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Assessment of Quality of Life among Selected Lower Limb Amputees in South-Eastern Nigeria

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Abstract

Background: Lower limb amputation in low-income countries such as Nigeria imposes significant economic, social, and psychological burdens. Mobility—and thus quality of life (QoL)—is shaped by prosthetic design, rehabilitation, and psychosocial adaptation.

Objective: To assess the quality of life among adult lower limb amputees in Southeastern Nigeria who had used prostheses for at least six months, and to examine the influence of sociodemographic characteristics and prosthetic componentry on rehabilitation outcomes.

Methods: A cross-sectional survey of 47 amputees using prostheses for ≥6 months was conducted in two private institutions in Enugu and Imo States. Data were collected with a researcher-designed proforma and the TAPES-R questionnaire, covering psychosocial adjustment, activity restriction, and prosthetic satisfaction. Analyses employed Spearman's correlation and Mann-Whitney U tests.

Results: Participants' mean age was 50.6 years; trans-tibial amputation predominated (68.1%). Most used SACH feet and PTB sockets. Psychosocial adjustment was high for general (M=21.15) and social (M=21.70) domains but lower for limitation adjustment (M=16.11). Activity restriction was greatest in athletics (M=9.17). Functional satisfaction scored highest (M=20.34). Age correlated significantly with activity restriction, while suspension type correlated with limitation adjustment and weight satisfaction.

Conclusion: Despite positive psychosocial adjustment, reliance on basic prosthetic components and marked athletic restrictions highlight gaps in functional rehabilitation. Findings underscore the need for more adaptive prosthetic designs and context-specific interventions to enhance QoL among amputees in low-income settings.

Keywords: Quality of life, lower limb amputation, prostheses, rehabilitation, Nigeria

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INTRODUCTION

Limb amputation in low-income countries like Nigeria, where prosthetic services are developing, often has profound economic, social, and psychological effects on the patients and their families.[1,2,3,4,5] The quality of life (QoL) of an individual has been defined as an individual's perception of his/her position in life, in the context of the culture and value systems in which they live, and about their goals, expectations, standards, and concerns.[6] Individuals with lower limb amputations typically have reduced mobility, which affects their ability to perform daily tasks and hence impacts a poor/low QoL on them. Hence, to successfully integrate them into community life, enhancing their mobility is the goal of rehabilitation, and this will, in turn, improve their QoL.[7]

Factors influencing the success of prosthetic rehabilitation and QoL of amputees are well documented in literature. These include cause and level of amputation, post-operative/pre-prosthetic rehabilitation, duration of prosthesis use, prosthetic design, stump pain, phantom limb sensation, phantom limb pain, and psychosocial status.[8,9]

Enhancing the QoL of the amputee drives not only the prosthetic industry but the entire rehabilitation process. As a result of the need to improve the QoL of amputees, there has been tremendous improvement in the engineering of the prosthetics sector. From sophisticated energy storing prosthetic foot with ground reaction force enhancing effects[10]; Myoelectric upper limb prosthetics which enable the upper limb amputee to use the limb more naturally when compared to conventional passive or body-powered upper limb prosthesis; to the C-leg computerized knee joint which gives the amputee a near natural ambulation.[11,12] These modern designs in prosthetics can be attributed to QoL research in particular and rehabilitation outcomes in general.

However, such QoL studies are sparse for Nigeria, and worse still, non-existent in Owerri, Imo state, and the South Eastern part of Nigeria to the best of our knowledge. In view of the unfriendly topography, lack of social welfare and discrimination that Nigerians with disability face, in addition to the cultural differences between Nigeria and other countries where such data exists, findings from these countries may not be extrapolated to Nigeria.

Objective: To assess the quality of life among adult lower limb amputees in Southeastern Nigeria who had been fitted with prostheses for at least six months, using a cross-sectional survey design. The study aimed to examine how sociodemographic characteristics (age, gender) and prosthetic componentry (socket type, suspension system, liner, and foot type) influence rehabilitation outcomes, including psychosocial adjustment, activity restriction, and prosthetic satisfaction.

METHODS

***Research design*:** The study used a cross-sectional design and was conducted on a group of lower limb amputees attending follow-up prosthetic interventions from two privately owned prosthetic and orthotic institutions. Patients amputated between 2019 and 2021, and who have received and used lower limb prostheses for up to 6 months, were recruited. This ensured that the patients could still recollect details of their pre- and post-amputation rehabilitations. A purposive data sampling technique was adopted on available patients, and details of participants were sourced from the records of the institutions utilized. Ethical approval was obtained from the participating centers before commencement of data collection. Consent was obtained from the patients before data collection.

Study area: The population comprised amputees, amputated between 2019 to 2021 (3 years), who had received and used lower limb prostheses for at least six months. Two privately owned prosthetic and orthotic centers in Imo State and Enugu were used to collect data used in this study. Imo and Enugu are Igbo-speaking people of Southeastern Nigeria, with Owerri and Enugu being the state capital cities, respectively. Owerri and Enugu are the hubs of socio-economic activities of the two states, respectively. The selected centers were used because they are sure places to get in contact with the respondents (amputees).

***Sampling procedure*:** A homogeneous purposive data sampling technique was adopted for this study. Details of lower limb amputees that were rehabilitated during the study time frame and agreed to participate in the study were sourced for from the records of the institutions utilized. Purposive sampling (also referred to as judgmental, selective or subjective sampling) is a widely used non-probability sampling technique in qualitative research, particularly suitable for medical rehabilitation contexts where specific participant characteristics (e.g., patients with certain conditions, therapists with specialized expertise) are essential to obtain rich, relevant data.[28]

Inclusion/Exclusion Criteria: The included participants were adult men and women who had lower limb amputation and were successfully fitted and hence ambulatory with a prosthesis. The lower age limit for participants was 18 years, while there was no upper age limit. All the participants can read and understand the English language. Patients with distorted memories of

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their pre- and post-amputation rehabilitation details were excluded.

***Data collection and analysis*:** Data from lower limb amputees who had undergone prosthetic rehabilitation at two private prosthetic and orthotic centers in Enugu and Imo States. The participants, who had been amputated between 2019 and 2021 and had used their prostheses for at least six months, were chosen to ensure accurate recall of their rehabilitation experiences. Data were collected on sociodemographic and clinical characteristics using structured questionnaires, and analysis was carried out using descriptive statistics. Continuous variables were analyzed using means and standard deviations, while categorical data were summarized with frequencies and percentages. Non-parametric tests such as Spearman's correlation and the Mann-Whitney U test were used for assessing relationships and group comparisons, respectively, with SPSS version 23 employed for the analysis.

To explore how prosthetic design and components influence quality of life, researchers used a detailed proforma to document various aspects of the prostheses, such as socket design, fit, suspension system, liner, and foot type. The Trinity Amputation and Prosthesis Experience Scales-Revised (TAPES-R), a validated instrument, was used to evaluate both prosthetic usage and quality of life. TAPES-R includes three psychosocial subscales—general adjustment, social adjustment, and adjustment to limitation—each rated on a 5-point scale with scores ranging from 5 to 25, where higher scores reflect better adjustment.

TAPES-R also features three subscales for assessing activity restrictions—functional, social, and athletic—each rated on a 3-point scale, with higher scores indicating more significant limits. Additionally, the tool includes three satisfaction subscales: functional satisfaction (5 items, scores 5–25), aesthetic satisfaction (4 items, scores 4–20), and weight satisfaction (1 item, score 1–5). Higher scores in these subscales denote greater satisfaction. The reliability and validity of these subscales are well-established, with high internal consistency and proven construct and predictive validity, ensuring that the instrument provides a comprehensive assessment of prosthesis-related outcomes.

Ethical approval: The Ethics and Review Committee of the Department of Prosthetics and Orthotics, School of Health Technology, Federal University of Technology Owerri, Imo State, Nigeria gave ethical approval for the study. Participants freely gave informed consent after the assurance of the confidentiality of their information and their safety in the study, and were at liberty to withdraw

RESULTS

A total of 100 questionnaires were submitted to the 2 institutions. Out of these, 47 questionnaires were returned, showing a response rate of 0.47. Reason for the low response included availability of amputees that matched the inclusive criteria (level of amputation, time frame). Also, only amputees that gave consent were recruited.

Table 1 below shows the distribution of the results according to Gender, Age, level of amputation, and type of prosthesis.

Table 1: Distribution of Age, Gender, level of amputation, and type of prosthesis

Age	Mean	N	Standard Deviation
MALE	50.69	26	28.41
FEMALE	50.52	21	12.07
TOTAL	50.62	47	22.41
Level of Amputation/Type of Prosthesis			
Level of amputation/prosthesis			**Percentage**
Below knee			68.10 (n= 32)
Through Knee			4.30 (n= 2)
Above knee			27 0(n= 13)

There were 26 males and 21 females. The mean age of the participants was 50.62±22.41. The males' particulars mean age was 50.69±28.41 and the females was 50.52±12.07. Transtibial amputation (transtibial prosthesis) dominated this group, followed by above knee amputation/prosthesis.

Prosthetic design and componentry

Table 2: Prosthetic design and componentry

Type	Frequency % (N)
Suspension type	
PTBSC/SP	53 (n= 25)
Cuff/Silesian	28 (n= 13)
Pin lock/vacuum assisted	17 (n= 8)
Others	2 (n= 1)
Total	**100% (n=47)**
Type of Prosthetic Foot	
Local SACH	
SACH	2 (n= 1)
Articulated/Dynamic	96 (n= 45)
Total	2 (n= 1)
	100% (n=47)
Type of Liner	
Fabric	23.4 (n = 11)
Closed cell foam (EVA)	66 (n=31)
Gel/Silicone liner	10.6 (n=5)
Total	**100% (n=47)**

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Type	Frequency % (N)
Type of Socket	
Transtibial	**n** = 32
PTB	n = 31
TSB	n = 1
Transfemoral/Knee disarticulation	n = 15
Quad	n = 12
IC	n = 4
Total	**n=47**
Types of Knee Joint (for TF/KD prostheses; n = 15)	
Mechanical Single axis	(n= 9)
Mechanical Polycentric	(n= 5)
Hydraulic	(n= 1)

Table 2 above shows the prosthetic design/componentry utilized in the prosthetic rehabilitation of the participants.

The distribution of the suspension types: The socket incorporated PTBSC/SP/SCSP dominated this category. The leather/belt-assisted Cuff/Silesian method of suspension followed. The advanced pin lock/vacuum-assisted suspension had less than 20% contribution.

Types of feet in use by the patients and their various magnitudes: The Solid Ankle Cushioned Heel (SACH) foot dominated with almost 96% of the feet assessed. Locally fabricated but non-articulated SACH and Dynamic feet shared only 2.1% each.

***Type of liner material utilized*:** 66% of all the liners used by participants were closed-cell foams (Ethylene Vinyl Acetate (EVA) Foam Liner. While 23.4% did not use any liner, 10.6% used the advanced Gel Liner.

Types of sockets: There was a dominance of Patellar tendon bearing sockets as opposed to the Total Surface bearing socket for Transtibial prosthesis, while considering the Trans-femoral socket had more of Quadrilateral sockets.

Types of prosthetic knee joint (transfemoral/through the knee participants): The single-axis knee joint had the highest usage, followed by the polycentric knee, then the hydraulic/pneumatic. There was no mention of the Computerized/intelligent knee.

TAPES QoL Outcomes

Table 3: Descriptive Statistics of the TAPES R QoL

Domain	N	Min	Max	Mean	Std Dev
General Adjustment	47	12	25	21.15	3.65
Social Adjustment	47	5	25	21.70	3.49
Lim Adjustment	47	6	25	16.11	6.12
Athletic Activity Restriction	47	4	12	9.17	2.13
Functional Activity Restriction	47	4	12	7.17	2.47
Social Activity Restriction	47	4	11	6.30	2.26
Aesthetic Satisfaction	47	4	20	16.00	3.50
Weight Satisfaction	47	1	5	3.85	1.30
Functional Satisfaction	47	5	25	20.34	4.46

Table 3 above shows the descriptive statistics for the TAPES R QoL response from the study respondents.

Table 5 shows the Mann- Whitney U Test of Influence of Gender on QoL Outcomes. Considering Activity Restriction outcomes, while the Females were more restricted than the males in all the 3 subscales, this was however only significant for the Social Activity Restriction subscale (P = 0.043).

Statistically significant positive correlations were observed between Age and all the Activity restriction subscales (P = 0.01; P = 0.018; P = 0.004); i.e. for Athletic, Functional and Social Activity restrictions respectively. However, a statistically significant negative correlation was found for Age and Adjustment to limitation subscale of the General adjustment scale (P = 0.009).

The analysis attempted to test whether there would be a better perception of QoL as the efficiency of Suspension increases from Cuff/Belt to the Silicone Liner. A statistically significant negative correlation was recorded for the adjustment to Limitation Subscale (P=0.046) while a Positive correlation was observed for the Weight Satisfaction perception (P=0.032).

Correlation analysis between Prosthetic feet and liner type did not yield and significant result across all the subscales of the TAPES-R Outcomes.

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Table 4: Influence of Gender on QoL

QoL Perception	Gender	N	Mean Rank	Sum Ranks	Mann – Whitney U	P Value
General Adjustment	Male	26	26.48	688.50	208.500	.155
	Female	21	20.93	439.50		
Social Adjustment	Male	26	25.12	653.00	244.000	.529
	Female	21	22.62	475.00		
Limb Adjustment	Male	26	24.02	624.50	272.500	.991
	Female	21	23.98	503.50		
Ath Act Restriction	Male	26	20.65	537.00	186.000	.057
	Female	21	28.14	591.00		
Fun Act Restriction	Male	26	22.29	579.50	228.500	.336
	Female	21	26.12	548.50		
Soc Act Satisfaction	Male	26	20.46	532.00	181.000	.043
	Female	21	28.38	596.00		
Aesth Satisfaction	Male	26	24.08	626.00	271.000	.966
	Female	21	23.90	502.00		
Weight Satisfaction	Male	26	26.04	677.00	220.000	.229
	Female	21	21.48	451.00		
Funct Satisfaction	Male	26	25.87	672.50	224.500	.295
	Female	21	21.69	455.50		

Table 5: Correlations between Age, Type of suspension and QoL

Qol Perceptions	Age r (p value)	Type of Suspension r (p value)	Prosthetic foot type r (p value)
General Adjustment	0.018(0.453)	0.102(0.247)	0.086(0.282)
Social Adjustment	-0.137(0.178)	-0.011(0.470)	0.131(0.190)
Lim Adjustment	-0.343(.009)	-0.249(0.046)	0.187(0.105)
Act Restriction	0.430(0.001)	0.122(0.207)	-0.140(0.174)
Fun Act Restriction	0.307(0.018)	0.238(0.053)	-0.161(0.139)
Soc Act Restriction	0.308(0.004)	0.089(0.276)	-0.078(0.300)
Aesth Satisfaction	-0.045(0.382)	-0.109(0.233)	0.061(0.341)
Weight Satisfaction	0.164(0.135)	0.272(0.032)	0.210(0.79)
Func Satisfaction	0.205(0.084)	0.076(0.305)	0.196(0.94)

Table 5 above shows the Non-Parametric Correlation between Age, Suspension Type and QoL.

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DISCUSSION

Adjustment to amputation and artificial limb encompass the physical functioning, psycho-social functioning and satisfaction with the artificial limb[14]; at individual level as well as in the society with respect to the physical change brought about by amputation and the challenges posed by the changed state, which truly reflects the degree to which the individual is adjusted to amputation and artificial limb. The prominent self-reported scales which are being used to study functioning with prosthesis and assessment of prosthesis are PEQ, Prosthesis Evaluation Questionnaire.[13,15]

The results of this study were analyzed in the light of the three relevant limitations: (a) a severe shortage of baseline studies on the relationship between QoL in amputees and patient-centric parameters; (b) nonrandomized sampling based on convenience; and (c) the low number of subjects selected. The study reflected a response rate of 47%. This is higher than a similar study, which reported a response rate of 33% in the United Kingdom. [16] However, it is lower than the 55% reported by Rudney et al. in 2011 in Brazil.[17] Additionally, the study sample consisted of 47 participants. Deans et al. used 25 participants[16]; Rudney et al. utilized 22 participants[17,] while Zidarov et al. utilized 19 participants.[18]

The study yielded above average-midline score of (19.3/25) for the Psychosocial subscales (approximately 21, 21, and 16, respectively, for General, Social, and Limitation adjustment responses). Gallagher & MacLachlan[14] reported strong psychosocial resilience among amputees, consistent with our high general and social adjustment scores.

On a maximum scale of 12 each, the Activity restriction subscale responses showed average scores of 9, 7, and 6.30 for the athletic, Functional, and social restrictions, respectively. Deans et al.[16] and Rudney et al.[17] both reported reduced sports participation among amputees, similar to our finding of high athletic restriction (M=9.17). Van der Linde et al.[21] highlighted those basic components (like SACH feet) limit adaptability, which matches our dominance of low-activity prosthetic designs. The higher Athletic restriction could mean that these amputees find it difficult to engage in sporting activities with their prosthesis. For an amputee to engage in athletic activity, the use of modified high activity components must be in place, like the modified prosthetic foot for swimming, skiing, running, etc.[19] In the present study, no such specialized device was documented. Hence, none of the prosthetic designs in use reflected a specialized design for sports or higher activities. Studies have also shown that higher and advanced prosthetic components, like microprocessor knee joints as opposed to the mechanical knee joints, dynamic response foot as opposed to SACH foot, etc, could help in improving QoL by reducing activity restriction.[20,21,22]

Although there were above average-midline scores for Activity restrictions, the study found that the Satisfaction scores yielded above-midline scores for the 3 subscales. Hence, the subjects were satisfied with the use of their prostheses amidst a highly restricted activity index with their prosthesis. According to Adegoke et al.[23], since most Nigerians do not engage in leisure-time activities such as sports, the loss of a lower limb through amputation may not seriously hinder their daily activities and impair their quality of life. Webster et al.[26] found that satisfaction can remain high even when functional performance is modest, echoing our participants' high satisfaction despite restrictions. This could therefore be responsible for the above-average scores recorded by this study on the various QoL parameters. Despite the above assertions, this study suggests that the Nigerian prosthetic community should start looking into the increased utility of these modern, advanced, and kinetically enhanced prosthetic components. It is believed that such components can help reduce activity restrictions placed on amputees by their prosthesis. They can increase the physical activity levels of these amputees as well as increase participation in sports and exercises.

The present study found a significant positive correlation between age and all the activity restriction subscales. Our positive correlation between age and activity restriction mirrors Madsen et al.[24] and Zidarov et al.,[18] who found older amputees report lower function and QoL. Hence as the age increases, the participants became more restricted in their prosthetic usage. Also, a significant negative correlation was observed between age and Adjustment to Limitation. This could mean that as the age of the participants increases, their ability to Adjust to Limitations decreases. This is understandable as it is a known fact that with ageing, the physical ability of the body reduces. Hence, younger individuals are more active and can overcome limitations than their older counterparts.[24,25,26] Considering the above, more needs to be done for the older amputees to ensure good outcomes with their prosthetic rehabilitation.

Considering gender, the female respondents were significantly more restricted from social activities than their male counterparts. This restriction was sustained for the athletic and functional activity restrictions as well, though not significantly. Our finding that women experienced greater social restriction aligns with Adegoke et al., who reported lower QoL scores among Nigerian women compared to men. This is also in agreement with a study conducted in 2024 by Kenon et. al.[27] However, Cox et al. found women scored higher in

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some domains, while Gallagher & MacLachlan and da Silva (Rudney et al.) found no gender differences. This could suggest cultural context in Nigeria may amplify gender disparities. Hence, it could imply that the females had social issues as a result of their amputation and subsequently, prosthesis. The reason for this should be further studied to ensure equity between the two genders in terms of prosthetic usage and restriction. Hence, from the present study, more should be done to reduce the restrictions placed on female amputees.

Strengths and Limitations of the Study

The study, unlike many other similar ones, attempted to view QoL through the lens of the type of prosthetic component utilized in the prosthetic rehabilitation. Hence, we can see how the type of prosthetic components can influence QoL. The study relied on a small or localized sample, which may not represent the broader amputee population. Also, the study focused primarily on lower-limb amputees, leaving gaps in understanding for upper-limb amputees. This gap needs to be filled.

Implications of the findings of the study

1. Component upgrades: Introducing dynamic-response feet and microprocessor knees could reduce restrictions, as shown by Berry et al.[20] and Burçak et al.[22]
2. Tailored rehabilitation: Age- and gender-sensitive programs are needed to address the specific challenges faced by older and female amputees.
3. Context-first strategies: In Nigeria, reliable fit and everyday mobility may matter more than leisure activity capacity but expanding access to advanced components could broaden opportunities for sports and social participation.

CONCLUSION

Our results confirm international findings that age increases restriction, basic components limit function, and psychosocial resilience remains strong. However, satisfaction levels in our study are higher than expected given functional limitations, likely due to cultural expectations and limited alternatives. Gender disparities appear more pronounced in Nigeria than in Western studies. As opposed to the use of low activity components reported by the present study, the Nigerian prosthetic community should start looking into the increased utility of modern, advanced, and kinetically enhanced prosthetic components. It is believed that such components can help reduce activity restrictions placed on amputees by their prosthesis. They can increase the physical activity levels of these amputees as well as increase participation in their environment. Considering the demographic findings of the present study, the elderly and female prosthesis users are exposed to many activity restrictions and limitations in their prosthesis usage. Hence, focus should be placed on enhancing their prosthetic rehabilitation to reduce these.

Declarations

Ethical Consideration: The Ethics and Review Committee of the Department of Prosthetics and Orthotics, School of Health Technology, Federal University of Technology Owerri, Imo State, Nigeria gave ethical approval for the study. Participants freely gave informed consent after the assurance of the confidentiality of their information and their safety in the study and were at liberty to pull away from the study at any time without consequences.

Authors' Contribution: CKO conceptualized and analyzed the data, EJ supervised the study, TNU wrote the manuscript, KDK collected the data and typed the manuscript. The final draft was approved by all the authors.

Conflict of interest: The authors have no conflict of interest to declare.

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