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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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