

The Effect Of Hyperbaric Therapy On The Quality Of Life Of Diabetic Foot Ulcers Patients

Rahardyan Dika Wiratama¹,

Abdul Muhith², Siti Nur
Hasina³

^{1,2,3} Department of Nursing,
Faculty of Nursing and
Midwifery, Universitas
Nahdlatul Ulama Surabaya,
Surabaya, Indonesia

***Email:**

abdulmuhith@unusa.ac.id

ABSTRACT

Diabetes mellitus (DM) is a metabolic disease condition characterized by increased blood sugar levels or hyperglycemia. Uncontrolled diabetes mellitus can cause complications such as diabetic neuropathy (nerve damage), stroke, blindness, and diabetic ulcers (wounds that are difficult to heal). This study aims to determine the effect of hyperbarics on the quality of life of diabetic foot ulcer sufferers.

This research uses a quasi-experimental design with a non-equivalent Control Group Design where an intervention group and a control group are selected and then pre- and post-tests are carried out. The sample was 27 people with diabetes. The instrument used is (WHOQOL-BREF). Data analysis used the analysis technique used was Wilcoxon and Mann Whitney. on the post test. The results showed that the average pre-test score for the quality of life of respondents was in the low category, namely the physical domain 68 people (97.1%), the psychological domain 67 people (95.7%), the social domain 54 people (77.1%), and environmental domain 62 people (88.6%). The p value obtained for the physical domain was 0.00 ($p < 0.05$), for the psychological domain 0.012 ($p < 0.05$), for the social domain 0.003 ($p < 0.05$), and for the environmental domain 0.001 ($p < 0.05$). It can be concluded that there is a significant difference between the patient's quality of life before and after hyperbaric therapy according to the physical, psychological, social and environmental health domains, and there is an influence of hyperbaric therapy on the patient's quality of life.

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INTRODUCTION

Diabetes mellitus (DM) is a metabolic disease condition characterized by increased blood sugar levels or hyperglycemia. This condition is caused by a disturbance in the body's production or use of the insulin hormone, which plays a role in regulating blood sugar levels, insulin action, or both. As a result, uncontrolled diabetes mellitus can cause complications such as diabetic neuropathy (nerve damage), stroke, blindness, and diabetic ulcers (wounds that are difficult to heal) which significantly affect the sufferer's quality of life. Globally, the prevalence of diabetes in 2021 among those aged 20-79 years is estimated to be 10.5% (536.6 million people) increasing to 12.2% (783.2 million people) in 2045. The prevalence is similar in men and women and is highest in them. aged 75-79 years (Sun et al., 2022). According to Riskesdas, in 2018 the prevalence of diabetes was still high at 11.3%, which ranked 7th out of 10 countries with the highest number of sufferers at 10.7 million people. Where Indonesia is the only country in Southeast Asia with the highest prevalence of diabetes sufferers in the world (Rumaolat et al., 2022). In East Java, the prevalence of diabetes sufferers in 2021 reached 867,257

people (93.3%) with the highest sufferers in Mojokerto City at 124% of the estimated DM sufferers and the lowest in Probolinggo Regency at 51.7% of the estimated DM sufferers (Dinkes Jatim, 2021).

Decreased quality of life in UKD (Diabetic Ulcer) sufferers is related to limitations in carrying out activities, disability, and pain due to ulcers. Study conducted by (Adikusuma et al., 2018), also reported that the results of the relationship between therapy influenced the quality of life at 2jpp, where the higher 2jpp indicated the lower quality of life. Technological advances in the health sector support achieving the highest level of health. Hyperbaric oxygen (HBO) is one of the adjuvant therapy options in the treatment of UKD. HBO is the administration of 100% oxygen where the patient is in a high-pressure room and breathes pure oxygen at an air pressure greater than normal atmospheric air, namely 1 ATA (Absolute Atmosphere). The role of HBO is to improve the amount of oxygen delivered to the wound area, both bound to hemoglobin and dissolved in plasma. Thus, the rate of wound healing is directly related to oxygen levels in the tissue.

The effectiveness of HBO in treating UKD has been widely documented in various health centers around the world. Based on the results of several Randomized Control Trials (RCTs) that have been conducted, HBO is recommended as an additional therapy that is immediately given to sufferers of Wagner UKD grade 3 or more (moderate recommendation), to prevent major amputations and improve wound healing. (Huang et al., 2015). With a fast wound healing process, it can reduce the risk of amputation, minimize the risk of death, and reduce treatment costs for UKD patients. This will improve the quality of life of sufferers.

Quality of life education is considered important because quality of life is an individual's perception of their position in life, culture, value systems which are closely related to life goals, hopes and standards of living. Efforts that can be made to overcome changes in quality of life include reducing the intensity of pain and odor in ulcers so that UKD sufferers have the same opportunity to carry out activities and socialize with the environment, preventing amputations in UKD with appropriate wound care management and HBO as adjuvant therapy in accelerate wound healing.

METHODS

This research uses a type of quantitative experimental research with a quasi-experimental design. With a non-equivalent Control Group Design approach where an intervention group and a control group are selected then pre and post tests are carried out. The sampling technique used in this study used purposive sampling with a sample size of 27 people with diabetes in each group, but the number of respondents in this study was 70 people. Until the end of the study, no one dropped out so the number of respondents was 35 people in the control group and 35 people in the intervention group. The variables in this research are hyperbaric as the independent variable, and quality of life as the dependent variable. The intervention was carried out for one month in February-March 2024. The instrument used in this research was the respondent characteristics and quality of life questionnaire (WHOQOL-BREF). Data analysis used Mann Whitney in the post test.

RESULTS

General research data includes characteristics of respondents based on gender, age, education, occupation, etc.

The research results are as follows:

Table 1. Characteristics of respondents based on gender, age, education and occupation

No.	Respondent characteristics	n (%)				Amount	
		Control		Intervention		N	%
		N	%	n	%		
1.	Gender						
	Man	21	60.0	19	54.3	40	57.1
	Woman	14	40.0	16	45.7	30	42.9
	Amount	35	100	35	100	70	100
2.	Age range						
	Late Adulthood (36-45)	3	8.6	2	5.7	5	7.1

	years)						
	Early Elderly (46-55 years)	15	42.9	22	62.9	37	52.9
	Late Elderly (56-65 years)	17	48.6	11	31.4	28	40
	Amount	35	100	35	100	70	100
3.	Education						
	Elementary (Elementary-Middle School)	16	45.7	4	11.4	20	28.6
	Intermediate (High School)	13	37.1	19	54.3	32	45.7
	High (college)	6	17.1	12	34.3	18	25.7
	Amount	35	100	35	100	70	100
4.	Work						
	Retired	5	14.8	6	17.1	11	15.7
	TNI/POLRI/PNS	4	11.4	6	17.1	10	14.3
	Self-employed	1	2.9	7	20.0	8	11.4
	Private	19	54.3	8	22.9	27	38.6
	IRT	6	17.1	8	22.9	14	20.0
	Amount	35	100	35	100	70	100
5.	Income						
	< Minimum wage	17	48.6	7	18.5	24	34.2
	Minimum wage	13	37.1	17	51.9	30	42.9
	> UMR	5	14.3	11	29.6	16	22.9
	Amount	35	100	35	100	70	100
6.	Long time DM						
	≤ 5 years	8	22.9	5	14.3	13	18.6
	> 5 years	27	77.1	30	85.7	57	81.4
	Amount	35	100	35	100	70	100
7.	UKD degrees						
	Wagner 3	15	42.6	17	48.6	32	45.6
	Wagner 4	20	57.1	18	51.4	38	54.3

Based on the results of table 1, it shows that the majority of respondents were male, namely 21 people (60.0%) in the control group and 19 people (54.3%) in the intervention group. Most of them were early elderly, 37 people (52.9%). Most of them had secondary education, namely 32 people (45.7%). Most of the private employees are 27 people (38.5%). The majority of those who do not work are 25 people (35.7%) consisting of housewives and retired officers. In terms of income, 30 people (42.9%) had the majority of income according to the minimum wage. Most of them suffered from DM > 5 years as many as 57 people (81.4%) with the most UKD complications at Wagner grade 4, namely 38 people (54.3%).

Table 2. Data range of physical health domain values before and after giving HBO therapy to UKD sufferers

No	Range	Control Group				Intervention Group			
		Pre		Post		Pre		Post	
		N	%	n	%	N	%	n	%
1	Tall	0	0	0	0	0	0	5	14.3
2	Currently	2	5.7	8	22.9	0	0	12	34.3
3	Low	33	94.3	27	77.1	35	100	18	14.3
Total		35	100	35	100	35	0	35	100

Statistic test	p = 0.05 <i>Wilcoxon Signed Rank Test</i>	p = 0.000 <i>Wilcoxon Signed Rank Test</i>
	$p \leq$	$p \leq 0.05$
	p = 0.013 <i>Mann Whitney Test</i> $\alpha \leq 0.05$	

Based on the results of table 2, it shows that the post test scores for the intervention group were higher than the control group, namely 12 respondents (34.3%) got medium scores and 5 respondents (14.3%) got high scores. The results of the Mann Whitney test showed a significant difference in the physical health domain after being given HBO with a value of $p=0.013$. This is supported by the results of the Wilcoxon signed rank test ($p=0.000$), meaning that there is a significant difference between the pre and post test scores in the intervention group. Most respondents complained that the pain caused by UKD interfered with the respondent's daily activities.

Table 3. Data range of psychological domain values before and after giving HBO therapy to UKD sufferers

No	Range	Control Group				Intervention Group			
		Pre		Post		Pre		Post	
		N	%	N	%	N	%	N	%
1	Tall	0	0	0	0	0	0	1	2.9
2	Currently	1	2.9	4	11.4	2	5.7	10	28.6
3	Low	34	97.1	31	88.6	33	94.3	24	68.6
Total		35	100	35	100	35	100	35	100
Statistic test		p = 0.083 <i>Wilcoxon Sign Rank Test</i>				p = 0.012 <i>Wilcoxon Sign Rank Test</i>			
		$p \leq$				$p \leq 0.05$			
		p = 0.040 <i>Mann Witney Test</i> $\alpha \leq 0.05$							

Table 3 shows that there is a significant difference in the psychological domain after being given HBO, with the Mann Whitney test result being $p=0.040$. There was an increase in post test scores in the intervention group, from 33 respondents (94.3%) with low scores remaining 24 respondents (68.6%), 10 respondents (28.6%) of whom got medium scores, even 1 respondent (2, 9%) scored high. This is supported by the significant difference between pre and post scores in the intervention group, with the Wilcoxon signed rank test result being $p=0.012$. The length of the wound healing process made most respondents feel hopeless about the treatment they were undergoing.

Table 4. Data range of social relationship domain values before and after being given HBO therapy to UKD sufferers

No	Range	Control Group				Intervention Group			
		Pre		Post		Pre		Post	
		N	%	n	%	N	%	n	%
1	Tall	0	0	1	2.9	0	0	5	14.3
2	Currently	6	17.1	9	25.7	10	28.6	14	40
3	Low	29	82.9	25	71.4	25	71.4	16	45.7
Total		35	100	35	100	35	100	35	100
i statistics		p = 0.132				p = 0.003			
		Wilcoxon Signed Rank Test				Wilcoxon Signed Rank Test			
		p ≤ 0.05				p ≤ 0.05			
		p = 0.020							
		Mann Witney Test							
		α ≤ 0.05							

Table 4 shows that there is a significant difference in the social relations domain after being given HBO, with a Mann Whitney test value of p=0.020. This is supported by the results of the Wilcoxon signed rank test p=0.003, which means there is a significant difference between the pre and post test scores in the intervention group. Post test results for the intervention group showed that 5 respondents (14.3%) got high scores, 14 respondents (40%) got medium scores, only 16 respondents (45.7%) got low scores. Feelings of shame due to UKD give rise to dissatisfaction in personal or social relationships.

Table 5. Range of environmental domain values before and after giving HBO therapy to UKD sufferers

No	Range	Control Group				Intervention Group			
		Pr e		Pos t		Pr e		Post	
		N	%	N	%	N	%	N	%
1	Tall	0	0	0	0	1	2.9	2	5.7
2	Currently	1	2.9	4	11.4	6	17.1	16	45.7
3	Low	34	97.1	31	88.6	28	80.0	17	48.6
Total		35	100	35	100	35	100	35	100
Statistic test		p = 0.083				p = 0.001			
		Wilcoxon Sign Rank Test				Wilcoxon Sign Rank Test			
		p ≤ 0.05				p ≤ 0.05			
		p = 0.000							
		Mann Witney Test							
		α ≤ 0.05							

Table 5 shows that there is a significant difference in the environmental domain after being given HBO, with the Mann Whitney test result being p=0.000. The post test score of the intervention group was higher than the control group, where there were 2 respondents (5.7%) with high scores, 16 respondents (45.7%) of whom got medium scores, and the remaining 17 respondents (48.6%) with scores low. This is supported by the results of the Wilcoxon signed

rank test $p=0.001$, which means there is a significant difference between the pre and post test scores in the intervention group. Health support facilities determine the high value of a person's quality of life, where respondents who have the availability of funds to meet their health needs will have a higher environmental domain value.

DISCUSSION

Based on the research results, it shows that there is an influence of HBO on the quality of life in the physical health domain. The results of the Mann Whitney test showed that there was a significant difference between the group that received HBO and the control group in the physical health domain. This is supported by the results of the Wilcoxon test which states that there is a significant difference between the pre and posttest scores of the intervention group. UKD occurs due to poor circulation in the peripheral blood vessels and if not treated properly can cause chronic infections. Physical health that begins to decline due to ulcers can result in increased pain and medical needs, reduced ability to carry out activities and cause anxiety about one's health. The main role of HBO is to improve the amount of oxygen delivered to the wound or ulcer area, so that it can speed up the wound healing process. A fast wound healing process can reduce the inflammatory response and prevent amputations which can reduce the sufferer's quality of life. Improvement in the degree of injury and wound characteristics after HBO can reduce pain and medical needs. In addition, reducing pain means sufferers have sufficient rest time to increase vitality at work.

Most respondents were aged 45-54 years. In general, at this age changes occur in the elderly, both psychosocial, physiological and mental. Increasingly deteriorating physical conditions make older people feel that their lives no longer have meaning and they despair with the life they live now. To obtain optimum aging, physical activity for the elderly is very necessary, for example, HBO which is done routinely and regularly, apart from improving wound healing, will also really help maintain the fitness of the elderly.

Regarding the psychological domain, it was found that there was an influence of HBO on quality of life. There was a significant difference between the intervention group and the control group in the psychology domain from the results of the Mann Whitney test, as well as the results of the Wilcoxon signed rank test which stated that there was a significant difference between the pre and post test scores in the intervention group. Respondents with UKD experienced a decrease in physical function which indirectly affected their psychological condition. Respondents generally felt feelings of anxiety, depression and frustration. UKD is the most stressful complication because it causes DM sufferers to undergo hospitalization and lower extremity amputation.

The UKD healing process takes quite a long time to have an impact on the psychology of the sufferer. These psychological impacts include changes in self-image due to physical changes, self-esteem also experiences changes in accordance with the changing self-image. The long-term impact of sufferers will experience negative feelings towards themselves due to prolonged UKD injuries and the long healing process. In this way, the fast wound healing process can reduce the sufferer's anxiety regarding the condition they are experiencing.

This improvement in quality of life is in line with the hope and certainty of improving the characteristics of the wound condition. The great hope for recovery causes them to be motivated to continue to rise.

Most of the respondents in this study had a high school education. Education can shape emotional intelligence. Someone who has high emotional intelligence will be able to control themselves, manage their emotions, motivate themselves and direct themselves to be more productive in the various things they do. If emotional intelligence is low, people will become anxious, withdrawn, often afraid, feel unloved, feel nervous, sad and tend to be easily affected by depression. Stress can affect the level of satisfaction in life.

The increase in quality of life scores can also be seen in the social relations domain, based on the results of the Mann Whitney test, there is a significant difference between the intervention and control groups. Patients with UKD will generally experience impaired self-image. The presence of ulcers on the body causes DM sufferers to feel afraid in their social life. Most UKD sufferers feel insecure in social interactions because of their condition (Rohmin et al., 2017). As the degree of injury improves, the level of self-confidence of UKD sufferers will increase. A high level of self-confidence makes it easier for respondents to socialize with their environment. These results are supported by an increase in the value of the social relations domain in the intervention group based on the results of the Wilcoxon

signed rank test. Socializing with family and closest friends can help reduce the level of depression experienced regarding the illness.

In the environmental domain, the results showed that there was an influence of HBO on the quality of life in the environmental domain. The Mann Whitney test showed that there was a significant difference between the control group and the group that received HBO. An increase in quality of life in the environmental domain was also seen in the intervention group, where the results of the Wilcoxon Signed rank test stated that there was a significant difference between the pre and posttest scores. The results of research in the environmental domain are based on a person's personality, culture and environment which influence a person's cognitive perception in interpreting the quality of their life (Mabsusah, 2016).

In this study, the majority of respondents worked as private employees with incomes in accordance with the minimum wage that had been determined to be able to meet a person's living needs, where work was related to socio-economics so that health needs could be met. The availability of optimal health support in the wound healing process such as HBO can improve cognitive perceptions in interpreting quality of life. This is in line with research (Firman et al., 2012), new information received, satisfactory health services and easy access to health facilities have a positive impact on the quality of life of UKD sufferers.

This study shows that there is an effect of HBO on improving the quality of life of diabetic foot ulcer sufferers. This improvement in quality of life is in line with the improvement in wound conditions which is related to one of the benefits of HBO as wound healing. Study (Duzgun et al., 2008), stated that the use of HBO in the treatment of UKD statistically increases the prevalence of ulcer healing. HBO also reduces the prevalence of amputations, and when amputations are necessary, there are no amputations localized proximal to the metatarsophalangeal joint. So that HBO can be used as an adjuvant for diabetic foot ulcer sufferers.

CONCLUSION

The results of the research in each domain of the control and intervention groups, the average pre-test score shows that the quality of life of respondents is in the low category, namely the physical domain 68 people (97.1%), the psychological domain 67 people (95.7%), the social domain 54 people (77.1%), and environmental domain 62 people (88.6%). After testing using Mann Whitney in the posttest, the p value for the physical domain was 0.00 ($p < 0.05$), for the psychological domain 0.012 ($p < 0.05$), for the social domain 0.003 ($p < 0.05$), and environmental domain 0.001 ($p < 0.05$), where the intervention group had a better score compared to the control group.

Based on this research, it can be concluded that there is a significant difference between the quality of life of patients with ulcers before and after HBO according to the physical, psychological, social and environmental health domains, as well as the influence of HBO on the quality of life of patients with ulcers.

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