Original Article

Satisfaction with Prosthesis and Walking Ability among Trans-Tibial Prosthesis Users from Two Selected Rehabilitation Hospitals in Rwanda

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Cite as: Butoya P, Rukundo JD, Gatsinzi MJ, Ngulube JD, Kemigisha J, Izere D, Mbonyinshuti I, Assuman N. Satisfaction with Prosthesis and Walking Ability among Trans-Tibial Prosthesis Users from Two Selected Rehabilitation Hospitals in Rwanda. Rwanda J Med Health Sci. 2025;8(1): 75-88. https://dx.doi.org/10.4314/rjmhs.v8i1.6.

Abstract

Background
Satisfaction with the prosthesis is the key element to using the prosthesis for better walking and performing daily activities among transtibial prosthesis users. Different factors affect satisfaction and walking ability.

Objective
To evaluate satisfaction and assess walking ability among transtibial prosthesis users from two rehabilitation hospitals in Rwanda.

Methods
A quantitative cross-sectional study was conducted on 45 transtibial prosthesis users who received their prostheses from the University Teaching Hospital of Kigali and Gatagara Orthopedics and Rehabilitation Hospital, Nyanza. The research was done from February 1, 2024, to April 30, 2024. The Trinity Amputation and Prosthesis Experience-Revised (TAPES-R) was utilized to evaluate satisfaction whereas the Timed Up and Go (TUG) and the 2 minutes' walk test (2MWT) were used for walking ability assessment.

Results
Out of 45 participants, 71.1% (n=32) were males and the remaining were females. On satisfaction with prosthesis, 62.2% were satisfied while 37.8% were unsatisfied. The satisfaction was statistically significantly associated with shape ($p \leq 0.001$), appearance ($p \leq 0.003$), weight ($p \leq 0.001$), usefulness ($p \leq 0.027$), reliability ($p \leq 0.035$), fit ($p \leq 0.001$), and comfort ($p \leq 0.038$) of their prosthesis, their health status ($p \leq 0.011$) and physical status ($p \leq 0.001$). For walking ability, 60% of the participants demonstrated moderate walking ability.

Conclusion
Some transtibial prosthesis users were unsatisfied with their prosthesis. Moderate walking ability was observed generally. More rehabilitation including gait training, physiotherapy, early prosthetic fitting, rehabilitation team follow-ups and use of advanced prosthetic technology are recommended.

Rwanda J Med Health Sci 2025;8(1):75-88

Keywords: Transtibial amputation, satisfaction, prosthesis, walking ability & Rwanda

Introduction

Lower limb amputation (LLA) is becoming a global health burden that affects millions of people worldwide.[1] An estimated 65 million people across the world live with limb amputations, and approximately 1.5 million individuals get amputations annually, 60% of which are lower limb amputations.[1] Reasons including vascular, infectious disease, congenital conditions, tumours, or trauma may cause lower limb amputations.[2] In Rwanda, according to a retrospective study conducted by Murwanashyaka and Ssebuufu,[3] at the University Teaching Hospital of Butare, 37.38% of all amputations done between 2009 to 2012 were transtibial and they were the most frequent level of lower limb amputation.

People with lower limb amputations have a variety of difficulties, including learning how to walk, psychological issues associated with coping and dealing with their limb loss.[4] There is potential for improving functionality, independence, and psychological well-being through prosthetic rehabilitation.[5] After the delivery of the prosthetic devices, the patients should be able to use their devices happily because it is expected that satisfaction is associated with its acceptance and greater use.[6]

Satisfaction with prosthesis is generally subjective and emotional, as after an amputation, the prosthesis users struggle with their loss and stigma. The satisfaction is based on the artificial limb characteristics and its impact on the user, such as its cosmetic appearance, quality, fit, use, as well as the status of the remaining body part.[7, 8] Again, as reported in a study by Baar et al,[8] satisfaction with the prosthetic device was reportedly associated with factors such as comfort, durability, and safety. Conversely, other studies have consistently reported the dissatisfaction with devices among the users due to artificial limb causing pain, pressure sores, wounds and skin irritations, technical and functional problems and appearance.[9,10]

Regarding walking ability and the role the prosthetic devices play, the goal is achieving improved sitting, standing, balance, and walking ability, as post-amputation the patients experience a functional decline.[11,12] This calls for a need to assess the walking ability of only a few users to determine the impact of the prosthetic device and rehabilitation received before its full rollout to the community.[13]

Various studies on satisfaction with prosthesis and walking ability in developed countries are available and provide important insights into why research can contribute to rehabilitation outcomes among amputees. However, in low- and middle-income countries in which Rwanda belongs, there is a paucity of studies regarding the satisfaction with artificial limb and walking ability among users.[14,15]

Therefore, this study evaluated the satisfaction with prosthesis and the walking ability of transtibial prosthesis users from two selected hospitals in Rwanda.

Methods

Study design

A quantitative cross-sectional study design was used to evaluate satisfaction with prosthesis and to assess the walking ability of transtibial prosthesis users from two selected hospitals in Rwanda.

Study setting

The study recruited participants from two selected Health Institutions, the University Teaching Hospital of Kigali – [Centre Hospitalier Universitaire de Kigali (CHUK)] and Gatagara Orthopedics and Rehabilitation Hospital Nyanza – [Home de la Vierge des Pauvres (HVP)]. CHUK is a teaching hospital located in the City of Kigali while HVP Gatagara is located in Nyanza district, Southern Province. Both hospitals were chosen because they have equipped prosthetics and orthotics departments/units in which prosthetic and orthotic devices are designed, manufactured, and fitted, they receive a significant number of patients who need prosthetic devices, patients receive prosthetics and orthotics(P&O) services on community-based health Insurance(CBHI) and those settings represent urban and rural settings in Rwanda considering their respective geographical locations.

Study population

The population consisted of participants who had received their transtibial prosthesis from the selected settings and who had used their prosthetic devices for at least three months to 24 months,[16] before data collection started.

Sampling technique and sample size

Because of the small study population, census sampling was utilized to select 50 transtibial prosthesis users who met the inclusion criteria. Five participants were not available during the period of data collection, therefore, 45 transtibial prosthesis users participated in the study.

Inclusion and exclusion criteria

The researchers considered participants who received the prosthesis within 3 to 24 months before data collection, aged between 18 and 65 years, having received the prosthesis from one of the two selected hospitals. For legal consent requirements, participants under the age of 18 were excluded, while those over the age of 65 were excluded to establish a more homogeneous study population with comparable functional potentials. Transtibial amputees with multiple amputations, primary transtibial amputees, transtibial amputees with other chronic diseases, and transtibial amputees with intellectual impairments were also excluded from the study.

Instrumentation for data collection

Three data collection tools were used in the study.

1. Trinity Amputation and Prosthesis Experience Revised (TAPES-R)

The Trinity Amputation and Prosthesis Experience Revised (TAPES-R) was utilised to assess the satisfaction with prosthesis. It was adopted from the original TAPES which was created at Trinity College Dublin, the Department of psychology to assess the quality of life in lower limb prosthesis users. It comprises three components to assess adjustment psychosocially, restriction in activities, and satisfaction with the prosthesis.[17] The latter consists of the aspects of the prosthesis, each rated on a 3-point Likert scale (not satisfied, satisfied, and very satisfied), while the overall satisfaction with the prosthesis was categorized into unsatisfied(scoring less than or equal to 7) and satisfied (scoring 8 or higher) on a scale from 0 to 10.[17]

The tool was found to be reliable; its subscales had Cronbach's alpha's >0.8. For the internal reliability, the Intraclass Correlation Coefficient (ICC) was between 0.6 and 0.89 for all subscales.[18] The TAPES-R was translated from English to Kinyarwanda by a professional translator and back to English to address cultural and linguistic equivalences and the responses were the same. In addition, it was sent for revision to the prosthetics and orthotics and physiotherapy professionals experienced in using outcome measures. The feedback was then returned for final adaptation. For the translated version of the TAPES-R, the pilot study was conducted on a sample of five transtibial prostheses users and found the questionnaire was clear and comprehensible.

2. Timed up and Go (TUG)

The timed Up and Go (TUG) was used to assess walking ability.[19–21] In prosthetics, TUG is used to evaluate walking ability, the falling risks, and predicting the non-use of the devices among prosthesis users.[22, 23] The intra-rater reliability was 0.93 while the inter-rater reliability was 0.96, and the intra-class correlation was 0.88 (95%CI: 0.80-0.94).[21] Furthermore, TUG demonstrated high concurrent validity (correlation coefficient (r) of 0.85) with the Expanded Timed Up-and-Go (ETUG) test.[24]

3. Two-minute walk Test (2MWT)

The 2MWT was also used to assess the walking ability of the participants. With this test, the distance covered in a normal walk is measured within 2 minutes. The test-retest reliability was excellent (ICC=0.83) in Lower Limb Amputees (LLA).[25] The construct validity of 2MWT had an excellent correlation with the Locomotor Capabilities Index (LCI)5 ($r = 0.71$, $P < 0.01$) in LLA.[26] The reference values found for unilateral transtibial amputees after 3 months of using the prosthesis, the distance covered in 2 minutes ranged from 81± 47 metres in males and 81± 47 metres in females.[16]

Data collection procedure

The data collection procedures were done after obtaining the ethical clearance and the authorizations from both hospitals.

Fifty (n=50) transtibial amputees who were eligible for the study were contacted by phone calls, and were explained about the aim, objectives, and benefits of the study. The consent forms were provided to the remaining who agreed to participate (n=45). Five of them did not participate in the study voluntarily. The participants who met the inclusion criteria were invited to their respective settings, where they filled out the self-reported questionnaire TAPES-R and were physically evaluated on their walking ability using standardized tools, including the Timed Up and Go test (TUG) and the two-meter walk test (2MWT).

Participants filled the questionnaire (TAPES-R) and data collectors were available to provide assistance and guidance in filling the questionnaire when needed. On the same day, each participant after filling the questionnaire, did the performance assessment using the aforementioned tests to assess their walking ability. For the TUG, three metres (3m) were marked from a chair. Then, each participant seated in a chair was instructed to walk and cover the metres as quickly as possible at a comfortable, self-selected safe speed and come back and sit in the chair. The time spent was recorded to the nearest second. The participant took a rest of 10 minutes and repeated the test. Then the average of the two results was recorded to the nearest second.

After 10 minutes of recovery time, participants proceeded to the 2MWT. They were requested to walk the entire length of the corridor for two minutes at their natural walking speed, without being encouraged. When the two minutes were completed, the participant was instructed to stop where 2 minutes ended, then the examiner recorded the distance completed in metres. The participants were given 5 minutes to rest before undertaking the second trial. The final distance recorded was the average of the two distances.[27]

Data analysis

The data were analysed using STATA v13. The demographic data were counted in frequencies and reported in the sample's percentages. Bivariate analyses were computed using Pearson chi-square and fisher-exact tests to determine the factors associated with prosthesis satisfaction and walking ability of transtibial prosthesis users. In addition, multivariable analysis was performed using multiple logistic regression to identify the independent predictors of TUG and 2MWT from statistically significant variables.

Ethical considerations

The study was carried out after securing ethical approval from the University of Rwanda, College of Medicine and Health Sciences Institutional Review Board (CMHS/IRB/513/2023). Also, local ethical approval was obtained from CHUK (EC/CHUK/001/2024) and authorization from HVP Gatagara Orthopedics (Ref 00.02/DG/310/24) and Rehabilitation Hospital. Moreover, participants were explained about the study and consented to participate. Participants were compensated for the transportation fees and refreshments were provided during the activity. Personal codes were used for anonymity of participants; the obtained data were kept confidential, and only research team members had access to them. No risks were encountered in the study, and the participants had the right to withdraw from the study anytime without facing any repercussions.

Results

Socio-demographic characteristics of the study sample

Forty-five (N=45) transtibial prosthesis users participated in the study. The ages of the participants ranged from 18 to 65 years. The highest proportion of the participants were aged between 46-55 years (n=19; 42.22%). There were more males 32(71.1%) than females; and trauma was the leading cause of amputation (n=35, 77.78%). The descriptive characteristics of the participants are presented in Table 1.

Table 1. Socio-demographic and clinical data of the participants from both hospitals

Variable	Characteristics	CHUK	HVP Gatagara	Total
		n (%)	n (%)	n (%)
Age group (years)	18-25	1(20.00)	4(80.00)	5 (11.11)
	26-35	4(66.67)	2(33.33)	6 (13.33)
	36-45	6(85.71)	1(14.29)	7 (15.56)
	46-55	6(31.58)	13(68.42)	19 (42.22)
	55-65	5(62.50)	3(37.50)	8 (17.78)
Gender	Male	16(50.00)	16(50.00)	32 (71.1)
	Female	6(46.15)	7(53.85)	13 (28.89)
Years after amputation	< 10	6(46.15)	7(53.85)	13 (28.89)
	10 - 20	4(44.44)	5(55.56)	9 (20.00)
	21-30	10(55.56)	8(44.44)	18 (40.00)
	31-40	1(50.00)	1(50.00)	2 (4.44)
	≥ 41	1(33.33)	2(66.67)	3 (6.67)
Years after first Prosthesis	< 10	7(43.75)	9(56.25)	16 (35.56)
	10 - 20	7(63.64)	4(36.36)	11 (24.44)
	21-30	7(43.75)	9(56.25)	16 (35.56)
	31-40	0 (0)	0 (0)	0 (0)
	≥ 41	1(50.00)	1(50.00)	2 (4.44)
Years after the current prosthesis	Less than 1 year	17(48.57)	18(51.43)	35 (77.78)
	Above than 1 year	5(50.00)	5(50.00)	10 (22.22)
Cause of amputation	Trauma	18(51.43)	17(48.57)	35 (77.78)
	Peripheral vascular disorders	0(0)	4(100.0)	4 (8.89)
	Diabetes	2(100.00)	0(0)	2 (4.44)
	Cancer	2(66.67)	1(33.33)	3 (6.67)
	Congenital	0(0)	1(100.00)	1 (2.22)
Total		22(48.89)	23(51.11)	45 (100)

Key: n: Frequency; %: Percentage; *: Statistically significant; **: Statistically very significant.

Satisfaction with the current prosthesis

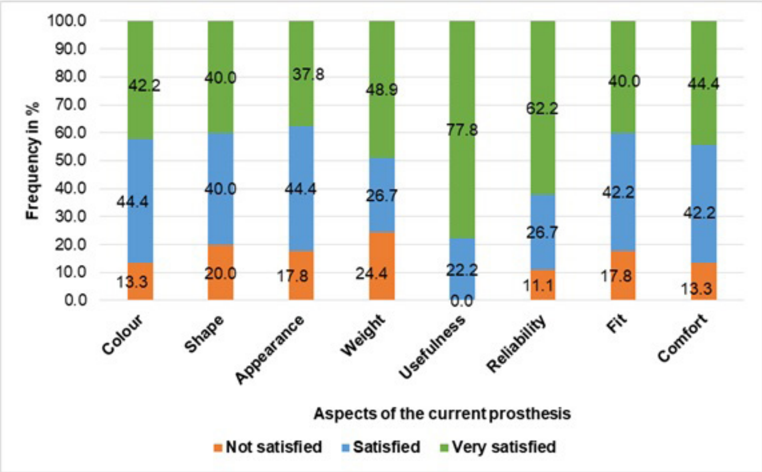

Figure 1. Level of satisfaction on various aspects of current prosthesis

The findings showed participants' satisfaction level on various aspects of the current prosthesis including colour, shape, appearance, weight, usefulness, reliability, fit and comfort. The majority of the participants were satisfied or very satisfied with the characteristics of their prostheses. However, some of the participants were not satisfied with some aspects including weight with 24.4%(n=11) and shape with 20% (n= 9) as presented in in Figure 1.

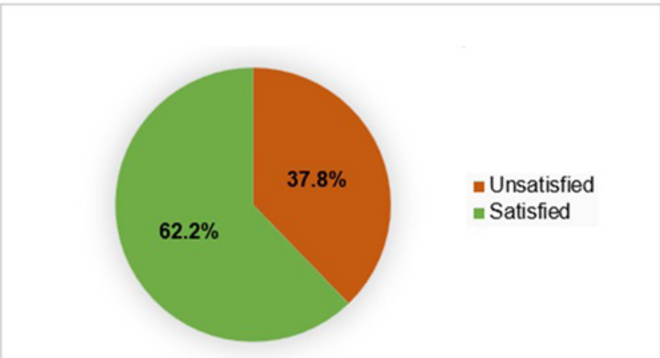

Figure 2. Overall satisfaction with current prosthesis

The satisfied participants with current prosthesis were 62.2% (n=24) while the unsatisfied participants with current prosthesis were 37.8% (n=17) as shown in Figure 2.

Bivariate analysis of factors associated with satisfaction with prosthesis

The bivariate analysis of overall satisfaction was computed using the Pearson chi-square statistic and Fisher's exact tests. It was done to identify the factors that are associated with prosthesis satisfaction.

There was a statistically significant association between satisfaction with prosthesis and health status, physical status, and aspects of the prosthesis including shape, appearance, weight, usefulness, reliability, fit, and comfort. However, no statistically significant association was found between satisfaction with prosthesis and age, gender, years after the first prosthesis, years after the current prosthesis, the prosthesis-providing rehabilitation hospital, and colour of the prosthesis as noted in Table 2.

Table 2. Bivariate analysis of factors associated with satisfaction with prosthesis

Overall Satisfaction	Characteristics	Unsatisfied (≤7)	Satisfied (≥8)	P-Value
		n (%)	n (%)	
Age Category/Years	18- 25	2(40.00)	3(60.00)	0.295
	26-35	0	6(100.00)	
	36-45	4(57.14)	3(42.86)	
	46-55	8(42.11)	11(57.89)	
	55 -65	3(37.50)	5(62.50)	

Table 2. Continued

Overall Satisfaction	Characteristics	Unsatisfied (≤7) n (%)	Satisfied (≥8) n (%)	P-Value
Gender	Male N=32	12(37.50)	20(62.50)	0.952
	Female N=13	5(38.46)	8(61.54)	
First Prosthesis/years	Less than 10	8(50.00)	8(50.00)	0.470
	11-20	4(36.36)	7(63.64)	
	21-30	5(31.25)	11(68.75)	
	31-40	0	0	
	Above 41	0	2(100.00)	
Current Prosthesis/Years	Less than 1 Year	12(34.29)	23(65.71)	0.366
	Above 1 Year	5(50.00)	5(50.00)	
The rehabilitation hospitals	CHUK	6(27.27)	16(72.73)	0.155
	HVP-GATAGARA	11(47.83)	12(52.17)	
Physical Status	Very poor	2(100)	0	0.001**
	Poor	6(100)	0	
	Fair	6(37.50)	10(62.50)	
	Good	2(10.53)	17(89.47)	
	Very Good	1(50.00)	1(50.00)	
Health Status	Very poor	2(100.00)	0	0.011
	Poor	1(100.00)	0	
	Fair	7(70.00)	3(30.00)	
	Good	6(24.00)	19(76.00)	
	Very Good	1(14.29)	6(85.71)	
Colour of Prosthesis	Unsatisfied	4(23.53)	2(7.14)	0.107
	Average	9(52.94)	11(39.29)	
	Satisfied	4(23.53)	15(53.57)	
Shape of Prosthesis	Unsatisfied	8(47.06)	1(3.57)	0.001**
	Average	6(35.29)	12(42.86)	
	Satisfied	3(17.65)	15(53.57)	
Appearance of Prosthesis	Unsatisfied	7(41.18)	1(3.57)	0.003**
	Average	7(41.18)	13(46.43)	
	Satisfied	3(17.65)	14(50.00)	
Weight of Prosthesis	Unsatisfied	9(52.94)	2(7.14)	0.001**
	Average	5(29.41)	7(25.00)	
	Satisfied	3(17.65)	19(67.86)	
Usefulness of Prosthesis	Unsatisfied	0	0	0.027*
	Average	7(41.18)	3(10.71)	
	Satisfied	10(58.82)	25(89.29)	
Reliability of Prosthesis	Unsatisfied	4(23.53)	1(3.57)	0.035*
	Average	6(35.29)	6(21.43)	
	Satisfied	7(41.18)	21(75.00)	
Fit of Prosthesis	Unsatisfied	8(47.06)	0	0.001**
	Average	5(29.41)	14(50.00)	
	Satisfied	4(23.53)	14(50.00)	
Comfort of Prosthesis	Unsatisfied	5(29.41)	1(3.57)	0.038*
	Average	7(41.18)	12(42.86)	
	Satisfied	5(29.41)	15(53.57)	

Key: n: frequency; %: Percentage; *: Statistically significant at p≤0.05, **: Statistically very significant at p=0.001

Walking ability of the transtibial prosthesis users

TUG-related results

The TUG results showed that 31(68.9%) participants used ≤10 seconds to walk 3 metres, 11, (24.4%) spent 11-15 seconds while 3 (6.7%) walked more than 16 seconds to complete the test as shown in Figure 3. The mean time was 9.8 seconds and the standard deviation was 3.5 seconds.

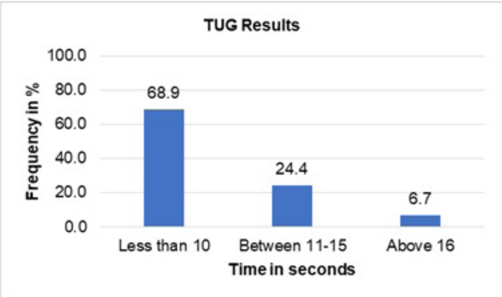

Figure 3. TUG results of the participants walking with their current prosthesis

Bivariate analysis of TUG

The bivariate analysis of the Timed-up and go (TUG) was computed using the Pearson chi-square statistic and Fisher's exact test. It was done to identify the factors that are associated with walking ability. There was a statistically significant association between TUG and years after the first prosthesis (p≤0.004), years after the current prosthesis (p≤0.008), physical status (p≤0.017), and aspects of the prosthesis including shape (p≤0.031), weight (p≤0.011), Usefulness (p≤0.001), Reliability (p≤0.001), and Fit (p≤0.004). However, no statistically significant association was found between TUG and age (p≤0.315), gender (p≤0.085), the prosthesis-providing rehabilitation hospital (p≤0.183), health status (p≤0.058), satisfaction with prosthesis (p≤0.064), colour of prosthesis (p≤0.731), appearance of prosthesis (p≤0.180) and comfort of prosthesis (p≤0.235).

2MWT related results

The 2MWT recorded the metres covered by the participants in 2 minutes while walking. The majority of participants (n=27, 6 %) walked a distance between 101 to 150 metres, 12 (22.7 %) participants covered a distance between 51 to 100 metres, and 5 (11.1 %) participants walked more than 151 metres.

Bivariate analysis of 2MWT

A statistically significant association was found between 2MWT and years since the first prosthesis (p≤0.001), physical status (p≤0.07), satisfaction with prosthesis (p≤0.034), and appearance of prosthesis (p≤0.015). However, no statistically significant association was found between 2MWT and age (p≤0.303), gender (p≤0.135), years since the current prosthesis (p≤0.055), the rehabilitation hospital providing the prosthesis (p≤0.369), health status (p≤0.137), and aspects of the prosthesis including colour (p≤0.684), shape (p≤0.198), weight (p≤0.365), usefulness (p≤0.270), reliability (p≤0.071), fit (p≤0.145), and comfort of the prosthesis (p≤0.377).

Multivariable analysis

Multivariable analysis was done using multiple logistic regression analysis to identify likely independent predictors of TUG and 2MWT from independent variables. The results showed that having had more years of experience using a prosthesis (Above 41) is more likely to have better 2MWT results(p≤0.03) and having very good physical status(p≤0.026) may predict better 2MWT results and walking ability (Table 3).

Table 3. Multivariable analysis of factors associated with walking ability

2MWT	Characteristics	Coef.	t	P-value	{95% CI}	
	Below 10	1				
Years after 1st prosthesis	Between 11-20	0.077	0.31	0.756	-0.423	0.577
	Between 21-30	0.009	0.04	0.968	-0.459	0.477
	Above 41	-1.037	-2.27	0.030*	-0.421	0.611
Satisfaction	Not satisfied	1				
	Satisfied	0.951	0.37	0.71	-0.421	0.611
	Very poor	1				
	Poor	0.233	0.48	0.631	-0.746	1.213
Physical Status	Fair	0.875	1.77	0.085	-0.128	1.880
	Good	0.999	1.95	0.059	-0.042	2.041
	Very Good	1.5	2.33	0.026*	-0.189	2.810
	Unsatisfied	1	-0.41			
Appearance	Average	-0.113	0.43	0.681	-0.672	0.444
	Satisfied	0.129		0.667	-0.476	0.735
TUG	**Characteristics**	**Coef.**	**t**	**P-value**	**{95% CI}**	
	Below 10	1				
Years after 1st prosthesis CAT	Between 11-20	-0.317	-1.18	0.25	-0.871	0.236
	Between 21-30	-0.273	-1.14	0.26	-0.763	0.217
	Above 41	0.719	1.63	0.11	-0.187	1.626
Years after the current prosthesis CAT	Below 1 year	1				
	Above 1 year	0.221	0.94	0.355	-0.261	0.704
	Very poor	1				
	Poor	-0.371	-0.8	0.43	-1.322	0.579
Physical Status	Fair	-0.758	-1.61	0.119	-1.726	0.208
	Good	-0.686	-1.39	0.177	-1.704	0.330
	Very Good	-0.84	-1.41	0.171	-2.065	0.385
	Unsatisfied	1				
Shape of the prosthesis	Average	0.166	0.42	0.675	-0.640	0.972
	Satisfied	0.25	0.58	0.567	-0.635	1.135
	Unsatisfied	1				
Weight of the prosthesis	Average	-0.002	-0.01	0.996	-0.795	0.790
	Satisfied	-0.155	-0.47	0.644	-0.838	0.527
Usefulness of the prosthesis	Average	1				
	Satisfied	0.121	-0.5	0.621	-0.622	0.378
	Unsatisfied	1				
Reliability of the prosthesis	Average	-0.807	-0.21	0.839	-0.887	0.726
	Satisfied	-0.017	-0.04	0.969	-0.948	0.913
	Unsatisfied	1				
Fit of the prosthesis	Average	-0.407	-1.02	0.316	-1.227	0.412
	Satisfied	-0.525	-1.15	0.26	-1.461	0.411

Key: 2MWT: 2 minutes walk test Coef: Coefficient correlation t: t-value; *: Statistically significant, 95% CI: 95% Confidence interval

Discussion

This study was conducted to evaluate the satisfaction and assess the walking abilities among transtibial amputees from two selected hospitals in Rwanda. The findings demonstrate that 62.2% of the participants were overall satisfied with their devices. The satisfaction level found was lower than the one reported in the study conducted by Hand Eones and others. They found that 75.3% of the prosthesis users were satisfied.[8] Other authors noted that individuals who had transtibial (91%) and transfemoral (78%) amputations reported high levels of satisfaction with prosthesis.[28]

The characteristics of the prosthetic devices contribute to the satisfaction with prosthesis. These include shape, usefulness, comfort, appearance, reliability, fit and weight of the artificial limb which were significantly associated with overall satisfaction.[29] However, some studies have highlighted less satisfaction with the colour and weight of the prosthetic limbs.[5, 28, 30] This could be the result of individual differences in expectations and preferences, where users prioritize cosmesis, function, and comfort differently based on their lifestyle, cultural context, or exposure to prosthetic technologies.[31] Limited access to lightweight and customizable prosthetic options, particularly in low-income countries, may lead to dissatisfaction with weight and colour in certain settings.[31] This implies that prosthetic design should balance cosmetic, comfort, and functional aspects of the prosthesis as well as consider the individualized needs of the prosthetic user.

Concerning the walking ability of transtibial prosthesis users, the majority completed the 3-meter walk in less than 10 seconds to walk 3 metres which demonstrates a lower risk of falls, greater independence in day-to-day activities, and a high level of walking ability, in consistence with prior research linking faster gait speeds to better outcomes.[21] Those requiring between 11 and 15 seconds to cover same distance may indicate mild mobility difficulties with moderate walking ability in lower limb amputees using prostheses.[21] Scoring 16 seconds or more is linked to a higher risk of falls, decreased independence, and the need for additional evaluation and intervention rehabilitation gait training.[21] The mean TUG time of all participants closely matched Newton's study findings among transtibial amputees, suggesting comparable baseline walking ability.[20] However, the results of the present study contrast with the findings of Mukkamala et al,[32] and Christiansen et al.[19] which showed slower gait speeds. This difference is likely due to different levels of prosthesis familiarity. For example, some of our study participants were used to walking with their prostheses, which made them more efficient. These results emphasize the significance of targeted gait training and prolonged prosthesis adaptability in order to enhance functional independence and reduce the risk of falls. Clinicians should prioritize interventions for individuals who exceed the 16-second threshold, while also utilizing their familiarity with prostheses as a critical factor in rehabilitation planning.
Years after first prosthesis, years after current prosthesis, physical status and other aspects of the prosthesis were associated with walking ability based on TUG results. The findings concur with other studies.[32, 33] This indicates that rehabilitation sessions should focus on transtibial amputees who take longer to complete the TUG to improve their mobility and lower the risks of falling. In addition, gait training, strengthening exercises, balancing physiotherapy sessions, and customized gait training based on individual needs should be included.[34]

The 2MWT is another mobility-measuring tool that was used to assess the walking ability of transtibial prosthesis users. The findings indicate that individual levels of mobility varied,with most showing acceptable walking distances between 101 and 150 metres.

It implies that many transtibial prosthesis users have attained the walking ability enabling them to take part in everyday activities. In comparison with the reference values reported in the study by Bohannon et al.,[35] the mean distance covered in the 2MWT for healthy individuals is substantially higher in men than in women. The top-performing participants in this study (those who walked more than 151 metres) remain below these standards, indicating that although the below-knee amputees manage to walk long distances, many do not reach the optimal level of walking observed in non-amputees. This implies that there is a need for more physical rehabilitation sessions such as more gait training and physiotherapy sessions to improve their walking performance.

The mean distance reported in this study is consistent with the findings from a cross-sectional study conducted among lower limb prosthetic users in Colorado, USA.[36] This shows that transtibial prosthesis users perform better, although more gait training is required considering the different factors such as physical status, experience with prosthesis use, and their satisfaction with the device. While some individuals adjust to their prostheses successfully, others require further prosthetic rehabilitation to improve their mobility, as indicated by the low number of participants who were able to cover more than 151 metres. This implies that the transtibial prosthesis users, who cover less than 100 metres, require more rehabilitation interventions to increase walking ability or change prosthetic components. In addition, regular follow-ups are required to evaluate their improvement over time.

Limitations of the study

The limitation of the study was that only two rehabilitation hospitals were included in this study and the number of participants was small due to some recording issues of prosthetic users in the research settings. Nevertheless, the findings of this study form the basis upon which further studies can be designed and undertaken to include more hospitals and more participants.

Conclusions and Recommendations

The majority of transtibial prosthesis users are satisfied with their prostheses and have moderate walking ability. Nevertheless, it is recommended that additional rehabilitation services be provided to amputees who are unsatisfied and those who demonstrate a low level of walking ability. Moreover, it is suggested that individuals who have undergone amputation obtain early and individualized prosthetic rehabilitation and physiotherapy sessions to improve their physical status. Regular follow-ups by the rehabilitation team to enhance amputee mobility is warranted.

Authors' contribution

PB contributed to designing the study, collecting data, interpreting data, manuscript writing, and publication. NA and JDR supervised the entire study. JGM, JND, and JK contributed to data collection, data interpretation and manuscript writing. DI and IM contributed to data collection.

Conflict of interest

None

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