglyceride levels of <155 mg/dL, a body mass index (BMI) ranging from 18.5 to 22.9 kg/m², and a blood pressure reading of 130/80 mmHg.[7]

In patients with diabetes mellitus, disruptions in the metabolism of carbohydrates, proteins, and fats occur due to quantitative and qualitative deficiencies in insulin. Elevated blood glucose levels characterize this metabolic dysregulation. When carbohydrate intake exceeds the body's capacity to metabolize them for energy, surplus carbohydrates are converted into triglycerides.[10] The rapid consumption of simple carbohydrates prompts a swift release of insulin, facilitating glucose uptake into muscle and liver cells. When glycogen storage capacity in these tissues is reached, excess glucose is redirected to adipose tissue, where it undergoes lipogenesis to be stored as fat.[11]

Adipose tissue is a primary energy source, and its excessive accumulation can lead to obesity. In individuals with obesity, adipocytes secrete various bioactive substances known as adipocytokines. These adipocytokines contribute to the development of insulin resistance. As a result of insulin resistance, the effective uptake of glucose by peripheral tissues is impaired, leading to elevated blood glucose levels or hyperglycemia.[12] Individuals with diabetes mellitus often experience insulin resistance, leading to elevated blood glucose levels, hypertension, and hyperinsulinemia. These metabolic disturbances are also associated with dyslipidemia, characterized by increased levels of total cholesterol and low-density lipoprotein (LDL) and decreased levels of high-density lipoprotein (HDL). Additionally, there may be an elevation in triglyceride levels, all of which are recognized as independent risk factors for cardiovascular disease.[10]

Cholesterol is a lipophilic substance that circulates in the bloodstream and is synthesized primarily by the liver. It plays a crucial role in various physiological processes in the body. However, excessive cholesterol concentration can lead to pathophysiological issues, particularly in the cardiovascular and cerebrovascular systems. Approximately 80% of blood cholesterol is endogenously produced, while the remaining 20% is derived from dietary sources. Cholesterol can be categorized into two main types: high-density lipoprotein (HDL) and low-density lipoprotein (LDL). Elevated LDL cholesterol levels can result in its deposition on the endothelial lining of blood vessels, promoting atherosclerosis by forming plaques that can occlude vascular lumens. In contrast, HDL cholesterol is responsible for reverse cholesterol transport, facilitating the removal of excess LDL cholesterol from the vasculature. Additionally, triglycerides, esters derived from glycerol and fatty acids, are formed during the metabolic processing of dietary fats and excess carbohydrates and proteins, serving as an energy reserve but potentially contributing to dyslipidemia when present in

elevated concentrations.[13]

Reducing insulin levels can impair glucose metabolism, resulting in hyperglycemia in individuals with DM. When glucose cannot be utilized for energy production, the body compensates by catabolizing alternative substrates such as proteins and fats. This metabolic shift can lead to an increase in cholesterol levels due to enhanced lipolysis. In patients with type II DM, the accumulation of lipids, particularly cholesterol, in cellular membranes can diminish the efficacy and number of insulin receptors. Consequently, this decreases glucose uptake, exacerbating hyperglycemia due to impaired insulin signaling.[14]

In light of the aforementioned details, the investigator expresses a keen interest in conducting a study titled: "Assessment of Blood Glucose Levels in Patients with Type II Diabetes Mellitus Following Carbohydrate and Cholesterol Consumption: A Cross-Sectional Study within an Outpatient Context."

Methods

The research methodology employed in this study is observational, utilizing a cross-sectional approach to examine the research subjects. The study was conducted at the Universitas Indonesia Timur Wisata Hospital Laboratory from August 20 to August 21, 2018. The target population consisted of outpatients diagnosed with type II diabetes mellitus at the aforementioned hospital. Inclusion criteria mandated that participants be diagnosed with type II diabetes, consent to volunteer as respondents, undergo a fasting period of at least 8 hours, possess recorded data on blood glucose levels, and have the capacity for effective verbal communication. Patients who did not meet the fasting requirement or exhibited communication difficulties were excluded from the sample. The sampling technique applied was purposive sampling, whereby subjects who presented at the facility and fulfilled the established criteria were selected as participants until the target sample size of 10 was achieved. The primary variable of interest in this study is blood glucose levels, and the findings will be presented in tabular format for clarity and ease of interpretation.

Result

A study conducted in August 2018 at the Universitas Indonesia Timur Wisata Hospital Laboratory involved 10 samples, with the baseline characteristics summarized in Table 1. The gender distribution among the subjects indicated a higher prevalence of female patients, with four males (40%) and six females (60%). Age distribution among the outpatient cohort with type II diabetes mellitus revealed that two patients (20%) were aged 22-37 years,

three patients (30%) were in the 38-53 year age range, four patients (40%) were aged 54-69 years, and one patient (10%) fell within the 70-85 year category.

Table 1. Baseline characteristics of study samples

Characteristics Respondent (N=10)	Frequency	Percentage (%)
Gender		
Male	4	40.0
Female	6	60.0
Age		
22 – 37	2	20.0
38 – 53	3	30.0
54 – 69	4	40.0
70 – 85	1	10.0

Table 2 presents the distribution of FBG levels and carbohydrate and cholesterol intake among the study participants. The FBG levels demonstrated a minimum value of 79 mg/dL, a maximum of 205 mg/dL, and a mean of 129.3 mg/dL. Based on the mean value, the FBG levels are classified within the diabetic range. The BG2PP levels indicated a minimum value of 158 mg/dL, a maximum of 313 mg/dL, and a mean of 244.1 mg/dL, situating them within the diabetic category based on the average measures. Carbohydrate intake ranged from a minimum of 137 grams to 309 grams, with an average consumption of 255.6 grams. Cholesterol intake varied from 81 to 392 mg, with a mean value of 223.9 mg.

Table 2. Frequency distribution of respondents' knowledge level

Variables	Minimum	Maximum	Mean
FBG (mg/dl)	79	205	129,3
BG2PP (mg/dl)	158	313	244,1
Carbohydrate (gram)	137	309	255,6
Cholesterol (mg)	81	392	223,9

BG2PP: Blodd glucose 2 hour post prandial, FBG: Fasting blood glucose

Discussion

Diabetes mellitus is a chronic metabolic disorder characterized by persistent hyperglycemia and impaired glucose homeostasis. This condition arises from insufficient insulin production by the pancreatic beta cells or an inadequate response to insulin in peripheral tissues. Diabetes mellitus is primarily categorized into two types: Type I diabetes,

characterized by autoimmune destruction of pancreatic beta cells leading to absolute insulin deficiency, and Type II diabetes mellitus, which is associated with insulin resistance and relative insulin deficiency, often linked to obesity and a sedentary lifestyle.[7]

Diabetes Mellitus is a chronic condition that currently lacks a definitive cure; however, it can be effectively managed through appropriate therapeutic interventions. The disease is closely linked to lifestyle factors, making the success of diabetes management largely contingent upon the patient's capability to regulate their condition and maintain optimal blood glucose levels.[15]

The measurement of an individual's blood glucose level is contingent upon the timing of the assessment, which may occur randomly, during fasting, or postprandially. Random blood glucose (RBG) reflects the glucose concentration measured at any time, irrespective of recent food intake, with normal values defined as <200 mg/dl. Values exceeding this threshold may indicate a risk for diabetes. Fasting blood glucose is ascertained in a fasting state, requiring the individual to refrain from caloric intake for 8-12 hours, with water permitted. The classification of FBG results is as follows: normal (<100 mg/dl), prediabetes (100-125 mg/dl), and diabetes (≥126 mg/dl). Following the fasting measurement, postprandial blood glucose is evaluated two hours after ingesting a 75-gram glucose solution. Aside from the glucose solution, the patient must restrict any food or medication intake during this period. The categorization of BG2PP is as follows: normal (<140 mg/dl), prediabetes (140-199 mg/dl), and diabetes (≥200 mg/dl).[15]

Fasting Blood Glucose levels exhibit a minimum threshold of 79 mg/dL, a maximum of 205 mg/dL, and an average of 129.3 mg/dL. Given that the average falls within the diabetic range, this indicates that the patient may be classified as having diabetes. The BG2PP measurements show a minimum of 158 mg/dL, a maximum of 313 mg/dL, and an average of 244.1 mg/dL, categorizing this level as diabetic based on the average results. Carbohydrate intake reports demonstrate a minimum of 137 grams, a maximum of 309 grams, and an average of 255.6 grams. Additionally, cholesterol consumption ranges from a minimum of 81 mg to a maximum of 392 mg, with an average intake of 223.9 mg. In clinical practice, if a patient presents with an FBG level between 100-125 mg/dL, this condition is classified as impaired fasting glucose. Conversely, if BG2PP levels are measured between 140-199 mg/dL, this signifies impaired glucose tolerance. It is important to note that impaired FBG is associated with a higher risk of progression to diabetes compared to isolated impaired glucose tolerance.[16]

Research findings indicate that gender significantly impacts blood glucose levels. Women exhibit a higher susceptibility to metabolic disorders than men, particularly after the age of 40, when they transition through menopause. Irregular fluctuations in estrogen and progesterone levels characterize this phase. A decline in estrogen can lead to insulin resistance, resulting in elevated blood glucose levels. Additionally, aging contributes to increased body weight, further influencing glycemic control. According to The Hormone Foundation, older adults undergo alterations in hormone production and secretion, including insulin, rendering them more vulnerable to the development of Diabetes Mellitus.[18]

According to Sukardji, individuals with diabetes are at an elevated risk for cardiovascular disease, including both heart and vascular conditions. It is essential to limit dietary intake of saturated fats and cholesterol, as elevated levels of these substances in the bloodstream can form atheromatous plaques on vascular endothelium, resulting in atherosclerosis. Additionally, food preparation methods should avoid excessive frying, and it is advisable to limit the variety of side dishes to no more than one per meal to manage overall dietary intake effectively.[18]

Diets high in saturated fats, such as those derived from coconut oil and various butters, have been shown to elevate serum cholesterol levels.[6] To promote a healthier dietary pattern, limiting saturated fat intake and prioritizing a balanced consumption of fruits and vegetables is advisable. This approach can reduce LDL cholesterol levels by 5-10% or more, depending on individual metabolic responses and overall dietary composition.[19]

Several factors contribute to elevated blood glucose levels, including a sedentary lifestyle, increased caloric intake, psychological stressors, weight gain, advancing age, and the influence of pharmacological agents such as corticosteroids.[18] Additionally, effective management of blood glucose levels is facilitated by engaging in regular physical activity and adhering to antidiabetic medication regimens as prescribed by healthcare providers.[13]

The study's limitations include insufficient consideration of confounding variables such as the participants' use of antidiabetic medications, their medical history, and the duration of their illness. Factors such as engagement in routine physical activities or sports were not assessed. Furthermore, the accuracy of dietary intake assessments relies heavily on the respondents' recall, which was conducted through interview methods.

Conclusion

The mean fasting blood glucose and 2-hour postprandial blood glucose levels fall within the diagnostic criteria for diabetes mellitus. It is noted that the presence of impaired fasting glucose is associated with a higher risk of developing diabetes in the future when

compared to individuals with impaired glucose tolerance.

Conflicts of Interest

We have no conflicts of interest to disclose

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ORIGINAL ARTICLE **Open Access**

Using Electrocardiographic Findings Utilized International Standards in Athletes from Gorontalo Province

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ABSTRACT

Introduction: The rate of sudden cardiac death among athletes is notably high due to cardiovascular disorders. However, there is a significant gap in fundamental electrocardiographic (ECG) data within the athlete population, particularly in Gorontalo Province. This study aims to describe the electrocardiography findings using international standards for athletes in Gorontalo Province, aiming to prevent the risk of sudden death through proactive early detection via ECG.
Method: Utilizing a cross-sectional descriptive design, we employed total sampling techniques with a population of 80 active athletes. Data was collected through direct examinations using a high-quality, internationally standardized ECG device, followed by thorough descriptive analysis.
Results: The results indicate that 90% of the athletes displayed normal ECGs, while 6.3% were classified as abnormal and 3.7% as borderline. Among the various athletic disciplines, endurance athletes showed a notable 9.4% rate of abnormalities, whereas athletes engaged in strength and mind sports consistently exhibited normal ECG results. Moreover, athletes in the productive age group (19–39 years) demonstrated a higher incidence of abnormalities than their counterparts in other age groups.

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Conclusion: This study emphasizes the importance of early electrocardiographic screening in athletes to identify potential cardiovascular risks and prevent sudden cardiac death. The findings reveal that most athletes in Gorontalo Province exhibit normal ECG results, followed by abnormal (6.3%) and borderline (3.7%) patterns, which undoubtedly require further investigation. These findings highlight the importance of regular ECG screening for active athletes to detect potential cardiovascular abnormalities early and prevent sudden cardiac events.

Keywords: Athlete, cross-sectional studies, electrocardiography, international criteria, sudden cardiac death

Introduction

An athlete is an individual who engages in sports or regular physical activity, prioritizing performance, and often participates in individual or team competitions. In athletes, cardiovascular adaptations occur as a physiological response to prolonged physical exercise. These adaptations include structural and functional changes in the myocardium, such as left ventricular hypertrophy, enlargement of cardiac chambers, and a reduction in resting heart rate.[1]

Based on data from the National Collegiate Athletic Association (NCAA), the incidence of sudden sports-related deaths from any cause in the general population ranges from 0.5 to 2.1 per 100,000 individuals annually. Sudden sports-related deaths are more prevalent among elite athletes compared to student-athletes, with an incidence of approximately 1 in 8,253 per year.[2]

The incidence of sudden cardiac death (SCD) among young athletes remains a subject of debate. The most robust data originates from a prospective observational study conducted in Italy, utilizing regional registry data with a mandatory reporting system. This study estimated an incidence rate of 3.6 per 100,000 annually during the pre-screening era. The prevention of SCD in athletes can be achieved through regular screening and electrocardiographic (ECG) monitoring. ECG screening aims to identify potential cardiovascular abnormalities early and is ideally performed during the athlete recruitment process.[5]

Electrocardiogram changes in athletes are commonly observed and typically reflect structural and electrical remodeling of the heart as an adaptation to regular physical exercise, a phenomenon known as “athlete’s heart.” However, abnormal ECG findings in athletes may indicate underlying cardiac pathology, which could elevate the risk of sudden cardiac death during physical activity.[6]

Electrocardiography is a graphical representation of the heart’s electrical activity, recorded on electrocardiograph paper. The underlying principle of ECG recording involves

electromagnetic forces, currents, or vectors characterized by magnitude and direction. A depolarizing current moving toward an electrode generates a positive deflection, while movement away from the electrode results in a negative deflection. Conversely, a repolarizing current traveling away from a positive electrode appears as a positive deflection, whereas movement toward the positive electrode produces a negative deflection. When the current flows perpendicular to the electrode, it aligns with the baseline, creating a biphasic waveform.[7,8]

Athletes are defined as individuals who excel in sports at regional, national, or international levels. They engage in structured exercises aimed at developing physical attributes such as strength, endurance, speed, agility, balance, flexibility, and other skills, all of which are systematically prepared well in advance of competitions. Based on various definitions, athletes can be characterized as individuals who participate in programmed, measured, and recorded sports activities with the objective of achieving peak performance and excellence in their field.[9]

In this study, sports are categorized into three main types based on the primary characteristics of physical activity: endurance sports, strength sports, and mind sports. Endurance sports are characterized by an individual's ability to engage their muscles in sustained contractions over a prolonged period under a specific load.[10] Examples of endurance sports include athletics, football, swimming, motorcycle racing, sepak takraw, table tennis, and gateball.

Strength training refers to the ability of muscles to contract and generate tension against resistance. Effective strength development typically involves resistance training methods.[11] Sports classified under strength training include Taekwondo, karate, kickboxing, martial arts, Muay Thai, weightlifting, and IBCA MMA (Indonesian Mixed Martial Arts). Mind sports, on the other hand, focus on strategy, concentration, and logical thinking skills while requiring minimal physical exertion.[12] Examples of mind sports include chess, bridge, e-sports, and billiards.

In the late 1800s and early 1900s, cardiac enlargement and bradyarrhythmias were noted in individuals with above-average exercise capacity. Structural and functional changes in the heart in athletes were generally detected during pre-participation screening, routine health checks, or when symptoms arose. The term "athlete's heart" was used to describe the structural and functional changes in the heart in individuals who exercised more than one hour per day. These changes were usually asymptomatic, with signs detectable on physical examination, such as bradycardia, systolic murmurs, and extra heart sounds.[13]

The International Consensus Criteria are a recent development that combines the Seattle criteria with new findings on cardiac adaptation in athletes of different ethnic backgrounds. These criteria have been adjusted to further reduce false-positive rates, particularly in black athletes, who often exhibit a more pronounced early repolarization pattern.[13]

Abnormal ECG patterns, such as left ventricular hypertrophy and repolarization disorders, can be early signs of pathological conditions that require further evaluation and intervention. Drezner et al. (2017), in their consensus statement International Criteria for Electrocardiographic Interpretation in Athletes, emphasize the need for routine cardiovascular screening in athletes, especially those involved in intensive sports. This study also found that the prevalence of ECG abnormalities may vary depending on the type of sport and the level of exercise intensity; this study emphasizes the importance of understanding athletes individual adaptation patterns to assess their cardiovascular health holistically.[14]

Male athletes are more susceptible to left ventricular hypertrophy and abnormal repolarization than females, especially in high-intensity sports such as professional basketball, according to Hamid et al. (2021), in their study on ECG characteristics among Malaysian Athletes emphasizes the need for gender and sport specific evaluations to understand the impact of training on athletes cardiovascular health.[15] Based on the findings and data above, this study aims to identify ECG images using international criteria in athletes in Gorontalo Province.

Methods

This study has received ethical approval from the Health Research Ethics Commission (KEPK) of Gorontalo State University with letter number 240/UN47.B7/KE/2024 dated November 11, 2024, and was conducted at the Rahmat Hotel Hall, which is the venue for activities held by the Office of the Komite Olahraga Nasional Indonesia (KONI) of Gorontalo Province. This study was conducted over a period of two days, starting from November 26, 2024 to November 27, 2024.

This study used a descriptive method with a cross-sectional design to assess the ECG picture in athletes in Gorontalo Province, with research variables in the form of univariate variables that include ECG finding. The population in this study were all active athletes in Gorontalo Province, totaling 80 athletes. The sample of this study consisted of all active athletes who were willing to participate in the study, with a sampling technique using total sampling. The inclusion criteria in this study were athletes aged between 14 and 60 years and were active athletes in Gorontalo Province, while the exclusion criteria were athletes who refused to become respondents.

The data processing process was carried out with the help of a computer using software such as Microsoft Office Word, Microsoft Office Excel, and the Statistical Package for The Social Sciences (SPSS) version 22, and the results were presented in tabular form. The main variables of the study were the results of ECG examinations based on international criteria, while additional variables included gender, age, type of sport, and length of time as an athlete. Data were collected through ECG examinations using tools that meet international standards, carried out by trained medical personnel. The results of the examination were recorded on the observation sheet that had been prepared.

The data obtained were analyzed univariately to present the frequency distribution of ECG results, using statistical software to ensure the accuracy of the results. This study complies with the ethical aspects of research, including obtaining informed consent from each respondent, maintaining the confidentiality of personal data, and obtaining approval from the authorized research ethics committee. The entire research process was carried out in accordance with the established protocol to ensure the validity and reliability of the results.

Result

In Table 1, it can be seen that the frequency distribution of the number of respondents shows that most athletes were aged between 19 and 34, totaling 58 athletes (72.5%). For the gender variable, it is known that most athletes were male, totaling 69 (86.2%), while females totaling 11 (13.8%). According to the variable of length of time as an athlete, it is known that most athletes had a duration of being an athlete more than one year, totaling 69 (86.2%), while athletes who had a duration of less than one year totaling 11 (13.8%). A total of 46 (57.4%) athletes participated in endurance sports and athletes who participate in mind sports and strength sports totaling 17 (21.3%). Most athletes had a normal BMI (50 athletes, 62.5%). Meanwhile, 13 athletes (16.2%) were classified as obese, 12 (15%) as overweight, and five (6.3%) as underweight. For the blood pressure variable of the athletes who were respondents, it was found that the majority of athletes had normal blood pressure, amounting to 69 (86.2%), while athletes with hypertension amounted to 11 (13.8%).

Based on Table 2, it was found that the majority of athletes experienced ECG with a normal category, namely 72 athletes (90%). In contrast, there were athletes who experienced ECG with an abnormal category, namely five athletes (6.3%). The remaining three athletes (3.7%) experienced ECG with a borderline category.

Table 1. Frequency distribution based on respondent characteristics

Respondent Characteristics (N=80)	Frequency (n)	Percentage (%)
Age (Years)		
14-18	12	15.0
19-34	58	72.5
≥35	10	12.5
Gender		
Man	69	86.2
Woman	11	13.8
Long Time Being an Athlete		
≤1 Year	11	13.8
>1 Year	69	86.2
Types of Sports		
Endurance Sports	46	57.4
Strength Sports	17	21.3
Mind Sports	17	21.3
Body Mass Index		
Underweight	5	6.3
Normal	50	62.5
Overweight	12	15.0
Obesity	13	16.2
Blood pressure		
Normal	69	86.2
Hypertension	11	13.8

Table 2. Frequency distribution of electrocardiography interpretation in athletes from Gorontalo Province

Electrocardiography Findings	Frequency (n)	Percentage (%)
Abnormal	5	6.3
Normal	72	90.0
Borderline	3	3.7
Total	**80**	**100**

Table 3 shows cross tabulation between gender and ECG. Of the 11 female athletes, there was one athlete (1.3%) who experienced an abnormal ECG and 10 athletes (12.5%) who experienced a normal ECG. While of the 69 male athletes, there were four athletes (5%) who experienced an abnormal ECG, 62 athletes (77.5%) who experienced a normal ECG and three athletes (3.7%) who experienced a borderline ECG.

Table 3. Frequency distribution of electrocardiography interpretation by gender

Gender	Electrocardiography Findings						Total	
	Abnormal		Normal		Borderline			
	n	%	n	%	n	%	N	%
Woman	1	1.3	10	12.5	0	0	**11**	**13.8**
Man	4	5.0	62	77.5	3	3.7	**69**	**86.2**
Total	**5**	**6.3**	**72**	**90.0**	**3**	**3.7**	**80**	**100**

Based on Table 4, a cross-tabulation between age and ECG was obtained. Of the 12 athletes aged between 14 and 18 years, there were 11 athletes (13.8%) who experienced ECG with a normal category and one athlete (1.3%) who experienced ECG with a borderline category. Of the 58 athletes aged between 19 and 34 years, there were five athletes (6.3%) who experienced ECG with an abnormal category, 51 athletes (63.8%) who experienced ECG with a normal category and two athletes (2.4%) who experienced ECG with a borderline category. Meanwhile, of the 10 athletes aged 35 years or older, all experienced ECG with a normal category.

Table 4. Frequency distribution of electrocardiographic interpretation by age

Age (Years)	Electrocardiography Findings						Total	
	Abnormal		Normal		Borderline			
	n	%	n	%	n	%	N	%
14-18	0	0	11	13.8	1	1.3	**12**	**15.0**
19-34	5	6.3	51	63.8	2	2.4	**58**	**72.5**
≥35	0	0	10	12.5	0	0	**10**	**12.5**
Total	**5**	**6.3**	**72**	**90.0**	**3**	**3.7**	**80**	**100**

Table 5 shows a cross-tabulation between the type of sport and ECG. Of the 46 athletes who are engaged in endurance sports, there were five athletes (6.3%) who had ECGs in the abnormal category, 39 athletes (48.8%) who had ECGs in the normal category, and two athletes

(2.5%) who had ECGs in the borderline category. Of the 17 athletes who are engaged in strength sports, all had ECGs in the normal category. Meanwhile, of the 17 athletes who are engaged in mind sports, there were 16 athletes (20%) who have ECGs in the normal category and one athlete (1.3%) who had ECGs in the borderline category.

Table 5. Frequency distribution of electrocardiography interpretation by sport type

Types of Sports	Electrocardiography Findings						Total	
	Abnormal		Normal		Borderline			
	n	%	n	%	n	%	N	%
Endurance	5	6.3	39	48.8	2	2.4	**46**	**57.4**
Strength	0	0	17	21.3	0	0	**17**	**21.3**
Mind	0	0	16	20.0	1	1.3	**17**	**21.3**
Total	**5**	**6.3**	**72**	**90.0**	**3**	**3.7**	**80**	**100**

Discussion

This study involved 80 active athletes under the auspices of the KONI Gorontalo Province. Normal EKG results were found in 90% of the respondents, which corresponds to 72 athletes. This finding indicates that the majority of athletes in Gorontalo Province have good cardiovascular health. This condition is supported by the routine physical activity performed by the athletes, which plays a role in enhancing vascular elasticity, maintaining normal blood pressure, and optimizing heart function. A study by Hamid et al. (2021) also showed that 61% of athletes in Malaysia with high training intensity exhibited normal ECG results, reflecting a healthy cardiovascular adaptation.[15]

There were 6.3% or five athletes with abnormal ECG results. These findings included abnormal QRS complexes (left posterior fascicular block/LPFB) and abnormal T waves (inversion in V1-V3, biphasic in V2-V4, or inversion in III and aVF). The proportion of athletes with abnormal ECG in Gorontalo was higher compared to the study by Hamid et al. (2021) which noted that 4% of athletes in Malaysia had abnormal results. However, this figure is lower than the study by Waase et al. (2018) on NBA athletes, where 15.6% of athletes had abnormal ECG results based on international criteria.[16]

ECG results in the borderline category were found in 3.7% of respondents, namely three athletes. This finding involves right axis deviation or a pattern that is not entirely normal but cannot yet be categorized as abnormal. According to Sharma et al. (2017), borderline ECG interpretation is often found in athletes who undergo intensive training and tends to be

influenced by age or training load factors. Although often not pathological, this condition requires further monitoring to ensure it does not develop into a more serious disorder.[1]

Meanwhile, of the 69 male athletes, 62 athletes (77.5%) had normal ECG results, four athletes (5%) showed abnormal ECG results, and three athletes (3.7%) showed borderline ECG results. Abnormal findings in male athletes are more often caused by higher physical stress from intensive sports, which can trigger left ventricular hypertrophy, axis deviation, or repolarization disorders. Research by Waase et al. (2018) also showed that men have a higher prevalence of abnormalities than women due to the influence of testosterone hormones and greater left ventricular mass.[16] The borderline ECG results in three male athletes are often associated with intensive training loads, as is the case in endurance sports that are common in Gorontalo, including soccer.

Of the 11 female athletes, 10 athletes (12.5%) had normal ECG results, while one athlete (1.3%) showed abnormal ECG results, and there were no borderline results. These findings indicate that the majority of female athletes in Gorontalo have good cardiovascular conditions. These results are in line with research by Harris et al. (2022), which states that women tend to have more normal ECG results than men due to smaller left ventricular mass and more moderate exercise intensity.[11] The abnormality in this one female athlete may be associated with specific factors such as uncontrolled exercise intensity or certain medical histories that affect heart health.[17]

This difference in distribution suggests that male athletes are more susceptible to abnormal or borderline ECG findings than female athletes, which is largely due to the type of sport and higher physical load in males. The types of sports often performed by male athletes in Gorontalo, such as endurance and strength sports, put greater hemodynamic stress on the heart, increasing the risk of ECG abnormalities. On the other hand, female athletes are more often involved in sports with lower physical intensity, so the cardiovascular stress experienced is relatively mild. These findings provide an illustration that gender influences the cardiovascular risk of athletes in Gorontalo, with males being more at risk of experiencing abnormal and borderline ECG findings. Therefore, routine monitoring of cardiovascular health is needed, both in male and female athletes, to prevent further complications.

The results of the electrocardiography interpretation analysis based on the age group of 14–18 years, from 12 athletes, 11 athletes (13.8%) had normal ECG results, and one athlete (1.3%) showed borderline ECG results, without abnormal findings. These results indicate that most young athletes in Gorontalo have healthy cardiovascular conditions. Borderline results in this group are usually associated with initial adaptation to intensive physical exercise, such as

right axis deviation or increased QRS voltage, which are often not pathological but still require further monitoring. Research by Idiazabal-Ayesa et al. (2023) also noted that the prevalence of significant abnormalities in adolescent athletes was very low, only around 2.32%, indicating physiological adaptation in the development phase.[18]

In the 19–34 age group, out of 58 athletes, 51 athletes (63.8%) had normal ECG results, 5 athletes (6.3%) showed abnormal ECG results, and 2 athletes (2.4%) showed borderline ECG results. These results indicate that the productive age group has a higher proportion of abnormal ECG results compared to other age groups. These abnormalities may be associated with the cumulative effects of long-term intensive training on the heart, such as left ventricular hypertrophy or concentric ventricular remodeling. Research by Waase et al. (2018) showed that the prevalence of abnormalities increases with age due to exposure to high and repeated physical loads for a long time. Productive age athletes in Gorontalo tend to be involved in endurance sports such as soccer and long-distance running, which put greater hemodynamic pressure on the heart, thereby increasing the risk of abnormalities.[16]

In the age group ≥40 years, out of eight athletes, all showed normal ECG results (100%). This result is different from the theory that states that with increasing age, the risk of structural and functional changes in the heart that can affect the ECG picture tends to increase. However, several factors can explain this finding. First, athletes who remain active until they are over 40 years old are usually those who have gone through a natural selection process, where only athletes with good cardiovascular conditions are able to survive intensive physical activity at this age. Research by Sharma et al. (2017) states that older athletes tend to have a more structured and controlled training pattern, so the risk of abnormalities can be minimized.[1] Second, more intensive medical supervision in older athletes allows for early detection and management of cardiovascular risk, as stated in the research by Ndongo Amougou et al. (2019).[19]

The distribution of ECG results by age in Gorontalo showed that young athletes generally have good physiological adaptation to physical training, while athletes of productive age are more susceptible to abnormalities due to greater training loads. Athletes aged ≥40 years showed normal ECG results, which can be explained by natural selection and stricter health surveillance. These findings emphasize the importance of monitoring cardiovascular health in all age groups, especially in the productive age group, to prevent further complications and ensure optimal athlete performance.

Of the 46 endurance athletes, 39 athletes (48.8%) had normal ECG results, five athletes (6.3%) showed abnormal ECG results, and two athletes (2.4%) showed borderline ECG results.

Abnormal findings in endurance athletes may be associated with the type of exercise that places a high volume load on the heart, such as left ventricular hypertrophy or abnormal repolarization. Sharma et al.'s (2017) study stated that endurance sports have a higher prevalence of ECG abnormalities than other types of sports, because continuous hemodynamic stress during intense exercise causes more significant cardiac adaptation.[1] In Gorontalo, sports such as football or long-distance running that are dominant in this group often involve high exercise intensity, thus increasing the risk of pathological electrocardiographic changes.

A total of 17 strength athletes, all showed normal ECG results (100%), with no abnormal or borderline findings. The absence of abnormal findings in strength athletes can be explained by the type of cardiovascular adaptation that occurs in strength sports, which triggers more concentric left ventricular hypertrophy due to pressure loads than volume loads. Research by Waase et al. (2018) stated that strength sports cause fewer electrophysiological changes in the ECG than endurance sports, because the load on the heart is more localized and does not provide significant chronic hemodynamic pressure.[16] In Gorontalo, common strength sports, such as weightlifting, tend to be done in short but intense durations, which results in different physiological adaptations than endurance sports.

Of the 17 mind sports athletes, as many as 16 athletes (20%) had normal ECG results, and one athlete (1.3%) showed borderline ECG results, with no abnormal findings. The absence of abnormal results in mind sports athletes is due to the low physical load given to the cardiovascular system. Mind sports athletes are more related to psychological stress, competitive pressure, and high expectations than physical activity that affects the structure and function of the heart. In Gorontalo, sports such as chess or esports dominate this category, with lower cardiovascular risks than physical sports.

The distribution of ECG interpretations in athletes in Gorontalo based on the type of sport shows that endurance sports have the highest proportion of abnormal results compared to other types of sports. This is due to the greater hemodynamic training load, which is at risk of causing pathological changes in the structure and function of the heart. In contrast, strength sports do not show abnormal results due to the different adaptation properties of the heart, which are more focused on increasing pressure without affecting repolarization. Mind sports athletes, although they do not have abnormal results, still show borderline results due to the influence of psychological stress which can trigger a sympathetic response in the cardiovascular system. These results indicate the importance of adjusting training programs and monitoring cardiovascular health that are tailored to the type of sport the athlete participates in. Endurance athletes require more intensive monitoring to detect a higher risk of ECG

abnormalities, while strength and mind sports athletes still need stress management education and health monitoring to maintain a balance between performance and health.

This study has several limitations, namely the number of samples used in this study is still relatively small, so the results of the study are less able to represent the overall athlete population in Gorontalo Province. With a wider scope, especially in various sports, the results of the study can better describe the ECG conditions of athletes in this area. Furthermore, the composition of the sample dominated by male athletes can affect the results of the study, considering the differences in risk and electrocardiographic patterns between men and women. Most of the samples came from endurance sports, with fewer representatives from strength and mind-sports. This can limit the generalization of the findings to athletes from other sports with different physical activity patterns and cardiovascular risks.

Conclusion

This study shows that the majority of athletes in Gorontalo Province have good cardiovascular health based on ECG results, although there are a small number of athletes with abnormal and borderline results that require further attention. These findings underline the importance of routine cardiovascular health monitoring, particularly for athletes involved in high-intensity endurance sports, to detect and prevent the risk of serious cardiac complications. Further research with larger samples and longitudinal analysis is needed to understand the long-term impact of physical activity on athletes' cardiovascular conditions.

Conflicts of Interest

We have no conflicts of interest to disclose

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CASE REPORT **Open Access**

Myiasis in A Chronic Untreated External Ear Lesion: A Case Report

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ABSTRACT

Myiasis is a prevalent parasitic infection which predominantly observed in rural regions among humans. In the practice of otolaryngology, this medical condition has the potential to impact the auditory organs, nasal passages, paranasal sinuses, nasopharynx, oral cavity, and the integumentary system of the craniofacial region. We reported a case in a 77-year-old woman who came to the emergency department due to chronic ear pain followed by the emergence of maggots. The chronic wound in the ear is the culprit in this condition. Dipterous larvae undergo their life cycle within the body of vertebrates which are attracted to open wounds. The primary objective in the treatment of myiasis is the eradication of maggots. In this case, we present successful treatment of aural myiasis following the complete removal of the maggot and treating the underlying condition. This case taught the lesson that myiasis could affect the human auditory system, especially in chronic untreated ear lesions with poor sanitation. Removing the larva and treating the underlying disease is the key treatment.

Keywords: Earache, myiasis, larva

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Introduction

Humans are susceptible to attacks not just from mature insects but also from their larval stages. Myiasis, also referred to as "fly strike," is the invasion of human and animal tissue by dipteran larvae, commonly known as maggots.[1] Myiasis is a condition when maggots infest the tissues and organs of living vertebrates, including humans, and feed on the host's live or decaying tissue.[1,2] The condition is widely recognized as a prevalent parasite infestation in livestock across tropical climates worldwide. In addition to animals, this illness has also been documented to manifest in humans residing in underdeveloped countries. While instances of myiasis in humans are infrequent, outbreaks are exceedingly uncommon. Human infestation is contingent upon the proximity of pets and livestock due to the zoonotic nature of the disease.[3] The prevalence is neglected worldwide, but it depends on seasonal variation, which is related to the latitude and life cycle of the various species of flies. Its incidence is higher in the tropics and subtropics of Africa and the Americas. A review of epidemiological and clinical data on human myiasis from Ecuador reported that the highest annual incidence was reported in the Amazon (23 cases/100,000 population), followed by Coast (5.1/100,000) and Andes (4.7/100,000).[4]

Instances of aural myiasis (AM) typically occur as facultative or accidental occurrences, meaning that the presence of larvae in the ear is coincidental. Aural myiasis predominantly occurs in regions with tropical and subtropical climates characterized by elevated humidity and warm temperatures. It is particularly prevalent in rural areas where humans frequently interact with animals.[5] Aural myiasis refers to the invasion of the outer and/or middle ear by parasitic larvae. Flies can lay eggs while in flight and are drawn to the scent emanating from the ear. The presence of chronic lesions, particularly chronic suppurative otitis media, plays a role in attracting flies to the ear. The extent of infestation is contingent upon the specific fly species, host organism, and surrounding environment, in addition to the immune response of the host.[6] Surgery is not necessary for the majority of AM cases. An analysis of 45 cases of AM documented in 34 studies revealed that 88.9% of patients did not have surgical intervention.[1] Therefore, this article intends to share clinical manifestation along with its treatment of this rare condition, aural myasis, particularly in chronic untreated ear lesions with poor sanitation.

Case

A 77-year-old woman was brought to the hospital's emergency room (ER) by her family due to her primary complaint of chronic left earache lasting for 5 years. Complaints followed with the emergence of maggots from the ear. The family confirmed that over the past month, over 30 larvae were emerging from the left ear. Complaints are present together with a

reduction in hearing, a sense of fullness, and a perception of movement in the ear. Previously, the patient had sustained long-standing wound in his left ear. However, due to uncertainty and a tendency to use unsanitary materials to clean his ears, he refrained from seeking medical attention. Thus yet, the wound had not underwent any cleaning or treatment. The patient and his family stated that there were no signs of maggots in other body organs, such as the nose, mouth, or eyes. There is a history of untreated hypertension. There were no constitutional symptoms present, such as fever, nausea, vomiting, or diminished consciousness. The individual resided in a highly populated residential region and was employed as a housewife. The patient and her family did not have any domesticated animals.

Upon careful inspection, a laceration was observed on the left auricle, along with a superficial ulcer that exhibited signs of pus and bleeding on its surface. During otoscopic examination, signs of inflammation such as swelling, redness, ulcers, pus, bleeding, and the presence of granulation were observed. Additionally, there were active fly larvae (maggots) inside the external ear canal (Figure 1a). The right ear did not exhibit any visible abnormality. There were no abnormalities detected in the nervous system. Routine blood testing showed leukocytosis which is 13.470/µL, with predominant granulocytes (differential count: lymphocytes 3.640/µL; granulocytes 8.810/µL; and mid 1.010/µL). The preliminary diagnosis is left AM, along with an auricular laceration. The first course for treatment in the emergency room was the administration of analgesics. Furthermore, the process of treating and disinfecting ear lesions was performed. The patient received local anesthetic using a 1% Lidocaine solution, followed by the removal of several maggots using forceps (refer to Figure 1b). Ear tampons were used to minimize the discharge and control bleeding.

The patient underwent consultation with an otolaryngology specialist, who then planned for the removal of necrotic wound tissue through debridement. Additionally, maggot extraction was intended to take place in the operating room, with the patient under general anesthesia. A thorough removal of the maggots and complete removal of fluids and granulation tissue was performed. Subsequently, the caustic substance is removed, completing the procedure by using a tampon soaked in Burow's solution. Suturing was conducted on the auricular laceration. Additional treatments included analgesics and broad-spectrum systemic antibiotics. Ear assessment was conducted every 24 hours, along with the application of caustics, Burow's tampons, and changes to the bandage. During the sixth day of treatment evaluation, significant reductions in ear discharge, pain reduction, and absence of maggots were observed. Laceration wounds absence of active inflammation. Patients are recommended to adhere to medication management and receive outpatient care at the polyclinic.

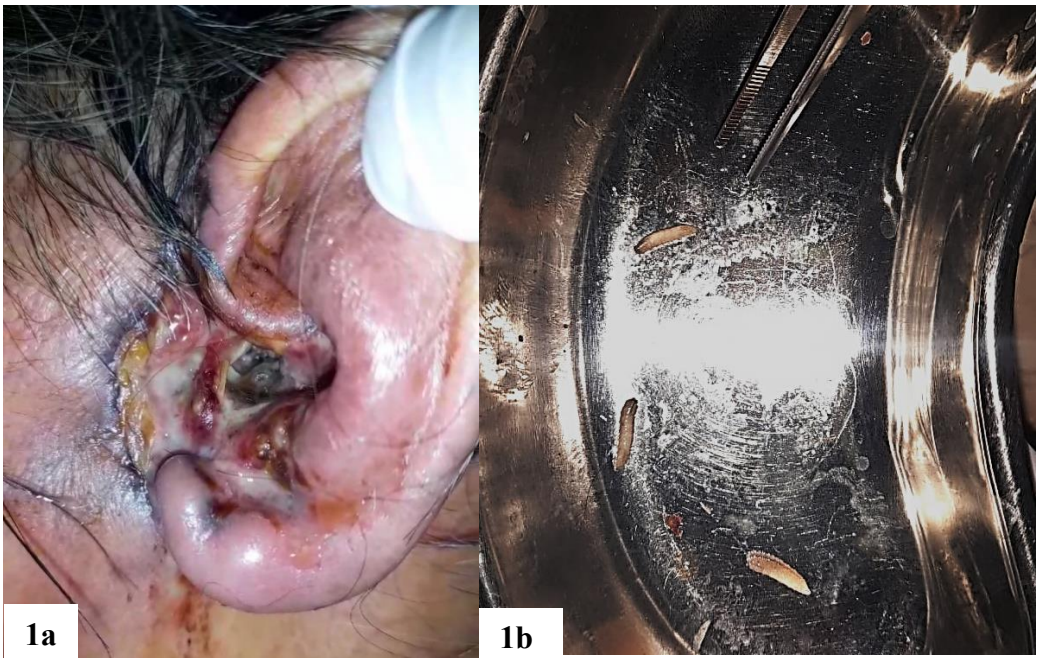

Figure 1a. Physical examination of the left auricle. The auricles exhibit edema, erythema, superficial ulcers, and lacerations, along with the presence of maggots in the external auditory canal. **1b.** The extracted fly larvae (maggots) can be observed, having been successfully removed in the emergency room.

Discussion

Myiasis is a prevalent parasitic infection in mammals. The condition is predominantly observed in rural regions among humans who have more proximity to animals. This condition arises when female flies deposit eggs, which then lead to clinical symptoms associated with the affected organs. In the practice of otolaryngology, this medical condition has the potential to impact the auditory organs, nasal passages, paranasal sinuses, nasopharynx, oral cavity, and the integumentary system of the craniofacial region.[5] As we discovered, the patient's ear was infested with mature maggots.

Dipterous larvae, commonly referred to as maggots, undergo their life cycle within the body of vertebrates, either completely or in phases. Gravid flies are attracted to visible wounds or other body organs such as the eyes, ears, nose, vagina, anus, and others to deposit eggs. Upon hatching, the larvae actively target compromised skin and nourish themselves by consuming the tissue. The fully developed third instar larvae descends to the soil to undergo metamorphosis into pupae. Following a specific duration, the fully developed fly emerges

from the pupa. Various types of flies infest human or animal tissue in their larval stage. Certain species necessitate a mammalian host for the growth of their larvae, whereas others may lay their eggs in exposed wounds as a replacement for decomposing animal or plant material. Blowflies (*Calliphoridae*), flesh flies (*Sarcophagidae*), and botflies (*Oestridae*, *Gasterophilidae*, *Hypodermatidae*, *Cuterbridae*) are the three main categories of flies that typically cause myiasis. However, flies from other families like *Muscidae* and *Phoridae* can also cause myiasis resulting in this issue.[7] In this particular case, the identification of the species or family of maggots that infested the patient was not conducted due to the obvious difficulty of visually differentiating the fly larvae. There have been 71 fly species identified in Indonesia, mostly in Sulawesi. All species are classified under the genus Simulium and categorized into five subgenera, namely *Gomphostilbia*, *Nevermannia*, *Wallacellum*, *Morops*, and *Simulium.*[8]

Myiasis is broadly classified into two categories: obligate and facultative myiasis.[7] Obligate myiasis-causing species require a living host for their growth while facultative-causing species sporadically deposit eggs or larvae on a living host and typically develop in decomposing matter. Facultative myiasis can be categorized into primary, secondary, and tertiary forms, depending on the species' capacity to initiate myiasis (primary) or to infest pre-existing myiasis (secondary and tertiary). Myiasis can also be categorized according to the specific location of the larvae in the host's body, which can be either external or internal. These locations include the ear, skin, gastrointestinal tract, eyes, mouth, and urogenital tract.[9] This case can be categorized as primary obligate auricular myiasis.

The larvae responsible for myiasis can enter the human ear cavity by producing mucopurulent secretions. Aural myiasis is infrequent in adults but prevalent in children, particularly in adults with underlying mental disabilities.[7] It was detected in a geriatric patient in this particular case. The patient had no prior medical record of psychological issues or psychiatric disorders. Potential risk factors include impairments in performing activities and patient mobility, leading to inadequate levels of hygiene and self-care. There have been similar instances in 2020 where elderly people with minimal socioeconomic risk factors and residing in remote locations with tropical temperatures have reported such incidences.[10] Extrinsic factors, such as inadequate sanitation and lack of permanent housing, contribute to the development of favorable circumstances. While livestock is commonly found in rural locations, the presence of flies in metropolitan areas with high rates of poverty can be attributed to rubbish and waste.[11]

Aural myiasis can manifest with symptoms including pruritus, hemorrhage, dyspnea,

and agitation. Additionally, one may experience sensations of gradual movement and auditory buzzing. Severe infestations might result in malodorous discharge emanating from the ear. Ear pain or otalgia are the most prevalent clinical signs of aural myiasis. Otorrhea, which refers to the discharge of fluid from the ear, can be an important sign to consider. The variety of symptoms may encompass eardrum perforation, tinnitus, and furuncles or blisters in the middle ear. Severe infestations might lead to the development of deafness and meningitis. Larval infestation can cause damage to the tissue surrounding the ear canal, including the bones, however, fatalities are uncommon. Tissue injury may arise from either mechanical disruption of the tissue or the secretion of the collagenase enzyme by the larvae.[7] Interestingly, a simultaneous anomaly was discovered in the form of auricula laceration. Based on the patient's medical history, it is unclear whether this aberration happened before or after the infestation of fly larvae. The laceration could either be the site of the egg's initial deposit or a result of myiasis-related complications.

This case exhibits similar clinical signs to other documented cases of AM, including otalgia, foreign body sensation and movement in the ear, impaired hearing, and the presence of purulent discharge and blood in the ear. In 2020, Wang et al. documented a case involving a 29-year-old lady who exhibited risk factors for congenital mental problems.[6] In the same year, Rummens et al. documented a case involving a 65-year-old lady who had multiple risk factors for a previous occurrence of cancer on the same side of her parotid gland. The patient had undergone surgical intervention, chemotherapy, and radiotherapy as part of her treatment.[10] In 2015, Al Jabr et al. documented a case of auditory myiasis in a 12-year-old kid with no prior medical conditions. One identifiable risk factor is the patient's residence in a desert area. There is an infection of obligate parasites belonging to the *Sarcophagidae* family, namely the species *Wohlfahrtia magnifica.*[5]

No additional study was conducted to ascertain the specific species of maggots that were infesting the patient in this particular case. The clinical value of species identification is uncertain and necessitates specialist biological and entomological laboratory equipment. The treatment principles for AM, particularly when it affects the ear canal, middle ear, and mastoid, remain the same irrespective of the specific species involved. The treatment protocol continues to involve eradicating flies and larvae, thoroughly cleansing the area affected by any residual larvae, and delivering antibiotics in the presence of a secondary infection.[11]

The primary objective in the treatment of myiasis is the eradication of maggots. It is crucial to refrain from directly squashing flies while removing them, as they may deposit their eggs. It is advised against killing maggots found in the ear, as they can be challenging to

locate, and leaving dead maggots in the ear can lead to a foreign body reaction. The ear canal can be irrigated using various substances such as 70% ethanol, physiological saline, urea, oil drops, dextrose, creatinine, iodine salts, and topical ivermectin. Among these, ivermectin is the most frequently employed and efficacious medication for eliminating any residual larvae. Local anesthetics can be employed to restrict larval mobility and prevent local irritation. Following manual cleansing, it is advised to undergo both local and systemic therapy. In cases of ear infections, such as ours, it is crucial to apply topical medicines.[6]

Various topical therapies have effectively treated myiasis affecting the external ear, middle ear, and/or mastoid. These encompass traditional therapeutic substances like alcohol and ether, as well as modern substances like combination antibiotic/steroid treatments. Before and following ear toilet and maggot removal, topical therapy is typically used to eradicate larvae and aid in their removal. Additionally, topical therapy is employed to promote healing of the outer and/or middle ear.[2] In this scenario, topical medication has been implemented, yielding satisfactory outcomes in alleviating inflammation and diminishing secretions. To halt the necrosis process in the ear tissue, a thorough larval extraction is performed. Administering antibiotics is conducted to mitigate and preempt subsequent infections.

An interesting point is that a systematic review conducted in 2020 highlighted the use of fly larvae (maggots) as a therapeutic intervention to facilitate the recovery of chronic wounds. The evaluated outcomes encompass the removal of dead tissue, eradication of bacterial proliferation, formation of new tissue, decrease in wound size, complete healing, adverse effects, and duration of the healing period. Several studies indicate markedly superior outcomes, whereas others indicate the contrary. Thus, this therapy remains a subject of controversy for various categories of wounds.[12]

The limitation of this presented case is that the identification of the causative fly species was not done. It is due to the lack of resources in our facility and the scarce of the case of human myiasis. Identifying the causative species would help clinician in treating this condition, such as the need for larvicidal to eradicate the maggot from wound infestation.

Conclusion

Myasis can be infested in humans, especially in the auditory system. From this case we can learn that myasis can occur in chronic untreated external ear lesions in patients with low-quality sanitation. This condition rarely becomes fatal. Complete removal of larva and treating the underlying condition can significantly treat this condition.

Conflict of Interest

All authors declare that they have no conflicts of interest.

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Nothing to declare

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