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Overview of Motor Nerve Damage in People with Diabetes Mellitus

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ABSTRACT

Damage to motor nerves in people with diabetes increases the risk of a foot injury. So far, the examination of motor nerve damage in people with diabetes in agricultural areas such as the Jember Regency is still rarely touched by primary health services. The purpose of this study was to identify motor nerve damage in people with diabetes in the agriculture area of the Jember Regency. This type of research is exploratory, descriptive, 102 respondents obtained by purposive sampling technique. Data collection uses instrument modification from MNSI (Michigan Neuropathy Screening Instrument) and MDNS (Michigan Diabetic Neuropathy Score). The analysis used in univariate and displayed in the frequency distribution. The results showed that the majority of respondents who suffer from DM are experienced in the middle adulthood category (71.6%), with a length of suffering more than five years (95.1%), and have a history of comorbidities (68.6%). The most common form of motor deformity damage was hallux valgus on the right and left legs (38.2%; 26.4%). Forms of motor damage in the form of muscle strength, severe damage to the abduction of the right and left legs (7.8%), and were found right or left toe extensions (1.9%; 2.9%). Motor damage in the form of no physiological reflexes was found in the right and left Quadriceps femoral (2%; 1%), and right or left leg Achilles (1%). The result of total motor damage assessment is that people with diabetes have decreased muscle strength in the right and left extremities (74.5%; 72.5%). This research shows that the majority of people with diabetes in the agriculture area of the Jember Regency suffer motor nerve damage. Therefore, there is a need for preventive measures to prevent the worsening condition of people with diabetes.

Keywords : Agriculture, Diabetes Mellitus; Motor Nerve Damage.

INTRODUCTION

Jember Regency is an agricultural region that has a high number of Diabetes Mellitus (DM) visits in 2018, 36,834 (PEMKAB Jember, 2012; Dinas Kesehatan Kab. Jember, 2019). The relatively high prevalence of DM in Jember was allegedly the possibility of exposure to the use of pesticides in agriculture. Reinforced by previous research, which states that exposure to pesticides can affect beta cells in producing the hormone insulin, so that blood sugar levels become high and DM will occur(Saputri, Setiani, YD, & Budiyono, 2018).

DM causes various complications, one of which is peripheral neuropathy (World Health Organization, 2016). Based on the results of Riset Kesehatan Dasar (2013) showed that the most complications of DM are neuropathy, and experienced by around 54% of clients treated at Cipto Mang unkusumo Hospital. Peripheral neuropathy that occurs can cause permanent disability such as amputation, which is caused by injuries with improper care (Al-rubeaan et al., 2015). Also, people with diabetes who have a history of DFU and previous amputations will aggravate the level of peripheral neuropathy of people with diabetes (Al-rubeaan et al, 2015).

Alik & Roup Research (2010) explains that motor nerve damage is a part of peripheral neuropathy, and currently, it is rarely examined by primary health care (Bansal et al., 2014). Damage to motor nerves causes muscle atrophy, leg deformity, changes in foot biomechanics, and pressure distribution will be disrupted so that it can cause diabetic foot injuries (Kartika, 2017). So far many studies have discussed diabetic peripheral neuropathy in general, but it is very rarely associated with motor nerve damage and especially in agricultural areas.

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METHOD

This type of research is exploratory descriptive. Descriptive research only analyzes and presents data system this explorative, descriptive study aims to describe the phenomenon of motor nerve damage in people with diabetes, not to test a hypothesis. The population in this study were all DM clients in the agricultural district of Jember, which included Jelbuk and Sukorambi Districts. The total population is 1373 people with diabetes.The sample in this study uses Total Population Sampling, which is a type of purposive sampling technique in which sample selection based on specific characteristics. Inclusion criteria set by researchers include people with diabetes> 18 years old, people with diabetes who do not have active DFU, people with diabetes who did not experience amputation in both legs.

From the results of sample calculation using the Slovin formula, the minimum number of samples is 93. However, in this study, 102 people who participated in it, so all subjects who met the criteria for the sample. Data collection uses instrument modification from MNSI (Michigan Neuropathy Screening Instrument) and MDNS (Michigan Diabetic Neuropathy Score). MNSI items are used in inspection for deformity, while MDNS using for forms of physiological reflex damage and muscle strength.

RESULT

Demographic Charateristics of people with diabetes

Table 1. Demographic Characteristics

Respondent Category	Frequency	Percentage (%)
Age		
Early adulthood	12	11.8
Middle adult	73	71.6
Late adulthood	17	16.7
Sex		
Male	47	46.1
Female	55	53.9
Duration of DM		
<1	5	4.9
1-5	60	58.8
>5	37	36.3
Blood sugar levels		
<90 mg/dL	5	4.9
90-199 mg/dL	59	57.8
≥200 mg/dL	38	37.3
History of Smoking		
Yes	69	67.6
No	33	32.4
History of comorbidities/Complication		
Yes	70	68.6
No	32	31.4
Types of comorbidities/Complication		
Hipertension	61	59.8
Stroke	5	4.9
Coronary heart disease	0	0
CKD	2	2
Etc..	2	2
History of DFU		
Yes	10	9.8
No	92	90.2
Total	102	100

Table 1 shows that the majority of people with diabetes are in the middle adulthood category (71.6%), with more than five years (95.1%), and with a history of comorbidities (68.6%).

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Description of Motor Nerve Damage

Deformity

Table 2. Frequency distribution of motor damage in the form of deformity

Checking Type	Frequency	Percentage (%)
Flat feet		
Right foot deformity	15	14.7
Left foot deformity	15	14.7
Both No Deformity	72	70.6
Hammer toes		
Right foot deformity	20	19.6
Left foot deformity	19	18.6
Both No Deformity	63	61.8
Claw toes		
Right foot deformity	8	7.8
Left foot deformity	7	6.9
Both No Deformity	87	85.3
Mallet toes		
Right foot deformity	7	6.9
Left foot deformity	4	3.9
Both No Deformity	91	89.2
Overlapping toes		
Right foot deformity	1	0.1
Left foot deformity	1	0.1
Both No Deformity	100	98.8
Hallux valgus		
Right foot deformity	39	38.2
Left foot deformity	27	26.4
Both No Deformity	36	35.3
Prominent metatarsal heads		
Right foot deformity	3	2.9
Left foot deformity	2	2
Both No Deformity	97	95.1
Charchot foot		
Right foot deformity	1	0.1
Left foot deformity	1	0.1
Both No Deformity	100	98.8
Total	102	100

Table 2, show that the most common deformity found on the right foot is hallux valgus, as many as 39 respondents (38.2%), while the deformity on the left foot was mostly found in the hallux valgus by 27 respondents (26.4%).

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Muscle Strength

Table 3. Distribution of the frequency of motor damage in the form of muscle strength

Scoring	Frequency	Percentage (%)
Abduction of the right toe		
Normal	47	46.1
Moderate	47	46.1
Severe	8	7.8
Abduction of the left toe		
Normal	47	46.1
Moderate	47	46.1
Severe	8	7.8
Extension the right toe		
Normal	48	47.1
Moderate	52	51
Severe	2	1.9
Extension the left toe		
Normal	51	50
Moderate	48	47.1
Severe	3	2.9
Dorsoflexion right ankle		
Normal	58	56.9
Moderate	44	43.1
Severe	0	0
Dorsoflexion left ankle		
Normal	60	58.8
Moderate	42	41.2
Severe	0	0
Total	102	100

Table 3 shows that the results of muscle strength tests that had the most normal values on the right and left legs were ankle dorsiflexion as many as 58 people (56.9%) and 60 people (58.8%). While those with the most moderate value on the right and left foot were toe extensions, 52 respondents (51%), and 48 respondents (47.1%). Forms of severe damage were found on the right and left abduction (7.8%), and right and left toe extensions (1.9%; 2.9%).

Physiological Reflexes

Table 4. Distribution of the frequency of motor damage in the form of physiological reflexes

Scoring	Frequency	Percentage (%)
Right biceps brachii		
Reflexes normal	60	58.8
Less of reflex	42	41.2
No Reflex	0	0
Left biceps brachii		
Reflexes normal	60	58.8
Less of reflex	42	41.2
No Reflex	0	0
Right triceps brachii		
Reflexes normal	59	57.8
Less of reflex	43	42.2
No Reflex	0	0
Left triceps brachii		
Reflexes normal	61	59.8
Less of reflex	41	40.2
No Reflex	0	0

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Table 4. Distribution of the frequency of motor damage in the form of physiological reflexes (cont.)

Scoring	Frequency	Percentage (%)
Right quadriceps femoral		
Reflexes normal	48	47.1
Less of reflex	52	51
No Reflex	2	2
Left quadriceps femoral		
Reflexes normal	49	48
Less of reflex	52	51
No Reflex	1	1
Right Achilles		
Reflexes normal	48	47.1
Less of reflex	53	52
No Reflex	1	1
Left Achilles		
Reflexes normal	49	48
Less of reflex	52	51
No Reflex	1	1
Total	102	100

Table 4 shows the examination of physiological reflexes, where the majority of people with diabetes still have reflexes on the right and left biceps brachii (58.8%; 8.8%), right and left Triceal brachii (57.8%; 59.8%). Physiological reflexes that are dominated by reflexes are lacking in the right and left quadriceps femoral muscles (51%; 51%), right and left Achilles (52%; 51%). Motor damage in the form of no physiological reflexes was found in the right and left Quadriceps femoral (2%; 1%), and right or left leg Achilles (1%).

Motor Damage Assessment Results

Table 5 Frequency distribution of motor damage assesement results (n=102)

Scoring	**Frequency**	**Percentage (%)**
Right Leg		
Normal	26	25.5
Decreased of muscle strength	76	74.5
No muscle strength	0	0
Left Leg		
Normal	28	27.5
Decreased of muscle strength	74	72.5
No muscle strength	0	0
Total	102	100

Table 5. shows that a decrease dominated the results of the motor damage assessment in muscle strength on the right side by 76 people with diabetes (75.4%) and the left leg with 74 people with diabetes (72.5%).

DISCUSSION

The results of this study indicate that increasing age is a risk factor for DM; in Table 1, which shows the middle and late adulthood of 90 people (88.3%). In theory, as the age increases, the body will decrease its function as well as the ability of β cells to produce insulin to metabolize glucose (Betteng, Pangemanan, & Mayulu, 2014; Iroth, Kandou, & Malonda, 2017). Likewise, the results of RISKESDAS in 2014 showed that the proportion of people with diabetes increased with age, and the category of adult age was in the highest proportion (Kementerian Kesehatan RI, 2014).

The results showed that the majority of people with diabetes had had diabetes for more than five years. This result is in line with Nistiandani, Juniarto, & Dyan research (2018) which shows that the majority of people with diabetes who have examined themselves in poly have suffered more than five years. This condition is a logical occurrence, because DM is a chronic disease, and if the sufferer can control blood sugar levels properly, his quality of life will improve.

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The majority of people with diabetes in this study had 70 people (68.6%). In line with the research ofNistiandani et al. (2018), the majority of people with diabetes have comorbidities. Chronic hyperglycemia can cause ischemia in various organs and cause other diseases such as hypertension and diabetic ulcers (Arsono, 2005).

Forms of examination of motor damage to the foot include checking deformity, checking muscle strength, and checking reflexes. This study shows that the deformity most commonly found in both legs is hallux valgus. The research here is different from what was found by Rosyida (2016) found that the deformity that often appears in people with diabetes is hammertoes.

Other studies also show different results than the most commonly found deformity is claw toes(Bus, Maas, Michels, & Levi, 2009).The researcher's assumptions are based on previous research and theory, differences in the results of research in the findings of the form of foot deformity can occur. Due to damage to nerve fibers, intrinsic muscles due to hyperglycemia do not look at the anatomical structure of the foot.

A deformity that occurs results in weakness and limitations in the foot due to the accumulation of collagen under the dermis, resulting in stiffness and deformation of the toe (Bus et al., 2009). This condition can be experienced by people with diabetes who rarely carry out activities such as sports and the habit of wearing narrow footwear that makes it difficult to move their feet (Syafi'i, 2018).

In addition to deformity, checking muscle strength is an assessment item of motor nerve damage. This study showed that severe damage founding in the right and left abduction (7.8%), and right and left toe extensions (1.9%; 2.9%). This is in line with the study of Rosyida (2016) who found the most severe disruption was foot abduction. This disorder occurs because there is stiffness in the distal extremities due to the peroneus communis nerve (Schie, Vermigli, Carrington, & Boulton, 2016). This can occur because, in theory, N. peroneus communis is prone to injury, which can be caused by external pressure or diseases such as diabetes mellitus (Japardi, 2002).

The table above shows the results of physiological reflexes, where the majority of people with diabetes still have good reflexes in the muscles in the upper limb, namely the right and left biceps brachii and the right and left Triceps brachii. Whereas physiological reflexes that are dominated by reflexes are lacking, which is the right and left quadriceps femoral and Achilles muscles. Motor damage in the form of no physiological reflexes was found on the quadriceps femoris and the right or left leg Achilles. Disturbances, in the form of decreased or loss of reflexes caused by damage to small fibers in the muscles due to injury agents (Sicco, 2009).

The results of motor damage assessment in this study found that the majority of respondents experienced a decrease in muscle strength in both legs. This is supported by researcher Rosyida (2016) that the majority of people with diabetes have decreased muscle strength in both legs. While other studies have found that motor damage in people with diabetes tends to be low because clients routinely go to community health centers (Syafi'i, 2018). people with diabetes who experience motor disturbances, as well as sensory and autonomic disorders, will cause diabetic ulcers.

People with diabetes who have diabetic ulcers have been clinically proven to have a history of peripheral nerve damage (Hampton, 2006).Peripheral nerves consisting of Schwan and myelin cells are susceptible to pressure injury, the cause of this vulnerability is still unknown with certainty (Japardi, 2002). However, diseases such as diabetes mellitus are suspected to be a risk factor for damage from the Schwan and myelin cells that line the peripheral nerves. Impaired motor nerve function is due to a lack of blood supply in the legs due to hyperglycemia (Syafi'i, 2018).

CONCLUSION

From the results of this study, the following conclusions can be concluded that demographic characteristics of people with diabetes are the majority in middle adulthood (71.6%), female sex (53.9%), with DM sufferings between 1-5 years (58.3%), have GDS levels between 90-199mg / dL (57.8%), have a history of smoking; history of comorbidities; and DFU (67.6%; 68.6%; 9.2%). Forms of motor nerve damage that are examined include deformity, muscle strength, and physiological reflex function. The most common deformity found in the right or left foot is hallux valgus (38.2%; 26.4%). Severe forms of damage to muscle strength were found on the right and left abduction (7.8%), and right or left toe extension (1.9%; 2.9%). Motor damage in the form of no physiological reflexes found in the right and left Quadriceps femoral (2%; 1%), and right or left Achilles foot (1%). The assessment of motor damage is dominated by a decrease in muscle strength both right and left (75.4%; 72.5%). Based on the results of the description of motor nerve damage to people with diabetes in the agricultural area, it is hoped that further action will take place in the form of real interventions from health services. The intervention is a preventive effort in order to prevent the worsening of motor nerve damage in people with diabetes.

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