Research Paper

# Independence Level as a Mediators Between Physical Activity and Activities of Daily Living in Lower Limb Amputation

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**Citation** Faris HI, Badr ShH, Hussein BH. Independence Level as a Mediators Between Physical Activity and Activities of Daily Living in Lower Limb Amputation. Iranian Rehabilitation Journal. 2025; 23(1):77-86. http://dx.doi.org/10.32598/irj.23.1.1989.2

http://dx.doi.org/10.32598/irj.23.1.1989.2

**Article info:**
**Received:** 16 Nov 2024
**Accepted:** 23 Dec 2024
**Available Online:** 01 Mar 2025

**Keywords:**
Physical activity, Activities of daily living (ADLs), Lower limb amputation, Independence level

## ABSTRACT

**Objectives:** Lower limb amputation can significantly affect levels of physical activity and ability to engage in daily sports, often affecting independence. Accordingly, this study investigates the association between physical activity and activities of daily living (ADLs) in humans with lower limb amputation, focusing on the mediating role of level of independence.

**Methods:** This cross-sectional study was conducted at the Babylon Rehabilitation Center between August and November 2024. A total of 246 samples were collected using purposive non-probability sampling. The data were collected using validated instruments: The international physical activity questionnaire (IPAQ), the Nottingham scale of daily activities, and the Barthel independence index. A data series, including structured interviews, was conducted and analyzed using the Pearson correlation and linear regression in the SPSS software, version 20.

**Results:** A total of 75.6% of the members had low levels of physical activity, 68.7% had low ADLs, and 77.6% were unable to complete daily tasks. A high-quality relationship was observed between physical activity and daily life (P=0.000). Simple linear regression revealed that independence levels predicted physical activity (P=0.000) and ADLs (P=0.000).

**Discussion:** The study highlights the importance of promoting independence as a pathway to improving physical activity levels and functional independence in ADLs.

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## Highlights

- This study shows a significant relationship between physical activity and the ability to perform activities of daily living (ADLs) in lower limb amputees, highlighting the importance of physical engagement in promoting meaningful independence.

- Independence is an important predictor of both physical activity and ADLs, highlighting that prolonged independence allows for better engagement in daily responsibilities and physical activity, ultimately leading to improved quality of life for amputees.

## Plain Language Summary

This study explored how physical activity and independence influence the ability of lower-limb amputees to participate in daily activities. Many amputees were observed to have low levels of bodily pastime, which made it difficult for them to participate in day-by-day sports. However, those with better degrees of independence were much more likely to participate in each day's sports. These findings highlight the significance of rehabilitation programs in selling independence. This is because rehabilitation programs that sell independence can considerably improve degrees of physical hobby, the capability to satisfy each day's obligations, and the primary stage of daily living for amputees.

## Introduction

Physical activity has an important role in maintaining the fitness and freedom of lower limb amputees, a lot of have attributed it to their capability to carry out each day residing sports [1]. Research indicates that an appropriate volume of physical activity improves the high-quality of lifestyle, practical skills, and intellectual fitness of amputees [2, 3]. In addition, regular physical activity also lowers the risk of secondary diseases, such as heart and diabetes, that amputees are especially vulnerable to as a result of reduced mobility and lifestyle changes after amputation [4].

The capability to interact each day by exercising is an essential degree of beneficial capability and the first-rate of existence for human beings with disabilities, mainly decreased limb amputees [1]. Research suggests that bodily activity complements the potential to perform each daily living responsibility by enhancing muscle power, stability, and strength, while also empowering amputees to take control of their exercise physical games, and private care responsibilities [5].

However, the level of independence, a critical issue for selling autonomy and lowering reliance on caregivers, may additionally moreover mediate this dating. Greater autonomy decorates motivation and self-guarantee in daily life, mainly to progress ordinary overall performance in normal responsibilities [6, 7]. Independence is likewise an idea to inspire sustained participation in bodily hobbies, growing a first-rate comments loop that enhances the bodily and practical talents of amputees [8].

The incidence of physical disabilities, especially amputations, has risen sharply in Iraq in recent years, significantly due to prolonged struggle, terrorism and injuries. Research suggests that Iraq has one of the maximum fees of bodily disabilities in the Middle East, with amputations being the numerous maximum time-honored varieties of incapacity [9, 10]. An observation conducted by using the use of the Iraqi Ministry of Health in collaboration with the World Health Organization (WHO) anticipated that approximately 2.8% of the Iraqi populace lives with some form of incapacity, with bodily disabilities constituting a splendid aspect [11]. Notably, around 5% of these disabilities result from limb loss, widely affecting men elderly 18 to 45 years, often due to struggle-related accidents [4]. In Iraq, civilian accidents due to explosives and landmines remain a leading cause of amputation, with hundreds of new instances mentioned every year, in particular in regions with confined army interests [12]. This excessive occurrence of disabilities and limb loss underscores the pressing want for specialized rehabilitation services and support structures, as cutting-edge centers attempt to fulfill the growing needs of the affected population [13].

In Iraq, wherein getting the right of entry to specialized rehabilitation centers for amputees is regularly constrained, inspecting the mediating position of independence is essential for growing centered interventions. Previous research in comparable contexts has shown that

difficult conditions, which include the shortage of physical rehabilitation centers, socioeconomic barriers, and the absence of social guidance, can limit amputees' participation in physical sports [4, 14, 15]. Recognizing the need for an incapacity-specific rehabilitation technique, this study investigates the relationship between physical interest and the capacity to carry out everyday responsibilities amongst Iraqi amputees, focusing in particular on the mediating effect of independence. Accordingly, this research evaluates the association between physical activity and activities of daily living (ADLs) in lower limb amputation, focusing on the mediating role of level of independence.

## Materials and Methods

### Study design

This study adopted a cross-sectional design to investigate the relationship between physical interest and sports in daily life among individuals with lower limb amputation. It also examined the mediating role of the independence stage in this study.

### Study sample

This study was conducted at the Babylon Center for Disabled Rehabilitation. The number of monthly visitors, according to the center's registrants, was 2502 monthly visitors with disabilities (lower limb amputation). The sample size was calculated using a cross-sectional study method based on a time interval of 95%, a percentage of 0.23 of the final scores, and an accuracy of 0.05 [16].

First, to calculate $n_0$, the initial pattern size without adjusting for the finite population size was done using the Equation 1:

1.
$$n0 = \frac{Z^2 \cdot p \cdot (1-p)}{d2}$$
$$n0 = \frac{(196)^2 \cdot 0.23 \cdot (1-023)}{(0.05)^2} \approx 272$$

We adjusted the formula to the finite population size. Then, we adjusted $n_0$ to include the finite population size (n=2502) (Equation 2).

Final sample size: With a total population of 2502, an expected proportion of 0.23, and a 95% confidence level of 0.05, the desired pattern size was approximately 246 participants.

2.
$$n = \frac{n0 \cdot N}{N + n0 - 1}$$
$$n = \frac{272 \cdot 2502}{2502 + 272 - 1} \approx 246$$

This observational sample was selected according to the inclusion criteria that required adults aged 18 years or older with a single or bilateral amputation who could successfully communicate and provide informed consent. The participants must be engaged in some form of physical activity and be willing to verbally ask for information about their daily activities and perceived level of independence. The exclusion criteria were individuals with cognitive impairment that impacts their ability to request information or understand study requirements, those with more serious disabilities or conditions (such as severe cardiovascular disease) that limit physical activity, and current amputees (within the past 6 months [9]) to ensure a strong level of independence for consistency of testing.

### Study instruments

The study instrument was prepared using a questionnaire that focused on investigating the sociodemographic characteristics of the participants in the research pattern. Specific measures were used in this study to examine the data and facts collected.

Physical activity level: Physical interest scores were assessed using the international physical activity questionnaire (IPAQ), which classifies physical interest into low, medium, and high levels. The IPAQ has been widely used to assess physical interests in diverse populations. The Arabic version [17] was adopted to classify an individual's physical activity score. The physical activity score for each male or female participant was divided into the following three categories: "High," for people who achieved high-intensity physical activity for at least three days or more each week, and reached a minimum metabolic equivalent (MET) of 1500 or had 7 days of any combination of physical activity (i.e. walking, light intensity and high intensity) achieving at least 3000 MET per week; "moderate," for subjects who engaged in 3 or more days of light-intensity physical activity of at least 20 min per day, 5 or more days of light-intensity activity or walking for at least 30 min per day, or 5 or more days of any combination of physical activity (i.e. walking, light intensity, vigorous intensity) achieving at least 600 MET per week; "low," for those who did not meet any of the criteria that would allow them to be clas-

**Table 1.** Sociodemographic characteristics

| Factors | Classification | No. (%)/Mean±SD |
|---|---|---|
| Age (y) | - | 49.37±12.757 |
| Gender | Male | 177(72.0) |
| | Female | 69(28.0) |
| Marital status | Single | 55(22.4) |
| | Married | 173(70.3) |
| | Divorced | 14(5.7) |
| | Widow | 4(1.6) |
| Education level | Illiterate | 6(2.4) |
| | Primary school | 33(13.4) |
| | Secondary school | 125(50.8) |
| | College | 82(33.3) |
| Monthly income | Enough | 88(35.8) |
| | Partially | 152(61.8) |
| | Not enough | 6(2.4) |
| Duration of disability | - | 12.58±8.975 |

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sified into other categories. Information from the IPAQ was processed and proposed according to guidelines.

ADLs: The Nottingham extended ADLs scale is a common outcome score in stroke research. Its psychometric properties have been examined in other settings, and its reliability and validity have been previously confirmed [18].

Level of Independence: The Barthel index of daily living is an ordinal scale that measures a person's ability to complete ADLs [19].

## Validity and reliability

Nursing professionals evaluated the validity of the questionnaire, and a pilot study was conducted on 20% of the study sample to evaluate the reliability of the instrument. IPAQ is widely used to assess physical activity levels and has shown adequate and high correlations when compared with objective measures, such as accelerometers, and is valid and reliable in some populations. In the case of the IPAQ, the intraclass correlation coefficient generally ranges between 0.60 and 0.80, indicating moderate to accurate reliability with high internal consistency for classifying physical activity levels as low, moderate, or high. The Nottingham ADLs scale are highly regarded in stroke research and other rehabilitation settings. Studies have shown high reliability (often exceeding 0.90 Cronbach α) and validity in performing ADLs, its use has been supported by strong psychometric support, and intraclass correlation coefficients for the ADLs scale often exceed 0.80, and its use in measuring ADLs shows high test re-test consistency.

## Data collection

The data were collected through independent interviews and self-administered questionnaires. The researchers guided the participants by completing the questionnaire and ensuring the accuracy of the answers. The interviews were conducted in a quiet area within the Babylon Rehabilitation Center for the Disabled and each interview lasted 25-30 min on an individual basis after obtaining verbal consent from the disabled.

**Table 2.** Distribution of study sample by their overall variables

| Variables | Levels | No. (%) |
|---|---|---|
| IPAQ | Low | 186(75.6) |
| | Moderate | 41(16.7) |
| | High | 19(7.7) |
| ADLs | Low | 169(68.7) |
| | Moderate | 54(22) |
| | High | 23(9.3) |
| Barthel index | Unable | 191(77.6) |
| | Need help | 28(11.4) |
| | Independent | 27(11) |

IPAQ: International physical activity questionnaire; ADLs: Activities of daily living. Iranian Rehabilitation Journal

## Statistical analysis

All statistical analyses were performed using IBM SPSS software, version 20.0. Numbers and percentages were used to rank the variables, while the Mean±SD were used to statistically describe the continuous variables. A straightforward linear regression test was used to evaluate the hypothesis of the relationship between study variables. The Kolmogorov–Smirnov and Shapiro–Wilk tests are two popular techniques for evaluating the distribution of data. The Pearson correlation coefficient and simple linear regression tests were performed to evaluate any statistical association. A 0.05 threshold for statistical significance was used.

## Results

The results showed the socio-demographic characteristics of the participants, with a mean age of 49.37±12.757 years. Regarding sex, males were more (72.0%) compared to females (28.0%). Regarding marital status, one-third (70.3%) of the participants were married. In terms of education, more than half of the studied participants were secondary school graduates (50.8%). One-third of the study sample had a partially sufficient monthly income (61.8%). The mean years of disability was 12.58±8.975 years (Table 1).

Findings indicate that 75.6% of studied participants were indexed low physical activity level, 68.7% were low ADLs and 77.6% were unable to complete ADLs (Table 2).

Findings in Table 3 indicate a positive relationship between physical activity and daily living in people with lower limb amputation (r=0.895, P=0.000).

Findings of simple linear regression indicate that the level of independence serves as a predicted variable of physical activity (β=0.728, P=0.000) and ADLs (β=0.754, P=0.000) in people with lower limb amputation (Table 4).

**Table 3.** Relationship between physical activity and daily living in people with lower limb amputation

| Variables | | IPAQ | ADLs |
|---|---|---|---|
| IPAQ | Pearson Correlation | 1 | 0.895** |
| | Significance (2-tailed) | | 0.000 |
| ADLs | Pearson correlation | 0.895** | 1 |
| | Significance (2-tailed) | 0.000 | |

Abbreviations: IPAQ: International physical activity questionnaire; ADLs: Activities of daily living. Iranian Rehabilitation Journal

**Correlation is significant at the 0.01 level (2-tailed).

**Table 4.** Mediators of Barthel index in physical activity and ADLs in people with lower limb amputation

| Variables | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|---|---|---|---|---|---|
| | B | Standard Error | β | | |
| IPAQ | 0.669 | 0.040 | 0.728 | 16.598 | 0.000 |
| ADLs | 0.742 | 0.041 | 0.754 | 17.926 | 0.000 |

IPAQ: International physical activity questionnaire; ADLs: Activities of daily living.

Note: Independent variable: Barthel index.

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Findings indicate that the every increase in the level of independence by (0.4295), there was the probability of increases in physical activity by (0.6687) (Figure 1), as well as, every increase in the level of independence by (0.4167), there were probability of increases in the ADLs by (0.7423) (Figure 2).

## Discussion

The findings underscore the massive challenges confronted by individuals with lower limb amputations in maintaining ok physical pastime degrees and acting sports of day-by-day residing (ADLs). Notably, 75.6% of contributors have been labeled as having low physical interest tiers and 68.7% exhibited low ADL rankings. Additionally, 77.6% of contributors could not independently complete important everyday duties, emphasizing the sensible obstacles encountered by way of this population.

The high incidence of low physical pastime among lower limb amputees aligns with earlier studies demonstrating the detrimental results of amputation on mobility and bodily overall performance. For instance, Lee et al. stated that amputees are much less possibly to interact in physical sports due to mobility boundaries, aches, and reliance on assistive devices, elements that may significantly impair general fitness and practical independence [20]. Similarly, Ladlow et al. diagnosed the bodily state of being inactive as a well-known trouble amongst decreased limb amputees, contributing to diminished physical fitness and an improved hazard of secondary morbidities consisting of cardiovascular sickness and weight problems [21].

The findings on physical activity and ADLs align with the present literature, emphasizing the complicated obstacles amputees come upon in self-care and exercise workouts. Al-Eqabi et al. maintained similar results, highlighting that many amputees struggle with regular physical activities and activities of daily dwelling, which

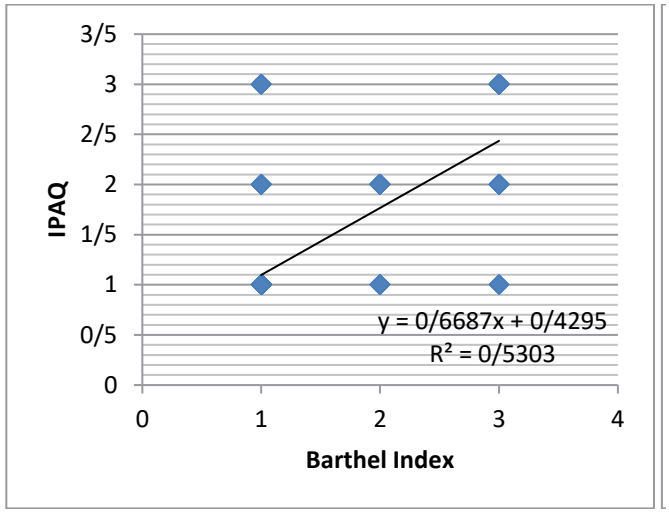


**Figure 1.** Barthel index and IPAQ

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IPAQ: International physical activity questionnaire; ADLs: Activities of daily living.

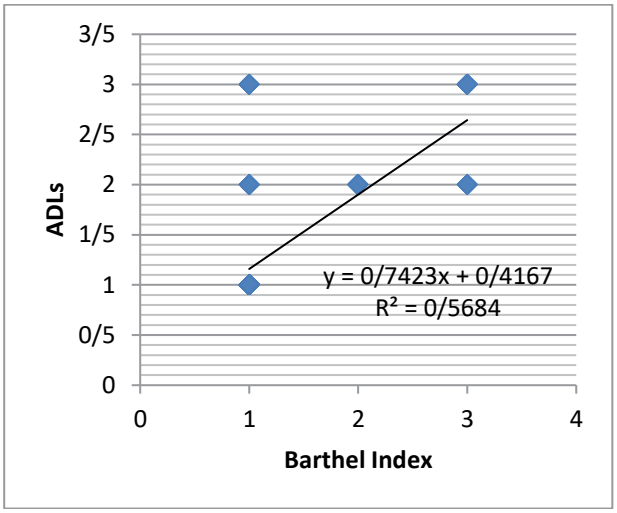


**Figure 2.** Barthel index and ADLs

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IPAQ: International physical activity questionnaire; ADLs: Activities of daily living.

notably impact their ordinary best of existence [1]. Similarly, Dickerson et al. stated that lower-limb amputees regularly depend upon caregivers for guidance in performing everyday activities and critical bodily obligations, which can be important for maintaining independence and social engagement [22].

Notably, 77.6% of amputees had been not able to finish day-by-day physical responsibilities, underscoring the pressing need for focused rehabilitation interventions to restore their independence and enhance their nice of existence. As established in Wijekoon et al.'s study, individualized bodily rehabilitation packages can substantially enhance amputees' useful skills and capacity to manipulate everyday activities [5]. Moreover, Mutar and Naji emphasize the role of the assistive era and synthetic education in promoting extra independence amongst amputees, whilst improving their physical and mental well-being [23].

The results in Table 3 indicate a widespread and sturdy affiliation between physical activity and each day residing talents in lower-limb amputees, with a correlation coefficient of r=0.895, P=0.000. This locating underscores that higher stages of bodily engagement are intently linked to stronger skills in daily living activities, highlighting the vital function of bodily participation in fostering independence amongst amputees.

Several research has established the effective impact of physical activity on improving the first-class of lifestyles and useful outcomes on this population. For example, Agamy et al. reported that aerobic exercising drastically enhances mobility and self-care in lower-limb amputees. Their research emphasizes that ordinary bodily activity induces enhancements in muscle energy and patience, which are essential for activities of daily residing and sports participation [24]. These findings align with the outcomes of our observation, further assisting the notion that physical interest is vital for boosting purposeful competencies and independence in amputees.

Moreover, the institutions discovered in our research are consistent with the findings of Al-Eqabi et al. who confirmed that people with higher degrees of physical hobby revel in much fewer problems in appearing day-by-day obligations, consisting of dressing, bathing and moving around [1]. This correlation shows that selling physical interest can help mitigate many disability-related challenges faced by decreased-limb amputees, thereby enhancing their usual exceptional lifestyles.

Our investigation adds to the growing body of literature assisting the role of physical rehabilitation and exercising as powerful interventions for reinforcing everyday living abilities in amputees. Research in rehabilitation has proven that individualized bodily interest packages tailored to the particular desires of amputees can significantly reduce the commonplace disabilities related to lower-limb amputation. The strong affiliation diagnosed in our findings underscores the significance of integrating bodily activity interventions into contemporary rehabilitation packages for lower-limb amputees.

Independence is a vital predictor of bodily interest and sports participation related to each day residing amongst

decrease-limb amputees. A strong advantageous dating change into found among independence and physical interest (β=0.728, P=0.000) as well as sports of each day dwelling (β=0.754, P=0.000). These effects indicate that more independence leads to multiplied engagement in physical activities and sports related to each day's dwelling. This aligns with previous research emphasizing the pivotal position of independence in improving the bodily and practical talents of lower-limb amputees. For example, Hester et al. mentioned that people with better degrees of independence proven considerably extra participation in physical and leisure sports activities [25].

Quantitatively, independence changed into determined to increase physical activity using 0.6687 for every 0.4295 boom in independence, consistent with research underscoring independence as a key issue in fostering mobility and lively living inside this population. Similarly, the link between independence and regular sports activities confirmed a 0.7423 growth for each 0.4167 boom in independence, corroborating Radhi et al.'s findings that rehabilitation interventions promoting independence extensively strengthen amputees' capability to carry out important everyday obligations [4].

These findings spotlight the importance want for tailor-made help and interventions that prioritize fostering independence to enhance the best of life for decrease-limb amputees. The robust affiliation between independence and activities of daily residing underscores the fundamental role of self-reliance in retaining normal fitness and well-being [26]. This perception is especially treasured for the development of rehabilitation applications, demonstrating that selling independence is quintessential to bodily and social reintegration post-amputation. Additionally, strategies that build self-belief and inspire various varieties of participation can empower decreased-limb amputees, facilitating stepped-forward bodily engagement and healthier lifestyles [9, 27]. These effects reaffirm the significance of independence as a pathway to improving bodily activity tiers, functional autonomy in everyday dwelling and contributing to the wider frame of knowledge on amputee rehabilitation.

## Conclusion

This study highlights the significant challenges that people with lower-limb amputations face in maintaining physical activity and daily exercise independently. The findings showed a high prevalence of low physical activity and limited ability to perform daily tasks, highlighting the beneficial barriers within this population. The positive association between physical activity and daily functioning suggests that enhancing physical participation enhances functional independence and life satisfaction in amputees. Rehabilitation programs should therefore emphasize personal physical activity, promote targeted support for independence, and include assistive technologies, custom prosthetic training, and adaptive technologies to promote both physical and mental health.

### Study limitation

The limitations of this study include its go-sectional design, which limits causal inference and captures establishments at simplest one component at a time. The pattern turned into constrained individuals attending an unmarried rehabilitation middle, which may additionally affect the generalizability to a broader population. Self-mentioned measures of bodily interest and everyday workout might also introduce a reaction bias, and the check did not account for confounding factors, including comorbidities or intellectual fitness factors which can have an impact on the consequences. Finally, this study trusted particular testing contraptions, which, even as reliable, might not seize all the nuances of beneficial independence on this populace.

## Ethical Considerations

### Compliance with ethical guidelines

The ethical approval was obtained from the Research Ethics Committee of the Jabir ibn Hayyan Medical University, Kufa, Iraq (Code: 72, dated 2/11/2024).

### Funding

This research did not receive any grant from funding agencies in the public, commercial, or non-profit sectors.

### Authors' contributions

Conceptualization, supervision and data analysis: Haitham Ibrahim Faris; Data collection: Shahznan Hassan Badr and Basim Hasson Hussein; Investigation and writing: All authors.

### Conflict of interest

The authors declared no conflict of interest.

### Acknowledgments

The authors thank the Health Authority of Babylon, Babylon, Iraq.

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